TM 11-7010-200-10-7

TECHNICAL MANUAL

OPERATION AND MAINTENANCE INSTRUCTIONS

DISK CARTRIDGE DRIVE SERIES, CAELUS MODEL 303, AN/UYQ ( )

HEADQUARTERS, DEPARTMENT OF THE ARMY

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" # HO534 (1)
" # AO049 (1)
" # SO392 (3)
" # JO861 (10)
" # CO214 (2)

NG: NONE

USAR: NONE

For explanation of abbreviations see, AR 310-50.

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SECTION I DESCRIPTION

1.1 GENERAL

The Model 303 Series Disk Cartridge Drives have been designed to interface with and provide peripheral storage capabilities for small, general purpose digital computers. The 303 series utilizes the Caelus CMIII (IBM 5440 type) disk cartridge to provide mass random access storage.

Model 303 series drives are available in two different configurations; a single removable disk configuration capable of 2200 BPI density and 24 megabit capacity and a disk drive with both fixed and removable disks. The dual disk model has a 48 megabit capacity. Both models include a self-contained power supply and can be mounted in a standard RETMA rack (8 3/4 inch height).

303/1 Disk Cartridge Drive, 2200 BPI, 24 megabit capacity
303/2 Disk Cartridge Drive with fixed disk, 2200 BPI, 48 megabit capacity

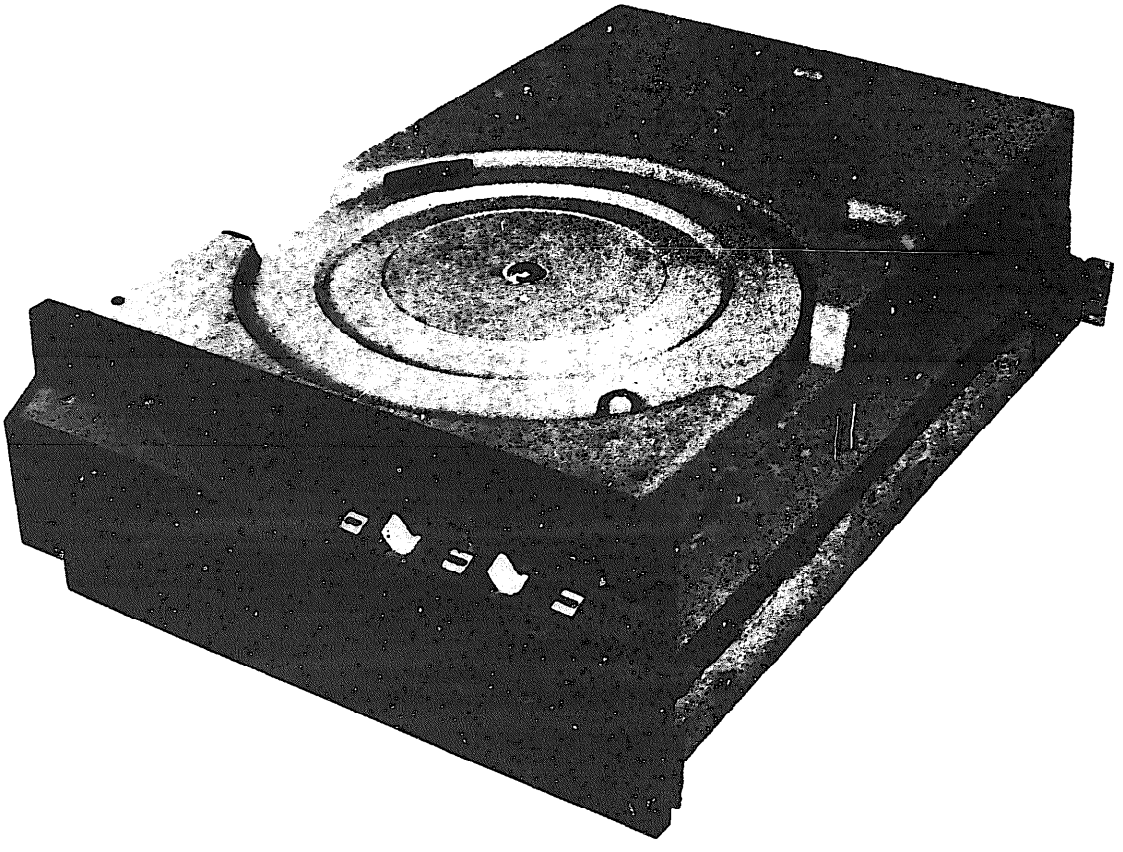


Figure 1-1. Model 303/2

1.2 FEATURES

Rotational motion and relative position of both disks is monitored by means of magnetic index/sector transducer(s) providing a highly reliable source of timing information to the controller.

Horizontal positioning of the read/write heads is accomplished by a servo driven voice coil actuator which receives positional information in digital format from an optical position transducer. Final positioning is accomplished by error comparison data from the same optical transducer.

Data recording is accomplished through read/write heads which utilize the latest edge erase technique, eliminating cross-talk between tracks. Read data is passed through electronic circuits designed to properly discriminate data while compensating for bit shift.

101-4

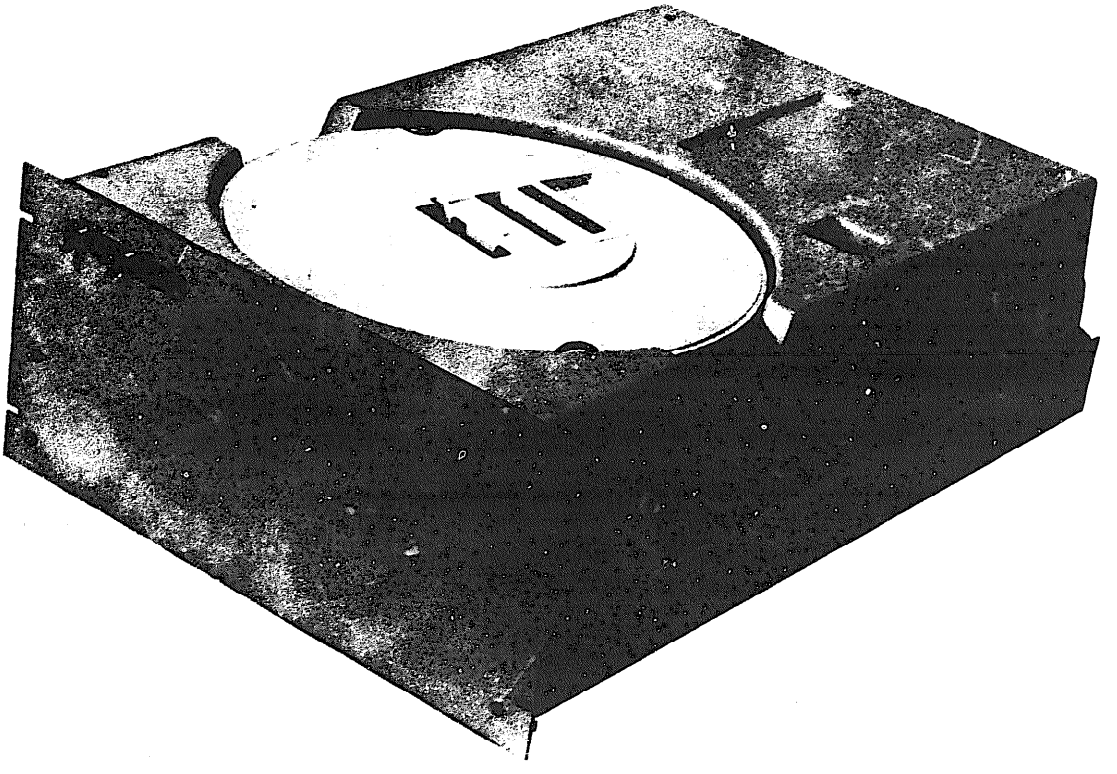


Figure 1-2. Model 303/l

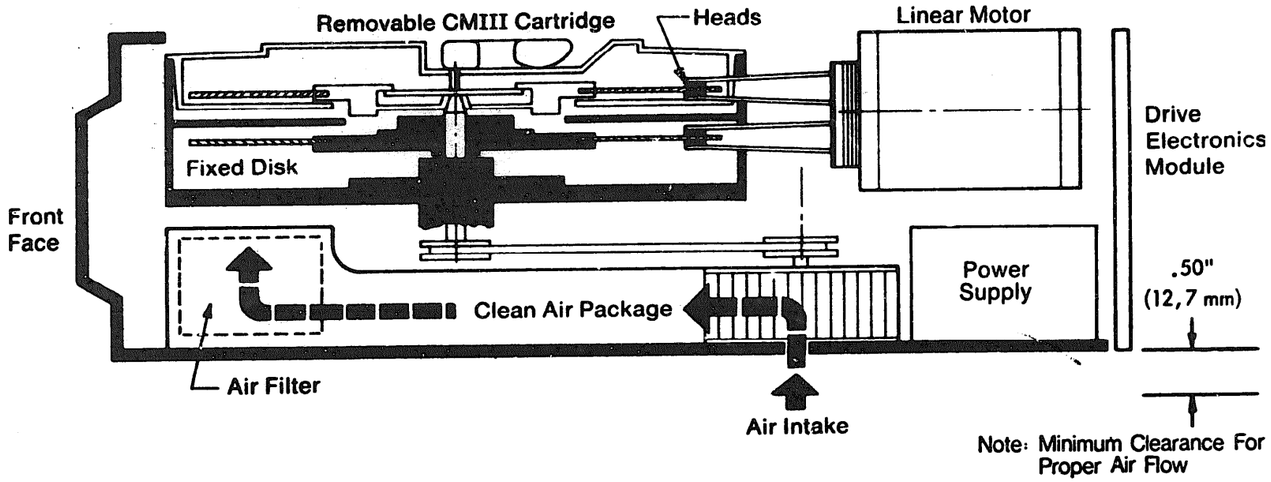


Figure 1-3. Model 303/2, Package Cross Section

1.3 PERFORMANCE SPECIFICATION

The performance specifications of the Model 303 series offers users capacities and access times which extend the capabilities and applications of general purpose minicomputers.

1.3.1 Recording Parameters

Bit density:	**2200 BPI inside track (maximum)**
Track density:	**100 TPI**
Medium:	**Interchangeable cartridge, double sided oxide coated disk in polycarbonate dust-proof housing, and Fixed double sided disk. (303/2 only)**
Recording band:	**2.04 inches (5.18 cm)**
Disk diameter:	**14 inches (35.56 cm)**
Cartridge diameter:	**15 inches (38.1 cm)**
Coding:	**Double frequency**
Transfer rate:	**1588.5 KHz (2200 BPI)***
Heads:	**The magnetic transducer is an air-bearing head with the magnetic elements supported in a ceramic shoe.**
Bit cell time:	**629.5 nanoseconds**
Sector Detection Error:	**± 10 microseconds maximum**
Write to read switching time:	**30 microseconds maximum**
Read to write switching time:	**7 microseconds maximum**
Erase after write delay:	**20 microseconds maximum**
Write clock frequency tolerance:	**± 0.1%**
Disk rotation speed:	**1500 RPM ± 1% ± Line Frequency Deviation**
Disk rotation time:	**40 milliseconds (nominal)**
Head switching time:	**5 microseconds maximum**
Data discriminator sync time:	**20 microseconds maximum**

* Standard - Special on Request

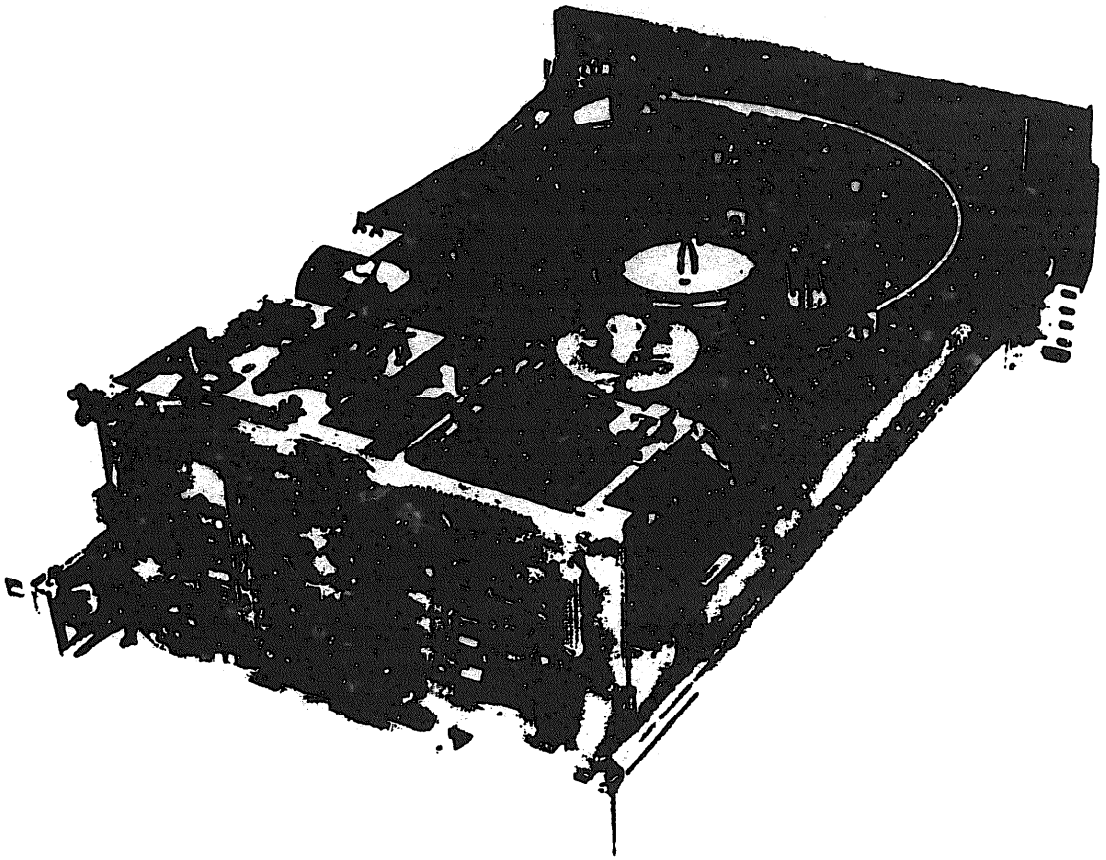


Figure 1-4. Model 303/2, Rear View, Covers Removed

1.3.2 Access Mechanism

Access motion time (including head settling)	
Track-to-track:	**14 milliseconds maximum**
Average random:	**60 milliseconds**
Maximum access (204 tracks):	**85 milliseconds maximum**
Average latency time:	**20 milliseconds**
	= $\frac{\text{Revolution Time}}{2}$

1.3.3 Operating Environment

Temperature:	**+ 50 to + 100°F, ambient**

Humidity:	**10 to 80% Relative humidity 85°F maximum wet bulb**
Cooling:	**Forced room air, ambient at installed location**
Air filtration:	**Absolute, 0.3 microns**

1.3.4 Shipping or Storage Environment

Temperature:	**- 40 to + 150°F**
Humidity:	**10 to 95% relative humidity, non condensing**

1.3.5 Reliability

When using a Caelus CMIII disk cartridge or equivalent, the following error rates are specified:

Soft error rate:	**1 in 10^{10}**
Hard error rate:	**1 in 10^{12}**

1.3.6 Maintenance

Under normal operational conditions, preventive maintenance is recommended every three (3) months. Mean time between failure, under normal operating conditions and with routine preventive maintenance, is specified at 2500 hours. Mean time to repair is 30 minutes.

1.3.7 Dimensions

Overall Length:	**30.06 inches (including front face) (76.35 cm)**
Rack Depth:	**28.0 inches minimum (71.12 cm)**
Rack Height:	**8.75 inches minimum (22.23 cm)**
Rack Width:	**17.75 inches (including slides) (45.09 cm)**
Overall Width:	**19.00 inches (including front face) (48.26 cm)**
Weight:	**75 pounds (less slides) (34 Kg)**

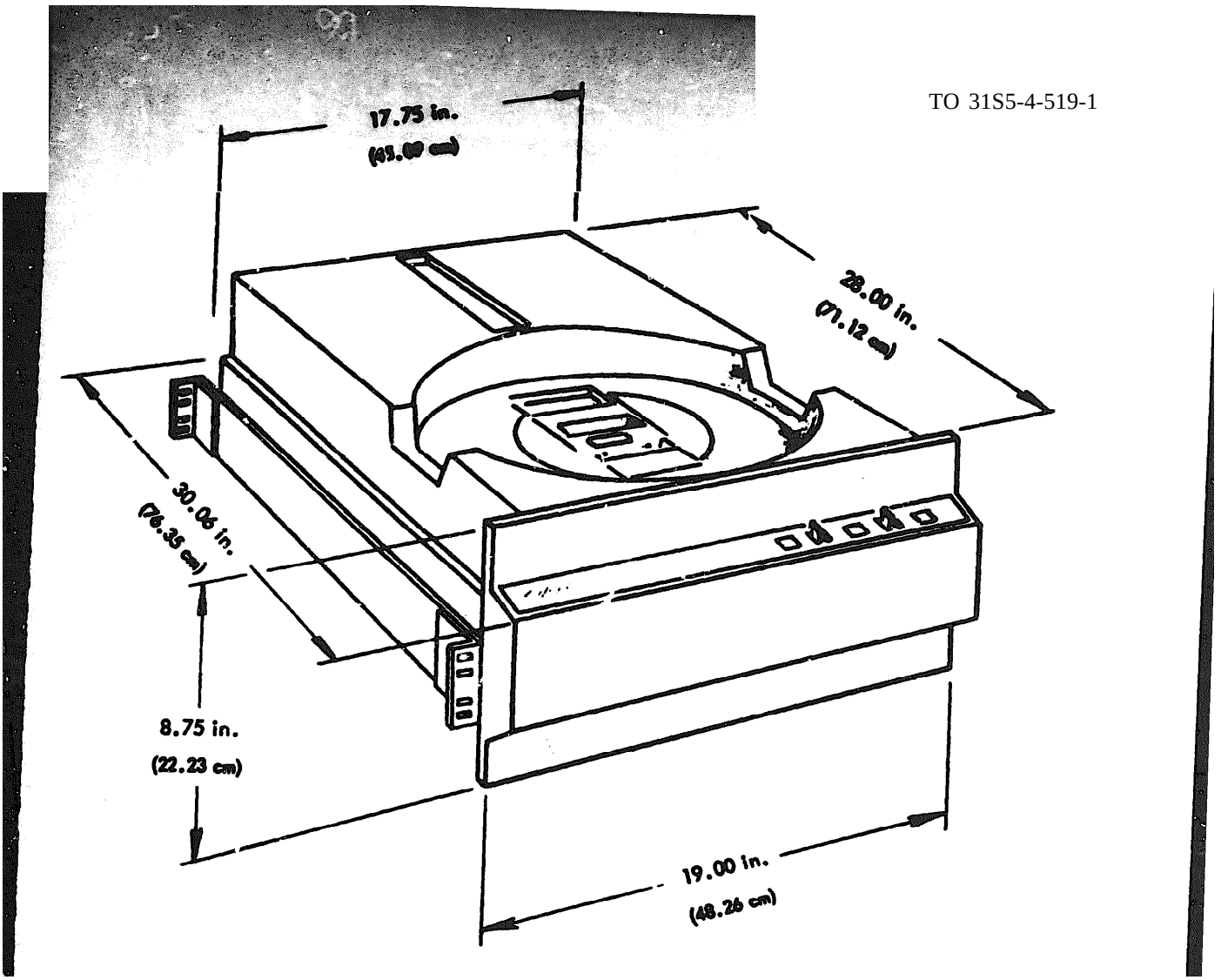


Figure 1-5. Model 303, Outline Dimensions

1.3.8 AC Power Requirements

Line Voltage Requirements for Models 303/1 and 303/2 are as follows:

Voltage:	100, 120, 200, 220, 230 or 240 VAC ± 10%
Frequency:	50 or 60 Hz, ± 1%
Phase:	Single Phase
Power Consumption:	Start 1100 VA (5 seconds) Run 350 VA

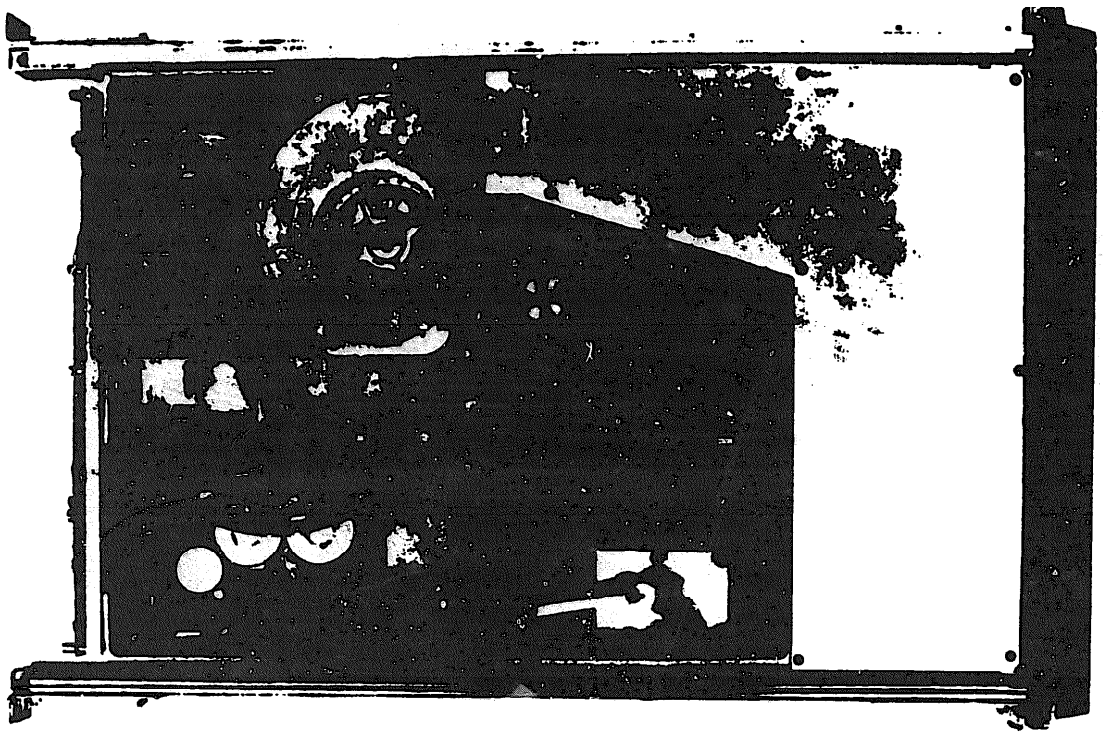


Figure 1-6. Model 303/2, Bottom View

Figure 1-7. Model **303/2, Front View, Covers** Removed

Line Voltage changes are accommodated by taps on the Power Transformer. Conversion from 60 Hz to 50 Hz (or vice-versa) requires only a change in the motor pulley.

1.4 RECORDING MEDIA

The recording media is the removable Caelus CMIII top loading disk cartridge (IBM 5440 type) and a fixed, double sided, oxide coated disk that is housed permanently within the drive.

The flexibility inherent in the design of the Model 303 Series by the availability of both fixed and removable media results in the ability to custom tailor the drive to specific customer systems/application.

1.4.1 Data Storage Capacity (303/2) (Unformatted)

Removable Disk:	3,000,000 data bytes (24 million bits)
Fixed Disk :	3,000,000 data bytes (24 million bits)
Track:	7,500 data bytes (60,000 bits)
Number of tracks per surface:	204
Number of sectors:	Index only standard (sector marks optional, 48 maximum)

1.5 DATA FORMATTING

Data is recorded serial-by-bit on concentric trucks of the oxide coated disk by two non-contact, flying heads which magnetize discrete areas of the disk. These heads float on a film of air, (approximately 100 micro inches thick) generated by the spinning disk. The data recording surface of the disk is 2.04 inches wide, measured on the radius. The outer radius measures 6.564 inches, and the inner radius 4.524 inches. Each of the 204 tracks measures 0.007 inch in width and are spaced 0.010 inch apart, measured center to center.

Data is double frequency encoded, permitting recording of self-clocked data at high densities.

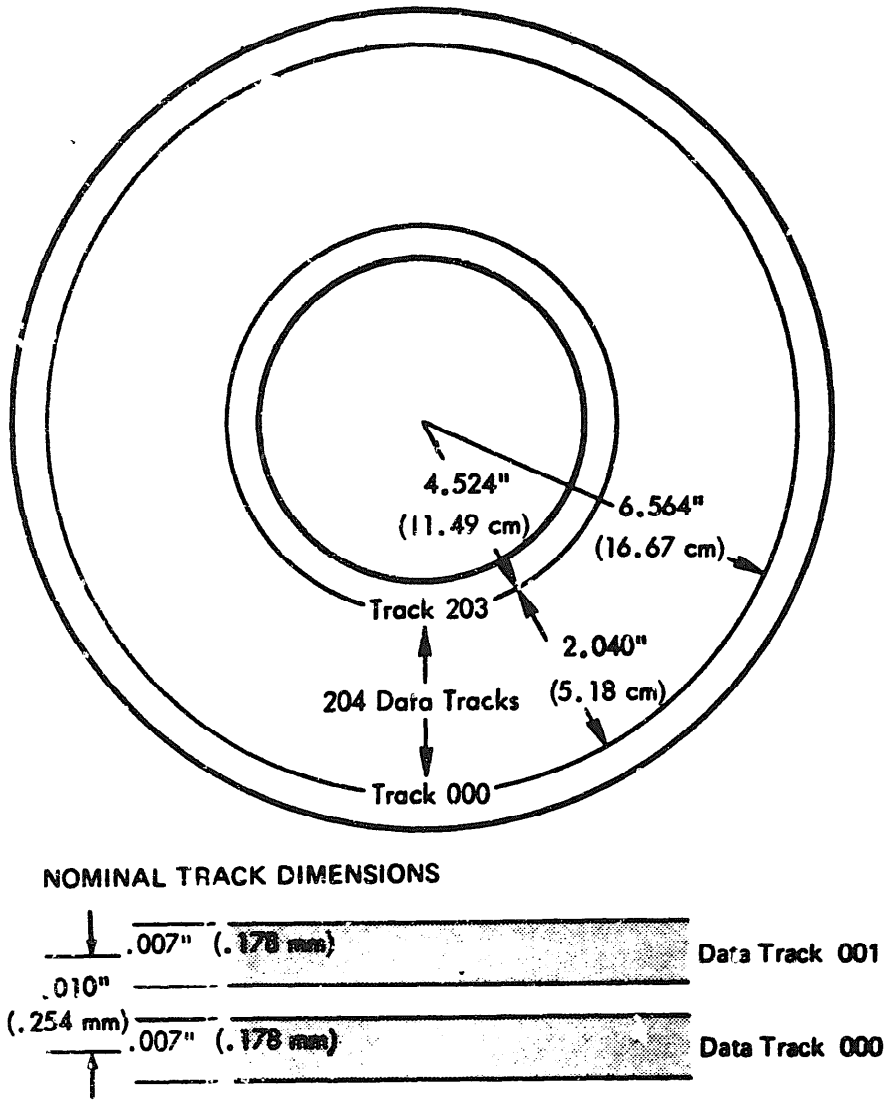


Figure 1-8, Data Track Configuration

1.5.1 Read/Write Heads

The read/write heads are mounted in a ceramic shoe and "Fly" over the surface of the disk. Edge erase coils follow the read/write coils on the head surface and are energized when data is being written, leaving a nominal recorded track width of .007 inch, on .010 inch centers.

1.5.2 Double Frequency Encoding

Write data is received in optional NRZ format from the Controller and is en-

coded internally to Double Frequency format prior to writing. A flux change occurs at every bit cell boundary when a logical "0" is recorded. An extra flux change occurs at the center of the bit cell when a logical "1" is recorded.

1.5.3 Data Decoding (Optional)

The user is supplied read data in NRZ format along with a Clock. The advanced and unique discrimination scheme employed by Caelus is capable of accommodating bit shifts that result from read resolution, drive spindle speed variations, etc. (Reference: Caelus Option No. 0200).

1.5.4 Sector Counting (Optional)

The user is supplied 5 lines which supply Sector Address information in binary format to the controller (not available with 48 sectors). (Reference: Caelus Option No. 0203).

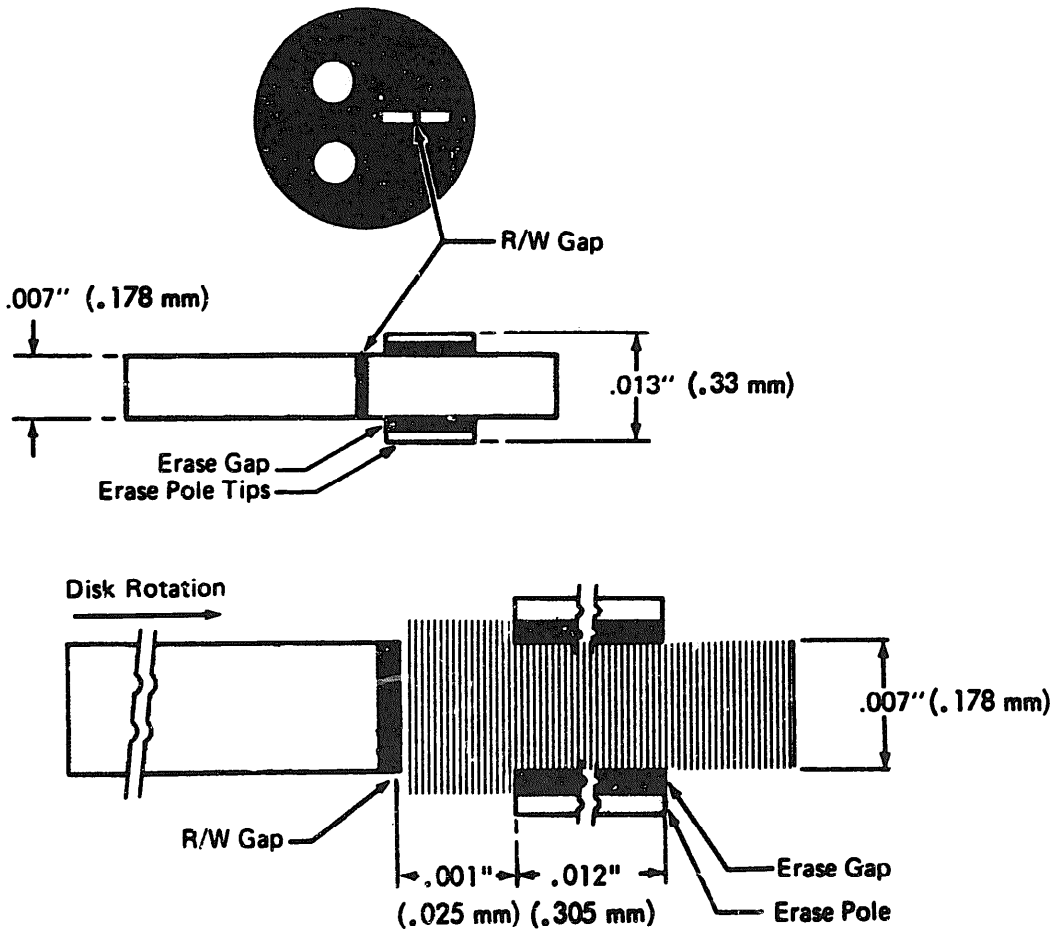


Figure 1-9. Edge Erase Concept

SECTION II - UNPACKING/INSTALLATION

2.1 UNPACKING THE DRIVE FOR INSTALLATION

2.1.1 Slide inner container out of exterior case.

2.1.2 Remove tape and by using the hand hole in the rear plywood support and the recess in the front casting, lift the drive from the container.

C A U T I O N

The plywood rear support is attached to the slide-to-frame mounting brackets which may be deformed if excess side loading is applied to the plywood support.

The drive mounting slides are not locked in a closed position and may open when removing drive from container.

2.1.3 Remove the top and back plastic covers from the drive.

2.1.4 Remove the carriage hold down screw and flag (Figure 2-2).

2.1.5 Install positioner coil plug (P4) on the Power Control Module (KM).

2.1.6 Select Unit I.D. per Section 2.5.

2.1.7 Replace top and back covers.

2.2 SHIPPING INSTRUCTIONS

2.2.1 Rack-Mounted Drives

The electronic enclosure which the drive is mounted in should have adequate shock insulation such that a 10 G ± 10% peak load will be transferred to the drive for a maximum duration of 11 ms ± 1 ms during shipping. (Ref: I L-E-4970 Procedure II).

2.2.2 Free-Standing Drives

If at any time the disk drive is to be shipped to a new location by itself, an unused Caelus shipping container must be utilized, which is available

PACKAGING SEQUENCE

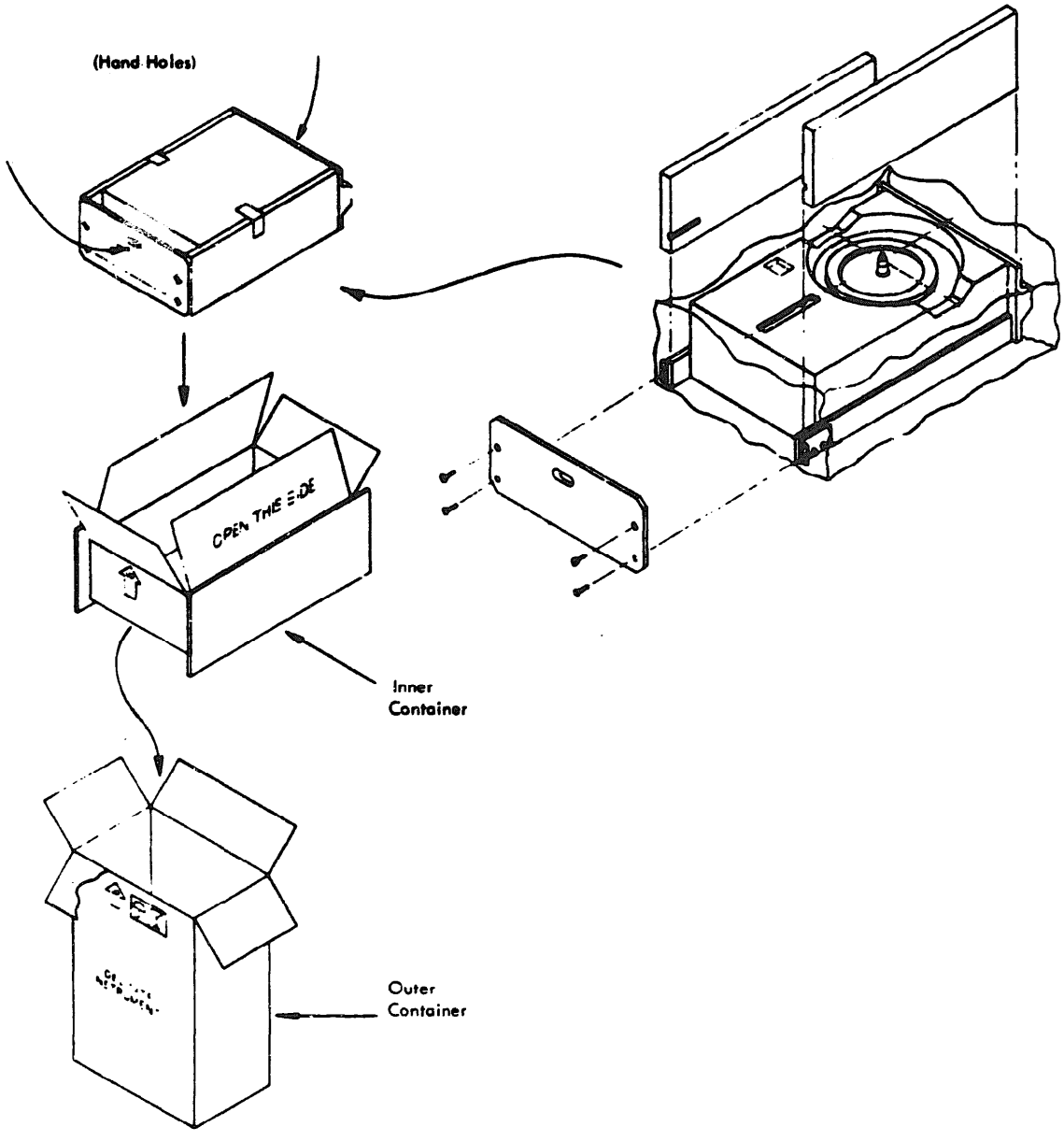


Figure 2-1. Model 303 Shipping Container

at a nominal cost. AT NO TIME SHOULD A CAELUS SHIPPING CONTAINER BE RE-USED. Re-use of shipping container voids warranty and holds customer liable for shipping damage.

2.2.3 Packaging

- Remove top and rear covers from drive and install carriage hold down screw using 4 to 6 in.-pounds of torque. (Ref: Figure 2-2).

- Replace top and rear covers

NOTE: Prior to packaging drive, a new shipping container must be used.

- Package by reversing procedure as outlined in paragraph 2.1 (Ref: Figure 2.1).

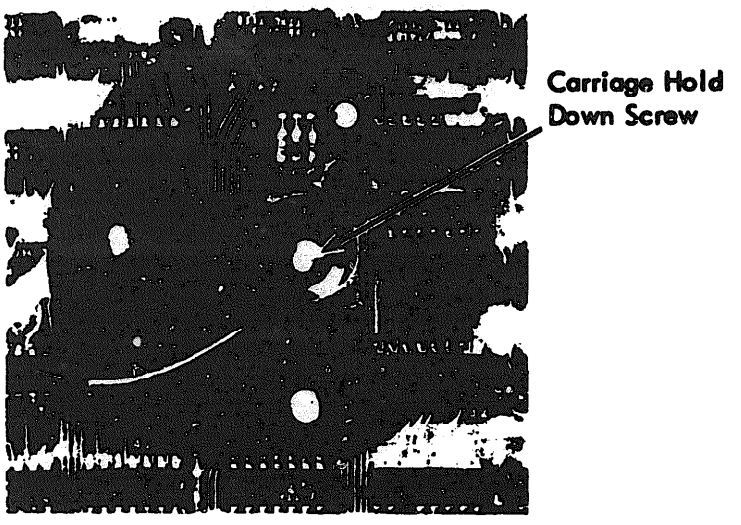


Figure 2-2, Carriage Hold-Down Screw and Flag

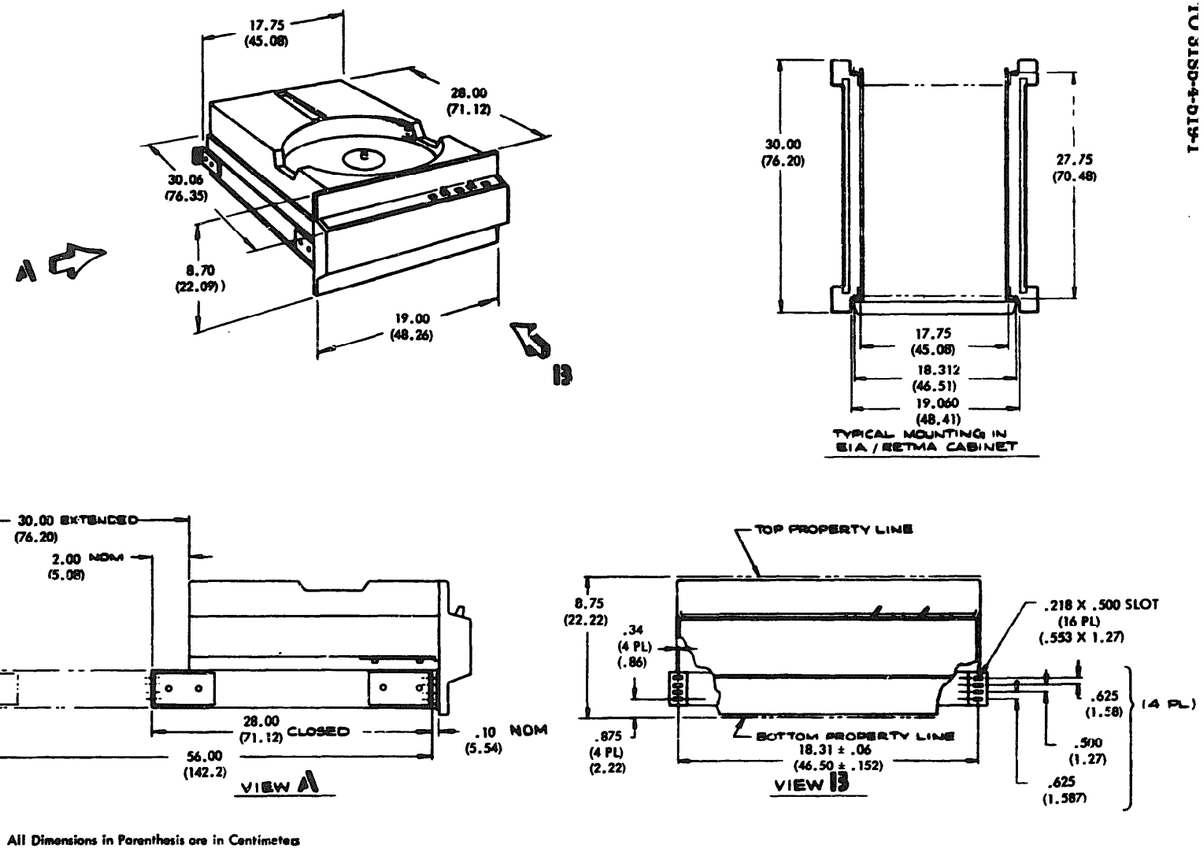
2.3 RACK INSTALLATION

2.3.1 Cabinet Types

The drive mounting hole pattern has been designed around the EIA/RETMA rack dimensions. If it is required that the drive be mounted in an enclosure other than the above, the mounting brackets attached to the slide may have to be replaced.

2.3.2 Slide Mounting

The Caelus disk drives are supplied with slides which have a disconnect feature. As such, the slides should be extended and released from the drive, attached to the enclosure, (Figure 2-3) and the drive then slid into the rack. (See Figure 2-4).



NOTE: All Dimensions in Parenthesis are in Centimeters

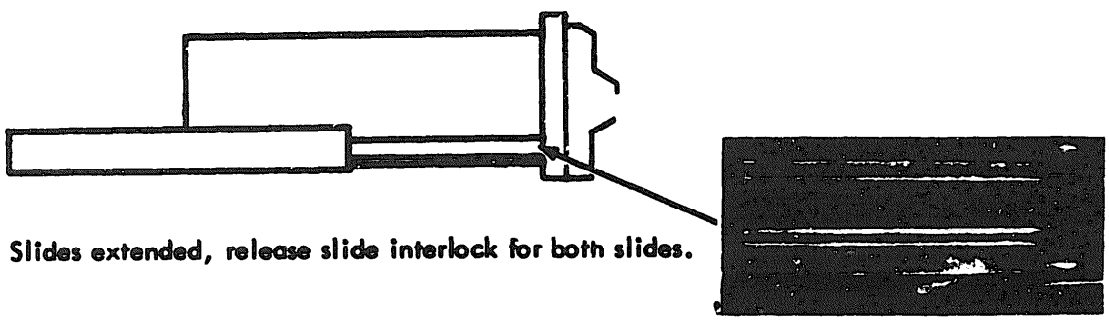
Figure 2-3. Installation Dimensions

TO 31S5-4-519-1

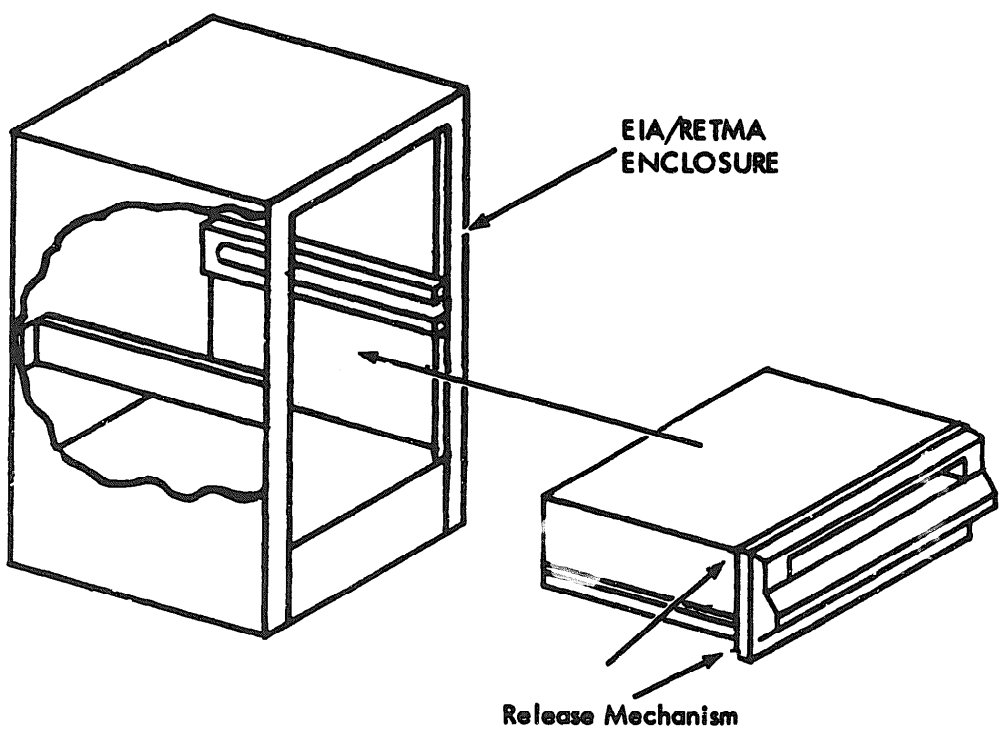
2.3.3 Ventilation

The enclosure used to house the drive must have adequate ventilation such that the maximum ambient temperature at the drive air intake is 100°F. during drive operation.

To achieve adequate air flow within the drive, a minimum of 1/2 in. (12,70 mm) clearance is required under the drive. (Figure 2-3).



Slides extended, release slide interlock for both slides.



Install released slides in enclosure. Once slides are secured to enclosure, slide drive assembly into rack and lock slide release mechanism on either side of drive.

Figure 2-4. Installation Sequence

2.4 DESK-TOP DRIVE INSTALLATION

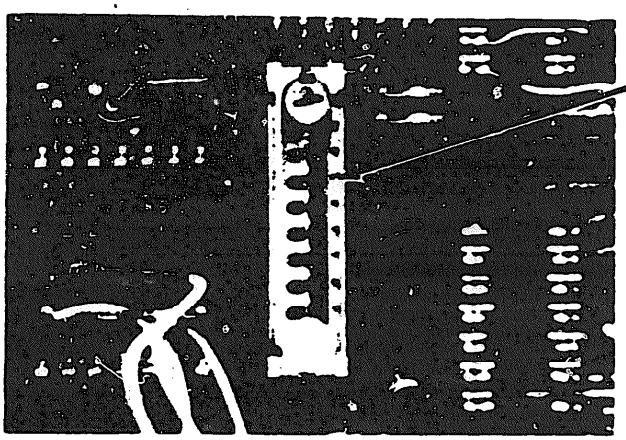
In order to provide proper air circulation to the drive when operated on a desk-top, the drive must be elevated approximately one half inch, using side supports, CAELUS Part Number 301277-001 (right hand) and 301277-002 (left hand).

2.5 SELECTION OF UNIT IDENTIFICATION

At time of installation, the unit I.D. of each drive must be chosen by a switch on the Drive Electronics Module (DEM) as follows:

Drive I.D.	Switch Position
0	1 and 6
1	2 and 7
2	3 and 8
3	4 and 9

If only one drive is to be connected to the controller, select Unit I.D. '0', per the above table. (Remove rear cover to gain access to DEM). For any drive to be operative, the controller must select the appropriate Unit Select Line in the I/O cable.



2.5.1 To set the unit select switch, open the clear plastic cover by lifting the cover at the red dot; using a small potentiometer adjustment screwdriver, rotate the wafer 180° clockwise ro move it down one notch, or 180° counterclockwise to move it up one notch.

CAUTION

Excessive force of too large a screwdriver can easily damage the switch wafer.

2.6 SPECIAL GROUNDING INSTRUCTIONS

An insulated grounding conductor that is identical in size and insulation to the grounded and ungrounded branch-circuit supply conductors except that it is green with one or more yellow stripes is to be installed as part of the branch circuit that supplies the unit or system.

The grounding conductor mentioned above is to be connected to the center terminal of the A.C. receptacle on the drive.

The attachment-plug receptacles in the vicinity of the unit or system are all to be of a grounding type, and the grounding conductors serving these receptacles are to be connected to the grounding conductor that serves the unit or system.

2.7 LINE VOLTAGE VERIFICATION

Before applying power to the drive, verify that the drive is wired for the proper power source as follows:

Locate the Drive Serial Number on the left side of the drive (above the slide bracket). The 3-digit number indicates the drive line voltage as shown below:

-009	120 vac
-019	100 vac
-029	200 vac
-039	220 vac
-049	230/240 vac

2.8 SINGLE DRIVE/CONTROLLER INTERCONNECTION

2.8.1 If the drive was purchased with the daisy chain option but no daisy chain is used, the controller cable shall be connected to J21 of the single drive and a terminator board shall be connected to J22.

- Terminator board must be supplied + 5 volts from either the DEM or the controller.

- Jumper A to B on the terminator to provide + 5 volts from the drive; jumper A to C on the terminator to provide + 5 volts from the controller.

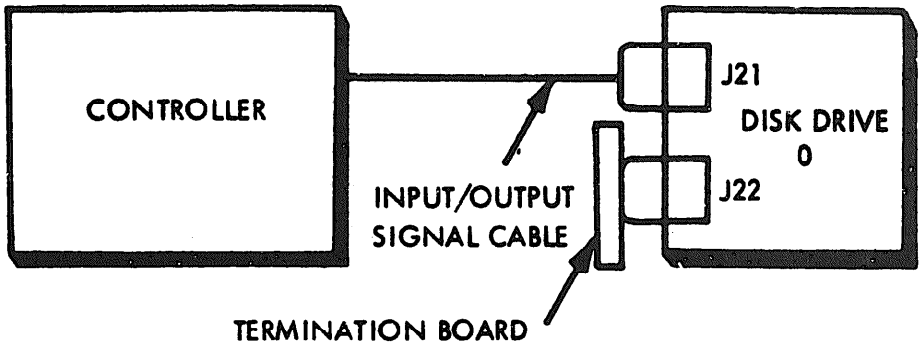


Figure 2-5. Single Drive/Controller Interconnection (With Daisy Chain Option)

2.8.2 If the drive was purchased without the daisy chain option, the controller cable shall be connected to J21 of the drive. No terminator board is used. Maximum I/O cable length is 50 feet.

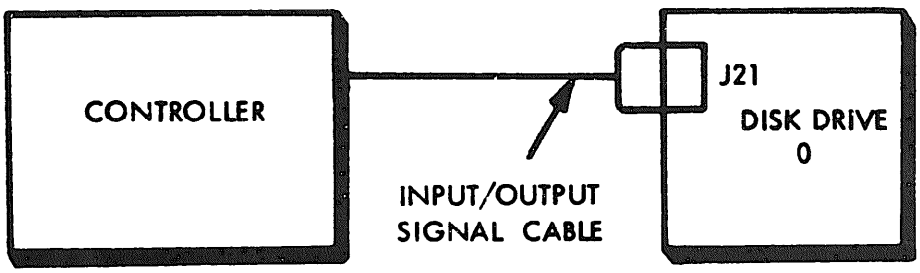


Figure 2-6, Single Drive/Control let Interconnection (Without Daisy Chain Option)

2.9 DAISY CHAIN INTERCONNECTION

The Daisy Chain option allows the external control to interface to a maximum of four drives. This option is mechanized by providing each drive with dual I/O connectors and eliminating all line terminations from the drive. An external termination board is required. (Reference: Caelus Option No. 0226).

2.9.1 Maximum cable length between the controller and last drive in a daisy chain shall be no more than 50 feet.

2.9.2 The controller cable shall be connected to J21 on first drive and the daisy chain cable shall be connected from J22 on the first drive to J21 on the next drive, etc.

2.9.3 The terminator board shall be connected to J22 on the last drive in the daisy chain.

- Jumper A to C on the terminator to provide +5 volts from the controller.

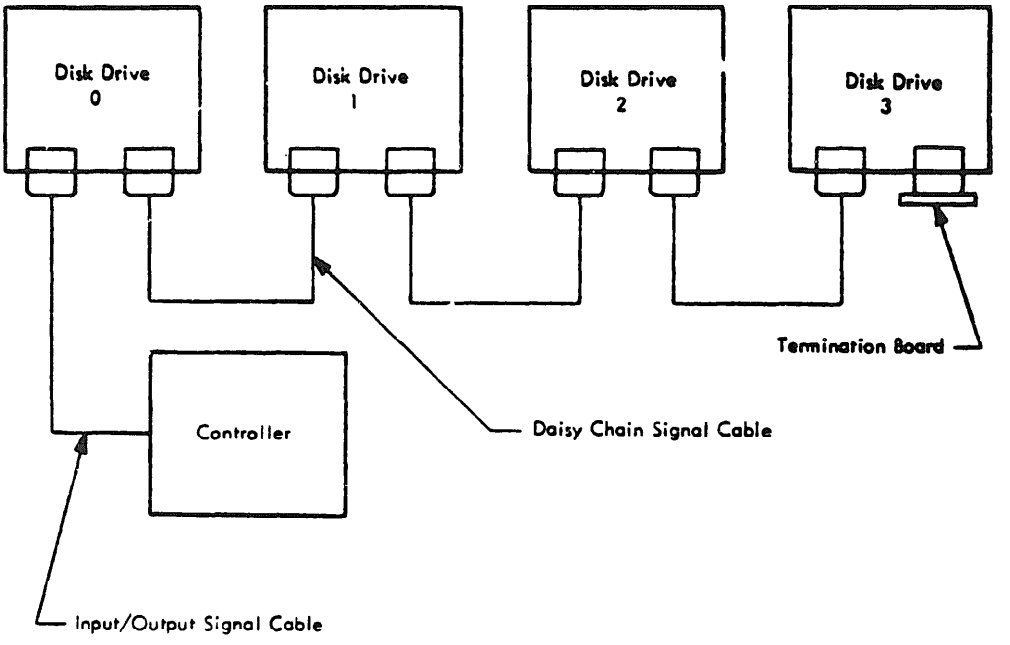


Figure 2-7, Daisy Chain Cabling Diagram

2.9.4 Power (+5 volts) to the drive terminator board can be supplied by either the controller or the last drive in the daisy chain. If the controller provides +5 volts to the drive terminator board, it must be the first device to be turned on, and the last device to be turned off. If the last drive in the daisy chain provides +5 volts to the drive terminator board, then it must be the first device to be turned on and the last device to be turned off,

SECTION III - SYSTEM INTERFACE

3.1 INPUT/OUTPUT INTERFACE (DRIVES WITH DAISY CHAIN OPTION

3.1.1 Input Receivers

The I/O interface for all drive input lines is an SP380A quad 2-input NOR gate. The input termination resistors require that the controller be able to sink 45 ma nominal, at 0.4 volts maximum. (Figure 3-1).

3.1.2 Output Driven (Control Signals)

The I/O interface for all control signals is a 7438 open-collector quad 2-input NAND gate, capable of sinking 48 ma, nominal. The termination shown below requires 45 ma and allows 2 standard gates to be driven without further buffering at the controlier. (Figure 3-1).

3.1.3 Output Drivers (Data Signals)

The I/O interface for data and clock signals is a 2N2369A open-collector high speed transistor, capable of switching 100 ma. The termination shown below is recommended for minimum line reflections. (Figure 3-1).

3.1.4 Double Termination

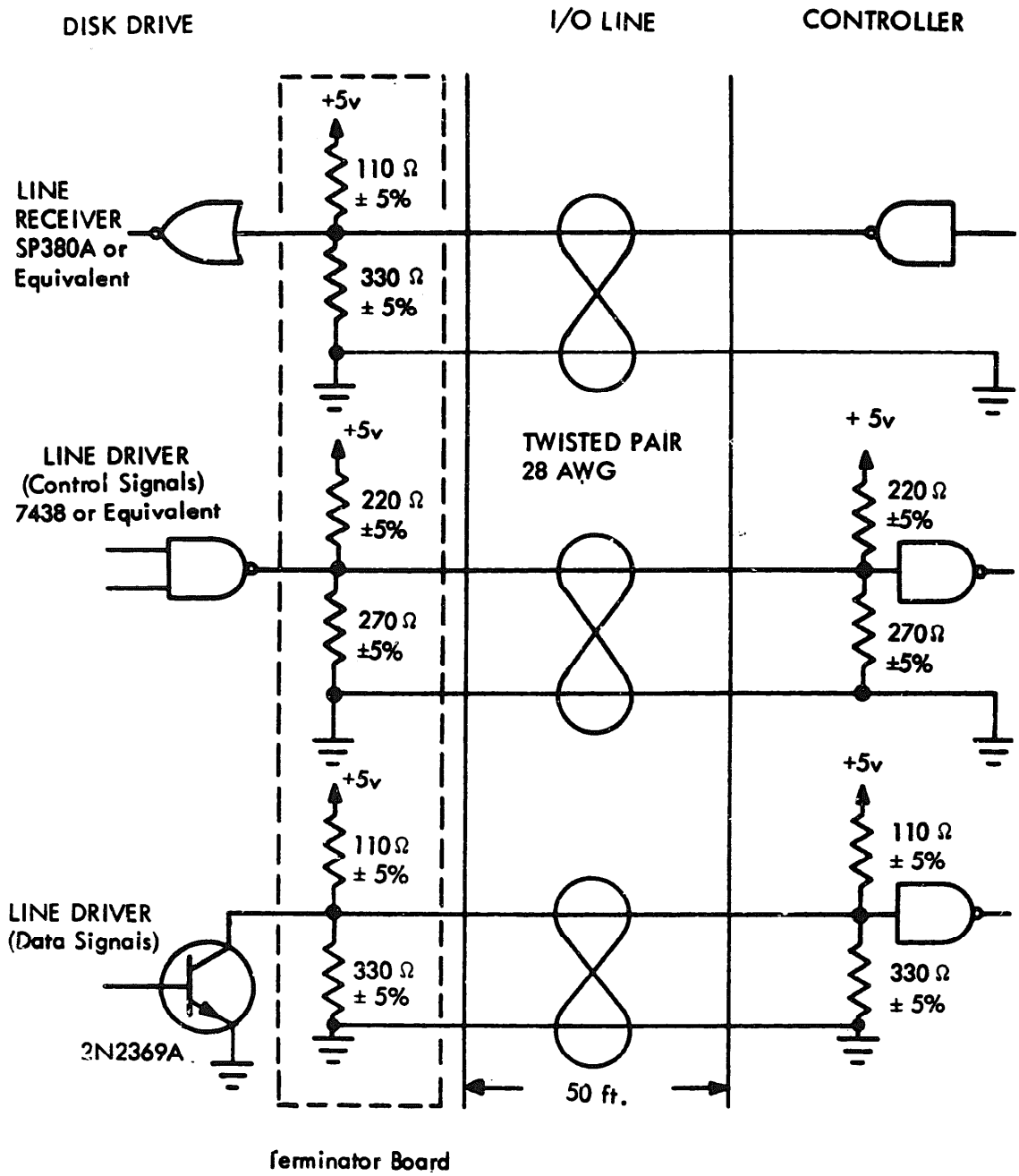
All output signals on the Model 303 Series Disk Drives are double terminated to prevent line reflections (i.e., terminated at driving and receiving ends) such that each drive in the daisy chain sees a properly terminated I/O line. (Figure 3-2).

If, for example, Drive 2 were selected, it will drive cable length 'A', terminated by the Termination Board, and cable length 'B', terminated by the Controller.

3.2 INPUT/OUTPUT INTERFACE (DRIVES WITHOUT DAISY CHAIN OPTION)

3.2.1 Input Receivers

The I/O interface for all drive input lines is an SP380A quad 2-input NOR gate. The input termination resistors, located on the DEM, require that the controller be able to sink 23 ma. nominal, at 0.4 volts maximum. (Figure 3-3).



NOTE: Termination resistance values shown may vary depending upon specific installations.

Figure 3-1. Line Driven and Receivers

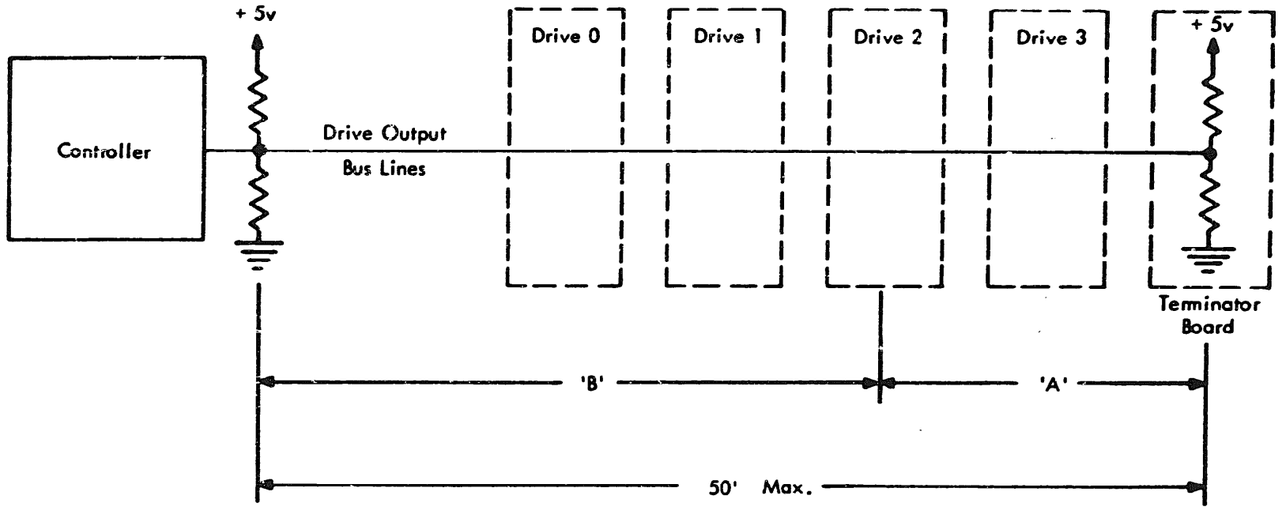


Figure 3-2. Double Termination

3.2.2 Output Drivers (Control Signals)

The I/O interface for all control signals is a 7438 open collector quad 2-input NAND gate, capable of sinking 48 ma., nominal. The termination shown below requires 45 ma. and allows 2 standard gates to be driven without further buffering at the controller. (Figure 3-3).

3.2.3 Output Drivers (Data Signals)

The I/O interface for data and clock signals is a 2N2369A open-collector high speed transistor, capable of switching 100 ma. The termination shown below is recommended for minimum line reflections. (Figure 3-3).

3.3 INTERFACE LOGIC LEVELS

Logical "1" is signified by a voltage level between 0 and + 0.6 volts. Logical "0" by a voltage level between + 2.7 and + 5 volts.

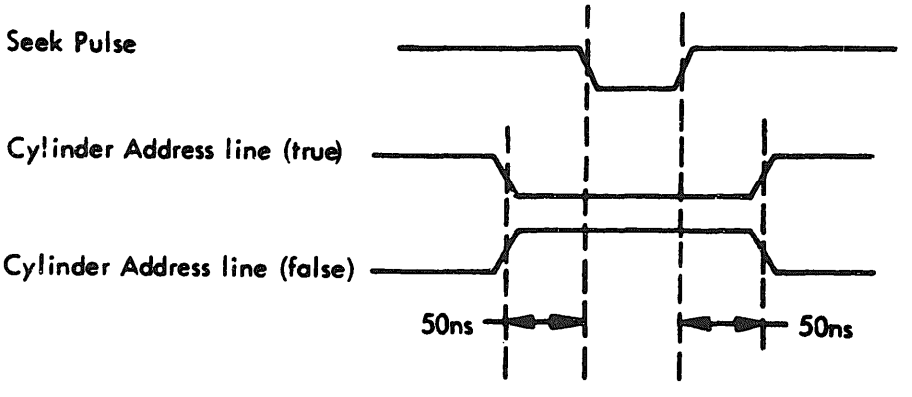
3.4 INPUT LINES

Unless noted, all input lines are gated (enabled) by Unit Select.

NOTE: All levels shown are taken at I/O connector

3.4.1 Cylinder Address

The Cylinder Address is transmitted on eight lines. These lines are strobed into an 8 bit address register by the cylinder seek pulse, and must be settled 50 nanoseconds prior to the seek pulse, and remain true 50 nanoseconds after the trailing edge of the seek pulse.



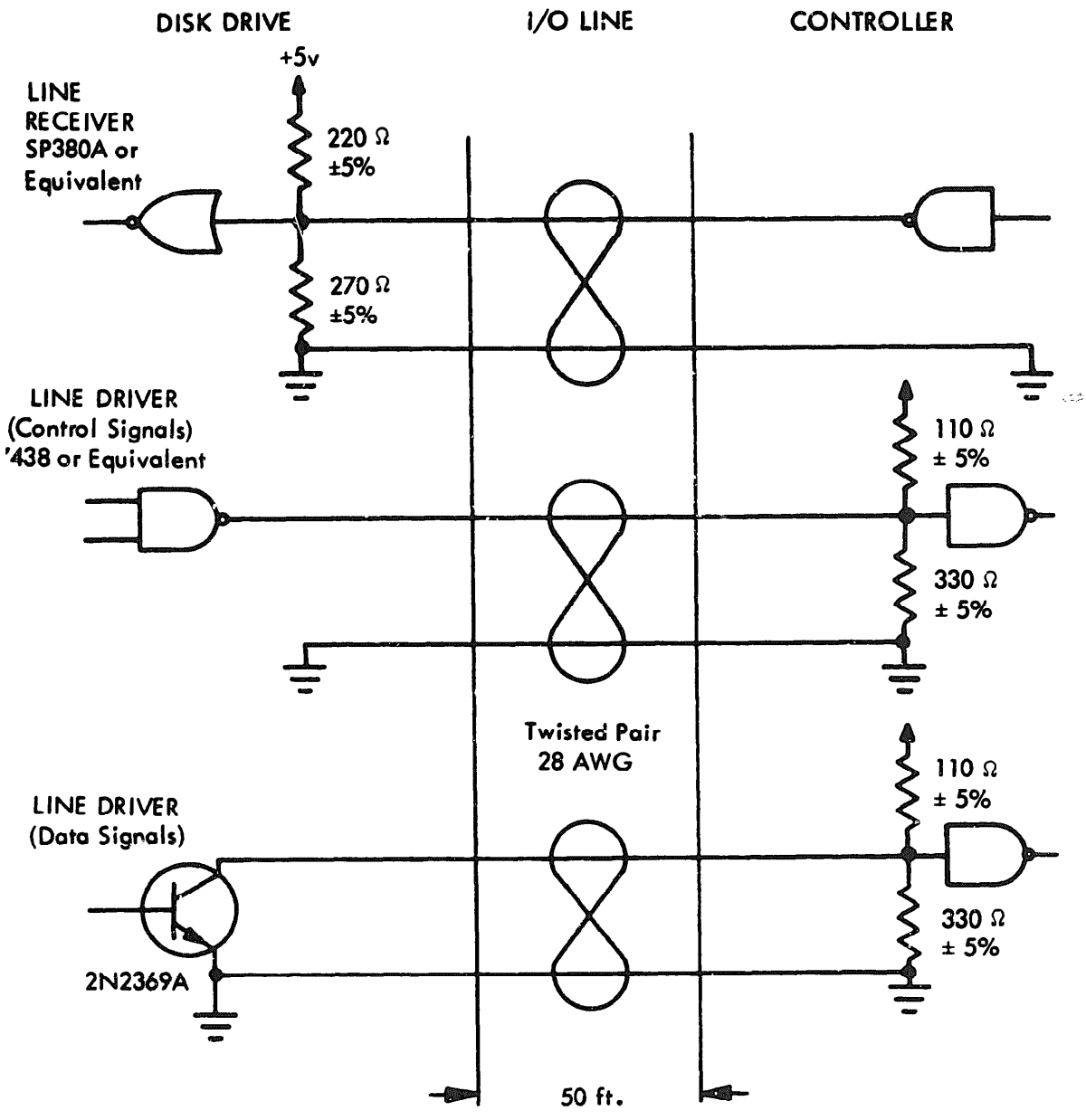


Figure 3-3. Line Drivers and Receivers (No Termination Board)

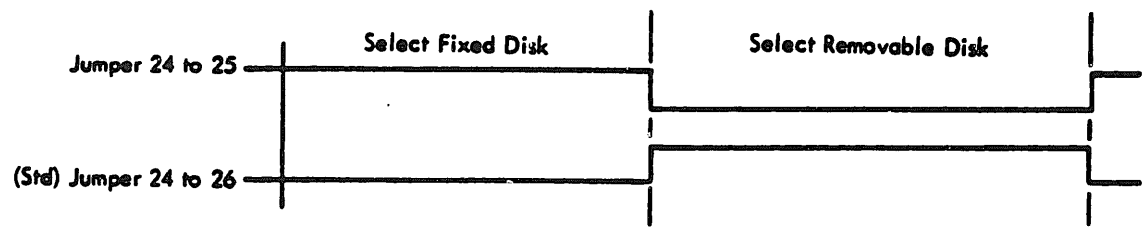
Each Cylinder is addressed using binary notation, as shown below:

Decimal Cylinder		Binary Address							
		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
204 Cylinders	000	0	0	0	0	0	0	0	0
	001	0	0	0	0	0	0	0	1
	002	0	0	0	0	0	0	1	0
	201	1	1	0	0	1	0	0	1
	202	1	1	0	0	1	0	1	0
	203	1	1	0	0	1	0	1	1

3.4.2 **Disk Select**

Disk Select is a one-input line which selects the fixed disk or the removable disk. The logic necessary for selecting the appropriate disk is made optional by selecting jumpers on the DEM, as shown below:

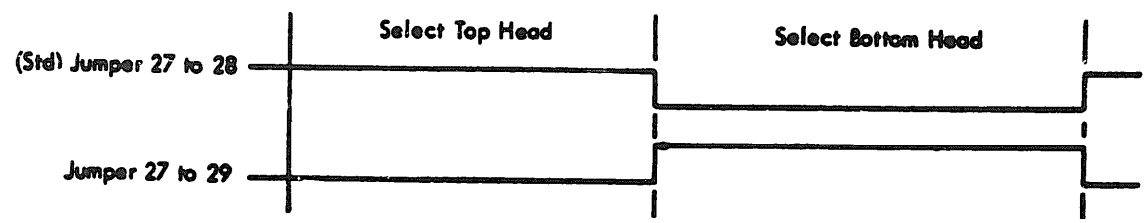
NOTE: Disk Select is not gated with Unit Select.



3.4.3 Head Select

The logic that permits this line to select the top disk surface or the bottom disk surface is optional by selecting the appropriate jumper on the DEM, as shown below:

NOTE: Head Select is not gated with Unit Select.



3.4.4 Cylinder Seek

This line provides a pulse that strobes the address information into the 8-bit address register in the drive unit. This pulse initiates the Cylinder Seek action, and must be a minimum width of 600 ns, with a rise and fall time of less than 150 ns.

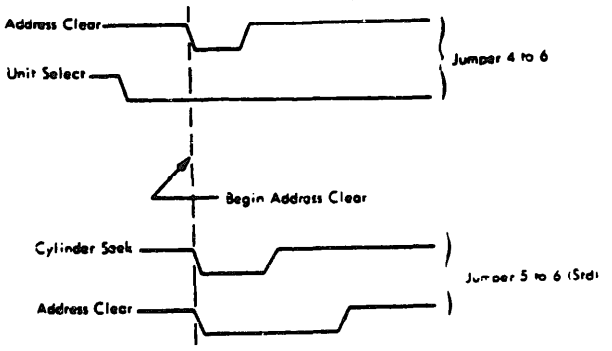
NOTE: A Cylinder Seek Pulse must not be issued prior to a valid Seek Complete or Seek Incomplete. See also Address Clear.

3.4.5 + 5 Volts

+ 5 volts D.C. at 1.4 amps maximum, 650 ma. nominal, from the Controller is fed through the I/O Cable and Daisy Chain cables to the terminator board, where it is used to drive the resistor networks of the terminator. In the event of a power shutdown of any drive in the daisy chain, the terminator will still be able to drive the I/O cables using this power source. As an additional option, by jumpering 1 to 2 on the DEM, the heads can be made to retract and go to the home position when this line goes to ground.

3.4.6 Address Clear

Address Clear is a pulse which (when used in conjunction with Cylinder Unit Select) will automatically position the heads at track "0". This function is automatic when an illegal address is issued unless defeated by optional jumper A to B (Standard) on the Drive Electronics Module (DEM), in which case the heads will remain at their present location.



NOTE: An Address Clear operation must not be started prior to a valid Seek Complete or Seek Incomplete.

3.4.7 Write Enable

This line turns on the write amplifier and edge erase when in the true state. The line must go false after the write operation has been completed. When the Option Board is installed, Crystal-controlled Write Clock Pulses appear on the Clock line when Write Enable is in the true state.

NOTE: Approximately seven microseconds are required before the Write Amplifier is fully turned on.

3.4.8 Read Enable (Optional)

This line turns on the read amplifier and Data Discriminator when in the true state, providing Read Clock pulses on the Clock line. Read Enable must be turned on during the preamble (a field of all zeros) such that a minimum of 20 microseconds is allowed prior to the Sync bit, to properly lock-in the Data Discriminator.

3.4.9 Write Data

The Write Data line carries the double frequency encoded write data from the Controller. NRZ encoding of write data is an option.

3.4.10 Unit Select

Unit Select consists of four lines and is selectable by a switch on the DEM within each drive, allowing each drive to be selected by any one of the four lines. See Section 2.5.

3.5 OUTPUT LINES - Unless noted, all output lines are active only when unit is selected.

NOTE: All levels shown are taken at I/O connector.

3.5.1 Drive Ready

This line indicates to the user that the disk drive is ready for operation. When the drive has achieved operational speed, all interlocks and safety circuits are satisfied, and heads are positioned over track "0", the line goes to a true level. Drive Ready remains true until such time that either inter-

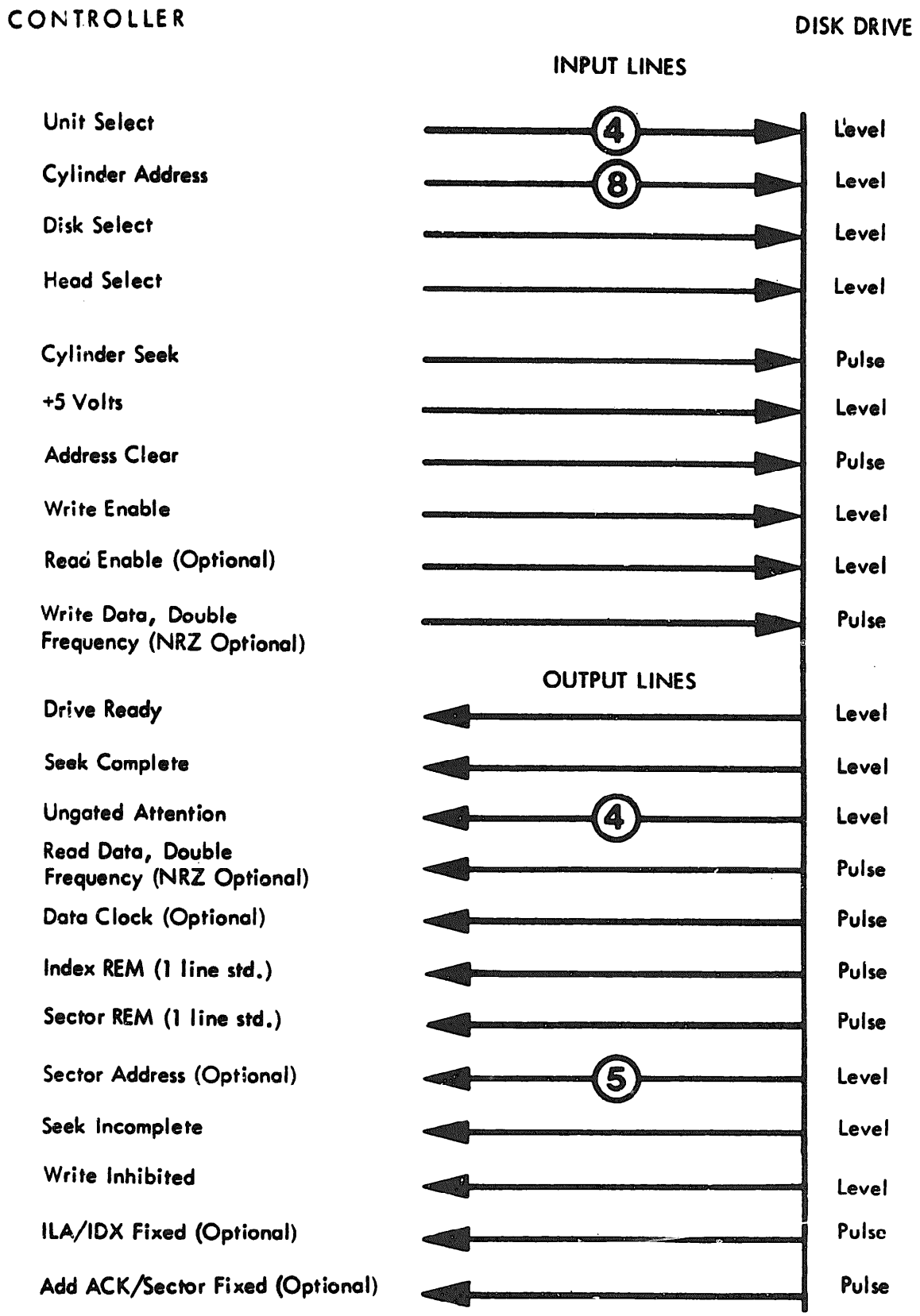


Figure 3-4. **Input/Output Interface**

locks are lost, safety circuits detect a malfunction, operational speed is lost, or Controller + 5 volts is lost (See paragraph 3.4.5).

3.5.2 Seek Complete

This line supplies a level to the user, indicating that the heads are positioned and stabilized. The drive is then ready to accept read or write commands. (Jumper 7 to 8, DEM, Standard).

Optionally, by jumpering 7 to 9 on the DEM, this line becomes inverted, offering the user a "Drive Seeking" level, which when true, indicates the drive is seeking a new cylinder.

Seek Complete must not be interrogated sooner than 500 ns after the leading edge of the Seek Command to guarantee a valid level. Optionally, by jumpering X to Y on the DEM, Seek Complete status will be delayed until nominally 4 microseconds after the leading edge of the Seek Pulse. (See Figure 3-5).

3.5.3 Seek Incomplete

This line supplies a true level 200 milliseconds after the Cylinder Seek pulse if the Seek Complete line indicates that an address has not been executed (jumper 21 to 22 , DEM). This line may also indicate a Seek Incomplete if an illegal address has been given (jumper 21 to 23, DEM, Standard). This line will be reset by the next Seek pulse or by an Address Clear operation, Section 3.4.6.

NOTE: Seek Incomplete Status may not be valid until approximately 60 μseconds following the Seek Pulse. (See Figure 3-5).

3.5.4 Ungated Attention

This function consists of four lines, one for each Unit Select I.D., and is selectable by a switch on the DEM. See Section 2.5. This signal indicates one of the following: That the heads are positioned and stabilized (Seek Complete); an illegal address has been written; or, the heads are not

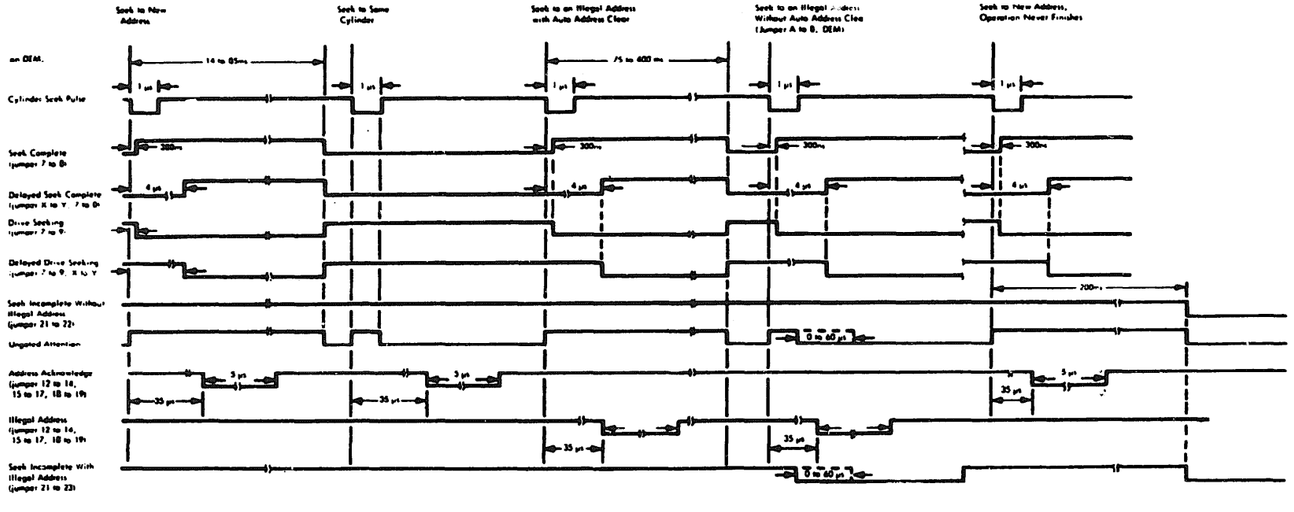


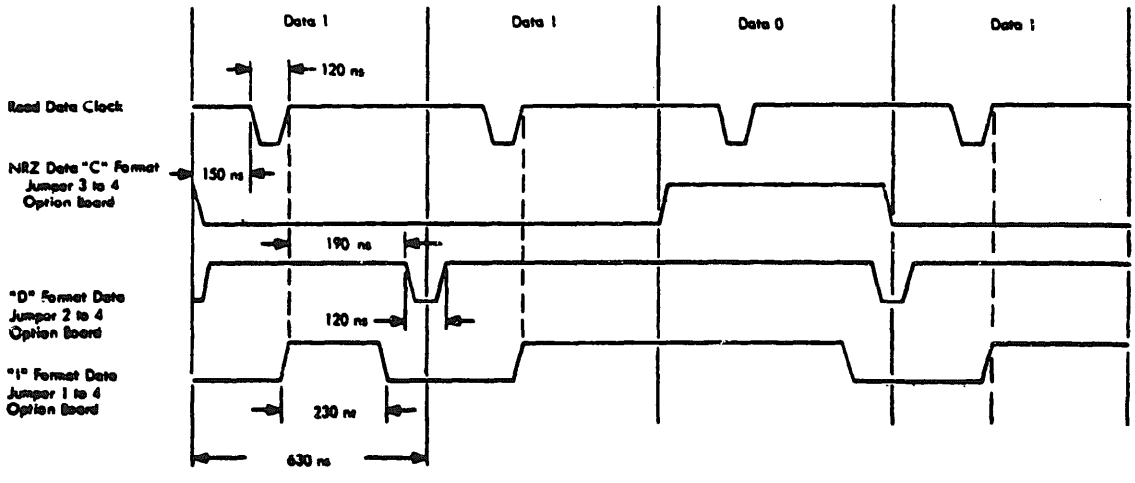
Figure 3-5. Seek Mode Timing Diagram

stabilized in 200 milliseconds (Seek Incomplete). This signal is not gated with Unit Select.

NOTE: Ungated Attention goes false for the duration of the Seek Pulse. (Figure 3-5).

3.5.5 Read Data

The Read Data line transmits double frequency encoded read data to the controller. When the NRZ option is specified, this line transmits decoded NRZ data, in one of three formats as shown below:



Note: Illustration is not to scale

3.5.6 Data Clock (Optional)

This line transmits the write or read clock for the data. The clock output is used by the controller to strobe the data.

3.5.7 Index

The Index line supplies a pulse for the index reference point on the disk. The index pulse is normally utilized to synchronize the controller's sector counter. This line is multiplexed by the Disk Select line, when jumpers E and F are connected on the DEM,(Standard) Individual index lines for each disk are optional by jumper on the DEM. See Section 3.5.8. Index pulses are nominally .75 µs wide.

3.5.8 ILA/IDX FXD

This line may be either an Illegal Address signal or a Fixed Disk Index signal by selecting the appropriate jumpers on the DEM, as shown below. If the ILA is selected, a pulse 5 µs wide, approximately 35 µs after the Cylinder Seek pulse, will appear when an illegal address is given. If IDX FXD is selected the fixed index pulse will appear at the appropriate time.

	FOR ILLEGAL ADDRESS OR ADDRESS ACKNOWLEDGE	FOR INDEX (FIXED DISK) OR SECTOR (FIXED DISK)
on DEM, jumper:	12 to 14	12 to 13 } Standard
	15 to 17	15 to 16 } Standard
	18 to 19	18 to 20 } Standard

3.5.9 Sector (Optional)

This line supplies a pulse at the beginning of each sector and is normally used to advance the controller's sector counter. This line is multiplexed by the Disk Select line, when jumpers E and F are connected on the DEM. Individual sector lines for each disk are optional by jumper on the DEM. See 3.5.10.

Sector Pulses are nominally .75 µs wide.

3.5.10 Add ACK/Sector FXD

This line may be either an Address Acknowledge signal or Fixed Disk Sector Pulses by selecting the appropriate jumpers on the DEM, per 3.5.8. If address acknowledge is selected, a 5 µs pulse approximately 35 µs after Cylinder Seek will appear if a legal address is given. If Fixed Sector is selected, sector pulses from the Fixed Disk will appear at the appropriate time.

3.5.11 Sector Address (Optional)

Sector Address consists of five lines which supply Sector Address information in binary format to the controller. Sector Address is reset to "0" by the trailing edge of the first sector pulse after the index pulse and the sector

I/O PIN ASSIGNMENTS

Description	Pin #	Return Pin #
INPUTS:		
Address 2^0	9	26
Address 2^1	5	20
Address 2^2	8	21
Address 2^3	4	19
Address 2^4	11	23
Address 2^5	7	21
Address 2^6	10	22
Address 2^7	6	20
+ 5 Volts (Retract by Controller power loss)	28	27
Address Clear	48	27
Seek	33	26
Unit Select 0	46	24
Unit Select 1	29	25
Unit Select 2	45	23
Unit Select 3	44	23
Head Select	32	26
Disk Select	49	27
Clock (Write/Read)	38	22
Read Enable	30	25
Write Enable	31	25
Write Data	50	27

Figure 3-6. Input Pin Assignments

I/O PIN ASSIGNMENTS

Description		Pin #	Return Pin #
OUTPUTS:			
* +5v		17	
Sector Address 2^0		14	24
Sector Address 2^1		12	23
Sector Address 2^2		13	24
Sector Address 2^3		15	25
Sector Address 2^4		16	26
Unit Address 0	Ungated Attention	43	22
Unit Address 1		42	22
Unit Address 2		41	21
Unit Address 3		40	21
Read Data		35	19
Seek Complete		39	20
Seek Incomplete		36	19
Ready		37	19
Index Removable		2	18
Sector Removable		3	18
Index Fixed/ILA		1	18
Sector Fixed/Add Ack		34	18
Write Inhibited		47	24

*Note: Termination voltage only and not supplied to Input/Output Connector

Figure 3-7, Output Pin Assignments

counter is advanced by the trailing edge of each sector pulse.

Sector Address is available up to and including 32 sectors only.

3.5.12 **Write Inhibited**

This line is true during all times that the Write Operation is inhibited.

3.6 OPTIONS

3.6.1 **Fixed Sector Format**

When this option is specified, the drive supplies sector pulses to the external control. This option requires the use of a special cartridge such as Caelus CM111/24. Up to 48 sectors are available. (Reference: Caelus Option No. 0205).

3.6.2 **Data Encoding/Decoding**

This option provides a crystal clock in the drive. It accepts data in NRZ form and encodes into double frequency for recording. In read mode a data discriminator is provided to separate clock and data. Availability of the fixed sector format is a prerequisite of this option. (Reference: Caelus Option No. 0200).

3.6.3 Data Decoding (Double Frequency)

For the user who supplies data in double frequency format, a read discriminator is available to separate clock and data. (Reference: Caelus Option No. 0201).

SECTION IV - OPERATION

4.1 MEDIA HANDLING

The magnetic recording disk is a precision instrument, requiring more careful handling than other media such as tape. This is most clearly seen in its relationship with the Disk Drive. The read/write heads on the Disk Drive float above the disk surfaces at 80 to 125 millionths of an inch. There is no actual physical contact between the heads and the disk except during the loading operation. This means that any deviation from an ultra-flat, uniform disk (or any particle larger than about 100 millionths of an inch, such as cigarette smoke or any other kind of contaminant) could cause head-to-disk interference and possible damage to the heads and disk.

Extreme care must be exercised to avoid contaminants entering the disk cartridge and to prevent a bent disk due to mishandling. To achieve maximum usage of a magnetic disk, it is necessary to become familiar with the proper methods of handling and operation. The life of the cartridge and disk can be extended indefinitely by observing the following procedures:

- Replace cracked, chipped or defective cartridges.
- Clean the cartridge periodically to remove dust and lint from the exterior of the housing, using a soft, lint-free cloth dampened with 91% isopropyl alcohol/9% water. (See paragraph 6.15.3).

CAUTION

Do not use medicinal isopropyl alcohols from a drug store. They often contain additives harmful to the disk cartridge and Disk Drive.

- A disk suspected of being damaged should be removed by a qualified Service Engineer until it can be inspected.
- Keep all foods, beverages and objects off the drive, and away from the disk cartridge. Any of these items can cause permanent damage to either disk or the Disk Drive, or both.
- If a cartridge has been dropped or is visibly damaged, DO NOT put it into operation.

- When a cartridge is not in use and the Drive is inoperable, remove the cartridge and ensure that dust and contaminants do not enter it.
- Store cartridges in an environment of 50 to 100°F with a relative humidity of 10 to 80 percent.
- Do not store disk cartridges close to magnetic fields. A flux field greater than 50 gauss at the cartridge will degrade data previously recorded.
- Use a storage cabinet made of fire-resistant material with a metal door. The cabinet should be kept clean and free of dirt and other contaminants.

CAUTION

Improper handling of the disk cartridges will not only cause disk damage but can cause extensive damage to the Disk Drive.

4.2 ACCLIMATIZATION

The disks are made of precisely machined aluminum with a magnetic oxide coating. They will expand and contract with significant changes in temperature. If the ambient temperature at the point-of-use is less than 50°F. or more than 100°F., the disk must be conditioned to the point-of-use temperature for a minimum of two hours before mounting it on the Drive. This prevents loss of data due to a shift in track location.

4.3 OPERATOR CONTROLS AND- INDICATORS

An operator control panel, which may be mounted remotely, is mounted on the front of the drive and contains the fallowing functions:

4.3.1 Power Switch

The power switch is mounted on the front panel of the disk drive. When activated, AC power is applied to the drive. Approximately 30 seconds after applying AC power, the STOP Light will come on, indicating that the cartridge latch may be opened to remove or insert the Disk Cartridge.

4.3.2 Power Indicator

When lit, the Power Indicator indicates the AC power is applied to the drive.

4.3.3 Start/Stop Switch

The Start/Stop Switch is a maintained contact switch which applies power to the spindle motor and initiates the start-up cycle, when it is turned to the start mode. When put in the stop mode, it removes power from the spindle and initiates the stop cycle.

4.3.4 Ready Indicator

At the successful completion of the start-up cycle, the Ready Indicator is lit. The start-up cycle requires 35 seconds after the Start/Stop Switch is activated.

4.3.5 Stop Indicator

At the conclusion of the stop cycle, when the motor comes to a complete stop and the disk cartridge is unlocked, the Stop Indicator is lit. The Stop cycle requires 30 seconds nominal after the Start/Stop Switch is turned to Stop.

4.3.6 Write Inhibit Switches

Write Inhibit Switches are mounted on the top of the disk drive shroud, one for each of the two disks. When activated the respective disk can not be written upon.

4.4 DISK CARTRIDGE LOADING AND SAFETY INTERLOCKS

The CMIII disk cartridge used on the Model 303 Disk Drives is sealed in a dust free container. To open the cartridge, the slide button on the handle must be actuated while raising the handle. This will release the bottom cover exposing the disk to the disk drive spindle. The drive must have power on and the stop light lit. This unlocks the latch mechanism and allows the operator to open the latches. The disk cartridge is then lowered into place and the handle lowered. The cartridge is keyed so that it cannot be installed rotationally incorrect. The bottom cover is then inverted, placed on top of the cartridge and the latches closed. If the bottom cover is not installed, interlocks will prevent the drive from starting. If the latches do not close over the cover, the cartridge is incorrectly installed.

4.4.1 The Start/Stop Switch can now be placed to the start position. This turns off the stop light, locks the latches, starts the disk rotation and the brush cleaning cycle. Thirty-five seconds later the heads will position to cylinder 000 and the ready light will come on.

4.4.2 Upon stopping the drive there is a nominal 30 second time delay to allow the disk to stop. At the end of that time the stop light will come on if the heads are fully retracted and the brushes are in the home position. If these conditions are met the latches will unlock enabling the operator to open the latches and remove the cartridge. Should the power be removed from the drive or the power switch turned off while the latches are closed, they will lock and prevent cartridge removal.

4.4.3 The cartridge is removed by actuating the slide button on the handle while raising the handle. Then lift the cartridge out, install the bottom cover, and lower the handle, locking the bottom cover in place.

4.4.4 The handle may then be raised without actuating the slide button and used as a carrying handle without the bottom cover coming off.

4.5 CMIII DISK CARTRIDGE

4.5.1 Carrying Handle

The handle is raised into the upright position for removal of the cartridge from the bottom cover and from a drive. It is used for carrying of the cartridge in this position. The handle is lowered into the cartridge top cover recess for storage and when the cartridge is installed in the drive.

4.5.2 Cartridge Release Button

With handle in the lowered position, the release button can be slid with the thumb in the direction of the arrow and the handle raised to unlock the cartridge from the bottom cover or from a drive.

4.5.3 Top Cover

The top cover is not removable from the data disk. It forms a permanent protective cover for the disk at all times; in storage or operation.

4.5.4 **O-Ring Gasket**

This gasket forms a dust seal between the top and bottom covers protecting the data disk during storage.

4.5.5 **Clamp Ring**

The clamp ring secures the data disk to the cartridge hub.

4.5.6 **Draw Plate**

The draw plate lifts the hub away from the magnet of the bottom cover or the drive spindle when the release button and handle are operated simultaneously, releasing the cartridge for removal.

4.5.7 **Data Disk**

The data storage disk is a rigid aluminum substrate coated with an iron oxide formulation designed specifically for compatibility with the read/write heads.

4.5.8 **Hub**

The hub is the rotating core of the cartridge upon which the data disk and all other rotating components are mounted.

4.5.9 **Armature Plate**

This plate contains index and sector slots for data timing and is also the magnetic attaching device for the bottom cover and drive spindle.

4.5.10 **Protective Cover**

This internal cover protects the bottom surface of the data disk when the bottom cover is removed.

4.5.11 **Bottom Cover**

The bottom cover protects the disk from contamination and damage. It is removed from the cartridge for loading into the drive and inverted and placed over the cartridge during the operating mode.

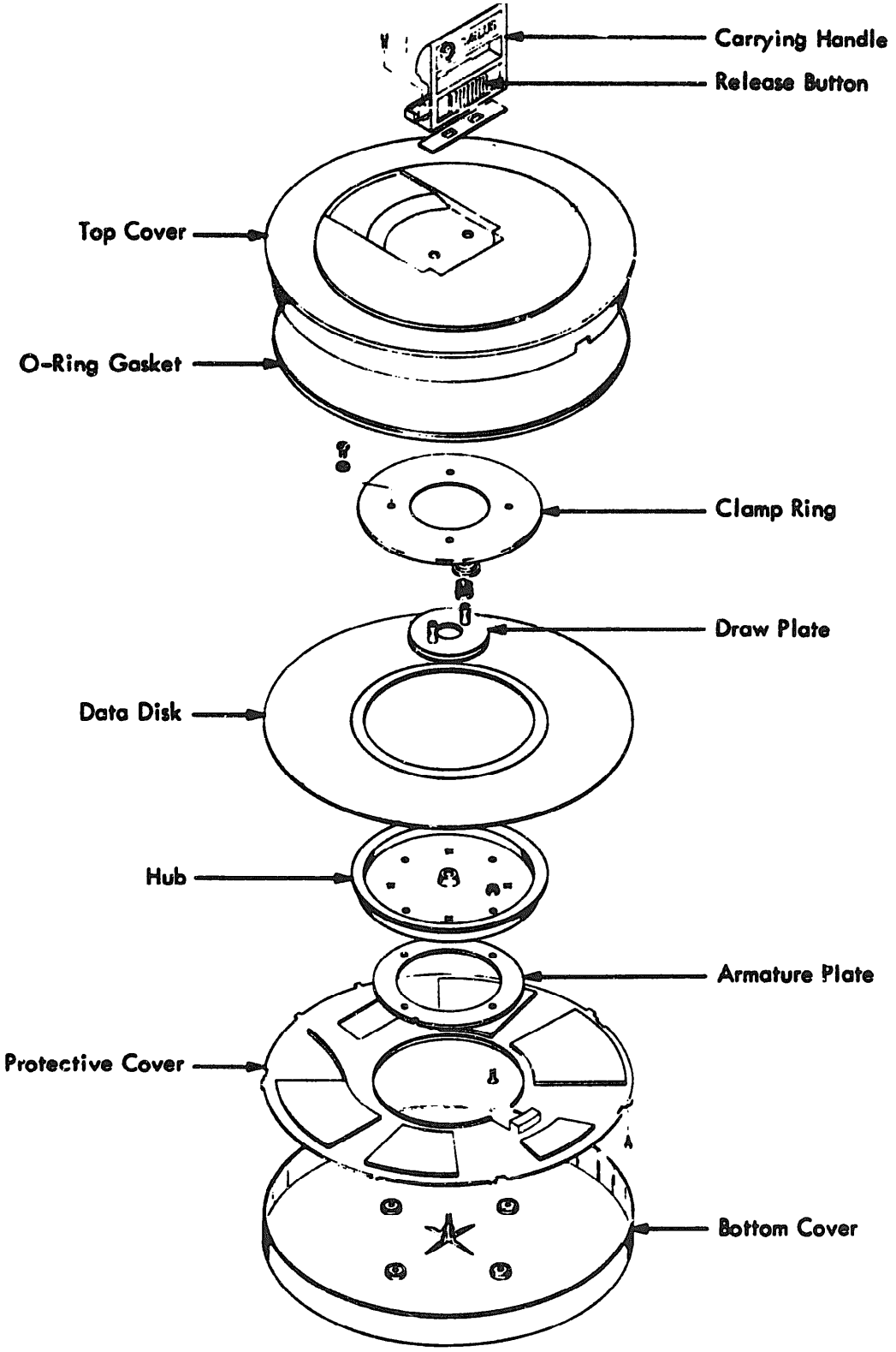


Figure 4-1. CMIII Cartridge

4 . 6 CARTRIDGE LOADING SEQUENCE

Be sure that drive power in On, the START/STOP switch is in Stop position and the Stop indicator is lit. This will allow cartridge latch arms to be unlocked and retracted.

CAUTION

Do not set cartridge on the rear part of the drive cover as magnetism from the Positioner Motor may degrade data on the disk.

Slide Release Button to the unlocked position to release bottom cover.

Lift carrying handle to the upright position while holding the release button in the unlocked position.

Lift cartridge clear of the bottom cover while holding bottom cover securely with the left hand.

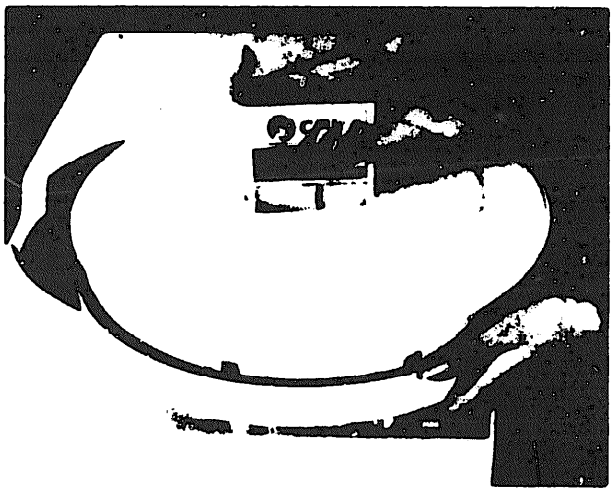
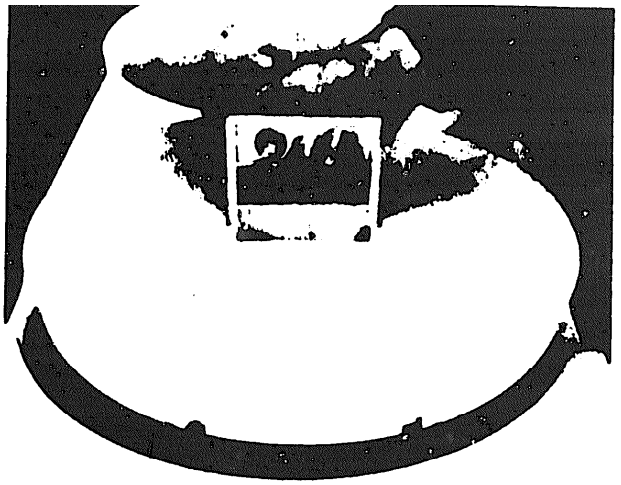
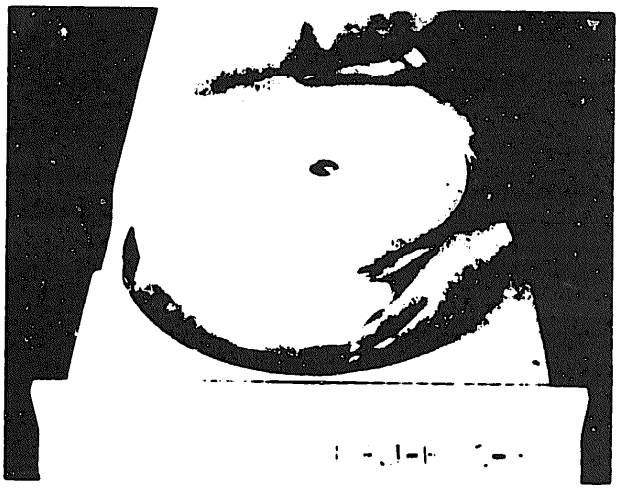


Figure 4-2. Cartridge Loading Sequence

With the Caelus logo on the carrying handle facing towards the front of the drive, lower the cartridge onto the drive spindle.

Once the cartridge is set firmly in place lower the carrying handle, allowing the cartridge hub to make contact with the spindle magnet.





Invert the bottom cover and place it evenly on top of the installed cartridge.

Move the cartridge latch arm into the locked position, moving the locking arms over the top of the cartridge, securing it to the drive.

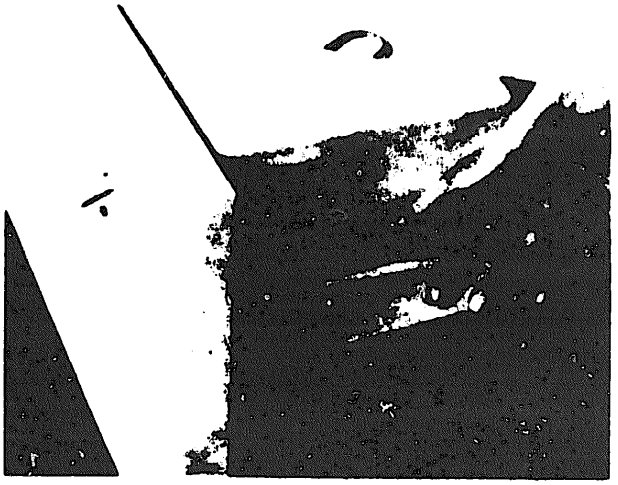


Figure 4-2. Cartridge Loading Sequence

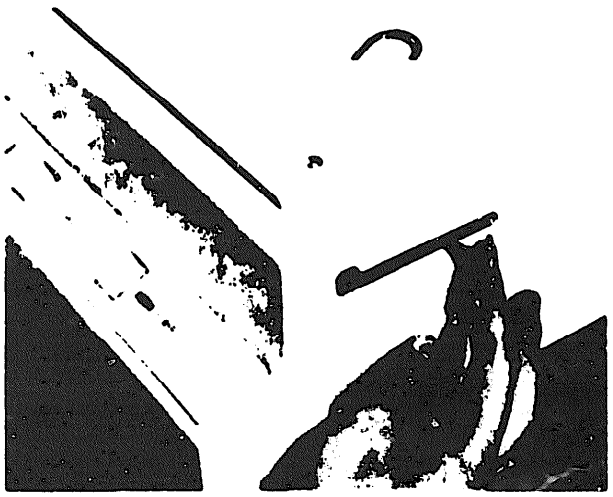
4.7 CARTRIDGE REMOVAL SEQUENCE

The drive START/STOP switch must be turned to the Stop position. The disk takes nominally 30 seconds to stop spinning. During this time the cartridge latch solenoid is locked and the cartridge cannot be removed.

CAUTION

No attempt to remove the cartridge must be made until the Stop indicator comes on.

NOTE: A CMIII cartridge should be installed on the drive when not in use to protect the fixed disk from contamination.



Retract the locking arms from over the cartridge by moving the latch arm to the forward position.

Remove the inverted bottom cover, exposing the cartridge.

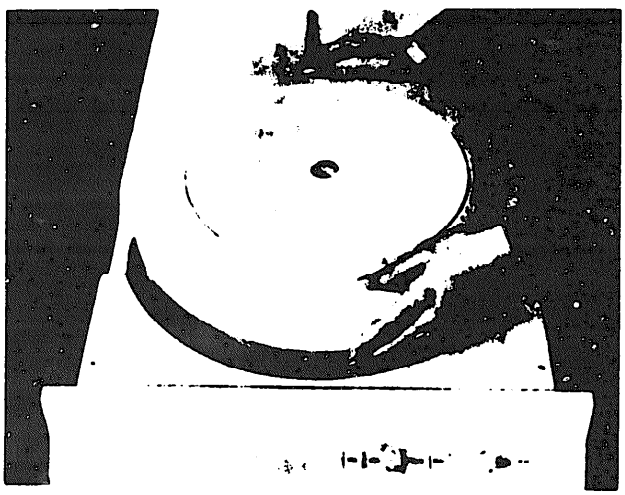


Figure 4-3. Cartridge Removal Sequence

Slide the release button to the unlocked position and lift the carrying handle to the upright position while holding the button. This releases the cartridge from the spindle magnet.

Lift the cartridge clear of the spindle housing and replace the bottom cover onto the cartridge to protect it from contamination.

Lower the carrying handle into the cartridge recess, locking the bottom cover. The handle may then be raised again to the carrying position.

Figure 4-3. Cartridge Removal Sequence

4 . 8 SYSTEM OPERATION

4.8.1 Operation Online

Once the Ready Indicator is lit, the Drive is ready for Online operations, under Computer Control. During this time, the following comments apply:

- DO NOT TURN either the Power or Start/Stop Switches off while the drive is accessing, to prevent inadvertent data loss, should the drive be in a write mode at the time.
- DO NOT SLIDE the Drive in or out of its enclosure, to prevent possible jarring of the heads during an operation.
- Flic g of the Ready and Power indicators is normal and indicates that the drive is accessing to a different cylinder location.

4 . 8 . 2 Power Failure

In the event of AC Power Failure, the heads will retract to the home position. Upon regaining power, a normal Start cycle (35 seconds) will be initated automatically, and the heads will position to Cylinder 000.

4.8.3 Write Inhibit Switches

Write Inhibit Switches are used by the operator to prevent data from being written on either or both disks. The switch settings should not be changed during an operation, to prevent inadvertent data errors.

4 . 9 OPERATOR MAINTENANCE

The only operator maintenance required is to ensure that the shroud area, into which the disk cartridge rests, is kept clean of all contaminants. The shroud and disk cartridge should be wiped clean frequently to prevent contaminants entering the disk cartridge or the fixed disk (under the shroud). Use of the Caelus Cleaning Kit is recommended. See Section 6.3.3.

4.10 OPERATOR TROUBLESHOOTING GUIDE

SYMPTOM	POSSIBLE CAUSE	REMEDY
1) Power Indicator does not lite	- Burned out bulb or fuse - Power cord unplugged - Main system power off	Call Field Service Personnel
2) Latch does not operate after 30 seconds/light inoperative	- Circuit problem	Call Field Service Personnel. DO NOT force latch
3) Motor does not turn when Start/Stop Switch turned on	- Cartridge improperly seated	Re-seat cartridge
	- Cover left off	Install cartridge cover
	- Motor overheated	Allow a few minutes to cool down. If problem re-occurs, call Field Service Personnel
4) Heads do not load, no ready light	- Shipping hardware installed	Call Field Service Personnel
	- Termination Board not installed (on drives that require one)	Install Terminator Board
5) Head retract during accessing operations	- Overcurrent sensed	Turn Power Switch off for one second; if symptom re-occurs, call Field Service Personnel

SECTION V - CIRCUIT OPERATION

5.1 GENERAL

The electronic circuits of the Model 303 Disk Cartridge Drives have been designed for high reliability and ease of maintenance. To facilitate troubleshooting, the circuit cards used provide test points located at strategic electrical locations within the circuits providing a rapid point-to-point signal tracing technique which isolates a malfunction to a particular circuit card.

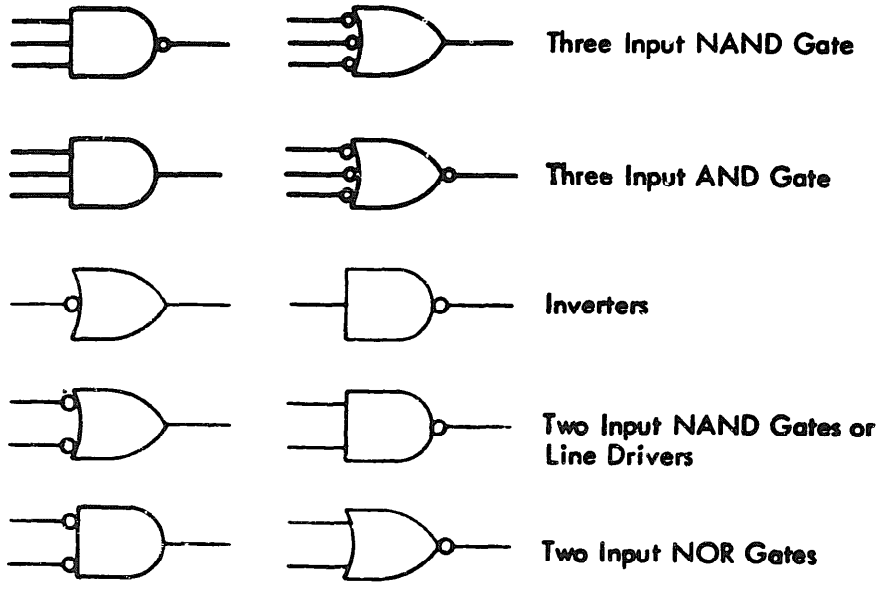
5.1.1 Circuit Cards

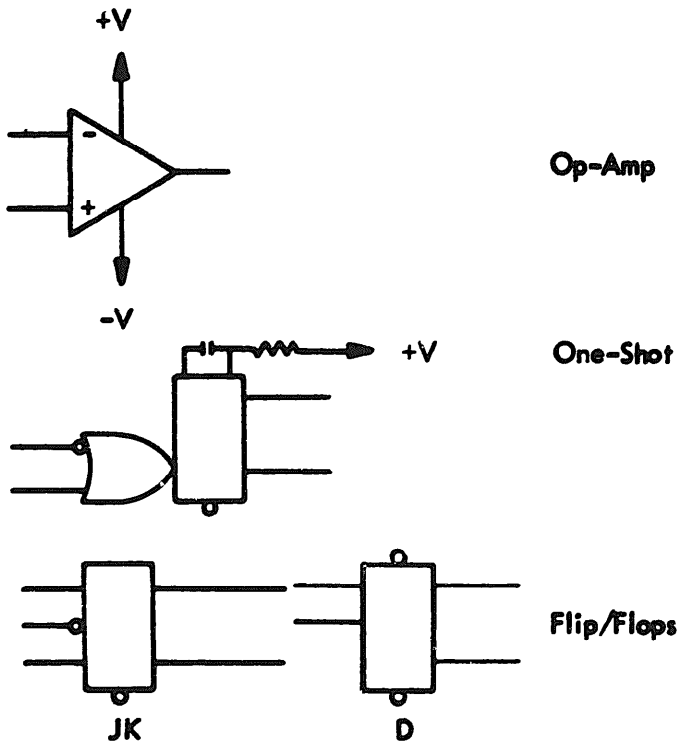
The Model 303 Disk Drives contain the fallowing circuit cards:

- Drive Electronics Module (DEM)
- Read/Write Module (R/WM)
- Power Control Module (PCM)
- Option Board (available upon request only)

5.2 LOGIC SYMBOLS

The following logic symbols are used in this section:





5.2.1 I.C. and Connector Numbering

I.C. numbers in this text follow the example below:

IC 27/6 indicates IC 27, pin 6

Similarly, J6/3 indicates J6, pin 3

A small circle, o, at the input of a logical symbol indicates a low signal on that line activates the input. A small circle, o, at the output of a logical symbol indicates a low signal is present when the function is activated. Similarly, a (-) after a signal name indicates a low signal is present when activated.

5.3 FUNTIONAL BLOCK DIAGRAMS

The following Block Diagrams represent three functional configurations of the Model 303 Disk Drive:

- Figure 5-1: Without Option Board; DF data in, DF data out
- Figure 5-2: With Option Board; NRZ data in, NRZ data out
- Figure 5-3: With Option Board; DF data in, NRZ data out

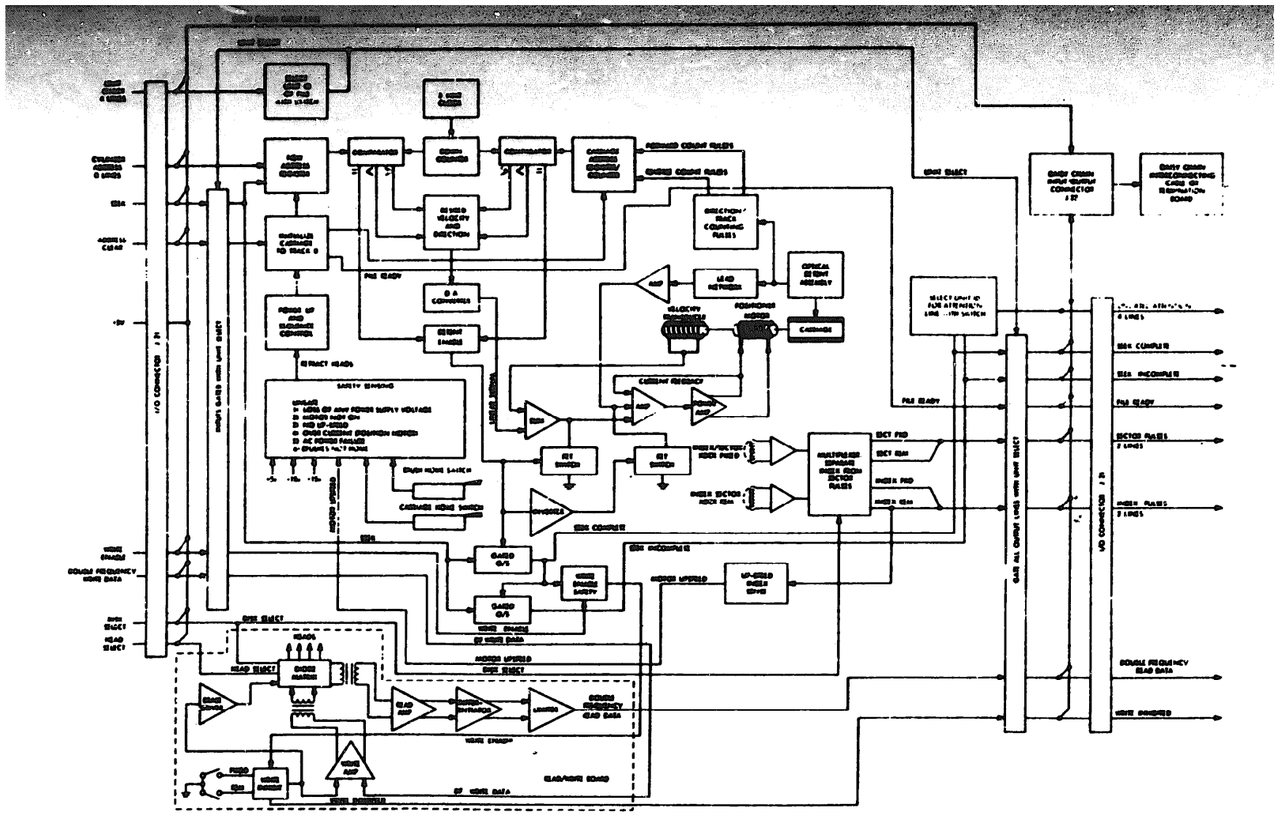
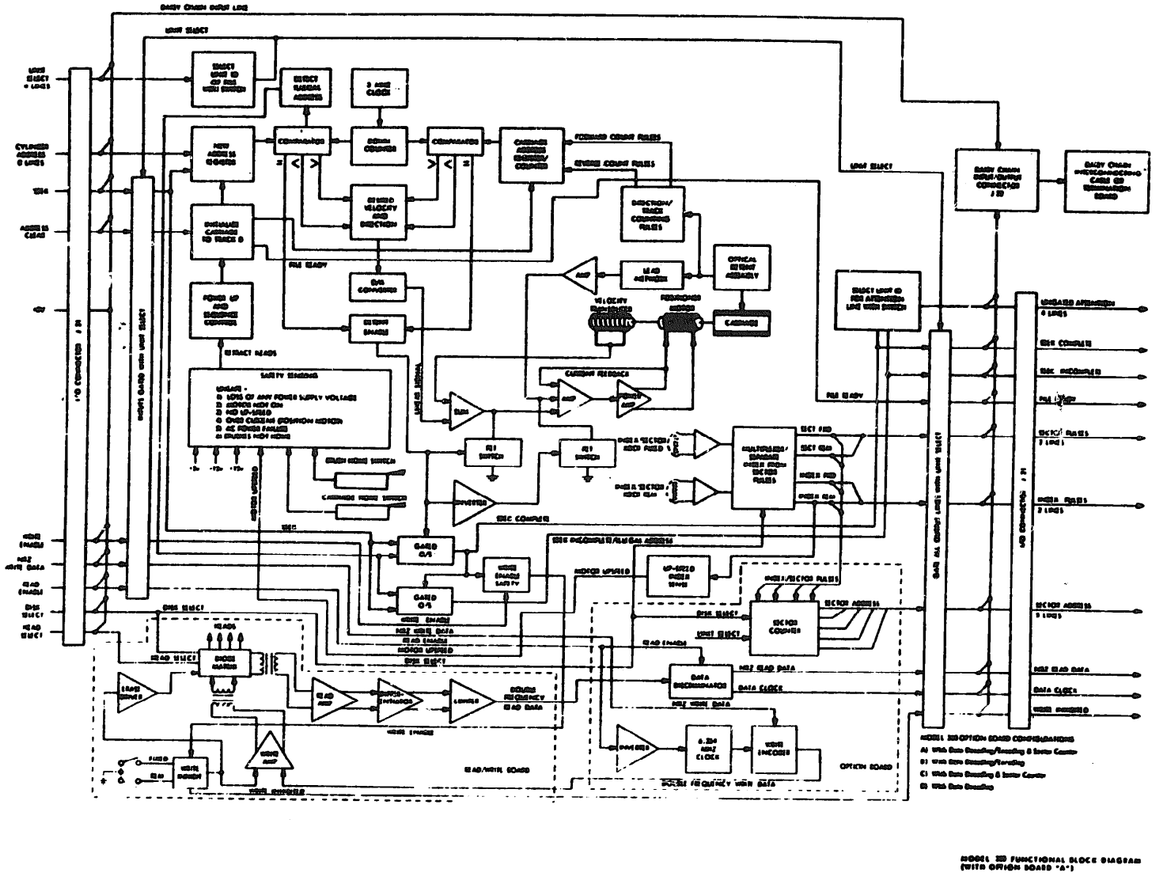


Figure 5-1. Functional Block Diagram TO 31S5-4-519-1



MODEL 33D FUNCTIONAL BLOCK DIAGRAM
(WITH OPTION BOARD "A")

TO 31S5-4-519-1

Figure 5-2. Functional Block Diagram, With Option Board "A"

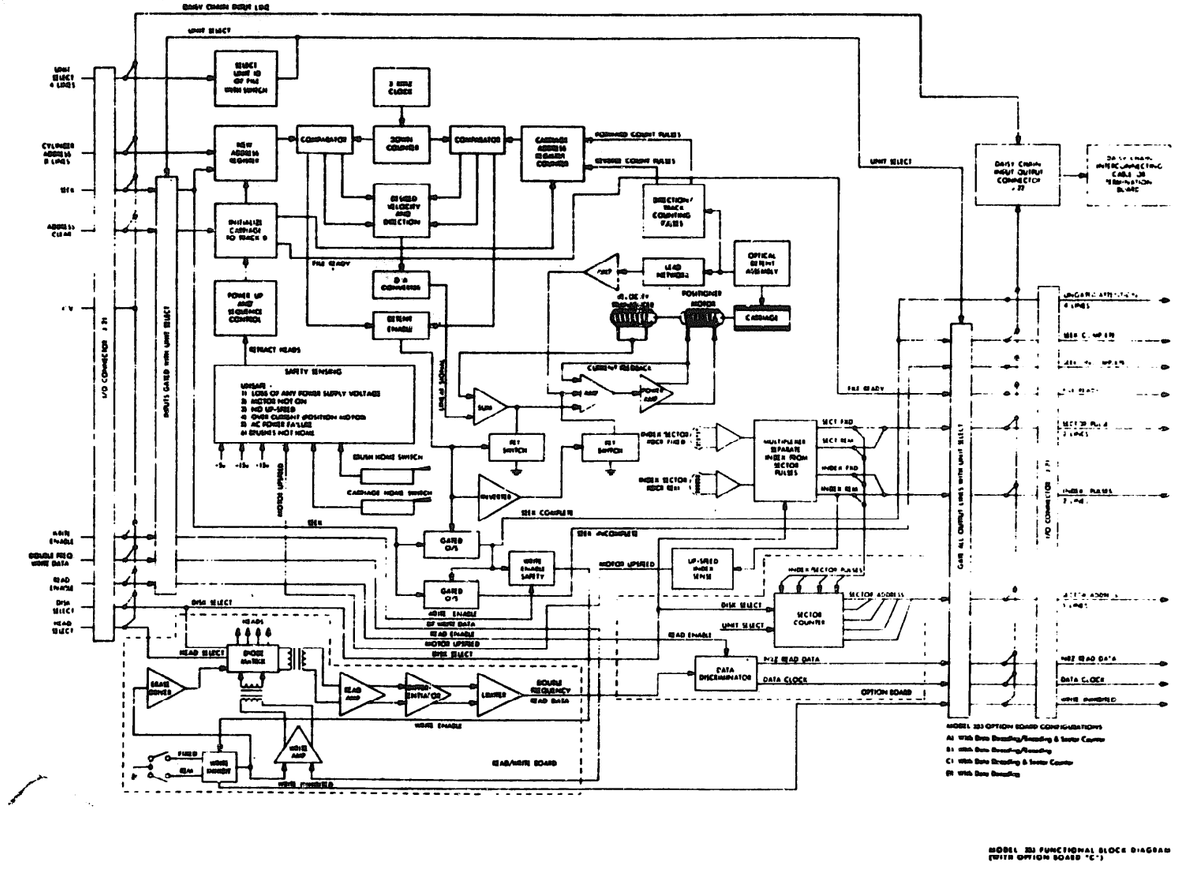


Figure 5-3. Function Block Diagram, With Option Board "C"

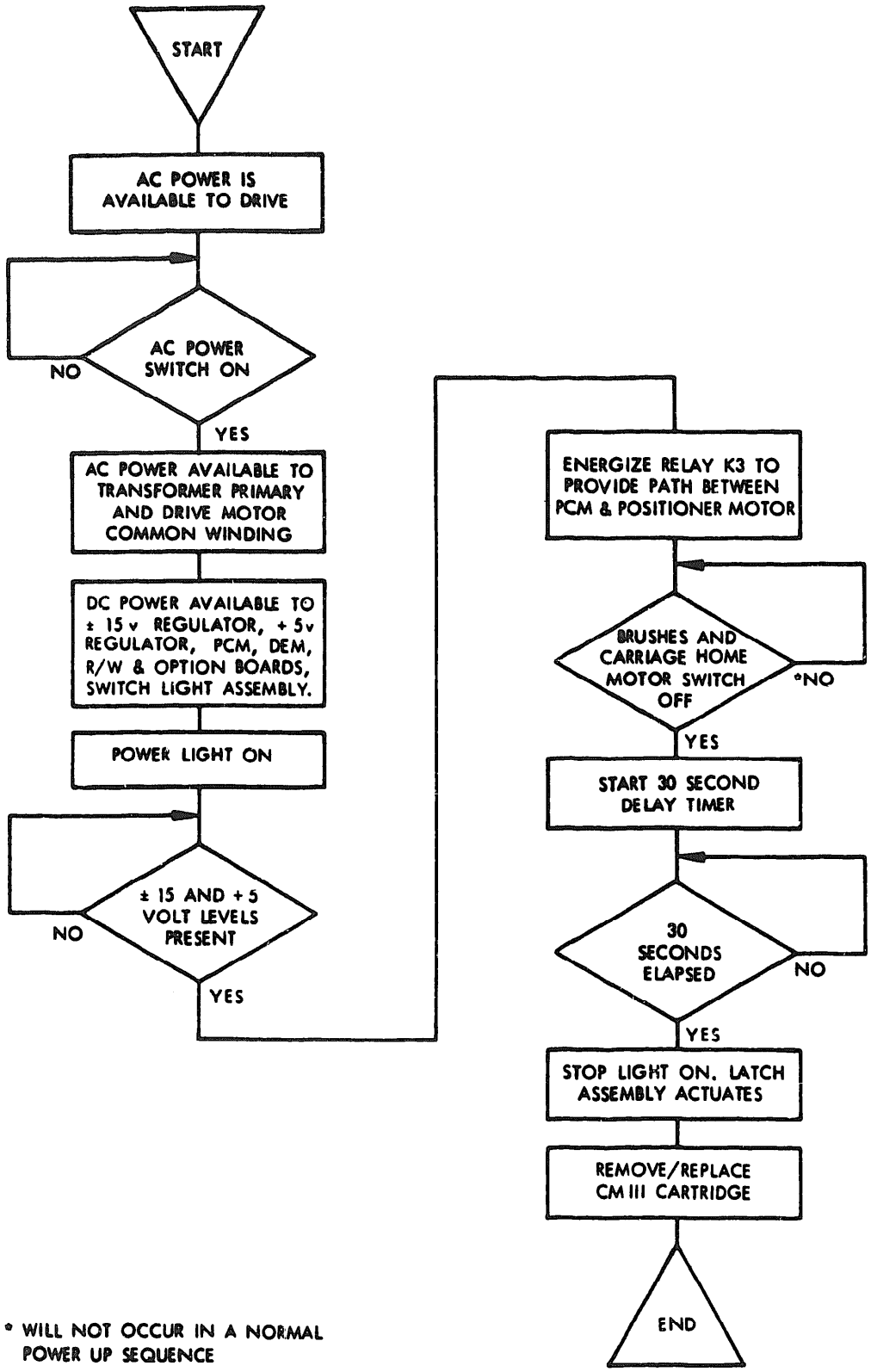


Figure 5-4. Optional Flow Chart Up/Install Cartridge

5 . 4 DRIVE ELECTRONICS MODULE (DEM)

The Drive Electronics Module is a multi-purpose circuit card containing controller interface and the following internal logic functions:

Unit Select Circuit
Safety Circuits
Latch Solenoid Logic
Index/Sector Circuit
Power On Logic
Drive Initialization Circuit
Drive Ready Circuit
New Address Register (NAR)
Servo Clock Circuit
Illegal Address Circuit
Carriage Address Register (CAR)
Digital-to-Analog Converter Circuit
Servo Positioner Control Circuit (Coarse Loop)
Servo Positioner Control Circuit (Fine Loop)
Detent Amplifier Circuit
Seek Incomplete Circuit
Address Clear Circuit

The DEM controls four major functions of the Disk Drive:

- Power Up
- Drive Initialization
- Programmed Seek
- Power Down

The circuits listed above will be described in detail, as they relate to these four functions.

5.5 POWER UP SEQUENCE

Figures 5-4 and 5-5 indicate the sequence of events that take place when System Power is applied to the Disk Drive.

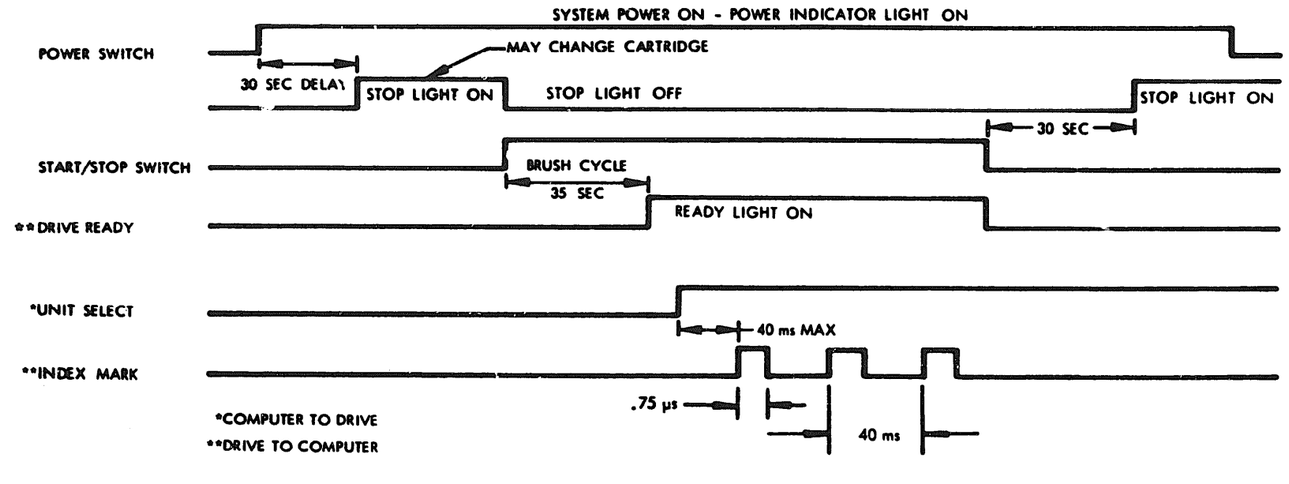


Figure 5-5. Power-Up/Power Down

5.5.1 Unit Select Circuit

For purposes of Daisy Chain interconnect of more than one Model 303 drive, Unit Select signals from the Controller are selectable by switch on the DEM within each file. Any individual drive can be chosen, per the table in paragraph 2.5.

Grounding TP N will cause the Drive to be selected, if not connected to external control.

All input and output lines with the exception of Head Select, Disk Select, and Ungated Attention, are enabled by Unit Select.

5.5.2 Safety Circuits

The following conditions must be complied with to satisfy the interal safety requirements of the 303 drives:

- + 5 volts must exist at Diodes CR15 - CR18, enabling IC 27/1
- + 15 volts must exist (IC9/4)
- - 15 volts must exist (IC 10/11)

If any of the above conditions are not met, IC 10/13 (RLY + and VOLTAGE SENSE +) remains false, preventing Drive Initialization.

- Brushes must have completed 30 second cycle (J7/3).
- Spindle motor must be on (J7/2).
- Up-Speed signal must be true (IC30/6); Spindle motor must have reached 70% of operational speed.
- Positioner coil overcurrent can not be true for more than 5 seconds (IC27/6).
- AC power loss (+) at J7/14 must be false.
- Controller + 5V must be true if jumper pins 1 and 2 are connected.

5.5.3 Latch solenoid Logic

During the Power-Up and Stop sequences, whenever UPSPEED (+) is false (IC 18/2), the carriage is home (IC 18/3),MOTOR ON (-) is false (IC 35/2), and BRUSH HOME (+) is true (IC 35/13), IC's 19 and 28 are enabled to count

5.5.3 (cont) six (6) safety circuit clock pulses (IC 27/11) which, after 30 seconds, cause the STOP (+) command at IC 10/10 to release the cartridge receiver door latch and illuminate the STOP indicator.

5.5.4 Index/Sector Circuits

While the disks are rotating, the Index/Sector circuits amplify and shape the pulses transmitted from the magnetic reluctance-type index/sector transducers, and monitor the rotational speed of the disks.

The outputs of the fixed and removable transducers (J20) are shaped by Schmidt triggers IC13A and 13B. The removable disk index signal is delayed by an adjustable one-shot, IC 38/9 to provide for index alignment to a C.E. cartridge. During the time the disk is stopped, false triggering of IC 38 is prevented by DISK STOP (-) at IC 38/11.

Index and sector signals of both transducers are further shaped at IC's 30 and 38 (removable disk) and IC 47 (fixed disk); these signals are fed to the Option Board, J9, for the sector counter and to the multiplexer, IC 37. If the multiplex function is desired, E and F must be jumpered together connecting the Multiplex chip to the Disk Select Line. The Multiplex chip is enabled by Unit Select at IC 37/15.

The Multiplex outputs drive IC's 20 and 29 which separate the index and sector pulses. Jumpers 12 through 20 are used to connect the Illegal Address/Address Acknowledge pulses to the Fixed Index and Sector Lines.

IC 30/6 is an Up-Speed detector which is driven by the index signal of the removable disk transducer and is in turn provided to the Up-Speed Safety circuit. IC 30/6 is reset if VOLTAGE SENSE (+) at IC 30/3 goes false. If a removable cartridge without sector marks is used, a jumper must be installed between jumper points "C & D" on the DEM.

5.6 DRIVE INITIALIZATION

Figure 5-6 indicates the sequence of events that take place as upspeed is reached, and the heads position at track 000.

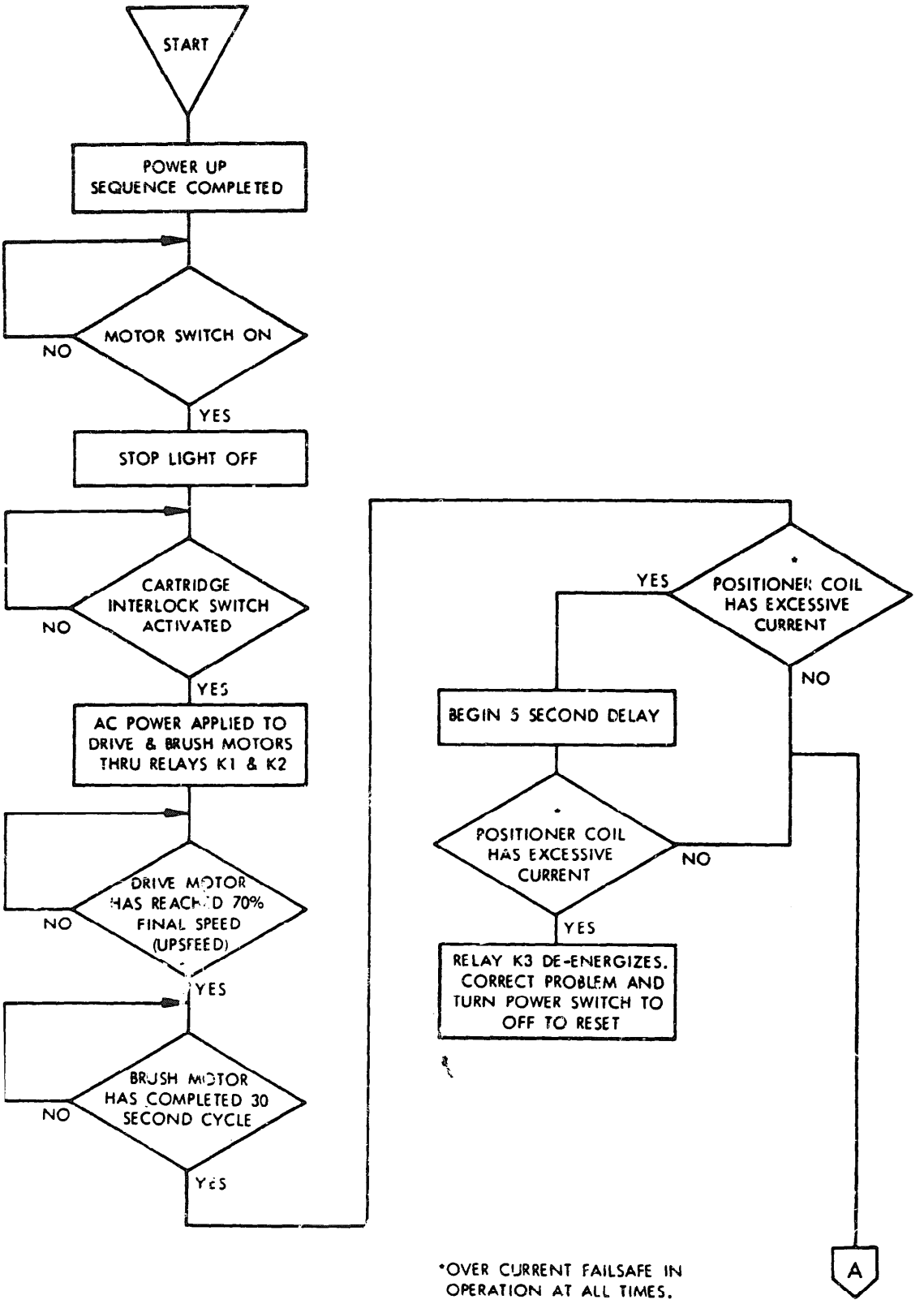


Figure 5-6. Operational Flow Chart, Drive Initialization, Sheet 1 of 2

(Fig. 5-8)

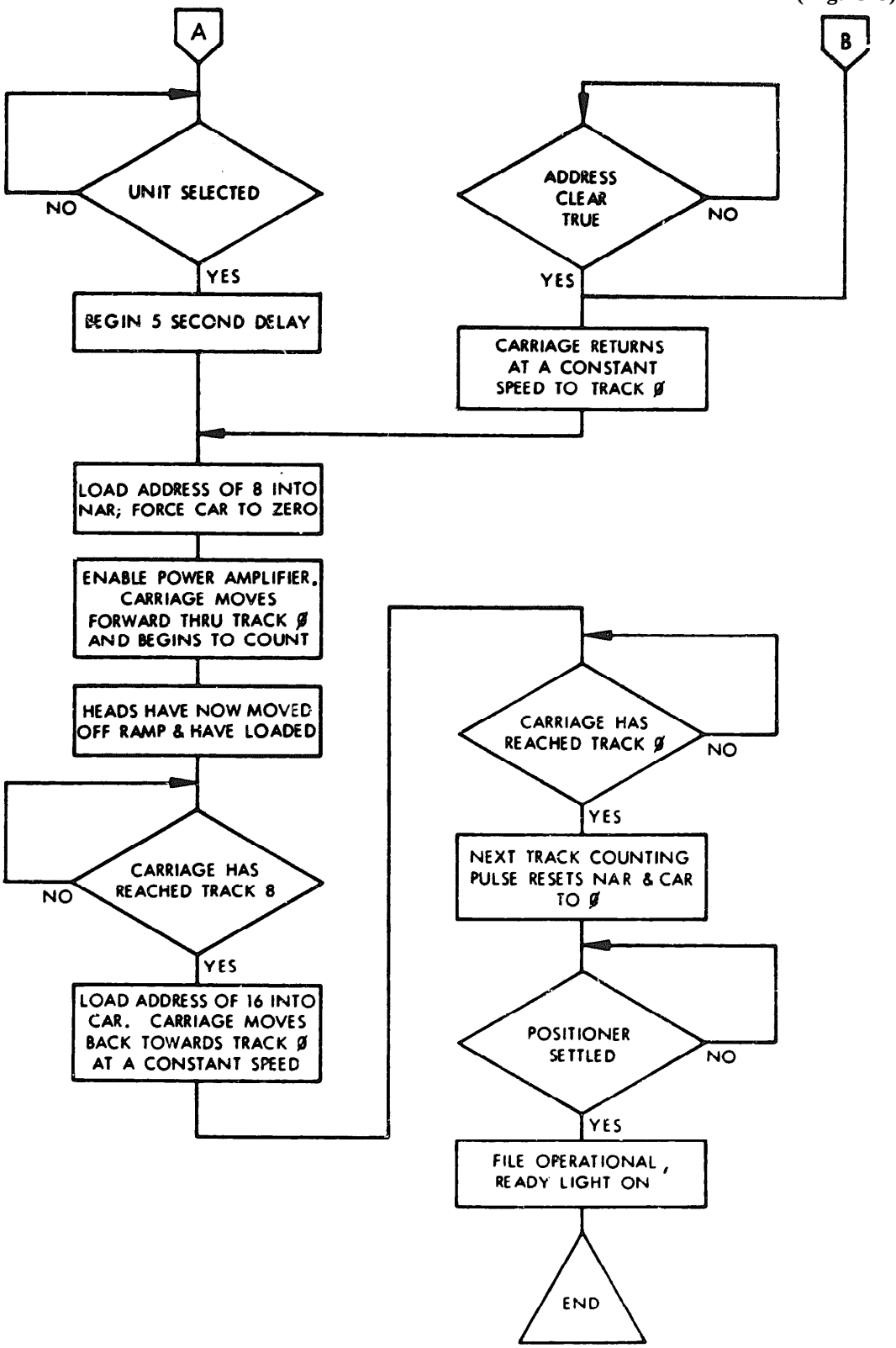


Figure 5-6. Operational Flow Chart, Drive Initialization, Sheet 2 of 2

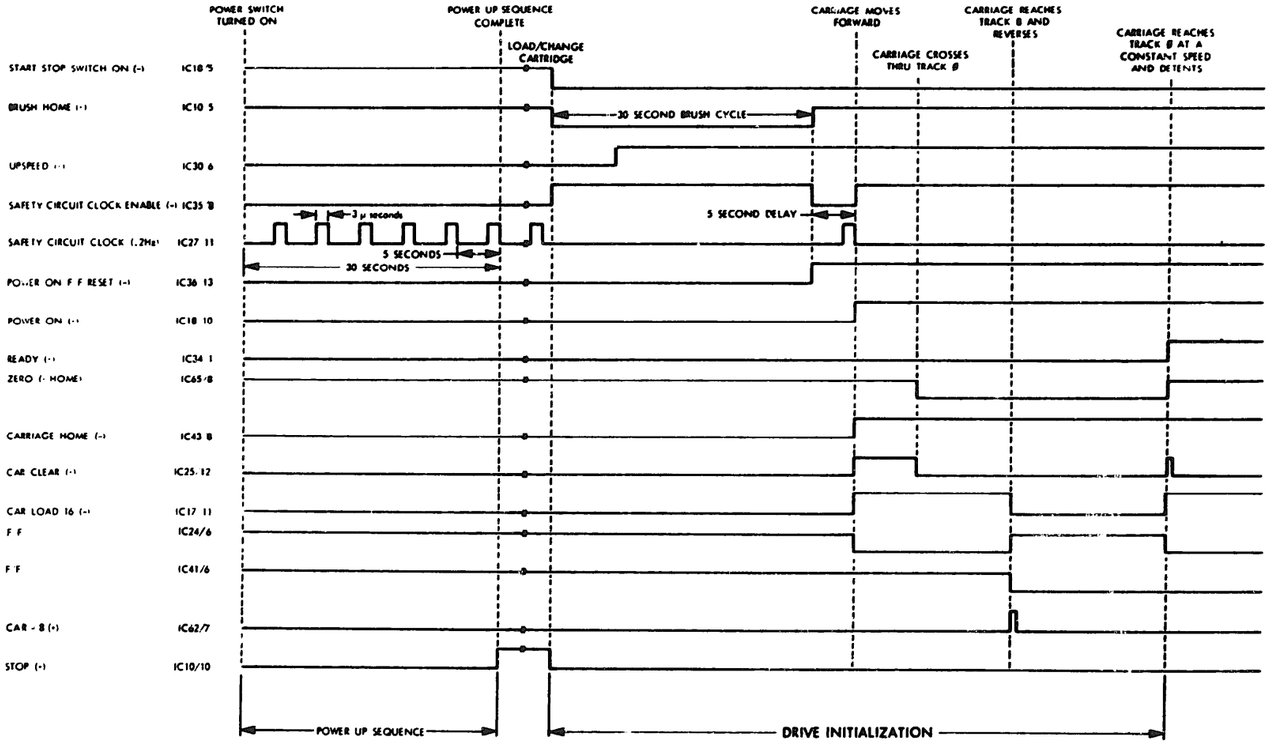


Figure 5-7. Timing Diagram, Power-Up/Drive Initialization

5.6.1 Power On Logic

After the Start/Stop Switch is turned to Start, and the 30 second Brush cycle is completed, MOTOR ON (+) at IC 35/5, BRUSH HOME (+) at IC 35/3 and UPSPEED (+) at IC 35/4 allows the POWER ON Flip Flop, IC 36/13 to be enabled. IC 18/13 goes high enabling IC 35/8, turning on the 0.2 Hz safety circuit clock, Q9 through Q11. Five seconds later, IC 36 sets, enabling POWER ON (+).

If at any time, overcurrent to the positioner coil exists (IC 27/6), the Safety Circuit Clock Enable (IC 35/8) goes true and the safety circuit clock (IC 27/11) starts generating pulses every 5 seconds (.2 Hz). If the overcurrent condition still exists at the end of 5 seconds, flip-flop IC 28/3 goes to a true state, disabling the Power On signal, retracting the heads.

Overcurrent is sensed by the voltage dropped across a 0.1 Ω resistor in series with the positioner coil, which appears at J7/7, and is compared with the + and - voltage comparators IC 45A and 45B.

5.6.2 Drive Initialization Chart

When the Power On logic level goes true (IC 18/10) during the Drive Initialization sequence, the CAR Clear line (IC 25/12) goes true and the input to the NAR comparator is set to 8, causing the carriage to move forward. When the carriage crosses through track "0" the CAR clear line goes false, enabling the CAR to start counting. When the carriage reaches approximately track 8, the CAR Load 16 line (IC 17/11) goes true causing the carriage to reverse at a constant speed until it crosses track "0". The very next count down pulse enables the Fine Servo Loop and the carriage detents. At this time the CAR is initialized to track "0", and Seek Complete goes true.

5.6.3 Drive Ready Circuit

The Drive Ready circuit is enabled (IC 11/11) when the following conditions are met:

- Unit is selected (IC 11/12).

- Operational signal is true (IC 36/5).

The Operational signal is triggered by the first Seek Complete signal (IC 4/1) after Power On goes true (IC 18/10).

Power On will go false at any time if all Safety circuits are not satisfied, retracting the heads.

5.7 PROGRAMMED SEEK

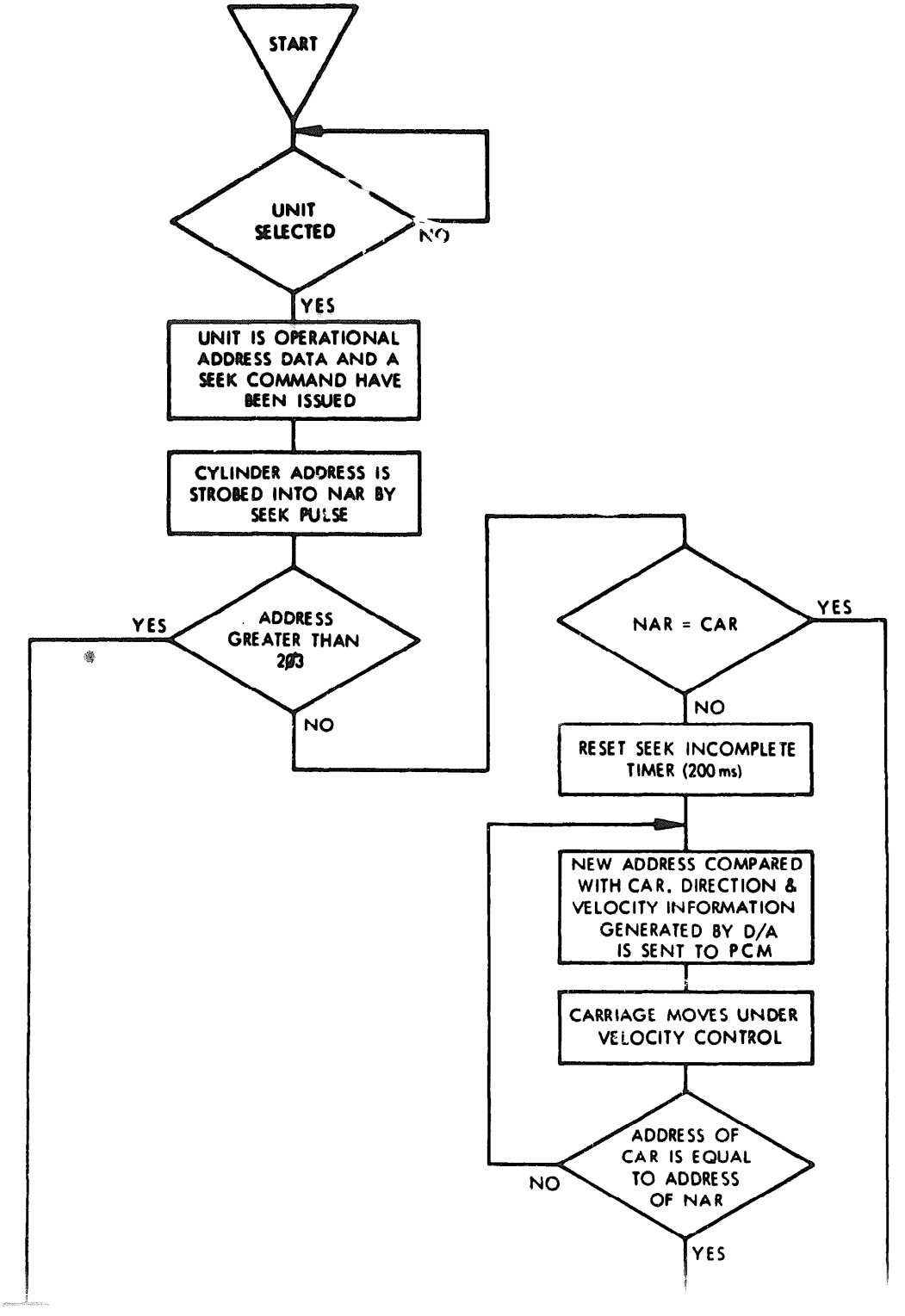
Figure 5-8 indicates the sequence of events that take place during a programmed seek. The new address generated by the controller is stored in the New Address Register and compared with the current location of the heads in the Current Address Register as follows:

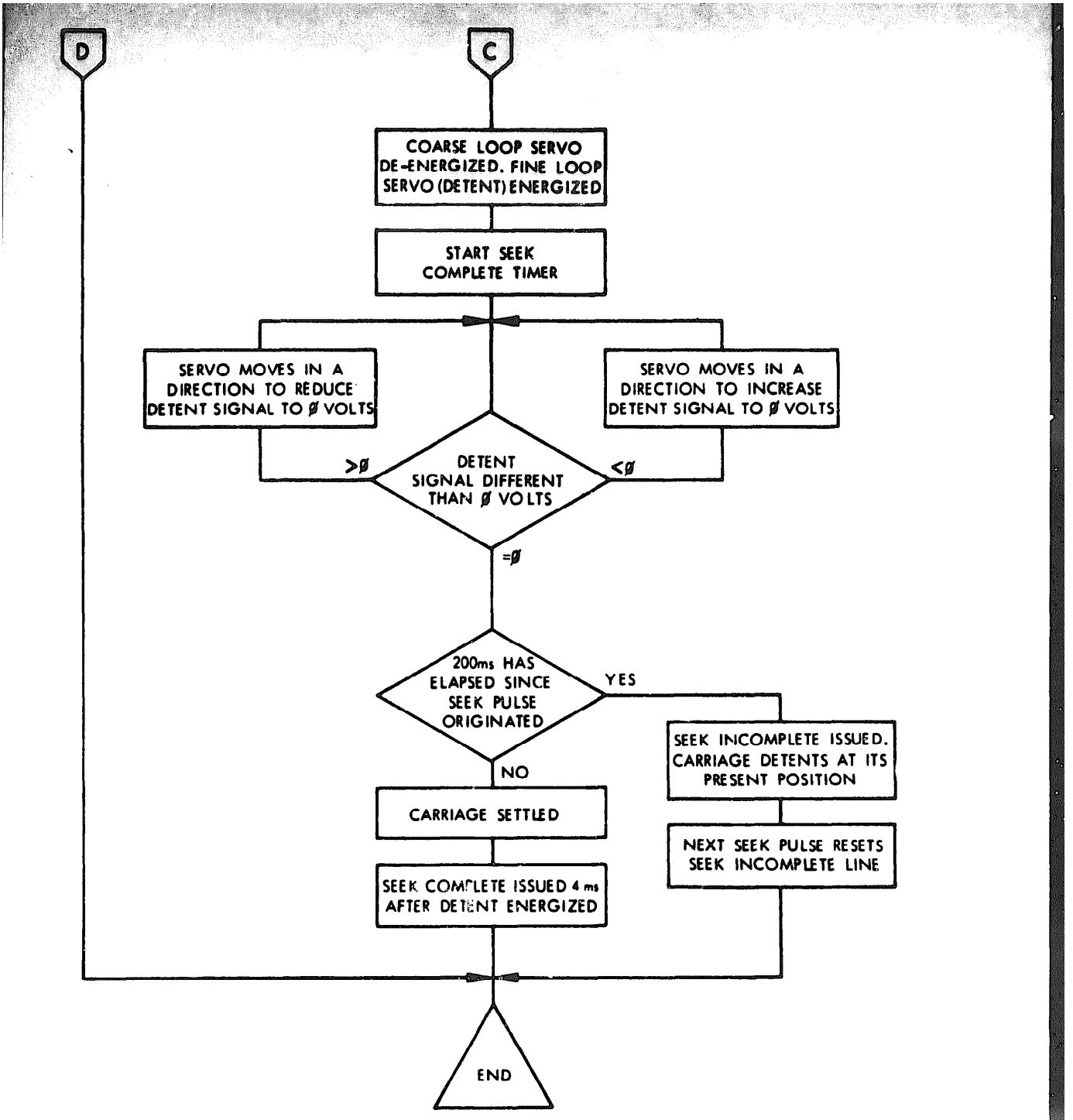
5.7.1 New Address Register (NAR)

The New Address Register (IC 31 & IC 32) consists of two 4 bit storage registers, outputs of which indicate the cylinder upon which the heads shall be positioned, and is set by the controller.

Each bit of the address is fed to the NAR from line receivers and is strobed into the register by the Seek Command pulse (IC 14/3) after the logical ready signal (IC 34/1) is true. The NAR is reset to Ø during the drive start and stop operations by the ready signal going false. It is also reset to Ø by the AC POWER LOSS (+) signal at IC 10/3, causing the heads to retract to track 000 under servo control. The output of each stage of the NAR is sent to the NAR comparator (IC 39 & IC 40) which compares the NAR address with the instantaneous address in the down counter (IC 48 & IC 49). The down counter runs at a frequency of 2.4 MHz which is derived from clock 2 (IC 6/8), continuously counting from track "204" to track "0".

The NAR comparator has three outputs; greater than NAR address (IC 39/15), less than NAR address (IC 39/2), and equal to NAR address (IC 39/14). The comparator generates a digital pulse train whose pulse width is determined by the NAR address. The frequency of the pulse train is approximately 12 KHz.


START
UNIT SELECTED
NO
YES
UNIT IS OPERATIONAL ADDRESS DATA AND A SEEK COMMAND HAVE BEEN ISSUED
CYLINDER ADDRESS IS STROBED INTO NAR BY SEEK PULSE
ADDRESS GREATER THAN 203
YES
NO
NAR = CAR
YES
NO
RESET SEEK INCOMPLETE TIMER (200 ms)
NEW ADDRESS COMPARED WITH CAR, DIRECTION & VELOCITY INFORMATION GENERATED BY D/A IS SENT TO PCM
CARRIAGE MOVES UNDER VELOCITY CONTROL
ADDRESS OF CAR IS EQUAL TO ADDRESS OF NAR
NO
YES


D
C
COARSE LOOP SERVO DE-ENERGIZED. FINE LOOP SERVO (DETENT) ENERGIZED
START SEEK COMPLETE TIMER
SERVO MOVES IN A DIRECTION TO REDUCE DETENT SIGNAL TO Ø VOLTS
SERVO MOVES IN A DIRECTION TO INCREASE DETENT SIGNAL TO Ø VOLTS
>Ø
DETENT SIGNAL DIFFERENT THAN Ø VOLTS
<Ø
=Ø
200ms HAS ELAPSED SINCE SEEK PULSE ORIGINATED
YES
NO
SEEK INCOMPLETE ISSUED. CARRIAGE DETENTS AT ITS PRESENT POSITION
CARRIAGE SETTLED
NEXT SEEK PULSE RESETS SEEK INCOMPLETE LINE
SEEK COMPLETE ISSUED 4 ms AFTER DETENT ENERGIZED
END

5.7.2 Servo Clock Circuit

The Servo Clock is generated by IC 58 and is the main system clock (2.4MHz) and is available at clocks 1, 2, & 3 (IC 52/3, 8 & 6). Clock 4 runs at 2.1 MHz and is available at IC 58/8.

5.7.3 Illegal Address Circuit

During the time that the Down Counter (IC 48 & IC 49) is being loaded with a count of 204, the NAR comparator (IC 39/15) checks to see that the new address is less than 204. If an Illegal Address (204 or greater) has been strobed into the NAR, IC 65/3 will go low, triggering IC 6/12, which sets the Seek Incomplete line. The Illegal Address Flip-Flop, IC 5/5, is also set, gating a 5 μs illegal address pulse at IC 68/1 onto the Index Fixed line, if the appropriate jumpers are chosen. IC 57/10 also goes to the true state and, if not shunted to ground by jumper A-B, will cause an automatic Address Clear.

5.7.4 Carriage Address Register (CAR)

The Carriage Address Register (IC 61 & IC 62) consists of two 4 bit up/down counters, outputs of which indicate the track at which the heads are presently positioned. The CAR is set to Ø upon the completion of the Drive Initialization operation. The inputs to the CAR consist of either Up counting pulses (IC 61/5) or down counting pulses (IC 62/4) derived from respective forward or reverse motion of the carriage, providing continuous true carriage position information to the CAR.

The output of each stage of the CAR is sent to the comparator (IC 54 & IC 55) which compares the CAR address with the instantaneous address in the Down Counter (IC 48 & IC 49).

The CAR comparator has three outputs corresponding to the outputs of the NAR comparator. The CAR comparator generates a digital pulse train whose pulse width is proportional to the distance between the present head position

5.7.5 Digital-To-Analog Converter (D/A)

The pulse trains generated by the greater than (>) outputs of the NAR and CAR comparators are gated together at IC 21/11 & 12. The less than outputs (<) are gated together at IC 21/8 & 9; and the equal to (=) outputs are gated together at IC 42/12 & 13.

The output of IC 21/10, which is used to drive the carriage forward, and the output of IC 21/13, which drives the carriage in reverse, are the inputs to the fast detent circuit of IC's 41, 46 and 50 which modifies the velocity output profile of the D/A Converter. The Fast Detent circuit adds a small velocity increment beginning one (1) track prior to detent, and lasting for 7.5 mils, thus enabling faster track-to-track positioning times.

The outputs of this circuit (IC 50/11 and IC 51/13) drive the D/A converter of Q1, Q2 and IC 44. The output of the D/A converter (IC 44/12) is an analog signal, which, when positive, drives the carriage forward and when negative drives the carriage in reverse. The output level is proportional to the pulse widths at IC's 21/10 and 21/13.

5.7.6 Servo Positioner Control Circuit (Coarse Loop)

A linear velocity transducer coil mounted inside the servo positioner magnet provides a voltage output (J16 & J17) directly proportional to the velocity of the magnetic rod moving through it, which is mechanically mounted to the carriage. This output is buffered by IC 26 and is summed with the analog output of the D/A converter (IC 44/1) at IC 44/6. The resultant voltage is switched by Fet Q3 to IC 60/2 where it is summed with the Positioner Motor Feedback.

The amplified and summed output (IC 60/1) drives the Servo Power Amplifier on the Power Control Module (PCM).

Down Counter (IC 48 & IC 49) is disabled by IC 6/8; re-triggering of the Seek Complete timer (IC 15/4) is disabled at IC 15/5, thus allowing the timer to time out, generating a Seek Complete level at IC 4/1; the FET Drive (Q5) enables FET Q12; thus enabling the Detent Amplifier (IC 67) to accurately position the heads over the center of the addressed track.

5.7.8 Detent Amplifier Circuit

Absolute positioning of the heads is accomplished through a electro/optical/mechanical system consisting of a detent assembly containing photocells and reticle, a carriage mounted mask assembly and an amplifier circuit (IC 67). Positioning accuracy is governed by critically spaced (10 mils) grid lines etched on the reticle and mask. Two sine waves are sent to the amplifier, 90 degrees out of phase, one providing positional information, the other detects direction.

The Quad photocell signal (J 19/3) is shaped by a Schmidt trigger (IC 66B) and the Zero photocell signal (J 19/4) is shaped by Schmidt trigger IC 66A.

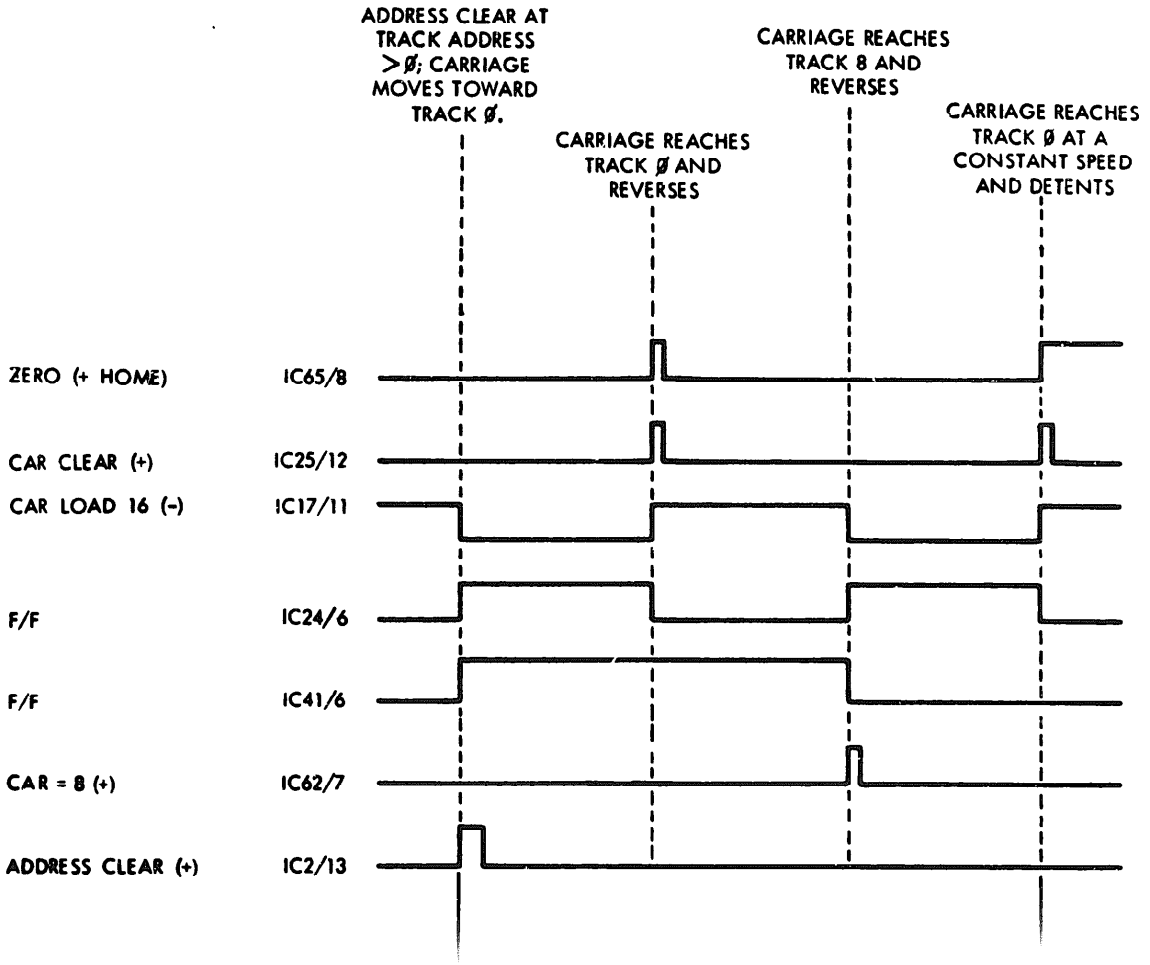
The shaped Zero P.C. signal is inverted by IC 65/8 and is high any time the carriage is between track "0" and Home. This signal will go low whenever the heads are positioned at tracks 1 to 203.

The Detent photocell signal (J 19/2) is amplified by IC 67 and shaped by Schmidt trigger IC 59A. The Detent P.C. analog signal is used to accurately position (detent) the heads directly over the center of the addressed track. 0 volts from the P.C. corresponds to the center of the track.

The Detent pulse and the Quad pulse, which are 90 degrees out of phase, drive the carriage position pulse generator (IC's 7, 8, 16, 24 & 33) which provide up counting or down counting pulses to the CAR.

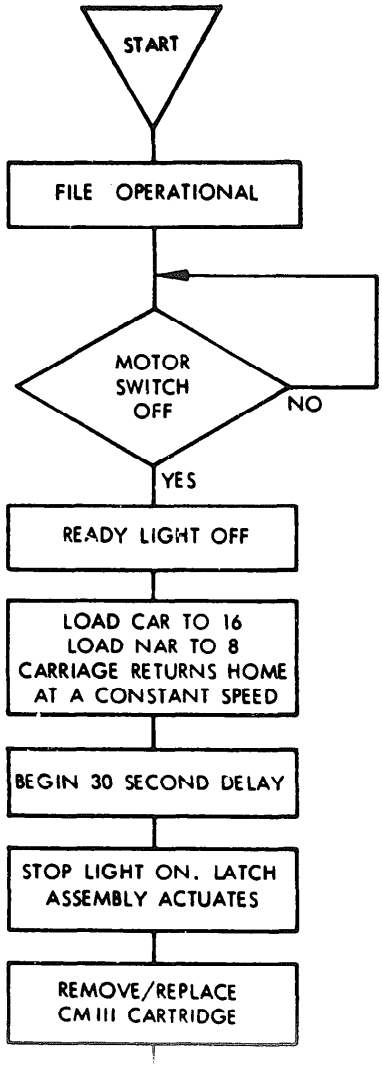
5.7.10 Address Clear Circuit

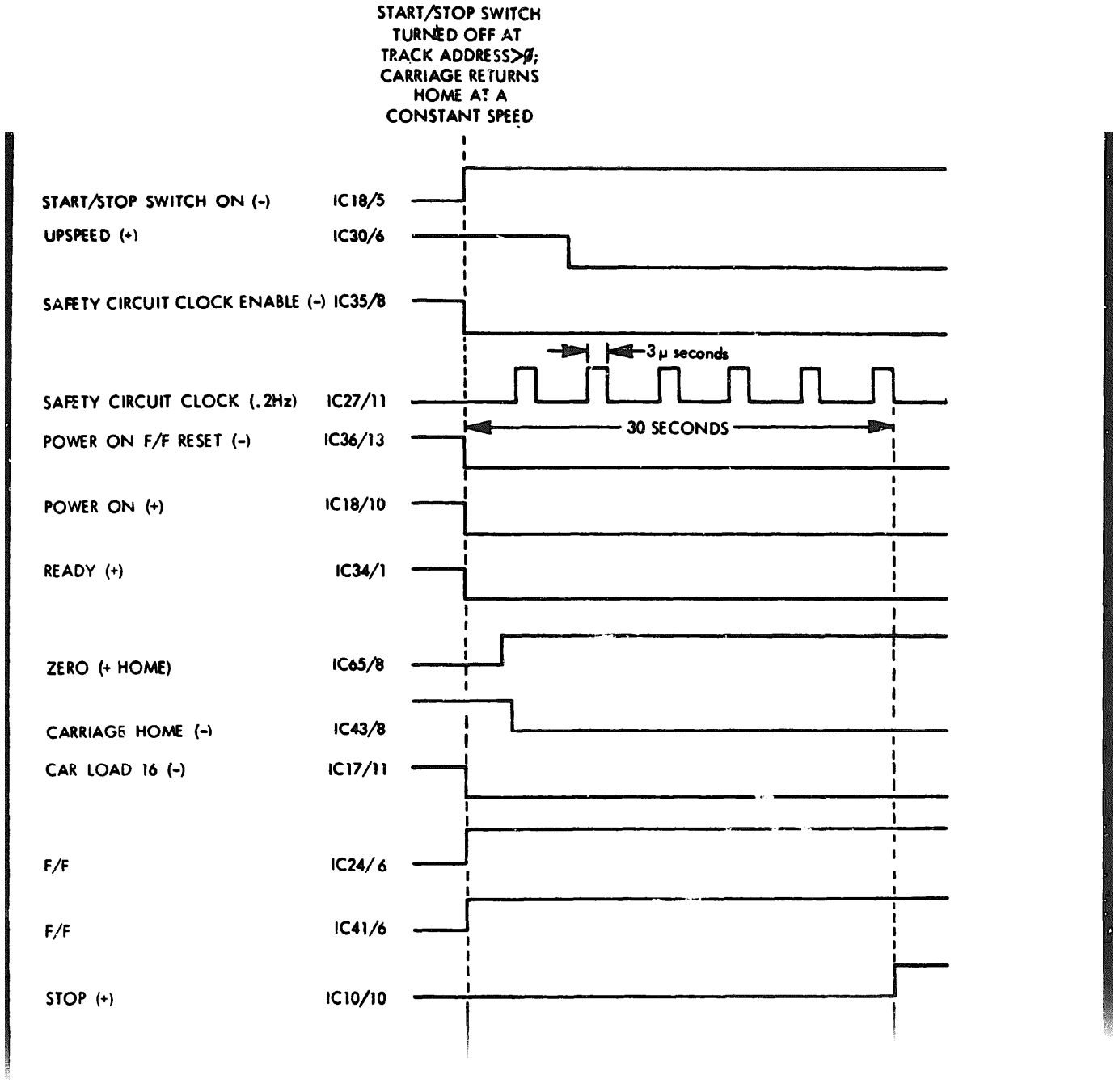
When an Address Clear command is issued by the Controller, the NAR comparator is loaded to 8, the CAR load 16 line goes true, and the carriage moves towards track "0" at a constant velocity. When the carriage reaches track "0" the Drive Initialization sequence is performed and the file is ready for the next address command.



5.8 POWER DOWN SEQUENCE

Figure 5-10 indicates the sequence of events that take p
is powered down. See also paragraph 5.5.3




START/STOP SWITCH TURNED OFF AT TRACK ADDRESS>Ø; CARRIAGE RETURNS HOME AT A CONSTANT SPEED
START/STOP SWITCH ON (-) IC18/5
UPSPEED (+) IC30/6
SAFETY CIRCUIT CLOCK ENABLE (-) IC35/8
3 μ seconds
SAFETY CIRCUIT CLOCK (.2Hz) IC27/11
30 SECONDS
POWER ON F/F RESET (-) IC36/13
POWER ON (+) IC18/10
READY (+) IC34/1
ZERO (+ HOME) IC65/8
CARRIAGE HOME (-) IC43/8
CAR LOAD 16 (-) IC17/11
F/F IC24/6
F/F IC41/6
STOP (+) IC10/10

5.9 READ/WRITE AMPLIFIER MODULE

The Read/Write Amplifier provides the circuitry necessary for recording and recovery of data and consists of the following circuit functions:

- Head/Disk Select Circuit
- Write Inhibit Circuit
- Write Circuit
- Read Circuit

5.9.1 Head/Disk Select Circuit

The Head/Disk Select circuit consists of IC's 1 and 2, Q1 through Q4, and diode matrix CR4 through CR 15. The Head Select and Disk Select signals (J8/16 & J8/17) are gated by IC 1 & IC 2 such that only one of the four head select transistors Q1 - Q4) is turned on at any one time, causing head current to flow through the appropriate head.

5.9.2 Write Inhibit Circuit

The Write Inhibit circuit (IC's 1 & 7, and Q17) becomes operational when the write function is inhibited for any of the following reasons:

- The Write Inhibit switches are inadvertently disconnected.
- A Write Inhibit switch is turned on and the corresponding disk is selected.
- Write Enable signal from the controller (J8/14 WRT INHB (+)) is true.
- The carriage is not seated on a track.

When any of these conditions exist and Unit Select is true, transistor Q17 turns on, providing a write inhibited signal to the controller (J8/12).

For the -019 configuration of the R/W Amplifier, transistor Q18 is added to gate the write inhibited signal with the controller WRITE ENABLE, such that a valid write inhibited signal exists only during WRITE ENABLE.

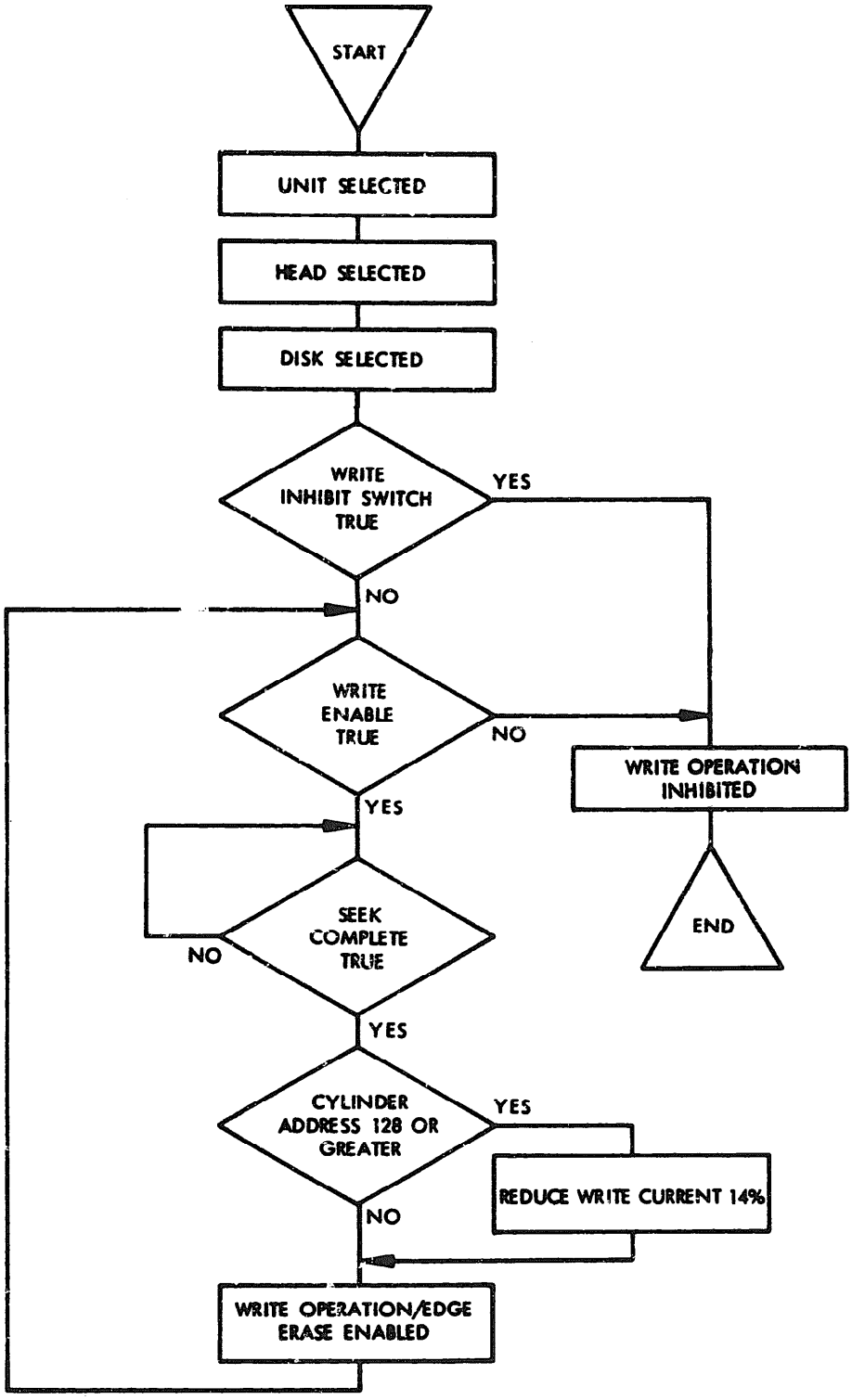


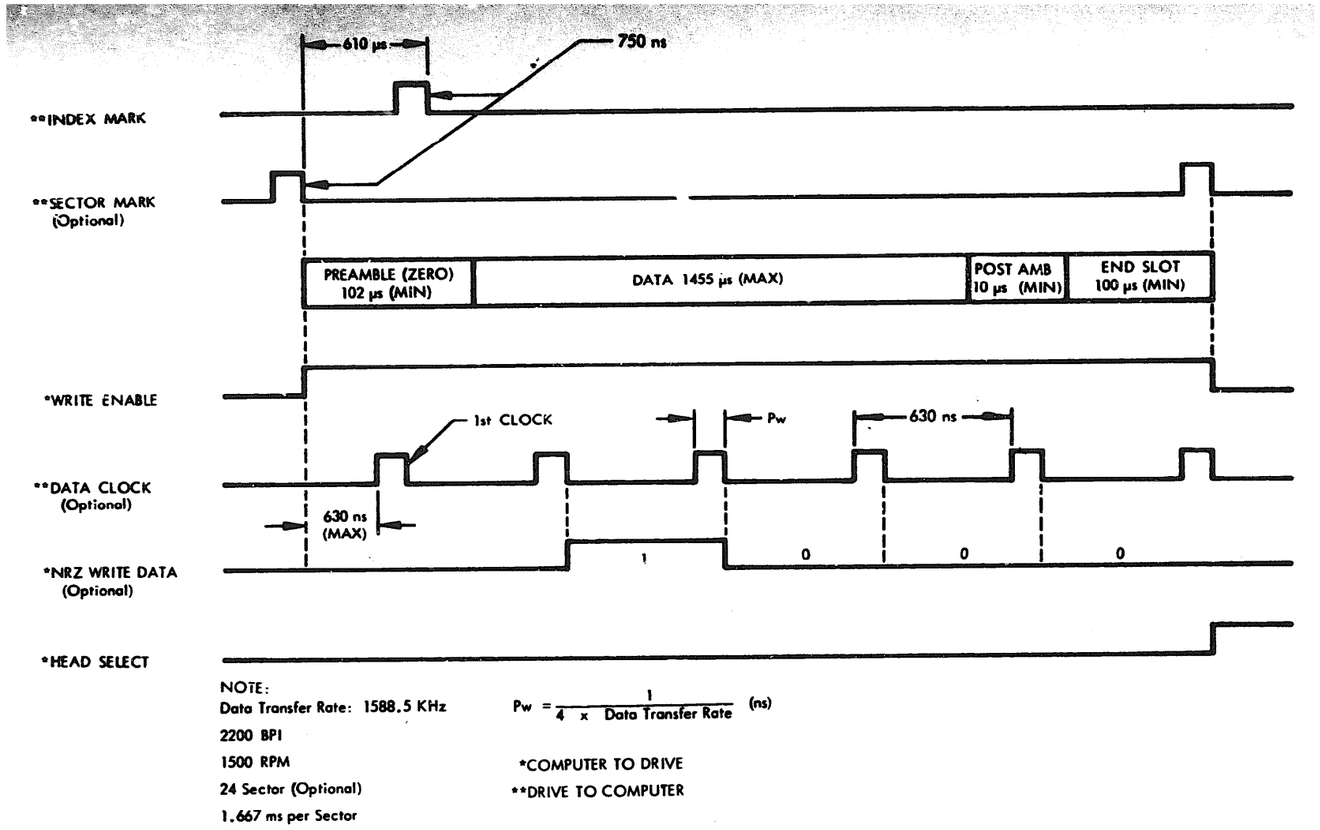
Figure 5-12. Operational Flow Chart, Write Mode

5.9.3 Write Circuit

The Write Circuit consists of the write flip-flop (IC 3), the write and erase drivers (Q9, 10 & 11) and the write current select circuit. Data to be recorded is supplied to the input of IC 3 in Double Frequency Format which drives the write amplifier, Q9 and Q10. The write amplifier is supplied current from Q6 and Q8 when writing tracks 0 to 127. When writing tracks 128 to 203, only Q6 supplies write current, reducing available current by 14%. Erase current is supplied by Q11. Turn-off of the erase current is delayed after the write operation ends by C11, R27 and R28.

5.9.4 Read Circuit

The Read Circuit includes isolation transformer T2 and diodes CR16 & CR17, preamplifier IC 4, differentiator Q14 & Q15, delay line DL1, and limiters IC 5 & IC 6. Q12 & Q13 convert the limited signal to + 5 volt logic, which is fed into line driver Q16. The output of the line driver (Q16) is double frequency read data.



NOTE:
Data Transfer Rate: 1588.5 KHz
2200 BPI
1500 RPM
24 Sector (Optional)
1.667 ms per Sector

$$Pw = \frac{1}{4 \times \text{Data Transfer Rate}} \text{ (ns)}$$

*COMPUTER TO DRIVE
**DRIVE TO COMPUTER

Figure 5-13. Timing Diagram, Typical Write Mode TO 31S5-4-519-1

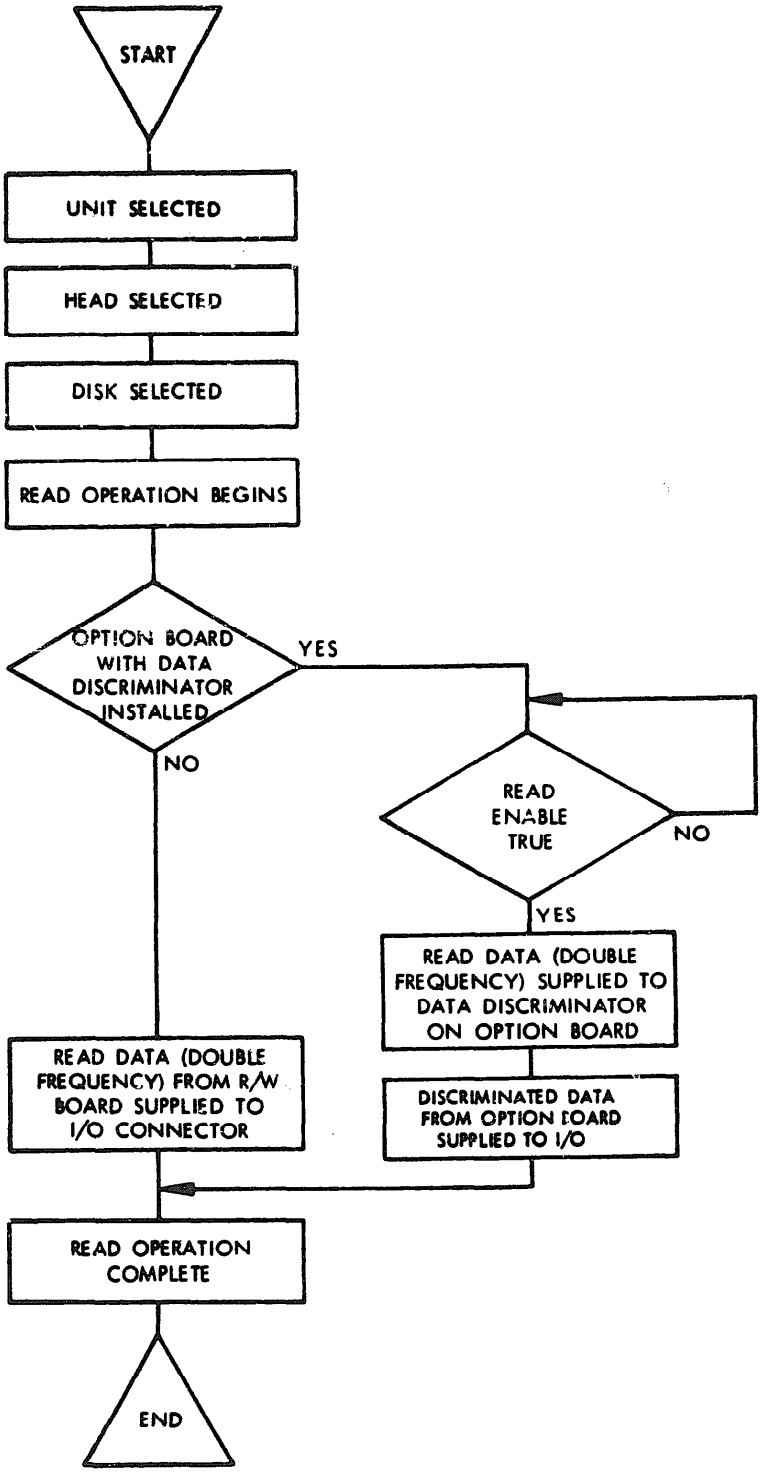


Figure 5-14. Optional Flow Chart, Read Mode

5.10 OPTION BOARD

The Option Board provides certain timing and data functions which are available as options to the Model 303 Series Drives. The circuits contained on this board are as follows:

- Data Discriminator Circuit
- Write Data Encoder Circuit
- Sector Counter

5.10.1 Data Discriminator Circuit

The Data Discriminator is composed of a sync circuit and a phase-locked loop circuit which is used to generate NRZ Data and a Read Data Clock whose accuracy is not affected by bit shift or rotational speed variations.

The Discriminator receives Read Data (J9/1) from the Read/Write Amplifier Module, separates the data pulses from the clock pulses, and transmits the NRZ Data (J9/2) and Data Clock pulses (J9/10) to the Drive Electronics Module (DEM) and on to the Controller.

The Read Enable signal (J9/7) must be true at least 20 μ seconds before the preamble sync bit under worst-case conditions. The first data pulse after Read Enable sets one half of sync flip-flop IC 14 and the next data pulse sets the other half of IC 14, triggering the Variable Frequency Oscillator (VFO) one-shot, IC 20, in synchronization with the Read Data. The output of the variable one-shot, IC 20/6, is used to trigger the fixed one-shot (IC 20/9), whose output is used to strobe the Read Data into the phase compensator circuit through IC 12.

The Phase Comparator (part of the phase-locked loop) is a two input (Phase 'A' and Phase 'B') current source that is enabled by the Data Discriminator outputs from IC 12. The circuit consists of IC 18 and Q2 through Q6 and charges the R.C. network of IC 20, including C8, R6, R7 and R8.
When the Phase 'A' input to the phase comparator is enabled, it indicates speed up (shorter time duration between read pulses) of the composite read

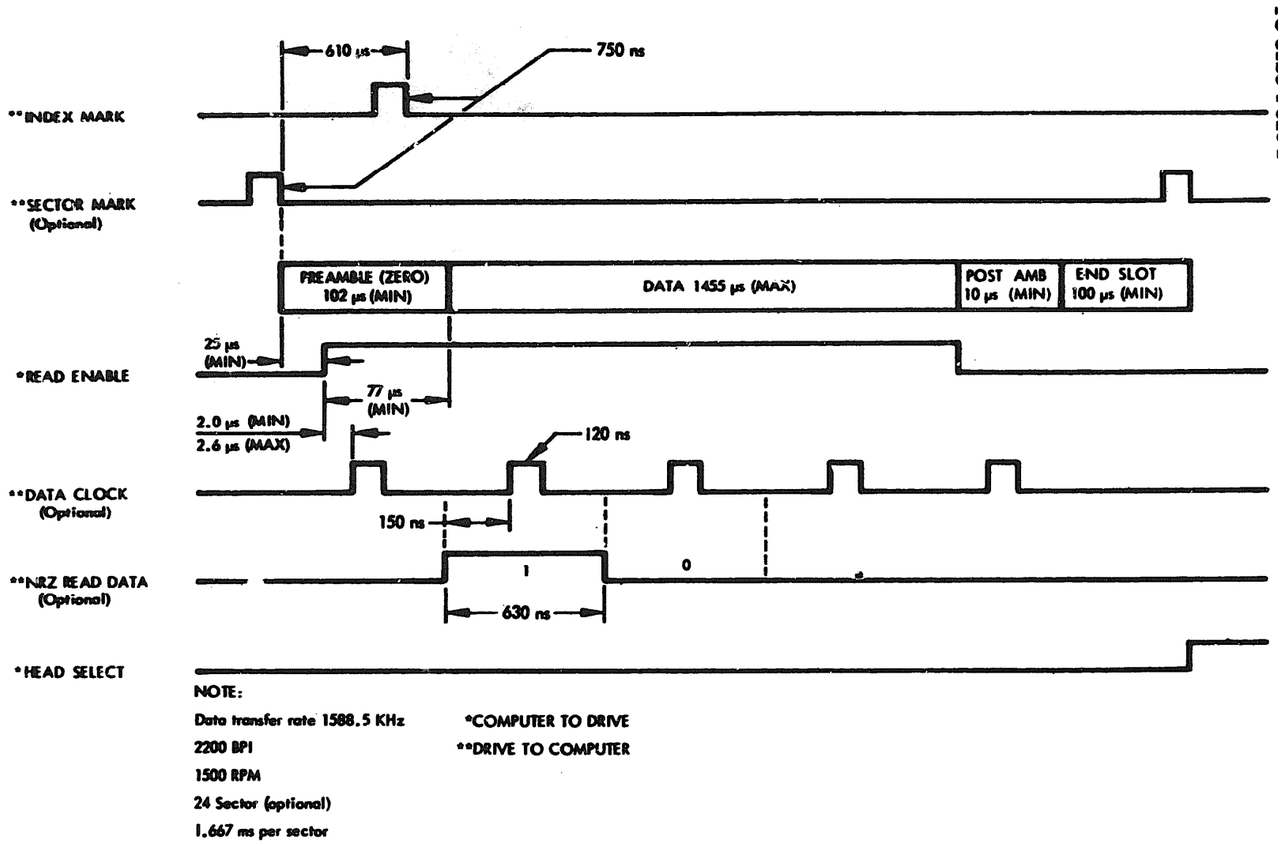


Figure 5-15. Timing Diagram, Typical Road Mode

5.10.1 (cont) IC 20, shortening its output, thereby compensating for the increased frequency and maintaining strobe sync.

The Phase 'B' input to the comparator is enabled when the time duration between the read pulses is lengthened. Less current is supplied to the R.C. network of IC 20, causing the output to lengthen and compensate for the reduced frequency.

IC's 15 and 19 are used to generate the three types of data discussed in paragraph 3.5.5.

5.10.2 Write Data Encoder Circuit

The Write Data Encoder Circuit converts NRZ Write Data into double frequency format. A crystal controlled oscillator circuit consisting of XTAL 1 and Q1 establishes the basic clock frequency of 6.354 MHz. This basic clock frequency is divided by two frequency reduction flip-flops (IC 17) into a transfer rate of 1588.5 KHz. This clock, during the Write mode, is sent to the Controller for reference (J9/10). Data is received in NRZ format (J9/9) and converted into Double Frequency mode by IC 10 and IC 18 and transferred to the Read/Write Amplifier Module (J9/11).

5.10.3 Sector Counter

The Sector Counter provides a 5 line Sector Address in binary format to the DEM at J9, pins 5, 3, 4, 6 & 8. Depending on the state of the Disk Select line, J9/17, either IC's 4 and 11 or IC's 8 and 11 are enabled, if Unit Select is also true. The trailing edge of the sector pulse is used to increment the counter.

Signals from the Index/Sector transducers are discriminated at IC's 2 and 6 and drive counters IC's 3 and 7, whose outputs are gated to the output lines by IC's 4, 8 and 11.

Figure 5-16 illustrates the output of the sector counter for a 24 sector disk.

5.11 POWER CONTROL MODULE (PCM)

The Power Control Module contains the following circuits:

- ± 15 volt regulator
- + 5 volt regulctor
- Servo Power Amplifier
- Emergency Retract Circuit

5.11.1 ± 15 Volt Regulator Circuit

IC 1 of the PCM is an adjustable dual tracking voltage regulator that is short-circuit-proof with foldback current limiting, designed to provide ± 15 volts. The + 15 volt regulator tracks the - 15 volt regulator. Q10 and Q11 are used as series pass transistors for the + 15 and - 15 volt supplies, respectively; enabling these supplies to produce one amp each.

5.11.2 +5 Volt Regulator Circuit

IC 2 is an adjustable voltage regulator that is short-circuit-proof with foldback current limiting used to provide + 5 volts to drive the logic circuitry. Q12 drives Q16, a series pass transistor used to provide up to 3 amps of current.

5.11.3 Servo Power Amplifier Circuit

The Servo Power Amplifier circuit of the PCM is driven by the Servo Power signal from the DEM (J3/8) and supplies the needed current to drive the Servo Positioner motor. The Power Amplifier, transistors Q1 through Q9, Q18 and Q19, supply current to the positioner coil through relay K3 and resistor R20. Current greater than 3 amps through R20 causes the Overcurrent sensing on the DEM to go true.

Since the force of the Servo Positioner coil is proportional to the current flowing through it, a current feedback signal (J3/7) is summed with the error voltage at IC 60/7 on the DEM to provide a force directly proportional to the error voltage.

5.11.4 Emergency Retract Circuit

Relay K3 of the PCM is energized by relay driver Q15. Any unsafe condition, including AC power failure, sensed by the Safety circuitry on the DEM causes the input to Q15 to go low, dropping out relay K3. The voltage left on capacitor C6 is then applied to the servo positioner coil through the Carriage Home Switch, S3, and Resistor R45, and the heads are then unloaded.

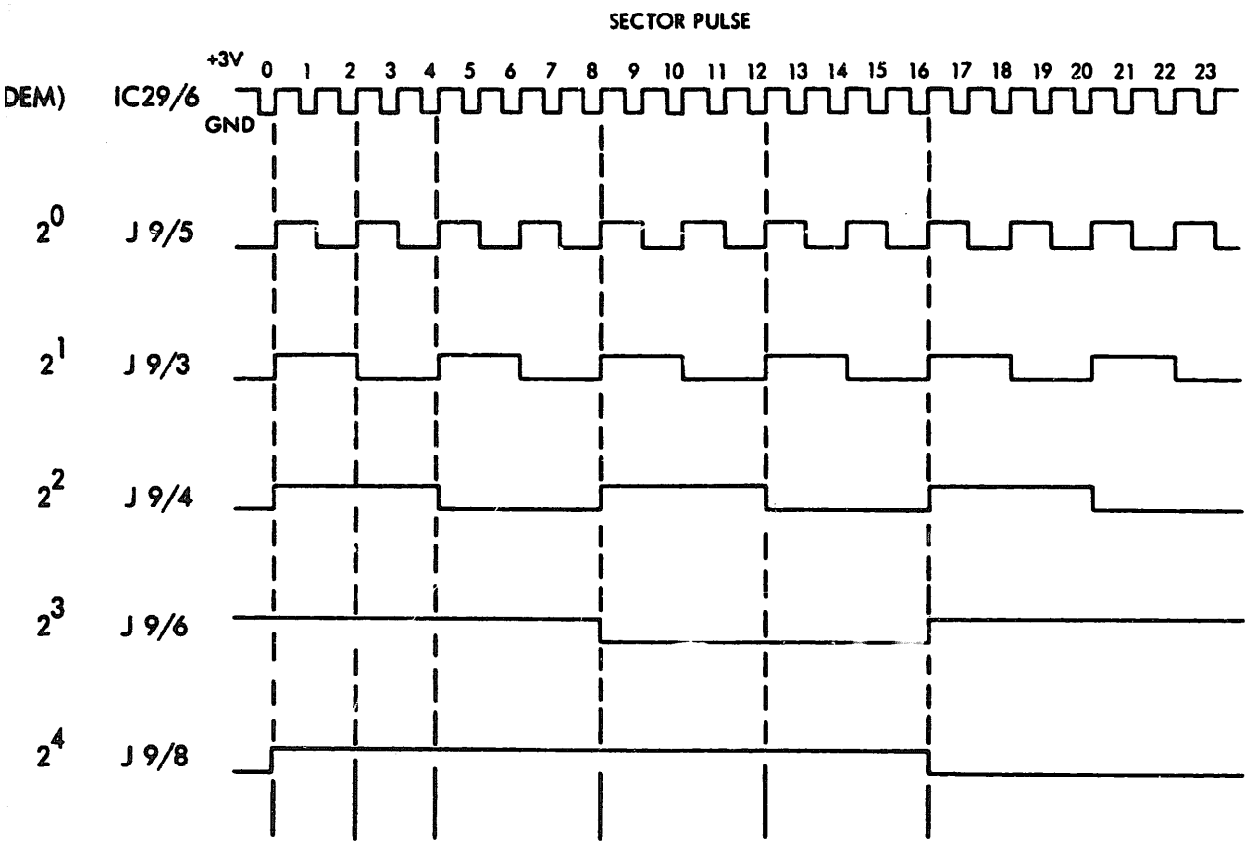


Figure 5-16. Sector Address Counter Waveforms

SECTION VI - MECHANICAL MAINTENANCE

6.1 GENERAL

The Model 303 Series Disk Cartridge Drives have been designed for accessibility of components to aid the field engineer in replacement and adjustment. In most cases a complete sub-assembly is replaced and all adjustments are made easily. However, it is recommended that the entire procedure be read before performing any replacements or adjustments.

6.2 CAUTIONS

Many procedures of this section require that the drive be exposed either by removing necessary covers or by pulling the drive out of the cabinet if it is mounted on slides. Operating in this manner for prolonged periods of time can result in damage to the read/write heads, disks, carriage, and positioner motor if care is not exercised to keep all foreign matter out of these areas. Even though the drive is equipped with a clean air filtration system, when operating without covers, the read/write heads should be checked for contamination at hourly intervals and cleaned, if necessary. The positioner motor has a strong magnetic field which will magnetize your wrist watch if worn while working on the drive. Also, if you should drop any hardware in this area while servicing the drive, it is likely that they will be attracted to the magnet.

6.3 TOOLS AND MATERIALS

The following is a complete list of the tools required for maintenance and alignment procedures outlined in this section. Most of the tools are standard tools (Allen wrenches, ball drivers, etc.); however, some are special and have been designed for a specific purpose. These are available at a nominal cost from Caelus.

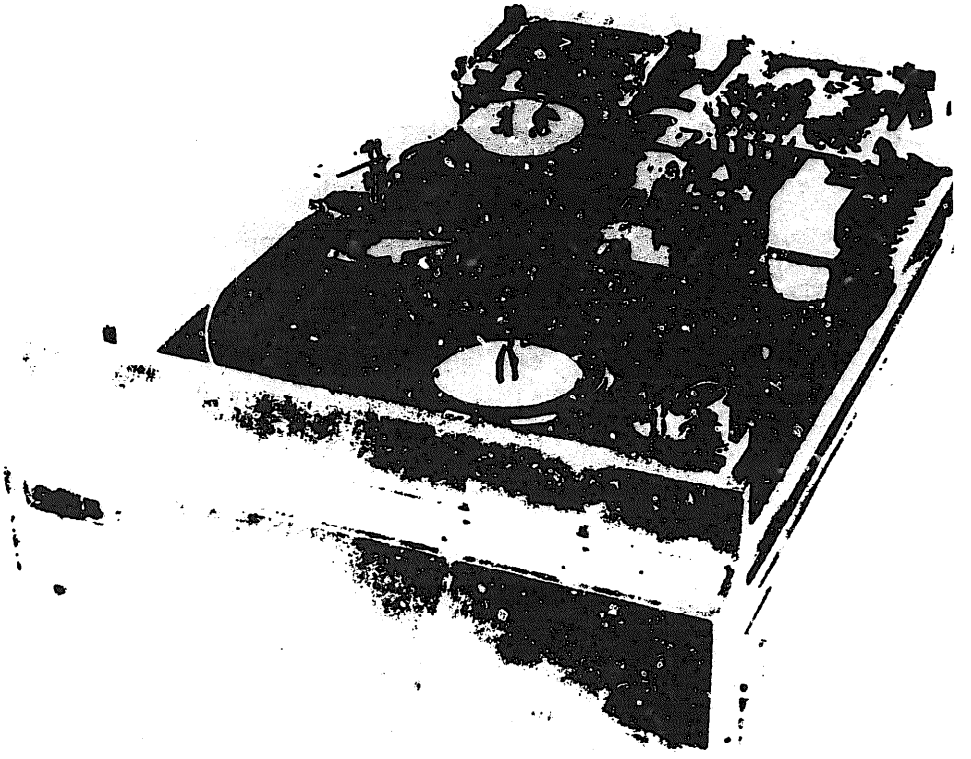


Figure 6-1. Front View, Covers Removed

6.3.1 Special Tools

Name	Manufacturer	Part Number
Mylar Shim, Positioner Motor	Caelus	430339
Mylar Shim, Detent	Caelus	430049
CMIII Test Hub	Caelus	430367
Drive Pulley Adjustment Tool	Caelus	430366
Termination Board	Caelus	301308
Mylar Insulator	Caelus	301425-001

6.3.2 Standard Tools

Name	Manufacturer	Part Number
Allen Wrench 1/16"	Handi Hex Key	607
Ball Driver 5/64"	Bondhus	BS 5/64
Ball Driver 3/32"	Bondhus	BS 3/32
Ball Driver 7/64"	Bondhus	BS 7/64
Ball Driver 1/8"	Bondhus	BS 1/8
Ball Driver 9/64"	Bondhus	BS 9/64
Ball Driver 5/32"	Bondhus	BS 5/32
6" Adjustable Wrench	Xcelite	46C
Retaining Ring Wrench	Truarc	0604
Screwdriver Set	Xcelite	PS 88
Torque Screwdriver	Utica	TS-30
Socket Tip	Utica	HW-4A
Phillips Tip	Utica	HW-17
Potentiometer Alignment Screwdriver	Walpco Elec.	2525
Soldering Iron	Weller	Model W60

6.3.3 Cleaning Kit

Cleaning kit includes 91% reagent grade isopropyl alcohol and 90% distilled water cleaning fluid with dispenser, head and disk cleaning paddles, and lint free tissues. Caelus catalog number is 303. Drug store isopropyl alcohol is not acceptable for this purpose as the residue which remains after use will cause head to disk interference after repeated use.

6.3.4 Fixed Disk Replacement Kit

This kit contains a Caelus C.P. recording disk, nylon glove and instructions. Caelus catalog number is 306.

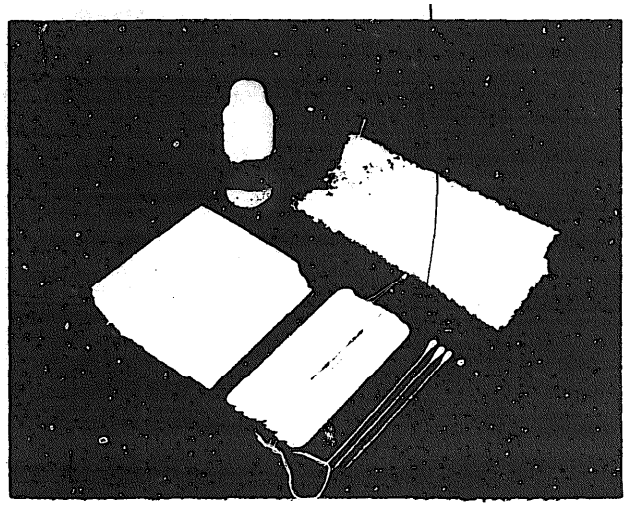


Figure 6-2. Cleaning Kit

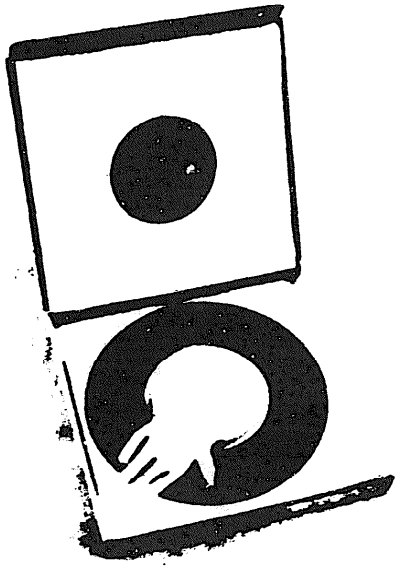


Figure 6-3. Fixed Disk Replacement Kit

6.3.5 Standard Test Equipment

Name	Suggested Manufacturer	Part Number
Gram Gauge	Scherr-Tumico	62-6383

Those tools required for each procedure are listed at the beginning of each section.

6.4 PREVENTIVE MAINTENANCE

The following preventive maintenance operations and routine checks are recommended to assure reliable operation of the Disk Cartridge Drive. These recommendations are, however, only a guide and should be modified to meet the individual requirements of drives operating under extreme usage or environmental conditions.

6.4.1 Periodic Maintenance (12 Month Intervals Approx. 2400 Hours Operating Time

Change Air Filter:

Before installing a new air filter, inspect the air passage and blower blades for contamination. If cleaning is required use a lint-free tissue moistened with alcohol/water solution in cleaning kit.

Clean Heads:

Although the Caelus Clean Air System greatly increases the required time interval for read/write head cleaning, as a precautionary measure, the heads should be inspected anytime the air filter is changed.

When required, head shoes are to be cleaned, using a cotton swab dampened in the alcohol/water solution. Wipe the face of the shoe until the swab shows no trace of oxide discoloration.

6.4.2 Periodic Checks (6 Month Intervals)

Routine checks should be limited to the following areas as long as drive is functioning properly. Refer to the specific sections of this manual for detailed procedures.

- Servo Positioner Mechanism
- Read/Write Head Inspection
- Disk Cleaning Brushes
- Detent Mask, checked and cleaned if necessary

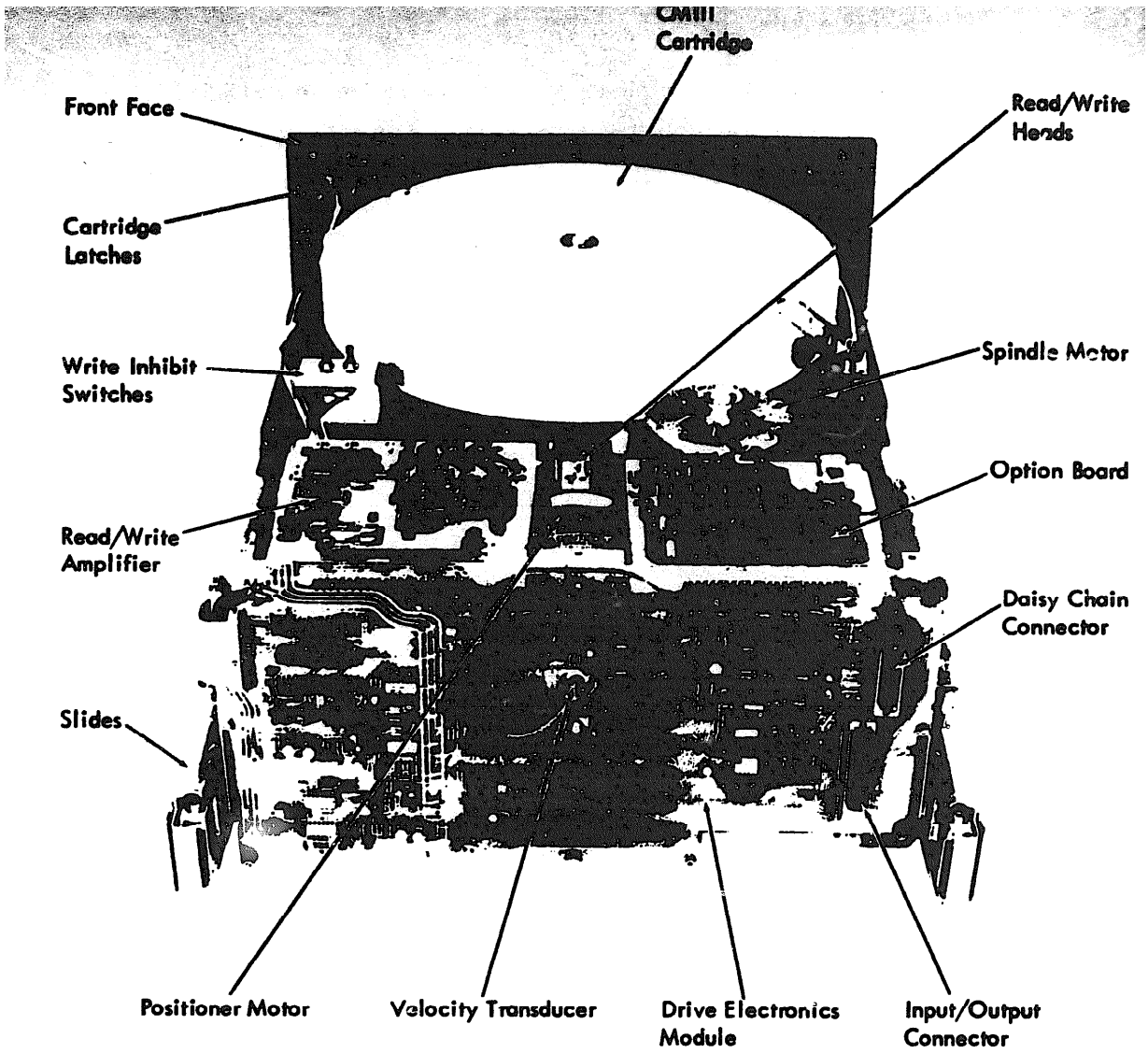


Figure 6-4. Model 303 Series Major Assemblies

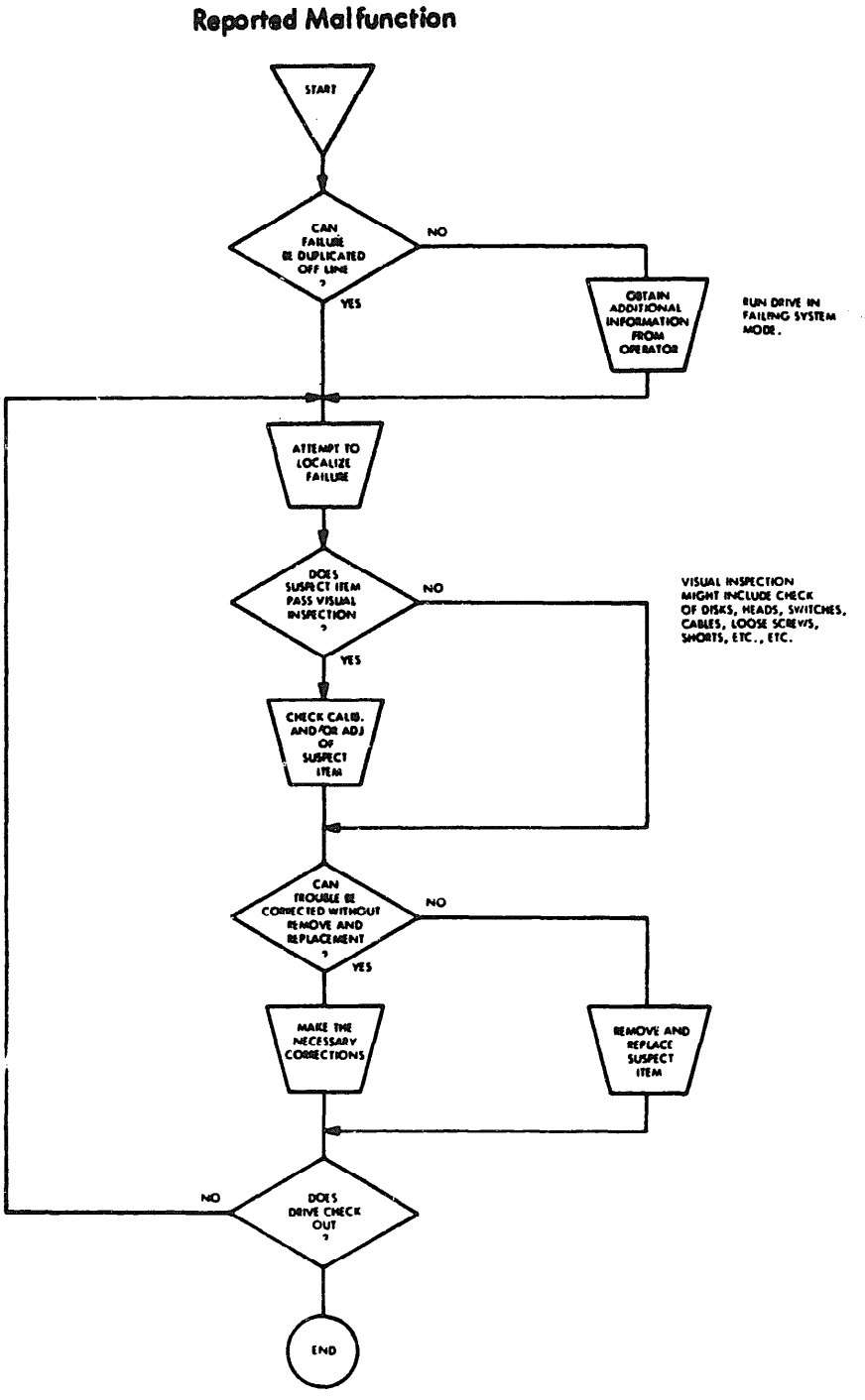


Figure 6-5. Diagnostic Flow Chart

6.6 POWER CONTROL MODULE (PCM) REMOVAL/REPLACEMENT INSTRUCTION

6.6.1 Tools and Materials Required

A) 7/64" ball driver

B) 3/32" ball driver

C) DVM

D) Heat sink compound - Wakefield Type 120 Thermal Compound

E) Mylar insulator - Caelus P/N 301425-001

6.6.2 PCM Removal

A) Turn off the power switch and unplug the AC power cord.

B) To gain access to the PCM, the Read/Write Board must be removed. To remove the Read/Write Board, disconnect the head connectors, the Write Inhibit switch connector, the ground strap and remove the Read/Write Board from its spring supports. The PCM is now accessible.

C) Remove the following connectors from the PCM:
- J3 connector (34 pin flat cable) to the DEM.
- J4 connector on the flex cable
- J2 Molex connector (15 pin connector)
- J5 and J6 for the detent lamp

D) Remove the two #6-32 cap screws that mount the ground strap and PCM to the base casting.

E) Remove the #4-40 cap screws mounting power transistor heatsink to the base casting.

6.6.3 PCM Replacement

A) Before replacing PCM, apply a thin coating of heatsink compound, Dow-Corning #5 compound, between the power transistor heatsink and the base casting.

B) Connect J5 and J6 for the detent lamp on the PCM (white wire on J5 and black wire on J6 Grd).

6.6.3 (cont) C) Install the #4-40 cap screws. Check with VOM to assure that the collector terminals of the power transistors are not directly shortened to the casting.

D) Install the #6-32 cap screws that mount the PCM to the casting being sure to reconnect ground strap to the Read/Write Board.

E) Replace J3 and J4.

F) Connect Molex connector J2 to the PCM.

G) Connect the AC power cord to the drive and turn on the power switch. The power light and the detent lamp should come on.

H) Remove power from the drive and replace the R/W Board as indicated in B) of paragraph 6.8.2 prior to resuming normal drive operation.

6.7 DRIVE ELECTRONICS MODULE (DEM) REMOVAL/REPLACEMENT INSTRUCTION

6.7.1 Tools and Materials Required

A) 7/64" ball driver

6.7.2 DEM Removal

A) Turn off spindle motor main power.

B) Remove the following connectors on the DEM:
- J7 to the PCM 34 pin flat cable)
- J19 to the detent assembly (rear of DEM)
- J16 and J17 of the velocity transducer
- J20 sector transducer (rear of DEM)
- Resistor termination board if installed on drive
- I/O Cable

C) Remove the R/W Board from DEM connector J8. Remove the Option Board from DEM connector J9.

D) Remove the six 6/32" cap screws from the DEM and four 6/32" standoff screws.

6.7.3 DEM Replacement

A) Install the six 6/32" screws and the four 6/32" standoff screws securing the DEM to the back cover plate.

B) Connect the R/W Board to J8 on the DEM and connect the Option Board to J9.

C) Connect J4 to the PCM.

D) Connect the following to the DEM:

- J7 from PCM
- J19 from the Detent Assembly
- J20 from the Sector Transducer(s)
- Connect the black wire of the Velocity Transducer to J17 and the red wire to J16
- Termination board to J22 (if used)

6.8 READ/WRITE BOARD REMOVAL/REPLACEMENT INSTRUCTION

6.8.1 Read/Write Board Removal

A) Remove the write inhibit switch connector, all head connectors and ground strap attached to hold down screw.

B) Relieve the board retaining springs and pull the Read/Write Board out of J8 on the DEM.

6.8.2 Read/Write Board Replacement

A) Relieve the board retaining springs and connect to J8 of the DEM.

B) Connect the write inhibit switch connector, all head connectors and ground strap to the Read/Write Board. Head connector locations are identified on the board.

6.9 OPTION BOARD REPLACEMENT INSTRUCTION

6.9.1 Option Board Removal

Relieve the board retaining springs and pull the Option Board out of J9 of the DEM.

6.9.2 Option Board Replacement

Relieve the board retaining springs and connect to J9 of the DEM.

NOTE: The Servo must be aligned and the head current must be adjusted before the Option Board can be checked out.

6.10 INDEX/SECTOR TRANSDUCER ASSEMBLIES

6.10.1 Tools and Materials Required

A) 1/16" Allen wrench

B) .005" Mylar shim P/N 430049

C) CMIII test hub

6.10.2 Removal and Replacement Removable Disk Index/Sector Transducer

Turn the spindle motor and main power off.

Remove the CMIII cartridge. Loosen the #6-32 set screw that holds the transducer on the right side of the transducer mount (Reference Figure 6-6). Unsolder the twisted pair cable. Remove the transducer by rotating the transducer CCW as viewed from the front of the drive.

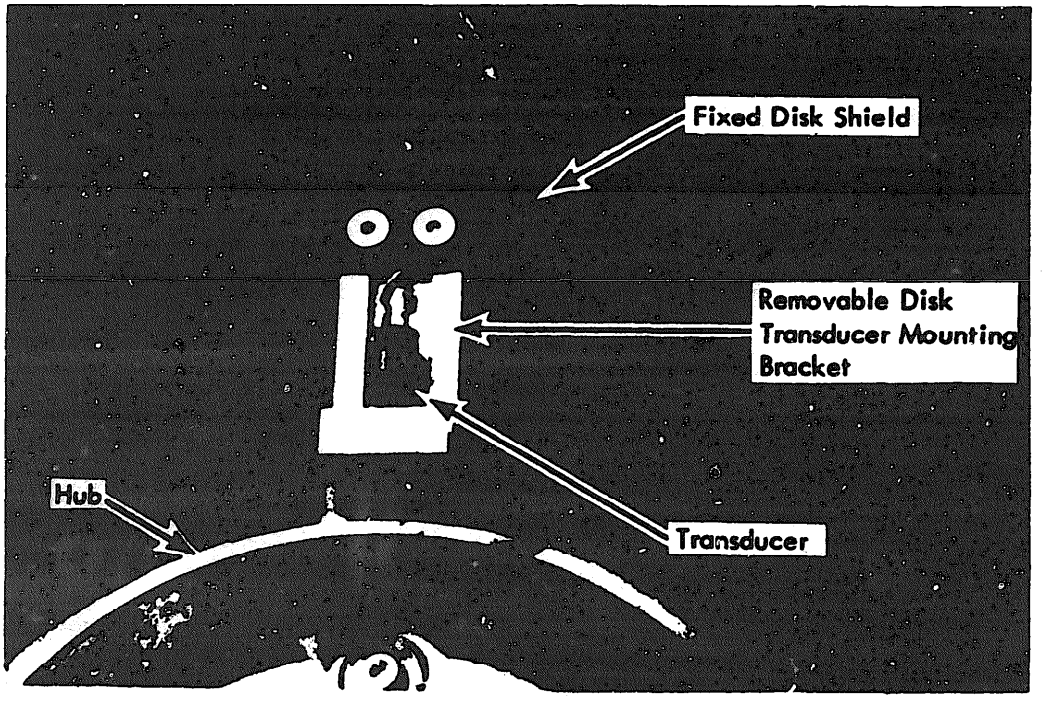


Figure 6-6. Removable Disk Index Sector Transducer

To replace the transducer for the removable disk, place the CMIII test hub on the drive. Rotate the transducer CW through the assembly until there is a .005" separation between the hub and the transducer. Use the mylar shim as a gauge. Solder the twisted pair cable with the black wire connected to the transducer unmarked pin. Remove the test hub and replace with the CMIII disk cartridge. The transducer can be now checked for electrical alignment. (Reference: Paragraph 7.7.1).

6.10.3 Removal and Replacement of Fixed Disk Index/Sector Transducer

Disconnect the mating connector at the transducer located on the underside of the baseplate casting (Reference Figure 6-7). Loosen the set screw on the transducer mount and rotate transducer CCW, viewing from the transducer toward the hub.

To replace the transducer, rotate the transducer CW through the transducer mounting bracket until there is a clearance of .005" between the hub and the transducer. Use the .005" shim as a gauge. Connect the mating connector to the transducer. The shielded wire mates with the unmarked pin. The transducer can now be checked for electrical alignment. (Reference: Paragraph 7.7.2).

6.11 MASK ASSEMBLY

6.11.1 Tools and Materials Required

A) 7/64" ball driver
B) 3/32" ball driver
C) 1/16" Allen wrench
D) Phillips screwdriver

6.11.2 Mask Removal

CAUTION

Transfer the data on the fixed disk to another disk. Unless a track has been pre-recorded to align the heads, data stored on the fixed disk may not be recovered when the mask or detent assembly is realigned.

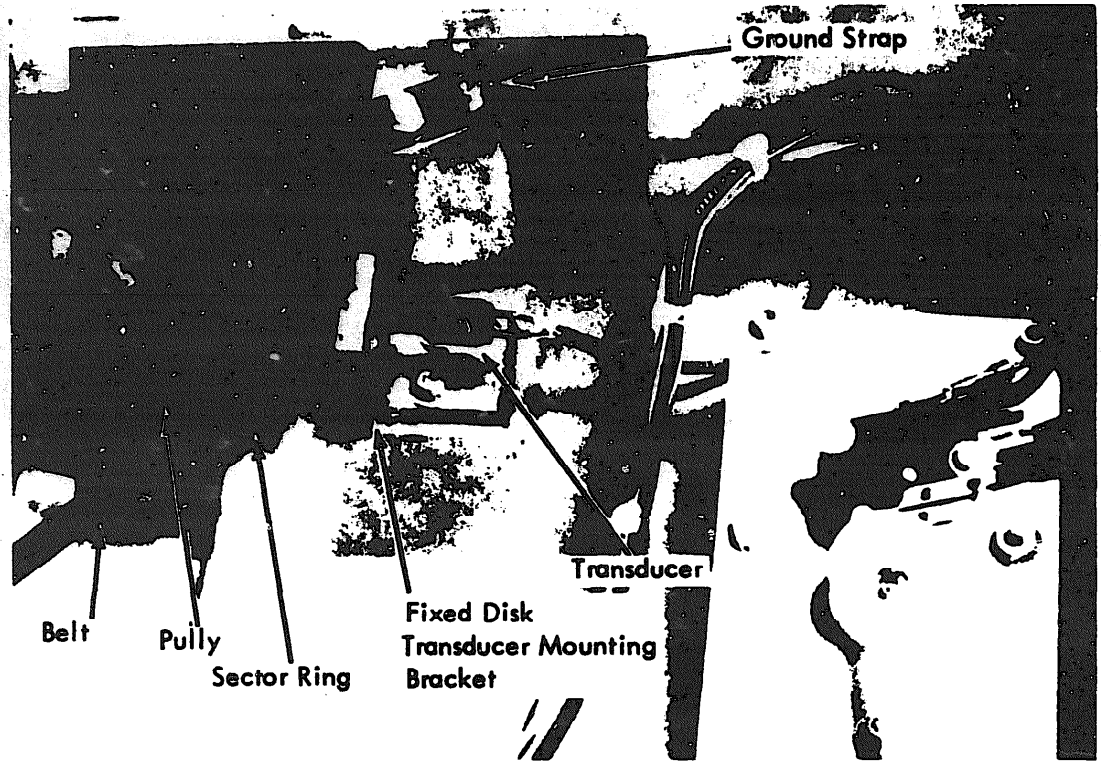


Figure 6-7. Disk Index/Sector Transducer

Extreme care must be exercised not to damage the heads when removing and installing the mask.

Turn off spindle motor and main power. Remove J4 from the PCM.

Separate the two top heads with a clean piece of paper.

To gain better access to the detent mask and to eliminate the possibility of damaging other components that are in the area of the mask assembly, remove the read/write board per paragraph 6.8.1 the head clamp support (Reference Figure 6-9) nd remove the two bottom (fixed disk) heads (Reference Paragraph 6.13).

Slide the carriage to the rear stop location (towards the positioner motor), remove the #4-40 Phillips screw holding the mask in place, and rotate the mask from under the detent assembly.

CAUTION

The mask to detent clearance is set at .005 in. As such, extreme care should be exercised when removing the mask to prevent damage to the detent assembly.

6.11.3 Mask Replacement

To replace the mask, reverse the procedure as defined in paragraph 6.11.2, respectively. Again: Care should be exercised when installing, due to the close proximity of the mask to the detent assembly. The plating that is on the mask assemblies is designed to resist minor abrasion; however, it will chip if care is not exercised.

Prior to tightening the #4-40 Phillips mounting screw, the mask should be positioned on the carriage such that it is as close to the positioner motor as possible and the shoulder on the underside of the mask assembly is flush with the edge of the carriage. (Reference Figure 6-8).

6.12 DETENT ASSEMBLY

6.12.1 Tools and Materials Required

A) .005" mylar shim P/N 430049
B) 7/64" ball driver
C) 3/32" ball driver
D) 1/16" Allen wrench

6.12.2 Detent Assembly Removal

CAUTION

Transfer the data on the fixed disk to another disk. Data stored on the fixed disk may not be recovered when the detent assembly is re-aligned. Extreme care must be exercised not to damage the heads when removing and installing the detent assembly.

Turn off spindle motor and main power. Remove J4 from the PCM.

Disconnect J19 on the DEM.

To remove the detent assembly, loosen the Allen screw on the rear of the detent assembly. Pull the detent assembly upward.

6.12.3 Detent Assembly Replacement

Install the detent assembly on the post in the casting. Place a .005" mylar shim between the detent assembly and the mask (Figure 6-8). Slide the assembly down until there is .005" clearance between mask and the detent assembly and remove shim. Tighten the Allen screw on the side of the detent assembly. (Reference Paragraph 7.8 for detent alignment).

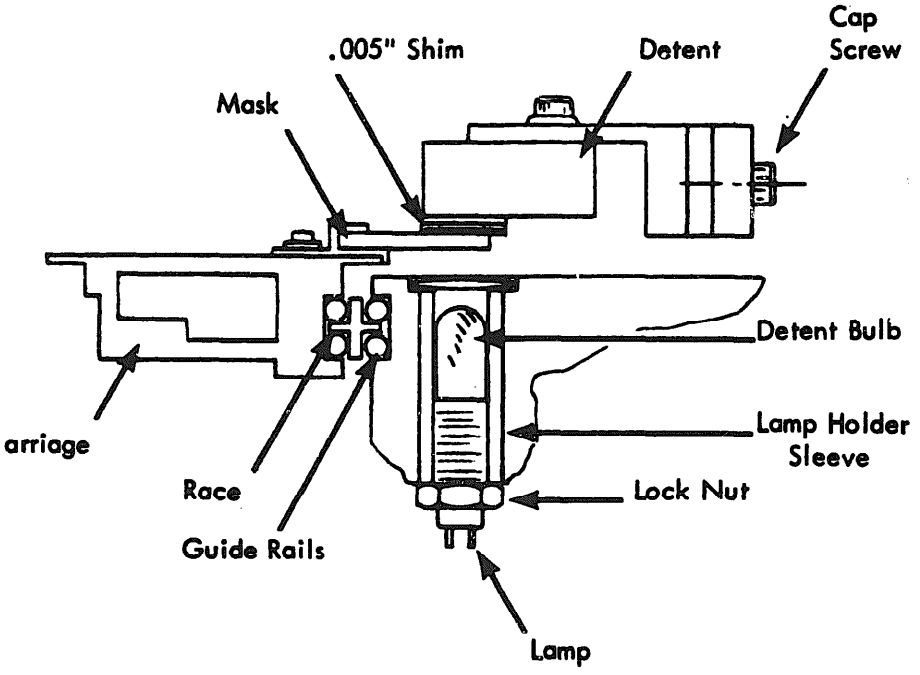


Figure 6-8. Mask/Detent Height Adjustment as Viewed From the Spindle

6.13 READ/WRITE HEAD REPLACEMENT

6.13.1 Tools and Materials Required

A) 7/64" ball driver

B) Small screwdriver

C) Torque screwdriver

CAUTION

Before replacing the heads for the fixed disk, it is required to transfer the data onto another disk. Previously stored data may not be recovered otherwise.

6.13.2 Head Removal

Turn off spindle motor and main power. Disconnect power cord.

Remove the ground strap connecting Read/Write Board to PCM.

Disconnect the head connectors to the Read/Write Board. Remove the head lead support attached to the carriage assembly by removing the #6-32 cap screws.

Loosen the #6-32 head lead clamp screws and remove the leads.

Remove the #6-32 cap screw holding the head clamp bracket for the top and bottom heads.

Gently set the top head away from the ramp support, slightly lifting the head and depressing the bottom surface head away from the head ramp. At the same time pivot the other end of the head away from the head support assembly and slide the head out. Do not touch the ceramic part or the gimbal spring of the head. Repeat for all heads to be replaced.

6.13.3 Head Replacement

To replace heads, carefully insert the head assembly into the head support and place the top of the head into the head loading area. Do not

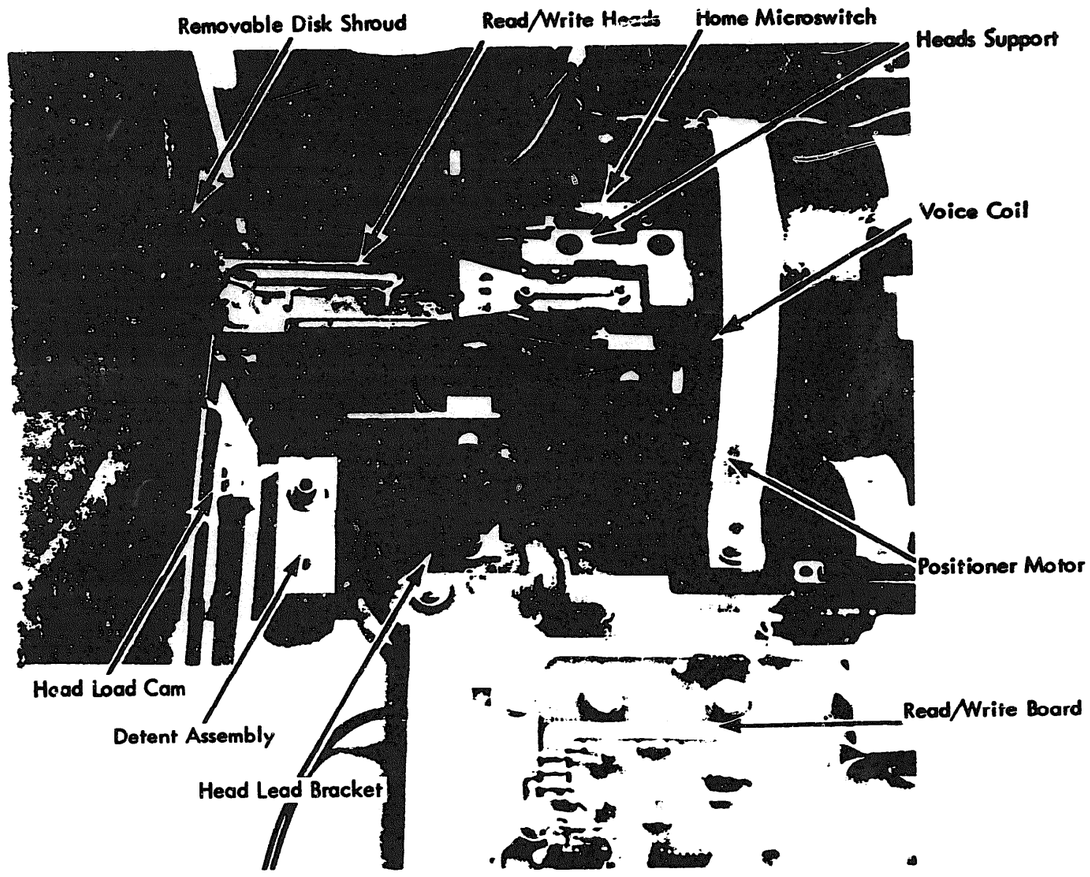


Figure 6-9. Read/Write Heads

touch the ceramic part or the gimbal part of the head. Install the cap screw and the head arm clamp insuring that the head arm is on the load cam. Replace the heads from the bottom to top.

Replace the head lead brackets and lead supports by reversing the procedure as defined in paragraph 6.13.2.

Connect the head connectors to the Read/Write Board. Their locations are identified on the Read/Write Board.

If all four heads are replaced, calibrate the Read/Write Board per paragraph 7.10 and head alignment per paragraph 7.12.

6.14 SPINDLE MOTOR BELT AND ADJUSTMENT

NOTE: Under normal operating conditions and with proper tension the Drive Motor Belt should last the lifetime of the machine. Proper belt tension must be maintained in order to avoid excessive wear.

6.14.1 Tools and Materials Required

A) 5/64" ball driver
B) 7/64" ball driver
C) 1/8" ball driver
D) 5/32" ball driver
E) 2000 Gram gauge
F) Phillips screwdriver

6.14.2 Removal of Spindle Motor Belt

Remove three screws and blower housing inlet cover. Loosen set screw, using 1/8" ball driver and remove blower impeller. Remove three blower housing screws, using 5/64" ball driver and remove blower housing. When removing blower housing care must be taken not to damage rubber seal between blower outlet and air plenum cover.

Remove two screws and ground strap using 7/64" ball driver. Loosen idler pulley screw using 5/32" ball driver. Belt is now exposed and may be removed.

6.14.3 Replacement of Spindle Motor Belt

Slide belt over motor pulley and spindle pulley taking care not to disturb adjustment of sector transducer. Make sure belt is centered on motor pulley. Using a gram gauge, range 0-2000 grams, adjust tension on belt by applying pressure against idler pulley. When tension reads between 1500 and 2000 grams, tighten idler pulley screw while maintaining pressure against idler pulley. Reassembly ground strap and blower assembly.

NOTE: Resonant frequencies within the drive may cause vibration when the belt is tightened at the low end of the adjustment range. If this occurs, increase tension on idler pulley to a maximum of 2000 grams.

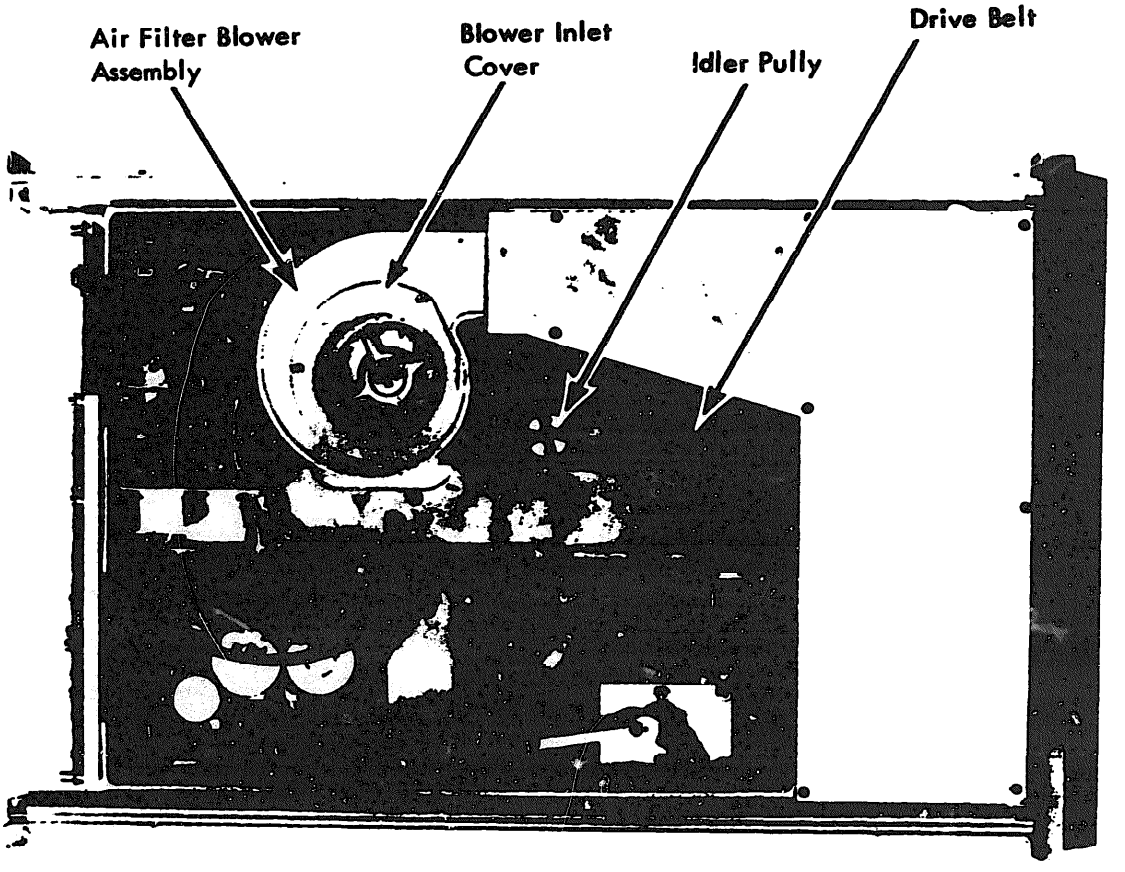


Figure 6-10. Model 303, Bottom View

6.15 FIXED DISK/SPINDLE ASSEMBLIES

NOTE: The condition of the faces of the Read/Write head is the guide to the state of the disk surfaces. A clean head that repeatedly accumulates oxide deposits indicates that the disk surface is dirty or scratched or has imbedded particles. If cleaning or changing the heads and cleaning the disks does not rectify the condition, carefully examine the disk surfaces for scratches, imbedded particles and discolored spots.

6.15.1 Tools and Materials Required

A) Fixed Disk Replacement Kit, Catalog #306

B) Torque screwdriver and Phillips tip

C) (5/64) ball driver

D) (5/32) ball driver

E) Adjustable wrench

F) Gram gauge

G) Cleaning Kit, Catalog #303

6.15.2 Fixed Disk Inspection

An indication of damage to the fixed disk may be gained from the condition of the lower read/write heads or presence of persistent read or write errors or ticking noises from the drive. If head to disk interference has caused visible damage, change the heads. Inspect the disk cartridges that have been used prior to the head-to-disk incident to make sure that they have not been dropping oxide or plastic particles.

Visually inspect the upper surface of the fixed disk after first removing the shroud and fixed disk shield. Examine the disk surface for (1) spiral scratches, (2) scratches that expose metal, (3) imbedded particles. If the lower surface is suspected, remove the disk to inspect it.

6.15.3 Cleaning

Clean both surfaces of the fixed disk as follows:

Remove the disk cartridge, the top cover, the shroud and the fixed disk shield. Wrap a lint-free tissue (Kimwipe) around the cleaning paddle and

6.15.3 (cont) dampen with isopropyl alcohol. Exert gentle pressure on the disk surface while rotating, keeping the paddle horizontal. Withdraw the paddle while the disk is still rotating. Dry the disk with a dry tissue in a similar manner to that for cleaning.

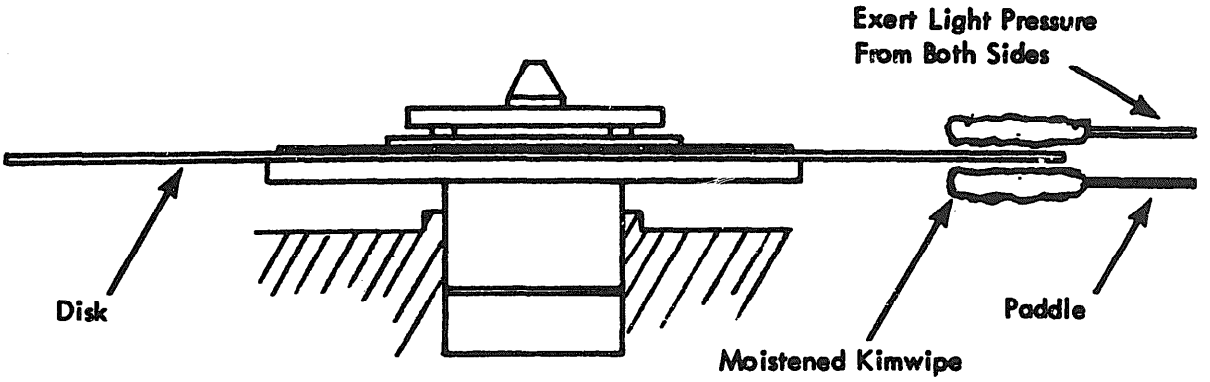


Figure 6-11. Fixed Disk Cleaning

6.15.4 Fixed Disk Removal

Before removing the fixed disk, give the customer an opportunity to recover the data that is contained on it. Remove the fixed disk as follows:

Turn off power, insuring first that the disk cleaning brushes are fully retracted. Open the cartridge latches and remove the cartridge. Remove the drive top cover. Unplug the write/inhibit switch P14 and the latch solenoid plug. Remove the shroud assembly. Unplug the sector transducer. Remove the fixed disk shield assembly, being careful not to damage the sector transducer or the disk as it is exposed at this point. To remove the fixed disk, remove the eight Phillips screws and nylon washers, and the clamp ring. Store the screws and clamp ring flat, protected by tissue. Push down on one side of the disk while holding the other side and lift out the disk.

6.15.5 Spindle Inspection

The head to disk interference which has caused the fixed disk to be removed may be related to a spindle bearing that has prematurely failed.

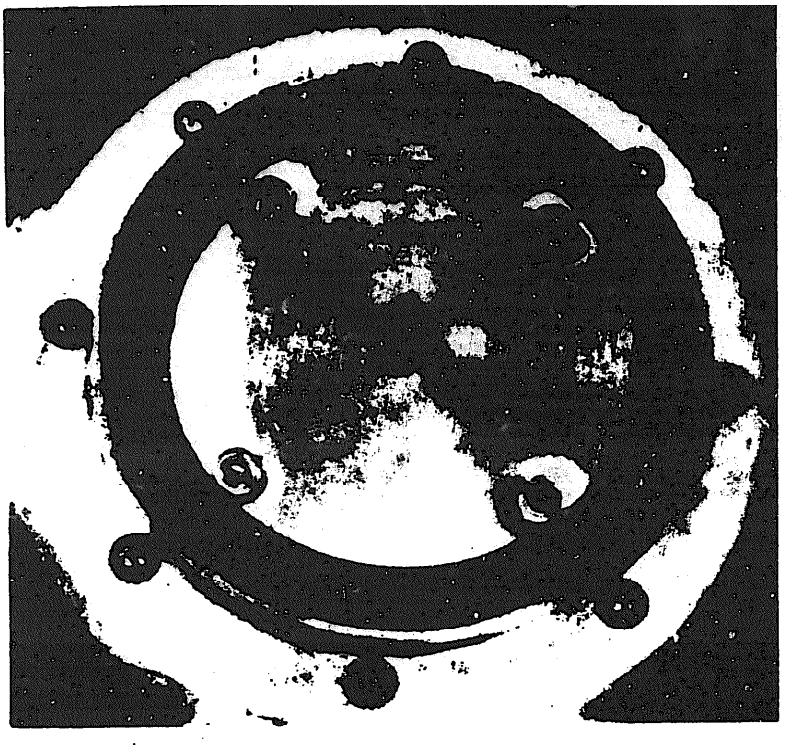


Figure 6-12. Fixed Disk Mounting

This will be evidenced by a buzzing or rattling sound in the spindle during up speed. If this is the case, the spindle should be replaced.

6.15.6 Spindle Removal

Remove top cover and fixed disk per paragraph 6.15.4. From the underside of the drive, remove the Allen screws holding the ground strap in place. Rotating the ground strap out of the way, loosen the drive belt idler pulley and remove the belt. Remove the #4-40 screw holding the ground button. Remove the stud holding the spindle pulley in place and remove the spindle pulley. Now, using the special "E" ring removal tool found in fixed disk replacement kit, remove the retainer ring holding the spindle in place. Care should be taken in removing the retainer ring as metal chips in the area of the spindle may make it difficult to remove because of the close tolerances. The spindle may now be removed from the top of the drive.

6.15.7 Spindle Replacement

Thoroughly clean the cavity of the drive using a vacuum cleaner and alcohol moistened tissues. Carefully replace the new spindle, making sure that no chips are generated. Note: The tolerances between the spindle body diameter and the hole in the casting are extremely close, so care should be taken when installing. Repeat the steps in paragraph 6.15.6 in reverse order to complete replacement.

6.15.8 Fixed Disk Replacement

New fixed disks are supplied in Caelus fixed disk replacement kit, catalog #306, which also contains a nylon handling glove.

Thoroughly clean the cavity of the machine, using first a vacuum cleaner then isopropyl alcohol moistened tissue. Wipe the spindle chuck and clamp ring. Upon opening the disk shipping container, handle the disk only with the nylon glove. Moisten a lint-free tissue with isopropyl alcohol and clean the lower surface of the disk with the tissue. Dry the surface with dry tissue in a similar manner. Still wearing the glove, carefully place the disk on the spindle chuck without allowing the coated surface to touch any part of the machine. The chuck has a machined ridge which will align the disk to the spindle but care must nonetheless be exercised so that the disk seats properly in place. Place the clamp ring in position and insert the eight screws with nylon washers. Tighten the screws in sequence shown in Figure 6-13 with torque screwdriver to 18 ± 2 inch pounds.

NOTE: Avoid dropping metal particles from the screw slot. Use a strip of adhesive tape for picking up particles. Inspect the disk top surface for any foreign particles and clean with moist and dry tissues. After the disk has been reinspected, install the fixed disk shield, being careful not to drop any particles onto the disk.

Before the drive can be used, and prior to installing the top cover, perform any disk initialization program (that is in use) five times without error or alternate track assignment. If any alternate tracks

are assigned, change the disk. Three alternate tracks on any surface must be available to the customer on a newly fitted disk. Inspect lower heads after initialization for accumulation of oxide and clean as required.

Replace the fixed disk shield and shroud in reverse order as outlined in paragraph 6.15.4.

Replace the top cover and clean machine prior to release.

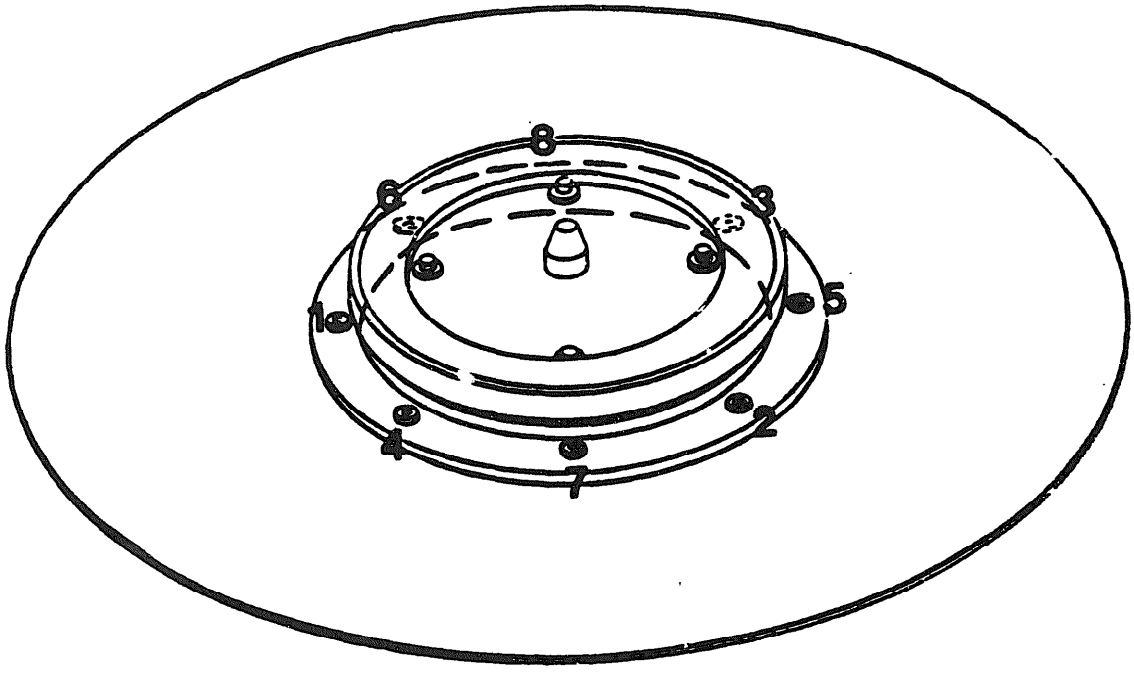


Figure 6-13. Fixed Disk Hub Screw Pattern

6.16 CARRIAGE/VELOCITY TRANSDUCER/POSITIONER MOTOR ASSEMBLY

6.16.1 Tools and Materials Required

A) 5/32" ball driver
B) 7/64" ball driver
C) 1/16" Allen wrench
D) #2 Phillips head screwdriver
E) Soldering iron

6.16.2 Removal of the Velocity Tranducer/Positioner Motor Assembly/Carriage

To remove position transducer, positioner motor assembly and carriage assemblies proceed as follows:

A) Remove DEM and mounting bracket as one unit:

- Remove option board
- Disconnect head plugs
- Disconnect inhibit switch plug
- Remove read/write board
- Disconnect velocity transducer wires J16, J17, J18 (J18 has been deleted on machines built after October 1972.
- Disconnect J19 detent plug
- Disconnect P7 PCM connector cable
- Disconnect J20 sector transducer plug
- Remove four #6-32 socket head screws holding support to top edge of base casting.

B) Remove read/write heads from carriage assembly per paragraph 6.13.2. Move carriage to the rear most position and remove detent mask assembly from carriage per paragraph 6.12.2.

C) Remove velocity transducer:

- Disconnect voice coil P4 from PCM board
- Loosen, no more than required for rotating position motor, the four #10-32 socket head screws that secure the positioner motor.
- Carefully rotate positioner motor clockwise (facing the rear of drive) approximately 30°.
- Connect power cord and start spindle. Wait for brush cycle completion and manually move carriage to the forward stop.

NOTE: It is required to start the motor so that the heads will fly on the disk when moving the carriage.

- Loosen #6-32 set screw two turns. This set screw is threaded into the motor core and is accessible through left air slot (Figure 6-14).
- Pull velocity transducer out from rear of positioner motor.
- Bring carriage home and disconnect power cord.

D) To remove positioner motor:

- Further loosen (do not remove) four #10-32 socket head screws securing positioner motor.
- Carefully remove positioner motor from rear of drive.

NOTE: A twisting motion will aid in removal of the motor. The velocity transducer magnet is particularly vulnerable during this operation.

CAUTION

Cover all openings of positioner motor with masking tape prior to setting down. This will prevent debris from being injested into positioner motor.

- Set positioner motor rear end down on a clean surface.

Motor has a very strong magnetic field and debris is difficult to remove.

E) The carriage race assembly is held in place with a leaf spring located on the bottom of the carriage. Access to that leaf spring is available through three holes located on the underside of the baseplate. Using these three holes, loosen but do not remove the three hold down screws

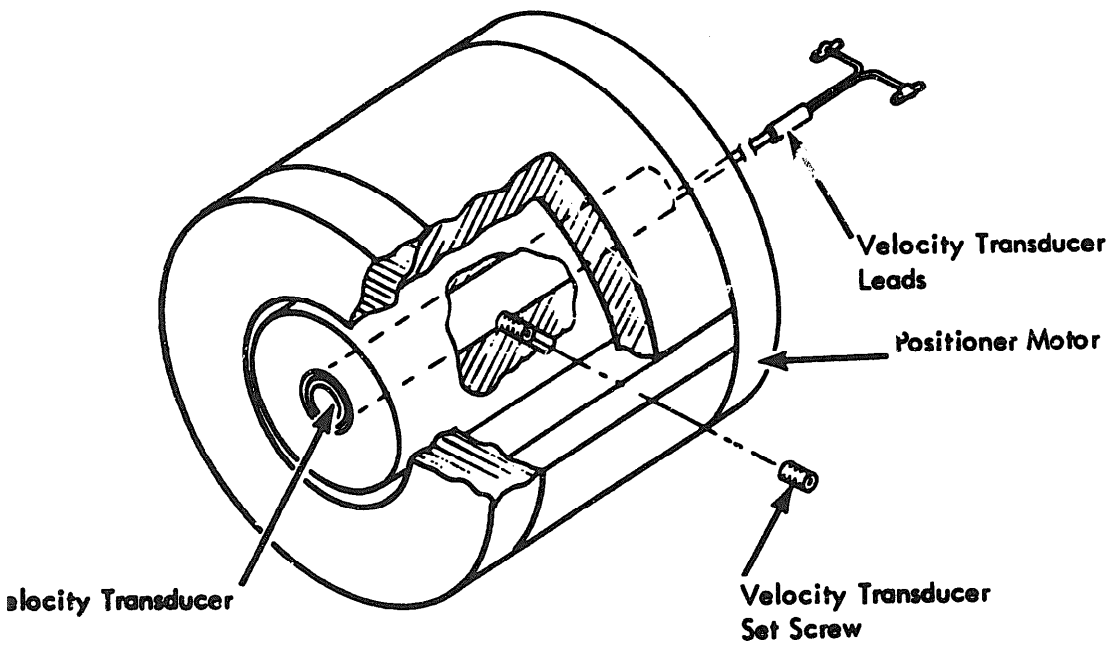


Figure 6-14. Velocity Transducer Alignment

holding the leaf spring in place. Now, from the top of the drive loosen the flex circuit hold down clamp and remove. Remove the rear cover plate on the carriage held on with two screws. While holding the race assemblies in place, located on either side of the carriage, carefully slide the carriage out of the casting. The carriage race assemblies ride on guide shafts which are located inside of the casting. These are now exposed. Remove all carriage guide shafts from casting. The complete carriage assembly, guide shafts, rack assemblies, race assemblies, and bearings should now be inspected for wear. If wear is visible on any of these parts they should be replaced. The head support is located to the carriage at the factory and should not be removed. This must be aligned at the factory and cannot be aligned in the field.

6.16.3 Replacement of the Carriage/Velocity Transducer/Positioner Motor Assembly

Prior to replacing the carriage assembly into the casting, clean the casting and all guide shafts with isopropyl alcohol/water mixture. If velocity transducer magnet, voice coil and/or flex circuit have to be replaced, proceed as follows:

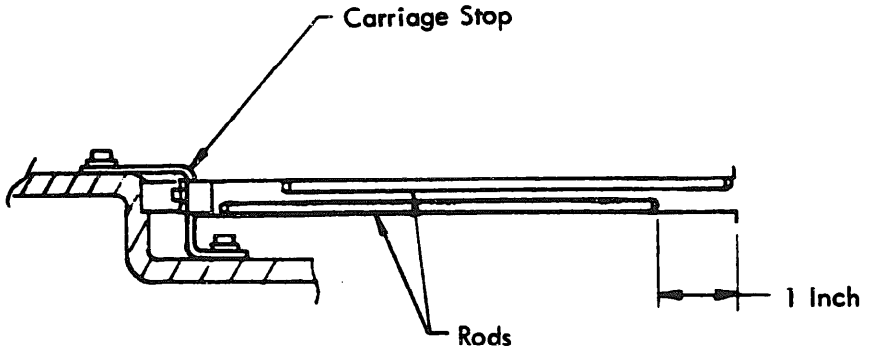


Figure 6-15. Carriage Rod Positioning

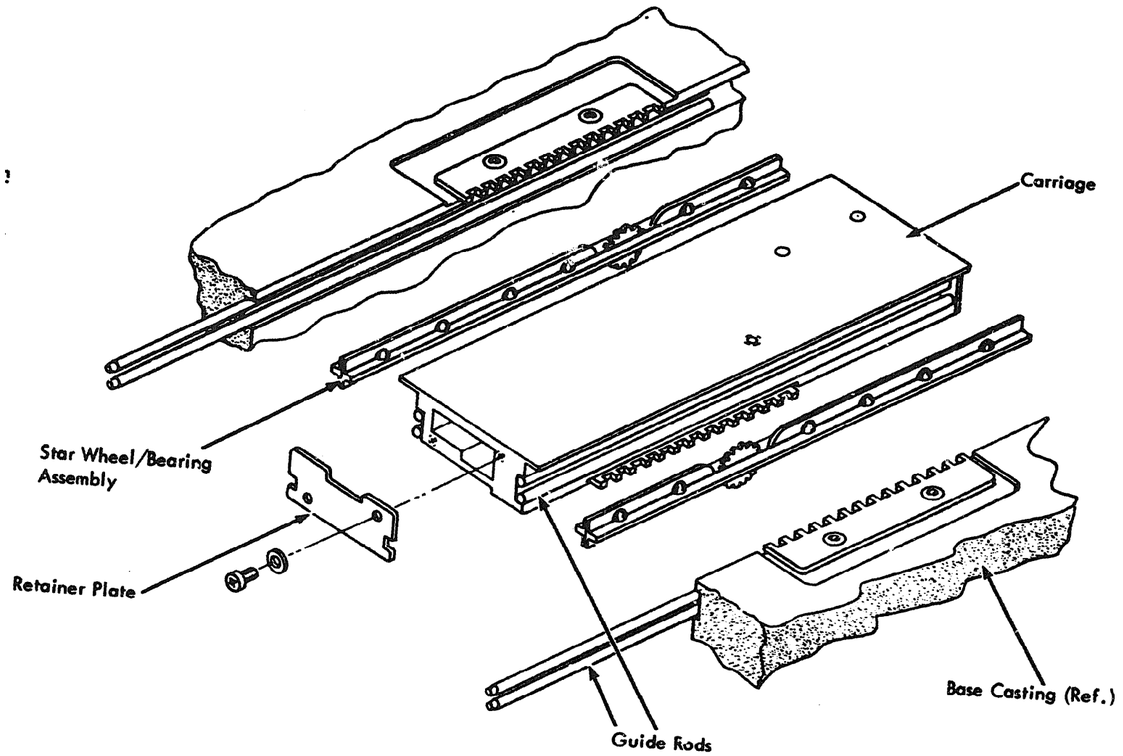


Figure 6-16. Carriage Slide Assembly

from voice coil are insulated and not grounding against the carriage assembly. Tighten velocity transducer magnet to voice coil assembly with hold down screw to .13 ± 2 inch/pounds. Loose assemble the voice coil assembly to the head support bracket with two hold down screws and assemble the flex circuit assembly and race retaining spring to the bottom of the carriage using three hold down screws. These should be loose assembled.

Check three screws holding rack tension in place to verify that they are loose. (Plastic rack must be movable).

Check two screws holding coil to head to verify that they are loose.

Prepare rods by wiping with a Kimwipe and very lightly greasing using (Aero Shell Grease #7/GIA, MIL-G23827A, AMA). Prepare only those rods being used on the machine being worked on.

Position four "long" rods in channel in baseplate with bottom two pushed toward spindle as far as possible (against stop) and top two rods protruding approximately 1" out further than lower rods. See Figure 6-15.

Position four "short" rods and two race assemblies in channel in carriage. Insert entire assembly in baseplate. Push all rods against stop towards spindle.

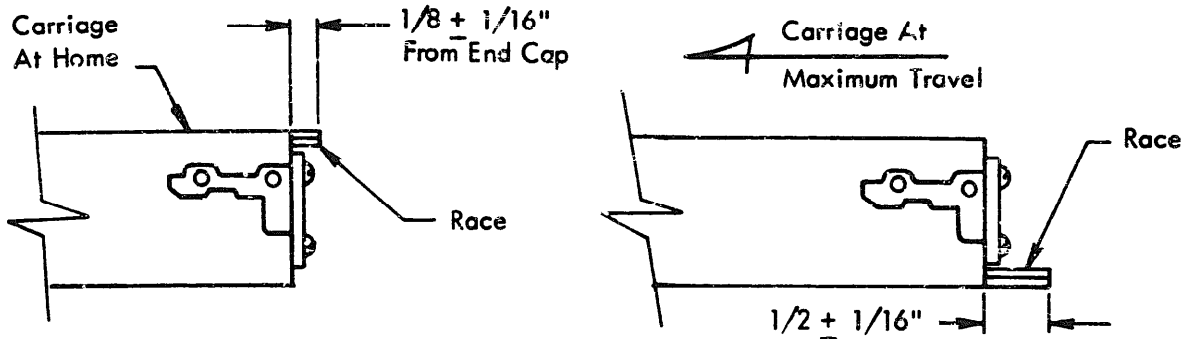


Figure 6-17, Carriage Race Alignment

Tighten the three rack tension screws through the access holes in the baseplate underside. Check position of rods, races and free movement of carriage.

Place shim inside coil. (2 turns of .0075 mylar) See Figure 6-18.

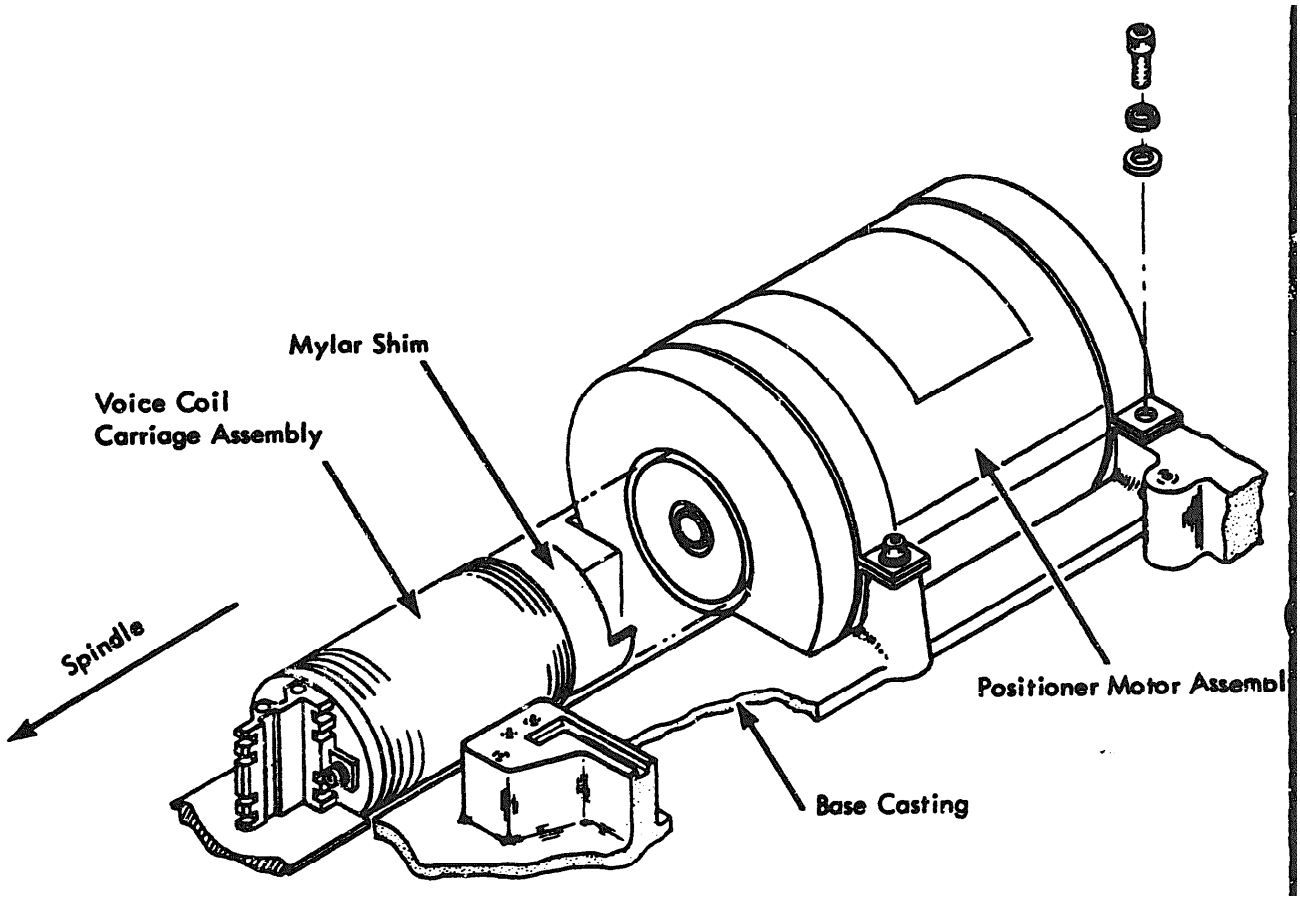


Figure 6-18. Voice Coil Alignment

Select two positioner motor clamps which closely match for bottom set. Attach all clamps leaving top rear clamp free on one side. Insert positioner motor and tighten clamps only to point where lock washers start to deflect. End of positioner motor is to be flush with edge of clamp on edge closest to spindle.

Push clamps away from spindle as far as they can go. Note gap between head support and coil end plate and move positioner motor to align correctly. (Use a plastic head hammer as needed to move positioner

motor). Tighten coil. The carriage should now move fairly stiffly because of the drag of the shim on the positioner motor. Realign positioner motor as needed with coil loosened from the head support.

Insert the velocity transducer with the coil pushed into the positioner motor as far as possible. Pull the velocity transducer out an additional 1/8" before tightening the set screw. Pull the carriage out to the point where the set screw holding the transducer in place can be tightened through the slot in the positioner motor. Tighten the set screw. The shim may have to be worked back into the carriage with a screwdriver or other tool.

Remove the shim.

If the carriage does not move freely, the velocity transducer will probably be rubbing on the magnet in the coil. Final adjustments can be be made by loosening the coil and adjusting the air gap around magnet so that it is fairly even at both ends of travel viewed through the end of the velocity transducer.

CAUTION

The carriage assembly must exhibit no drag, either on the voice coil, velocity transducer, or bearings. If drive is allowed to operate without the carriage moving freely, damage to the servo circuit may result.

Reassemble DEM supports and DEM to rear of casting. Reassemble mask onto carriage and replace heads. Reinstall option board, read/write board, and flex circuit. At this point the detent and servo alignment must be readjusted see paragraphs 7.8 and 7.9.

Check head alignment and realign if necessary. Tighten head arm clamp screws to torque specification, 12 ± 1 inch pounds.

6.17 AIR FILTER

6.17.1 Tools and Materials Required

A) 5/64" ball driver

CAUTION

Handle air filter with care to prevent it from becoming dirty. A dirty filter shortens the life of disks and Read/Write Heads.

6.17.2 Service Check

Examine filter every six months under normal office or computer room conditions. When drive is operated over prolonged periods in a dusty environment more frequent checks are recommended. Look for dirt and breaks in the material. Change a dirty or defective filter; do not attempt to clean or repair it.

6.17.3 Removal

Remove eight plenum cover screws and carefully lower plenum cover and filter from bottom of baseplate.

If filter is damaged or dirty, it should be discarded.

6.17.4 Replacement

NOTE: Prior to installing new filter, the plenum area of the casting should be vacuumed and wiped clean with isopropyl alcohol solution and water. This is required to prevent premature filter failure.

Install filter in opening in baseplate with air flow direction arrow pointing toward fixed disk.

Refit plenum cover to baseplate assuring that seal is intact.

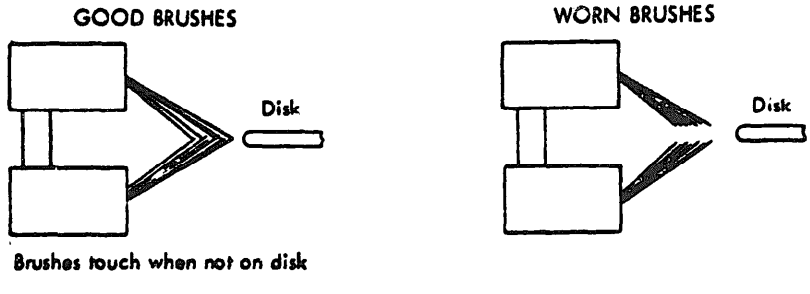


Figure 6-19. Disk Brush Condition

6.18 DISK CLEANING BRUSHES

6.18.1 Inspection

Check that brushes are not worn to extent that they fail to be deflected as they pass over the disk (See Figure 6-19). If worn, they should be changed.

6.18.2 Removal and Replacement

Change brushes if they are worn as follows:

- Turn off power and remove top cover
- Remove shroud assembly
- Remove spring clip holding brush arm to brush drive shaft. Take care not to damage clip
- Slide brush arm off of shaft
- Unclip worn brushes from end of brush arm and remove
- Slide on new brushes making sure that right and left hand brushes are in proper position and bristles are making contact per Figure 6-19.

6.19 SPINDLE DRIVE MOTOR REMOVAL AND REPLACEMENT

6.19.1 Tools and Materials Required

A) 7/64" ball driver

B) 9/64" ball driver

C) 1/16" Allen wrench

D) Slotted screwdriver

CAUTION

Always turn off power before working on the drive. The drive motor contains a thermal overload cutout that will restore power to the motor after overheating.

6.19.2 Removal

Disconnect motor from main drive harness by separating plug P24 on yellow motor wire.

Remove cover from relay module, disconnect blue and red motor wires from relays K1 and K2.

Carefully withdraw red and blue motor wires through opening in relay module and hole in baseplate.

Remove blower housing and impeller see paragraph 6.14.2.

Loosen idler pulley and slide drive belt off of motor pulley.

With drive in upright position, remove four screws, lockwashers and flatwashers holding spindle drive motor to baseplate.

Spindle drive motor, pulley and shaft may now be removed through top of baseplate.

Loosen upper pulley set screw (set screw on drive motor side of pulley) and remove pulley/impeller shaft from drive motor shaft.

C A U T I O N

Spindle drive motor pulley and impeller shaft should be left assembled as they are preadjusted for height at the factory. If it should become necessary to disassemble them for replacement, etc., use Caelus drive pulley adjustment tool #430366 to reinstall.

6.19.3 Replacement

Replacement motors are supplied complete with leads, connector, and lugs. Reinstall motor pulley/impeller shaft using drive pulley adjustment tool if parts have been disassembled.

Secure motor to baseplate.

Route red and blue wires through hole in baseplate and into relay module.

Reconnect wires to relays K1 and K2 in relay module. Reconnect yellow motor wire to main drive harness at connector P24. Replace cover on relay module.

Slide belt over motor pulley and adjust see section 6.14.3.

Replace blower housing and impeller.

6.20 HOME MICROSWITCH ADJUSTMENT

6.20.1 Tools & Materials Required

A) 7/64" ball driver.

6.20.2 Adjustment (Reference Figure 6-9).

- Disconnect voice coil (plug J4).
- Turn power on.
- Turn spindle motor on.
- Once the spindle motor has reached up speed, manually push the carriage to the home position.
- Slowly move the carriage towards the spindle until the home microswitch clicks.
- Check the location of the heads to verify that they are on the magnet side of the head protect bracket. (See Figure 6-20).
- Tighten limit switch with two #4-40 Allen screws to 6-8 in. pounds torque)
- Turn off power to drive and replace the voice coil plug P4.

6.21 PACK INTERLOCK SWITCH ADJUSTMENT

6.21.1 Tools and Materials Required

A) 7/64" Allen wrench

B) Q-tip

6.21.2 Adjustment Instructions

Turn power off of drive.

Remove drive top cover.

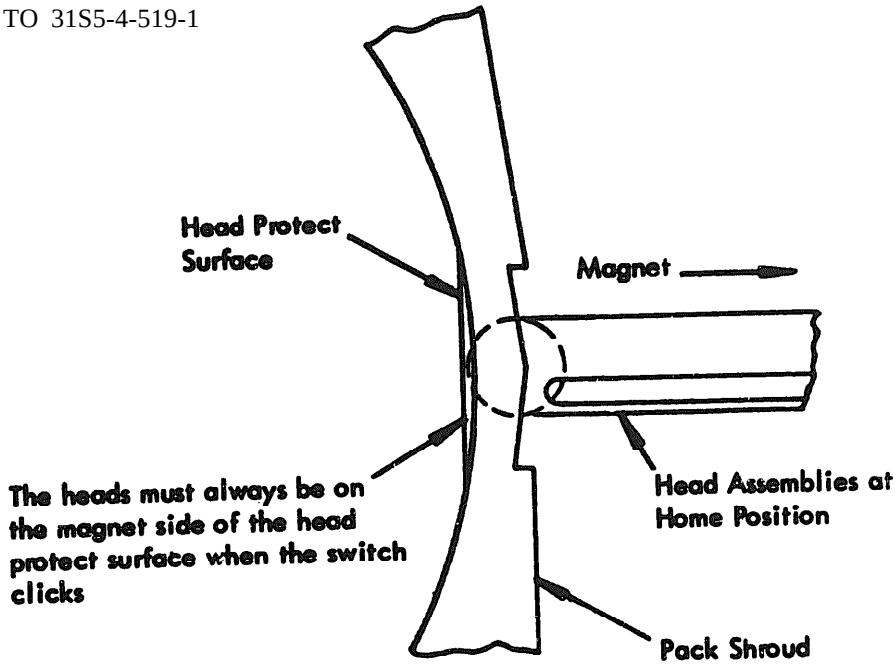


Figure 6-20. Home Switch Adjustment

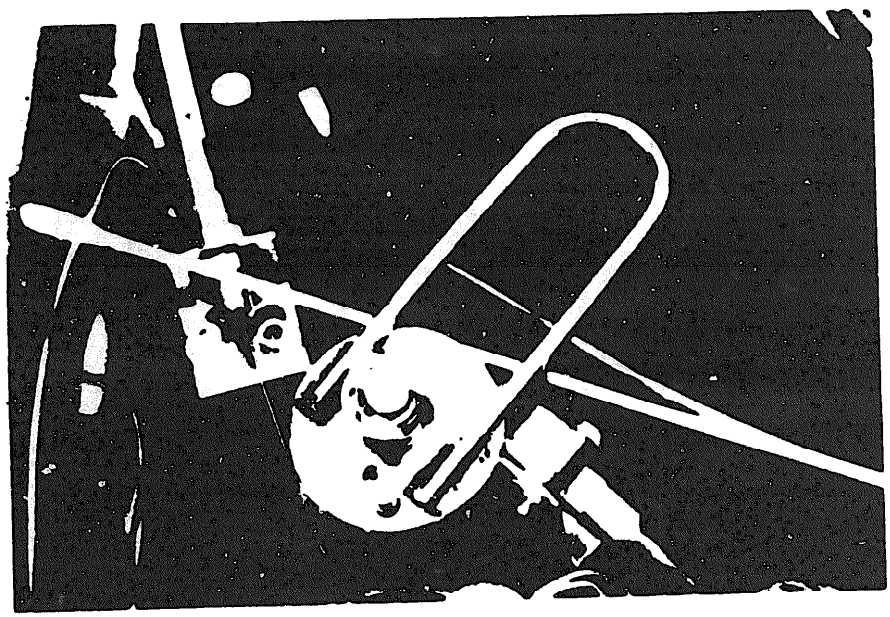


Figure 6-21. Interlock Switch

Insert Q-tip under solenoid plunger so that interlock handle can move the full stroke. (See Figure 6-21).

With handle in original position as shown, move handle in direction of arrow. Limit switch should click just after passing solenoid. Adjust limit switch for this condition and tighten. Remove Q-tip.

Remove disk cartridge top cover and replace drive cover.

6.22 HEAD LOAD CAM ASSEMBLY

6.22.1 Tools and Materials Required

A) 7/64" Hex Driver

B) Torque screwdriver

6.22.2 Head Load Cam Installation and Adjustment

NOTE: The Head Load cam assembly may be adjusted after the heads are installed; however, the assembly can only be replaced if the heads are removed.

A) Locate head load cam assembly #301000 on base casting and install two #6 socket head cap screws with flat and lock washer per Figure 6-22

B) Push head load cam assembly as far towards the positioner motor as possible and tighten to 15 ± 2 inch/pounds.

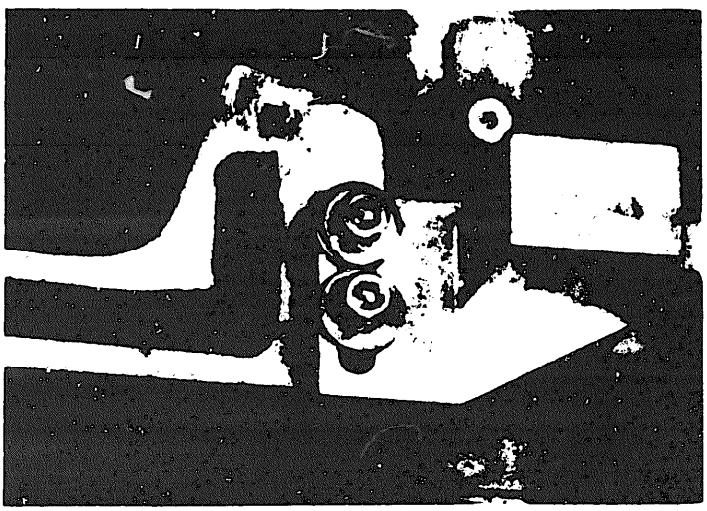


Photo Figure 6-22. Head Cam Load Assembly

7.1 TOOLS REQUIRED

Name	Mfg.	Part Number
Head Connector Loop Adapter	Caelus	430327
Termination Board	Caelus	301308
I.C. Extender 14 pin	A.P., Inc.	Model TC-14
I.C. Extender 16 pin	A.P., Inc.	Model TC-16
Potentiometer Alignment Screwdriver	Walpco Elec.	2525
Soldering Iron	Weller	Model W60

7.2 STANDARD TEST EQUIPMENT

Name	Suggested Manufacturer	Part Number
Oscilloscope	Tektronix	Model 453 or equivalent
Digital Voltmeter	Systron-Donner	7050 or equivalent
CE Alignment Cartridge or	IBM	5440 Cartridge P/N 2537301
CE Alignment Cartridge	Caelus	CMIII, 302209-009
Frequency Counter (Optional)	Systron-Donner	Model 8050 or equivalent
AC Current Probe	Hewlett-Packard	Model 1110 A or equivalent

7.2.1 Drive Test Unit

The Caelus Drive Test Unit (DTU-1) is a light-weight, portable electronic test device designed to check out the performance of the Caelus Disk Cartridge Drive and provides the versatile control and test functions required to evaluate disk drive integrity; specifically, access mechanism performance and data reliability. The DTU-1 is a valuable test instrument since it eliminates the necessity of using the computer for maintenance when a malfunction is suspected in a disk drive. The DTU-1, with internal power supply is enclosed within a molded, vinyl attache' type carrying case. Caelus catalog number is 304.

7.3 PERIODIC CHECKS (6-MONTH INTERVALS)

Routine checks should be limited to the following areas as long as drive is functioning properly. Refer to the specific sections of this manual for detailed procedures.

- PCM Voltages, 7.6
- Servo Positioner Mechanism, 7.9.3
- Read/Write Head Alignment, 7.12
- Transducer Output for Index and Sector Pulse, 7.7
- Data Discriminator, 7.11.1
- Read/Write Head Inspection, 6.13
- Detent Mask, checked and cleaned if necessary, 6.11.

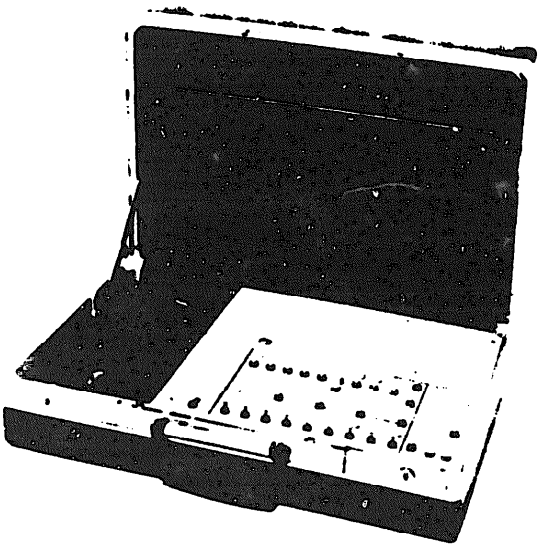


Figure 7-1. Drive Test Unit (DTU)

7.4 TROUBLESHOOTING GUIDE

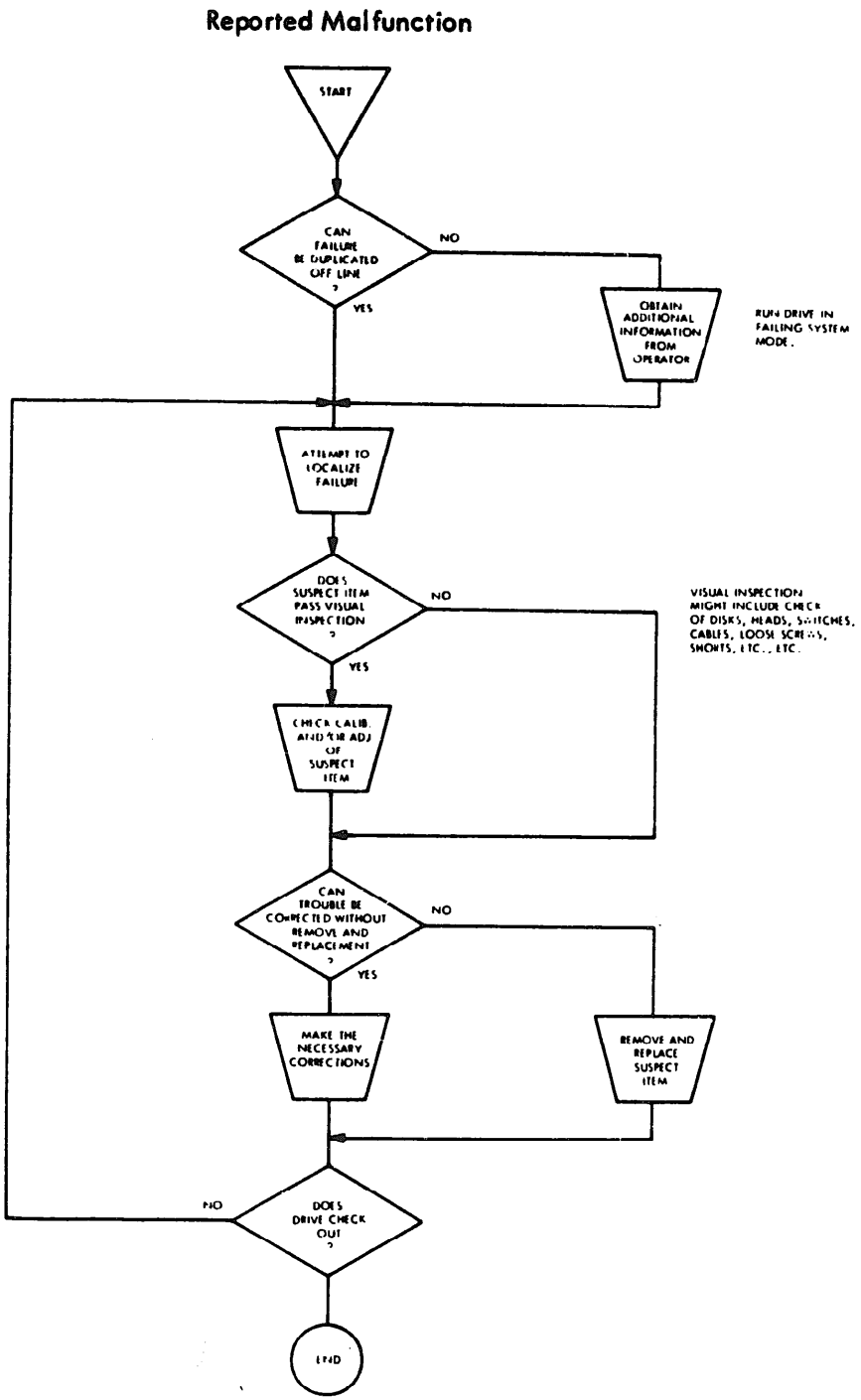


Figure 7-2. Troubleshooting Diagnostic Flow Chart

7.5 DIAGNOSTIC GUIDE

SYMPTOM	POSSIBLE CAUSE	REMEDY
1) Power Indicator does not lite.	- Burned out bulb or fuse	- Replace bulb or fuse
2) Latch does not operate after 30 seconds/ light inoperative.	- Carriage Home Switch out of adjustment	- Adjust Carriage Home Switch
	- Burned out bulb	- Replace bulb
3) Motor does not turn when Start/Stop Switch turned on.	- Cartridge Interlock Switch out of adjustment	- Adjust Cartridge Interlock
	- Motor temperature cut-out energized.	- Let cool down, check for excess friction in drive.
	- Receiver mis-alignment	- Check cartridge receiver alignment
4) Heads do not load, no Ready light.	- Shipping hardware installed	- Remove shipping hardware
	- No upspeed	- Jumper C to D if necessary
		- Check output of sector transducers.
	- No "Power On" logic signal	- Check "Power On" logic
	- Relay K3 not energized	- Check relay driver logic
	- P4 unplugged, or plugged in wrong	- Plug in P4
	- No ±15 volts or +5 volts	- Check PCM
	- No zero signal	- Check zero P.C.
5) Heads load but do not move when seek command issued.	- Unit not selected	- Select unit, with jumper
	- No seek complete issued	- Check circuitry
	- Seek incomplete issued	- Check circuitry
6) Heads land but act very erratically/ servo oscillates and/ or hums.	- P17, unplugged	- Connect
	- Detent lamp out	- Replace detent lamp
	- Excess friction in carriage	- Check carriage alignment
	- Incorrect clearance detent to mask.	- Shim correctly
	- P19 unplugged	- Connect
	- Servo out of adjustment	- Adjust Servo
	- Master clock set to wrong frequency	- Adjust clock
	- No terminator/no voltage to terminator	- Install terminator jumper
	- Carriage too loose	- Tighten carriage

7.5 DIAGNOSTIC GUIDE

SYMPTOM	POSSIBLE CAUSE	REMEDY
7) R/W Board does not write or read	- R/W not plugged in - NC ± 15; +5 volts	- Plug in R/W Board - Check PCM
8) Read waveform (TP1 or 2) on R/W Board poor or incorrect	- Wrong head current - Bad head - Poor head alignment - Head lead springs not grounded	- Adjust - Replace - Align - Correct problem
9) R/W Board does not write	- Write Inhibit Switches not plugged in or set incorrectly - No write data - No write enable	- Plug in Write Inhibit Switches/set to correct position - Check output of option board if installed - Check write enable circuit
10) Read data output missing or excessive errors	- No read clock out - No read data out - Data discriminator out of adjustment - No read enable	- Check Q13 - Check Q8 - Adjust data discriminator - Check read enable circuit
11) Detent Lamp not lit	- Burned out	- Replace bulb and align detent - Check servo and head alignment

7.6 POWER CONTROL MODULE ALIGNMENT

7.6.1

Too Is Required

- Digital Voltmeter
- Potentiometer alignment screwdriver

Refer to Section 6.6 of this manual for removal and replacement of the PCM.

7.6.2 DC Voltage Checks

Connect the AC power cord to the drive and turn on the power switch.

The power light and the detent lamp should come on.

Connect the positive and negative leads of the DVM as follows and assure that the required voltages are present:

NOTE: Do not ground the negative lead of the DVM to ground. The terminals on C5 and C6 are slotted screws.

Positive Lead To	Negative Lead To	Voltage
C5 (+) Terminal	C5 (-) Terminal	Minimum + 21 v Nominal + 24 v Maximum + 30 v
C6 (-) Terminal	C6 (+) Terminal	Minimum - 21 v Nominal - 24 v Maximum - 30 v
IC2/11	Ground	Minimum + 9 v Nominal + 12 v Maximum + 15 v

Connect the positive DVM lead to IC 1/11; negative lead to ground. Adjust R59 for - 15.0 volts ± 100 mv.

Connect the positive DVM lead to IC 1/4. Measure + 15.0 volts ± 500 mv.

Connect the positive DVM lead to J7. Adjust R30 for + 5.0 volts ± 100 mv.

Turn off Main Power.

7.7 INDEX/SECTOR TRANSDUCER ALIGNMENT

7.7.1 Removable Disk Transducer

Disconnect connector P4 on the PCM. Load CMIII cartridge and secure cover latch. Alternately, a CMIII Test Hub, illustrated in Figure 7-4 can be used, but the cover interlock switch will have to be defeated (a Q-tip inserted between the cover latch plate and the microswitch will prevent the switch from being operated).
As the motor pulley underneath the casting is rotated by hand, there should be no evidence of binding between the hubs and transducers. If binding occurs, see paragraph 6.10.

Turn Power On. Turn Start/Stop Switch to Start. Connect the scope, channel A, DC coupled to TP5 of the DEM with ground at TP6. The waveform of the Removable Disk Index/Sector Transducer is as shown in

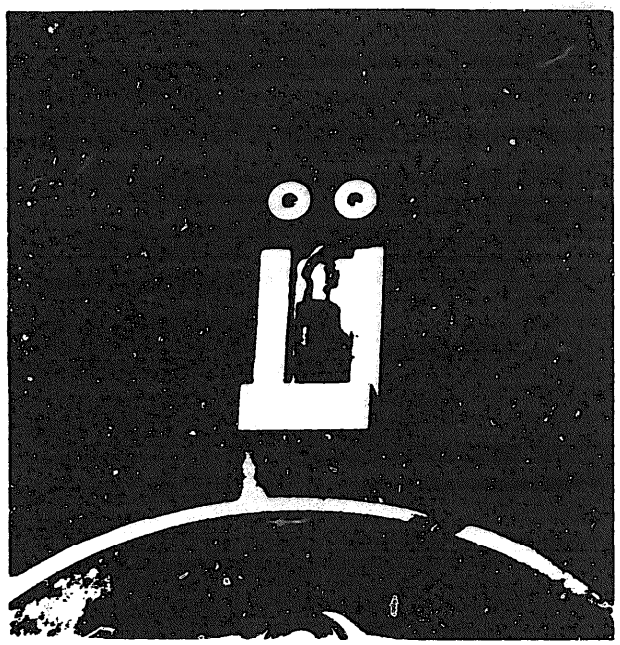


Figure 7-3. Removable Disk Index/Sector Transducer

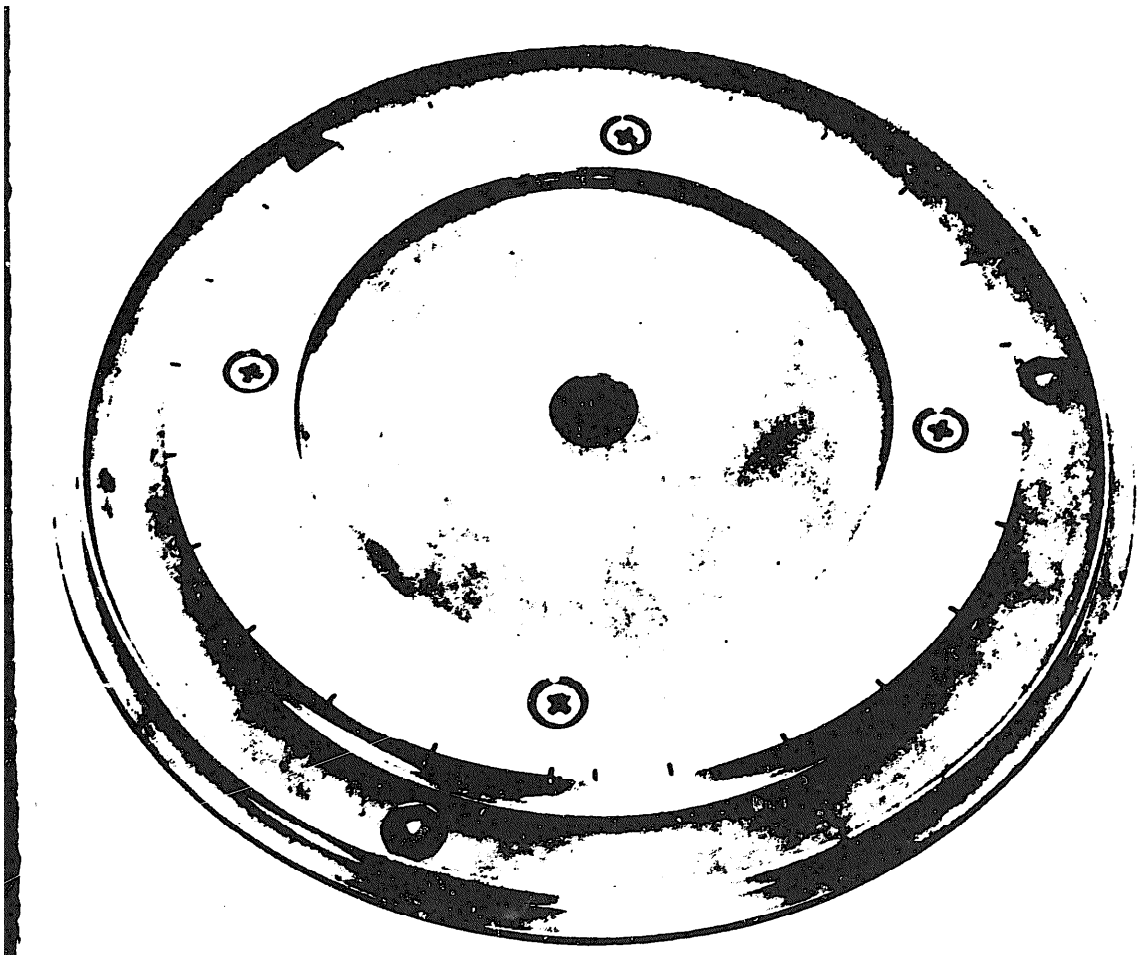


Figure 7-4. CMIII Test Hub (24 Sector)

Figure 7-5, Fixed Disk Index/Sector Transducer

Figure 7-6. The transducer shall be adjusted for an output of not less than 190 mv and not more than 600 mv measured base to positive peak.

7.7.2 **Fixed Disk Transducer**

Change channel A probe to monitor TP7 of the DEM with ground at TP6. The waveform for the Fixed Disk Sector Transducer is also as shown in Figure 7-6. The transducer shall be adjusted for an output of not less than 190 mv and not more than 600 mv measured base to positive peak.

It may be necessary to readjust either or both of the transducers to obtain the waveform of Figure 7-6. To increase amplitude, decrease gap distance between transducer and the hub per paragraphs 6.10.2 and 6.10.3.

Before turning on the spindle motor, again assure that there is no binding between hubs and transducers as the motor pulley is rotated manually.

The transducer shall be adjusted for an output of not less than 190 mv and not more than 600 mv measured base to positive peak.

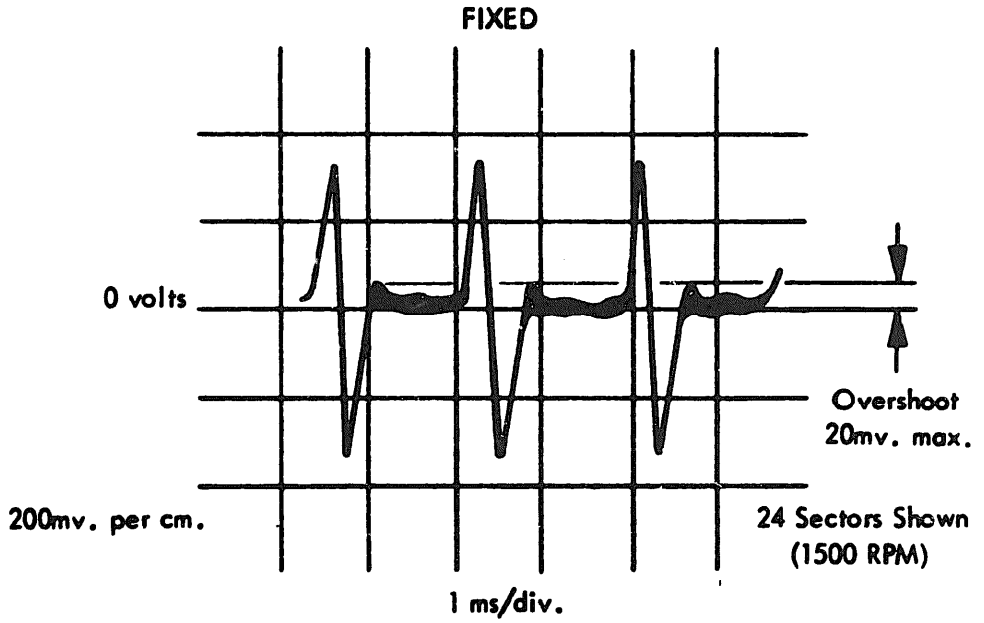


Figure 7-6. Index/Sector Transducer Output

Tighten the set screws (8 to 12 in. pounds of torque) that hold the transducers to their assemblies, and recheck outputs. Turn Power Off.

CAUTION

The transducers are molded plastic assemblies and can be easily damaged by exerting too much force on the set screw.

7.8 DETENT ASSEMBLY ALIGNMENT

7.8.1 Quad/Detent Adjustment

Insert four terminal pins (Amp 85931-5) to the detent connector P19 and disconnect P4 on PCM.

Turn main power and spindle motor on. Wait for brush cycle to complete. Check that the carriage is moving freely and check for .005" gap between detent and mask throughtout entire carriage travel.

Connect channel B probe to pin 2 of the detent connector (orange wire/ detent output). Pin 1 is ground (black wire). Connect channel A probe to pin 3 of the detent connector (green wire/quad output). Ground channel A at Pin 1.

Set scope to the chop mode displaying both channel A and channel B. Offset the two traces with channel A on top and channel B on bottom. Set the input to the scope to DC. Set the sweep to the slowest speed.

Move the carriage all the way forward and then slowly move the carriage in the reverse direction. The quad and the detent waveform must agree in phase and amplitude to Figure 7-7.

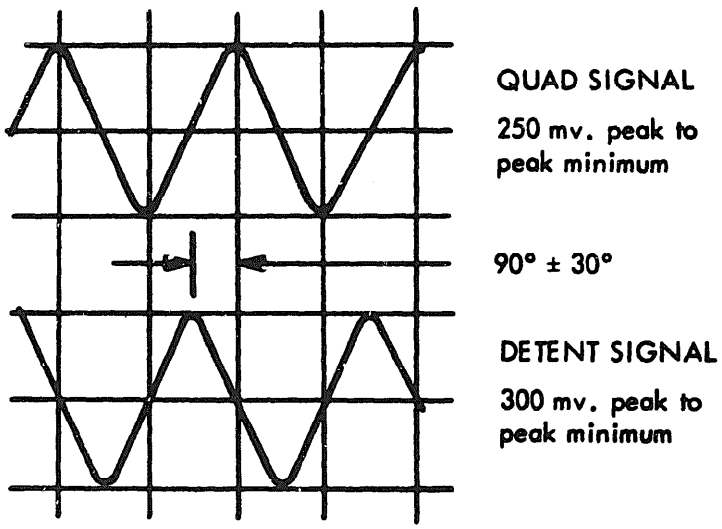


Figure 7-7. Quad/Detent Waveforms

NOTE: When the quad output is most positive, detent should be zero. Continue moving carriage in reverse; when quad output is zero, detent will be most negative. If not, proceed as follows:

Loosen the #6-32 cap screw and rotate the black housing that holds the photocell slightly. Tighten the #6-32 cap screw again and repeat the step. To increase the amplitude of the detent and the quad signals, it may be necessary to loosen the side set screw and rotate the entire assembly slightly and repeat above stop. Recheck .005" gap.

7.8.2 Quad/Detent Adjustment (Method 2)

Connect channel A to pin 3 of the detent connector, P19; ground to pin 1.

Connect the Horizontal input of the scope to P19/2; ground to pin 1.

Set scope to display X-Y mode. A Lissajou pattern will be formed as the carriage is moved manually forward and backward.

NOTE: It may be necessary to use a X1 probe on the Horizontal input, if the scope does not have enough internal gain.

Adjust the detent assembly (black housing) such that the Lissajou pattern of Figure 7-7A is achieved when the carriage is moving in reverse, towards home. The direction of rotation of the pattern must be counterclockwise.

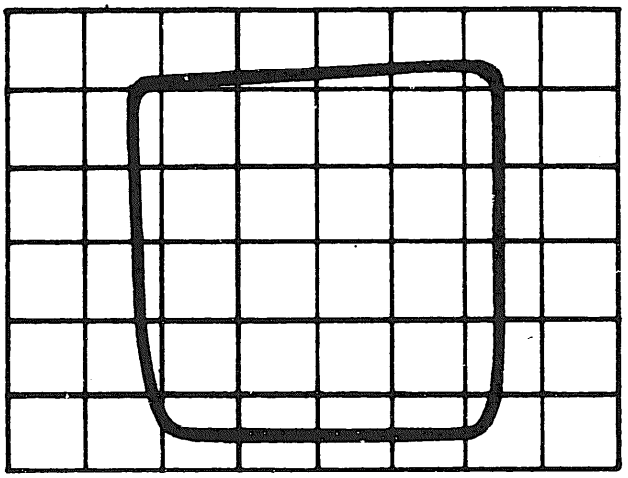


Figure 7-7A. Quad/Detent Lissajou Pattern, 90°

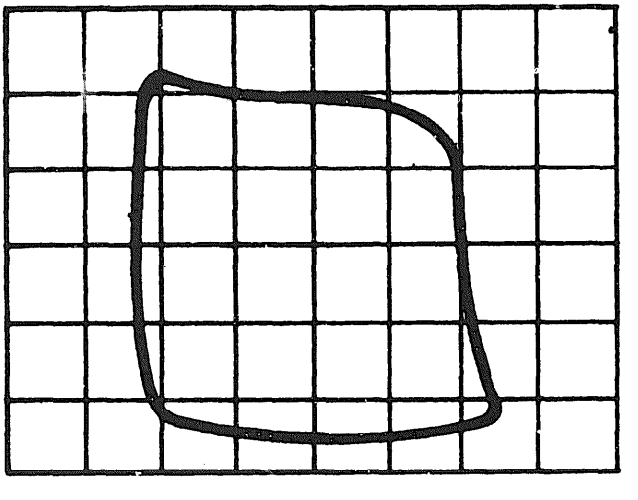


Figure 7-7B. Quad/Detent Lissajou Pattern, > 90°

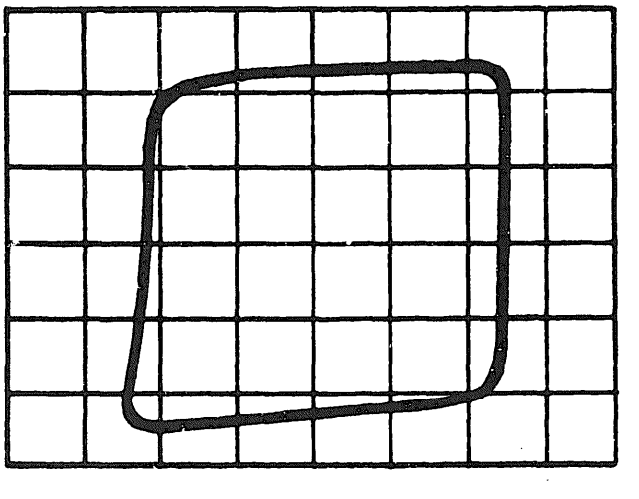


Figure 7-7C. Quad/Detent Lissajou Pattern, < 90°

7.9 DRIVE ELECTRONICS MODULE ADJUSTMENTS

7.9.1 Detent Assembly Adjustments

Connect P19 to the DEM. Disconnect P4 on the PCM. Turn main power and spindle motor on. Wait for completion of the brush cycle.

Connect channel A of scope to TP1. Adjust R72 until the quad waveform centers around 0 volts as carriage is moved forward or backwards.

Connect channel A to TP3. Adjust R122 until the Detent waveform centers around 0 volts as carriage is moved forward or backwards. Adjust R135 for a minimum of 2 volts peak to peak. Connect channel A to IC8/11. There shall be logic +5 volt pulses as carriage is moved forwards or backwards. These are the detent pulses.

Monitor TP2 and adjust R84 so that the output voltage at the home position is a positive one-third of the total swing between home and track 203. By example: if the total output swing is 90 mv between home and track 203, adjust R84 so that TP2 is +30 mv at home and -60 mv at track 203.

Connect channel A to IC65/8. The level shall change from +5 volts to 0 volts as carriage is moved from home to beyond track 0. This is the track 0 level.

Connect channel A to IC33/12. Move carriage forward and there should be very narrow negative-going logic +5 volt pulses. Move carriage in reverse and there should be no pulses. These are the CAR Up-Counting pulses.

Connect channel A to IC33/6. Move carriage in reverse and there should be very narrow negative-going +5 volt pulses. Move carriage forward and there should be no pulses. These are the CAR Down-Counting pulses.

If the pulses above are not as specified, the detent assembly may not be correctly aligned. Refer to Section 7.8 for alignment.

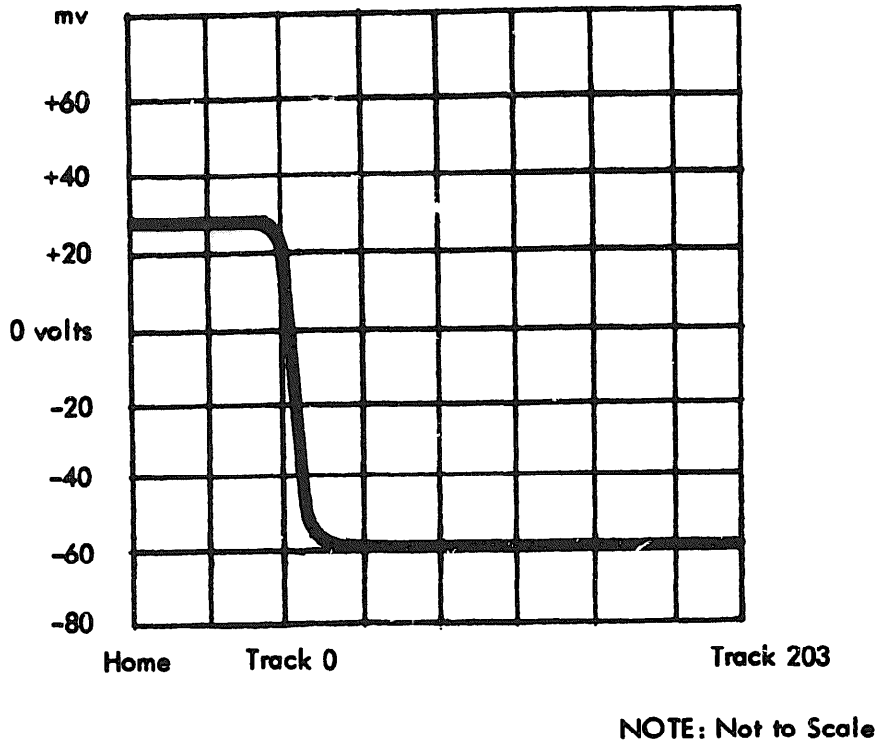


Figure 7-8. Zero P.C. Output Voltage

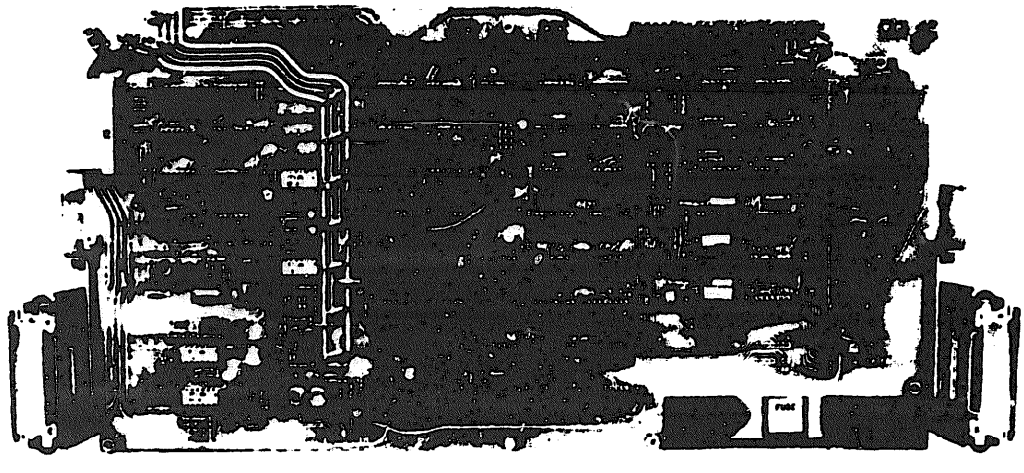


Figure 7-9. drive Electronics Module (DEM)

7.9.2 Index Pulse and Sector Pulse Monitoring

Connect P20 to the DEM.

The index pulse is a 750 nanosecond negative-going pulse (+3V to ground) occurring every 40 milliseconds. Verify that the resistor termination board is installed on the DEM at J22. Ground TPN of DEM. Connect scope channel B to IC29/3 of the DEM to monitor the index pulse for the fixed disk*. Connect scope channel A to IC29/11 of the DEM for the removable disk.

The sector pulses are 750 nanosecond negative-going pulses (+3V to ground), one pulse per sector. The number of pulses displayed every 40 milliseconds on the scope is the number of sectors on the hub. Connect the probe to IC29/8 of the DEM to monitor the removable disk sector pulses. Connect the probe to IC29/6 of the DEM for the fixed disk.*

*NOTE: If the Address Acknowledge/Illegal Address option has been wired (jumpers 18-19, 15-17, 12-14), Fixed Disk Index and Sector pulses will not be available.

To test the Multiplex circuits, there should be a jumper between pin E and pin F on the DEM. Connect the channel B probe to IC29/3, channel A to IC29/11. Trigger on IC29/3, negative slope, DC.

Set the scope to display alternate waveforms of channels A and B. There should be a narrow +3 volts negative-going pulse approximately every 40 milliseconds. Notice that the pulse between channel A and B will be shifted in time. This means that the index markers on the two hubs are not aligned, which is to be expected.

Ground pin F of the DEM. Both channel A and B will be synchronized in time because they both will display the fixed disk index pulse. Remove pin F ground.

7.9.3 Servo Pre-Alignment

Disconnect P4 on PCM, disabling the servo positioner motor during pre-alignment.

Connect oscilloscope to IC52/2 and ground. Adjust R145 for 5 volt pulses of 2.4 MHz nominal. (Minimum 2.15 MHz, maximum 2.65 MHz). Check IC64/12 for 2.0 MHz nominal frequency (1.75 MHz minimum, 2.25 MHz maximum). A frequency counter may be used, if available.

Connect channel A to IC26/1. Move carriage forward. There shall be a negative voltage whose amplitude is determined by the velocity of the carriage movement. Move carriage in reverse. There shall be a positive voltage level. Move carriage to the home position.

Verify that there is a logic high (approximately 4 volts) at the following IC pins:

- IC52/11, carriage home
- IC18/10, power on
- IC10/5, brush home
- IC10/13, power relay on
- IC27/10, upspeed

Ground TP4, manual detent, and ground TP8, error inhibit. Connect channel A to IC44/7. Adjust R147 for 0 volts, ± 20 mv. Remove the ground from TP4.

Monitor IC44/1. The voltage at this point will be slightly positive, indicating the servo is attempting to move the carriage forward. Manually move the carriage from home forward. At track 8, the voltage should go slightly negative to bring the carriage to track 0, at which point the voltage should be 0. The READY indicator light should now be on. Manually retract the carriage to home. Pre-alignment of the servo is completed.

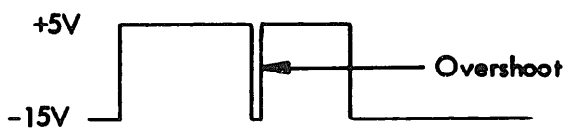
Remove ground wire at TP8, turn off spindle motor and main power and connect P4 to the PCM.

Turn on main power and spindle motor. The heads should load in 35 seconds. The READY light should go on.

Monitor TP9 (FET Drive) with channel B, 10 volts/div.; monitor TP3 (Detent) with channel A. Trigger + on channel B. Use chopped mode.

Connect DTU and alternate between tracks 0 and 1. Adjust R147 for symmetrical forward and reverse seek time as seen on channel B of scope. If servo is breaking up, as evidenced by oscillations at TP3, or by multiple pulses on the FET drive signal, TP9, reduce settle time gain adjustment R129 and/or coarse loop gain adjustment R23 until the above adjustment can be made.

Alternate between tracks 0 and 203 and adjust R23 for the fastest coarse loop seek time (FET drive channel B) without overshoot. Now using the Alternate/Sequential mode, slowly adjust R23 for no overshoot on channel B and no break up (or clipping) of channel A paying particular attention to the area between tracks 0 and 48.



FET Drive, TP9

Condition the DTU to alternate between tracks 0 and 203 and adjust R129 for minimum oscillations and fastest settle time as seen on channel A. Trigger on channel B (-), 2 ms/div. Observe that the amplitude of the detent signal should decay to 10% or less of the peak amplitude in approximately 2 to 4 ms. Check also alternating between 0 and 2, 0 and 32, 0 and 128.

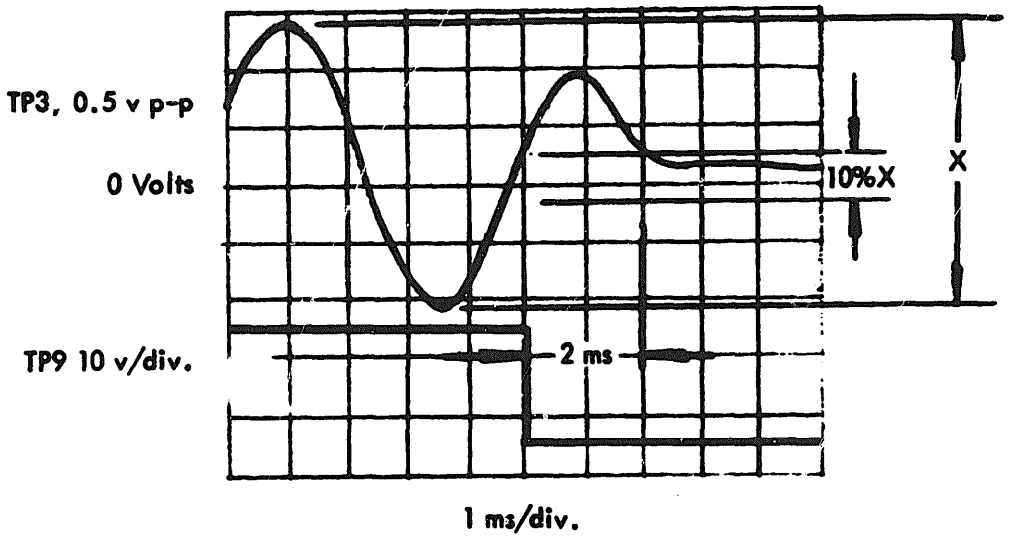


Figure 7-10. Detent Settle Time

Seek and stop on tracks 0, 128 and 203 to verify that no oscillations are present at TP3. If there are, readjust R129 as required and repeat the preceding paragraph.

Alternating between 0 and 203, lengthen the coarse loop seek time (channel B) a minimum of 5 ms such that the maximum seek time (channel B) is not less than 78 ms nor more than 81 ms.

Connect channel B to IC4 Pin 1, trigger external on TP9, sync negative and adjust R53 such that seek complete (IC4/1) goes positive no sooner than 1 ms after the detent wave form has reached 10% or less amplitude (settled), alternating from 0 to 1.

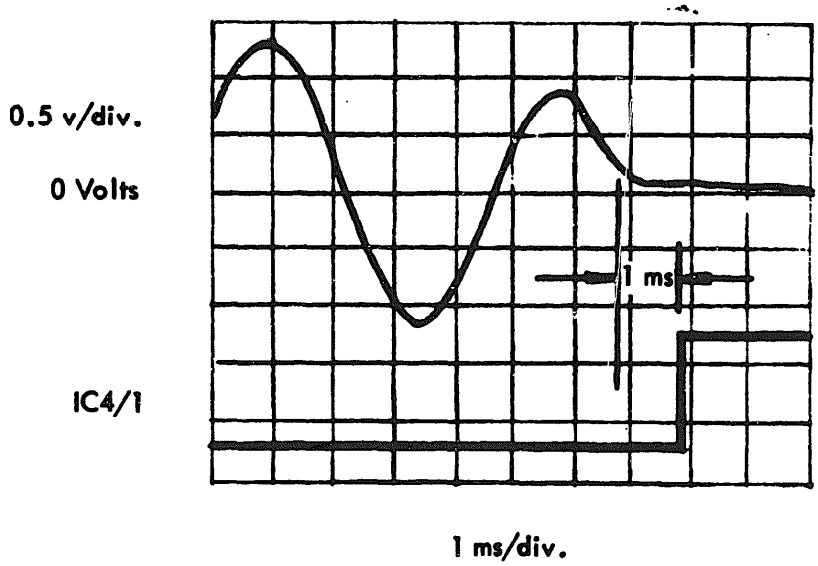


Figure 7-11. Seek Complete Time

Alternating between 0 and 1, trigger external TP9, sync positive and verify that the longest seek complete goes positive no later than 14 ms after the beginning of the seek.

Recheck the forward and reverse seek times. Readjust R147 as required.

Alternating between tracks 0 and 1,0 and 67 and 0 and 203 observe that TP3 is settled and the longest seek complete time (IC 4/1) goes true (+) in less than or equal to 14, 60, and 85 ms, respectively.

7.9.5 Track 0 Adjustment

Connect scope channel A to TP3; channel B to TP2; external trigger (+) on IC 32/3.

Set up DTU for a three-track alternate move (0 to 3) and obtain a display similar to Figure 7-12.

Adjust the zero offset pot, R so that the zero signal crosses ground at the center of the steepest portion of the curve, as shown in Figure 7-12.

The peak-to-peak voltage of the steepest portion of the zero signal should be 40 mv minimum, as shown by dimension "A".

The zero signal should cross at the negative-going Detent zero-crossing plus or minus 60°;shown in Figure 7-12 as dimension "B".

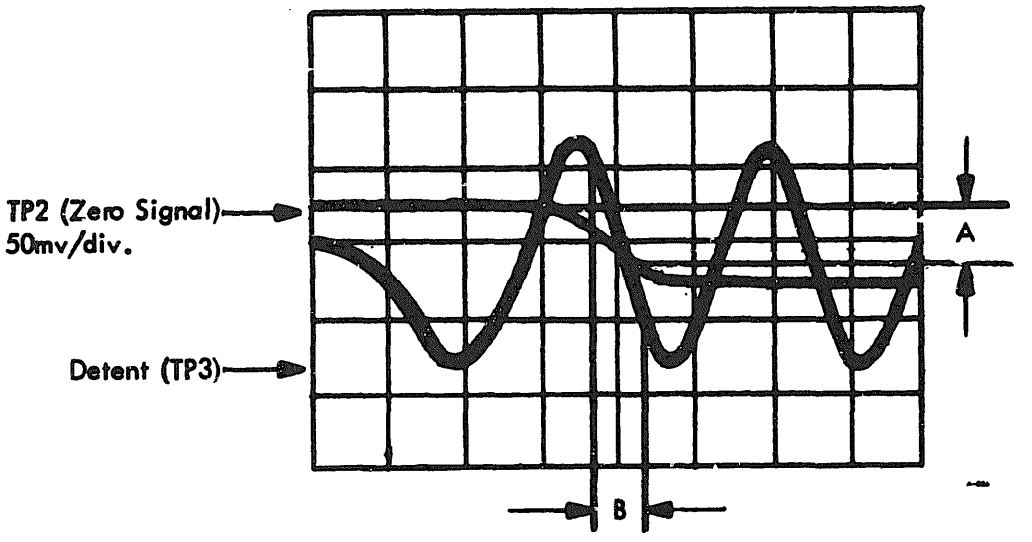


Figure 7-12. Track 0 Adjustment

7.10 READ/WRITE AMPLIFIER MODULE ADJUSTMENTS

7.10.1 Write Current Adjustment

Connect the head loop adapter to the removable disk, top surface head. The location for that head is specified on the Read/Write board.

Connect the oscilloscope current probe through the loop adapter and connect the probe to channel A of the scope.

Connect the DTU to the disk drive (J21). Assure that the termination board is plugged into J22. Set up the DTU to write all '0's on track 0 of the removable disk, top surface.

NOTE: To preserve data on the fixed disk, turn the Write Inhibit switch for the fixed disk ON.

With the Removable Disk Write Inhibit switch in the OFF mode, adjust R21 on the Read/Write board for the waveform as shown in Figure 7-13.

With the Write Inhibit switches set to the inhibit position, there should be no waveform on the scope. The correct head current is 35 ± 1 ma, with a maximum overshoot of 10%.

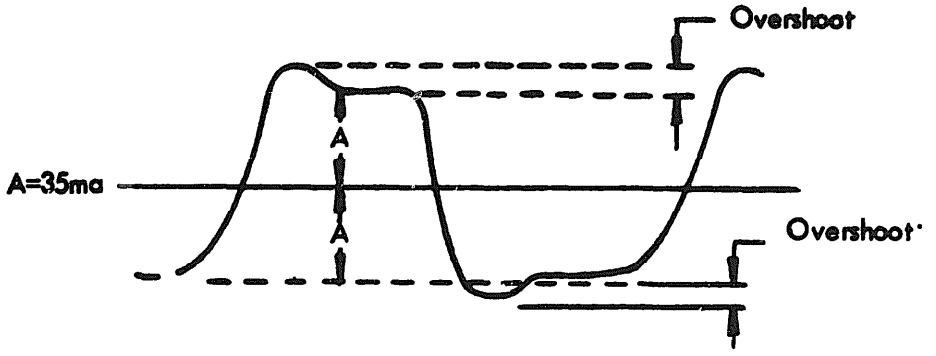


Figure 7-13. Current Characteristics

Set up DTU to write all '0's on track 128 of the removable disk, top surface. With the Write/Inhibit switch in the OFF mode the waveform on the scope should be the same as that shown in Figure 7-13, but with an amplitude of 30 -1, +2 ma instead of 35 ma.

7.10.2 Read Amplitude Measurements

Connect the channel A scope probe to TP1 on Read/Write Board. Display channel A, AC mode. Set the sweep speed to 5 msec per cm. Set delayed sweep to 50 μ seconds.

Set DTU to write all '1's on track 200, alternating between the top and bottom heads and units (1) and (0). It will write on both surfaces of the removable CMIII cartridge and the fixed disk.

NOTE: To preserve data on the fixed disk, turn the Write Inhibit Switch for the Fixed Disk ON.

Set the DTU to read back the '1's previously written on track 200. Record the minimum amplitude for each of the four heads as shown on channel A during the lowest 100 μ seconds as displayed on the delayed sweep. Each head must read a minimum of 80 mv peak to peak to meet specifications. External trigger (-) with IC29/11 of DEM.

Set the DTU to write all '1's on track 0 and 200 for the top and bottom heads and units (1) and (0). Set the DTU to read back the '1's previously written on track 0 and 200. Record the amplitude data for all four heads.

Repeat previous step to write and read all '0's instead of all '1's.

Head resolution as defined below must be a minimum of 33% and a maximum of 100%.

$$\text{Resolution} = \frac{\text{Amplitude of "1" signal}}{\text{Amplitude of "0" signal}} \times 100\%$$

If any head does not meet all of the above requirements, it should be placed. Refer to paragraph 6.13.

Remove the head loop current adapter from the Read/Write board. Reconnect the removable disk top surface head connector to the Read/Write board.

7.11 OPTION BOARD

7.11.1 Data Discriminator Adjustment

Connect channel A scope probe to IC9/11 on the Option Board. There should be logic +5 volt pulses at 6.354 MHz.

Connect the DTU to the drive. Assure that the termination board is plugged into J22. With the carriage stationary at track 0 write a pattern of alternate '0's and '1's.

With the DTU in the Read mode, connect the oscilloscope as follows:

Channel A: Across C7, option board (be sure to ground scope probe at C7); AC coupled, 50 mv/div.

Channel B: J9/7 (Read Enable +); 5 v/div, DC coupled

Trigger (+) on Read Enable. Adjust R8 on the option board until the error light on the DTU extinguishes. Observe the voltage waveform across C7 during the time Read Enable is active (+). Further adjust R8 until the error voltage across C7 is 350 ± 50 mv. Ignore the 60 Hz ripple in the waveform. The tilt in the waveform is due to the input coupling

capacitor in the oscilloscope, as there is 5 volts DC present at this point. The measure is to be made at point "A" in Figure 7-14.

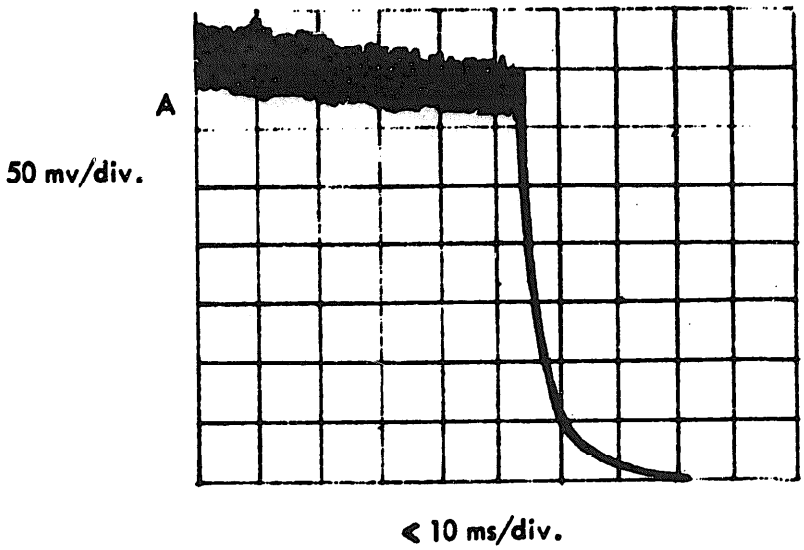


Figure 7-14. Data Discriminator Error Voltage

Remove channel A scope probe from C7 and place it on IC21/7. Adjust R38 so that the one-shot (IC21/7) has a pulse duration of 18 ± 1 microseconds.

7.11.2 Sector Address Counter Checkout

To check out the sector address counter option, connect channel A of scope to IC29/8 on DEM. Set scope to external trigger negative on IC29/11 (index pulse). Set DTU for the removable disk. Jumper E to F on DEM.

Channel A will display a series of negative going +3 volt sector pulses externally triggered by the index pulse (Figure 7-15). The number of pulses equal the number of sectors on the hub. This series of pulses will repeat itself every 40 msecs.
The first sector pulse is defined as sector 0 as seen on channel A.

Connect the channel B probe to the following IC pins; the waveform should be a square wave from +3 volts to ground. Set scope to alternate

between channel A and channel B. Offset the two traces with the position control to display both traces. For a 24 sector hub: At J9/5 of DEM, observe that the waveform will be low from the trailing edge of sector 1 to the trailing edge of 2, 3 to 4, 5 to 6, etc. At J9/3, the trailing edge of 2 to the edge of 4, 6 to 8, 10 to 12, 14 to 16, 18 to 20, 22 to 0.

At J9/4, the waveform will be low from trailing edge of sector 4 to trailing edge of 8, 12 to 16, 20 to 0.

At J9/6, the waveform will be low from trailing edge of sector 8 to trailing edge of 16.

At J9/8, the waveform will be low from trailing edge of sector 16 to trailing edge of 0.

At the trailing edge of sector zero, J9 pins 5, 3, 4, 6 and 8 are reset to +3 volts.

Set DTU for Fixed disk. Repeat 7.11.2.

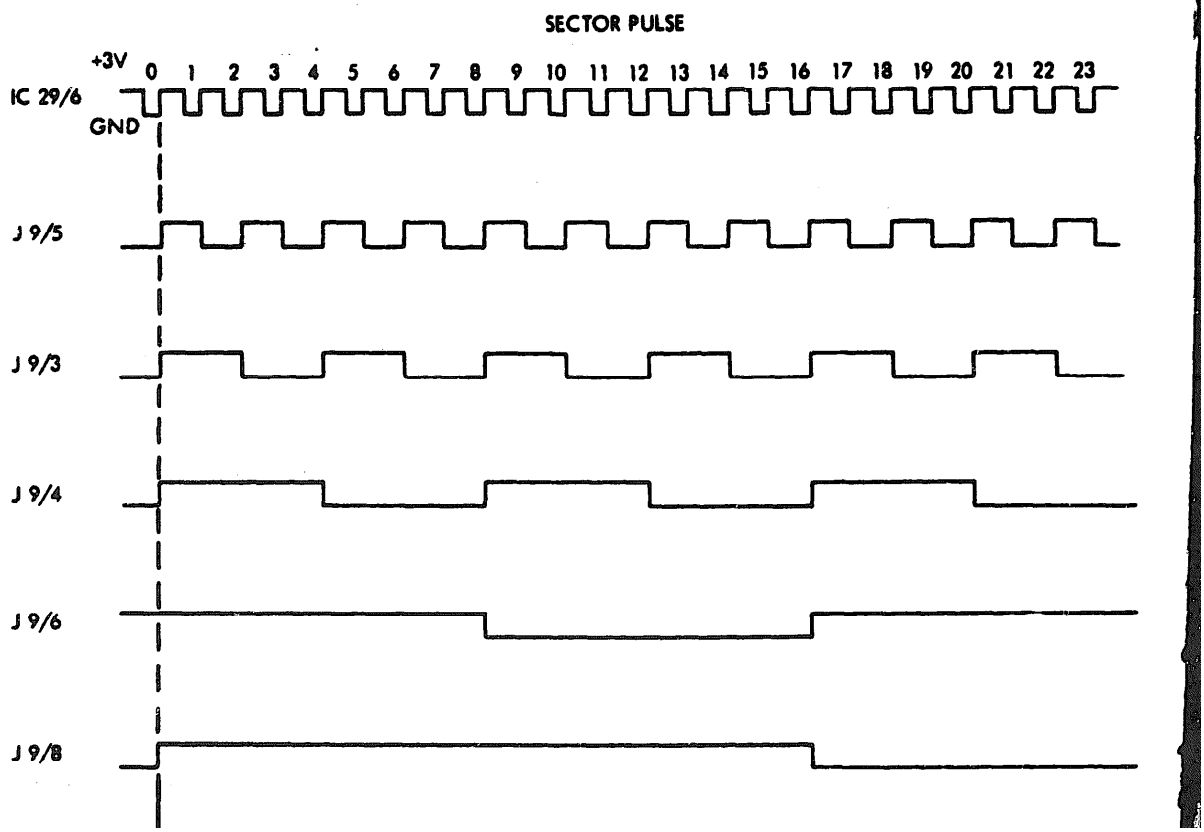


Figure 7-15. Sector Address Counter Waveforms

7.12.1 Head Alignment Using IBM Cartridge

Replace the CMIII Disk Cartridge with the C.E. cartridge. Disconnect the Write/Inhibit Switch connector P14 on the Read/Write board. Jumper pin C to D of DEM.

Loosen the head arm clamp cap screw for the removable disk.

Connect channel A of scope to TP 1 of Read/Write board and set the input for AC. Set sweep for 5 milliseconds/cm. Externally trigger negative on IC29/11 (Idx Rem) on DEM.

Set DTU to seek track 73. Select removable disk and bottom surface. Read only. Move the bottom surface head either toward or away from the magnet to achieve the correct waveform shown in Figure 7-16.

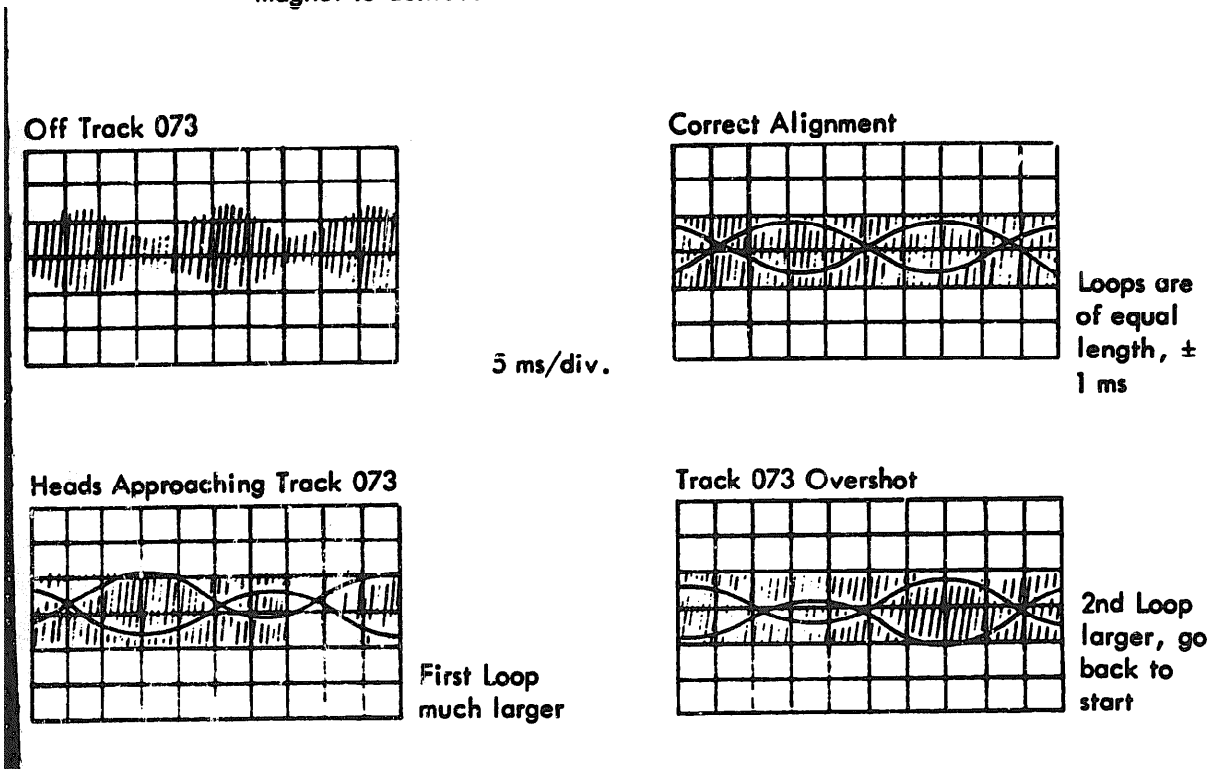


Figure 7-16. Head Alignment Waveforms with IBM Cartridge

Set DTU for the top surface head. Adjust the top head until the correct waveform is as shown in Figure 7-16.

Torque the #6-32 cap screw for the head arm clamp to 12 ± 1 inch-pounds. Seek track 200, initiate emergency retract and recheck alignment.

Set the DTU to seek track 5, external trigger on index and adjust R87 of the DEM to the waveform as shown in Figure 7-17. to align the index.

NOTE: If R87 does not have enough range the Index/Sector Transducer will have to be mechanically re-adjusted per 6.10.

Change the DTU to read the bottom surface head. The waveform should be as shown in Figure 7-17.

Turn off spindle motor.

Remove C.E. cartridge and replace with CMIII cartridge.

Connect Write/Inhibit Switch connector J14 to Read/Write board and remove jumper from pin C to D.

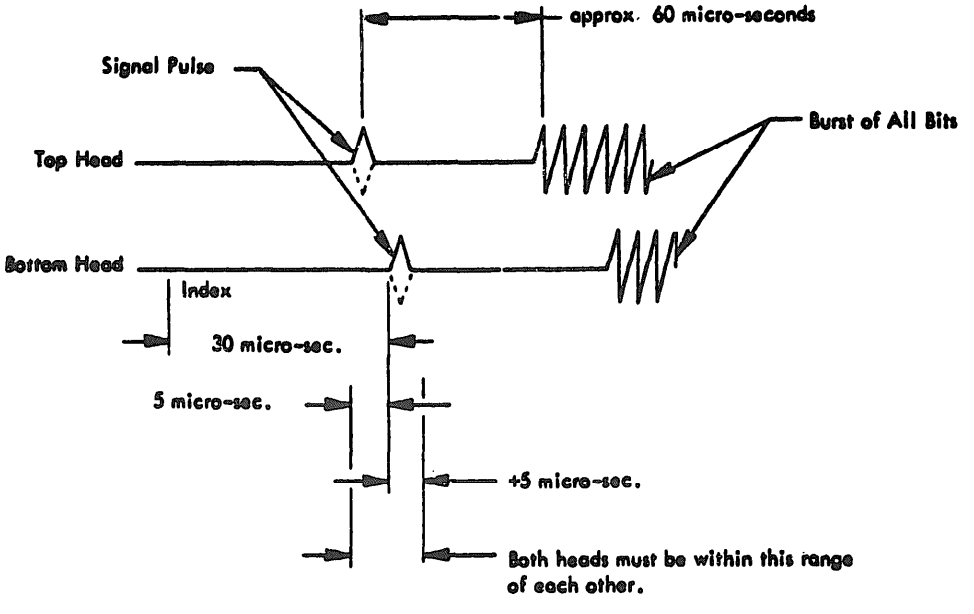


Figure 7-17. Index Alignment

7.12.2 Head alignment Using Caelus Cartridge

Place the alignment cartridge on the disk drive. Turn on main power and spindle motor. Disconnect P14 on the R/W Board. Jumper C to D on the DEM if the cartridge is Index only. Allow a 15-minute warmup period before beginning head alignment procedures. Set oscilloscope to 20 microseconds/cm, TP1 on R/W Board, and select the bottom surface head on the DTU. Locate track 73 by observing dibit information as indicated in Figure 7-18. Note in which direction the head must be moved when carriage assembly is physically positioned to cylinder 73 Seek cylinder 73 on DTU.

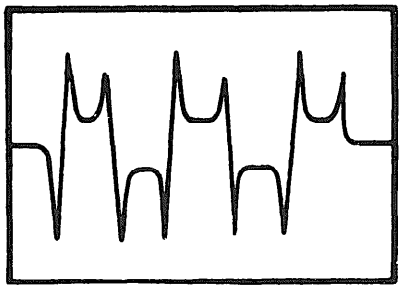


Figure 7-18. Dibit Information track 073

Adjust bottom surface head until dibit information is again observed. Set oscilloscope to 5 milliseconds/cm. Externally sync on index, IC29/11. Continue to adjust the head until the fringe areas A and B (Figure 7-19). are equal or as close to equal as possible, as indicated in Figure 7-21. If fringe area equality is impossible, horizontally position the data envelope so that the maximum point of runout is positioned at the center of the scope. See Figure 7-20. Two centimeters to the left or right of this reference is the point at which average runout is observed and from which point measurements c & d, as indicated in Figure 7-20 will be taken. The ratio of c/d x 100% shall not be less than 85%. (c/d x 100% = 85 to 100%).

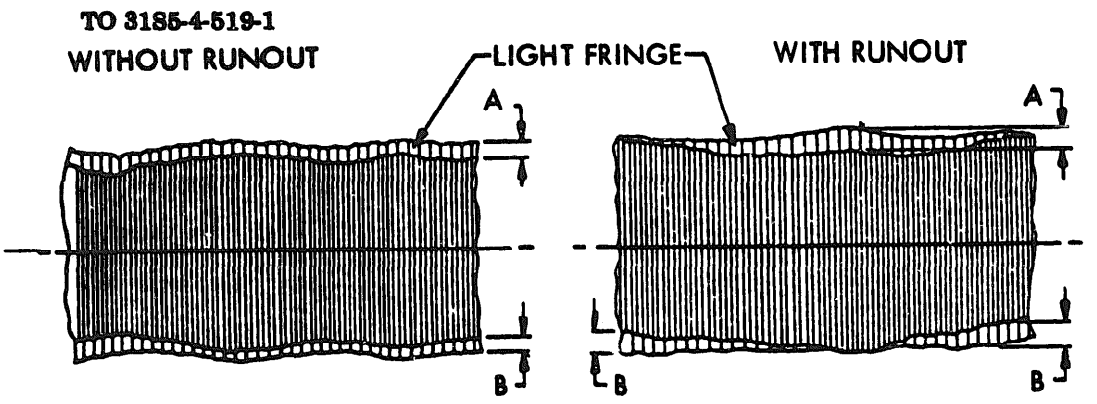


Figure 7-19 **Dibit Pattern Fringes**

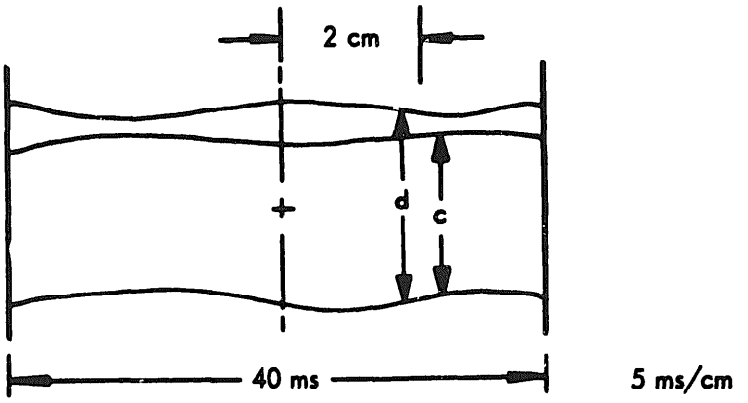


Figure 7-20. Dibit Pattern Fringes with Runoul Centered on Scope

Repeat preceding paragraph for top surface head.

Torque the #6-32 cap screw for the head arm clamp to 12 ± 1 inch-pounds.

To align the index transducer, access track #5 and set the scope to synchronize on the leading edge of the index pulse. Set the sweep for 5 microseconds/division and the gain for a signal amplitude of approximately 4 cm peak to peak. Select the top head.

Adjust the index transducer, see Section 6.10, or the index Pulse delay R87, DEM, until the peak of the first pulse (positive or

negative) after the DC erased zone is located at 30 ± 5 microseconds from the leading edge of the index pulse.

Select the Bottom head. The peak of the first pulse after the DC erased zone must be within 30 ± 5 microseconds. If not, readjust R87, DEM, or the index transducer til both heads are within 30 ± 5 microseconds. See Figure 7-17.

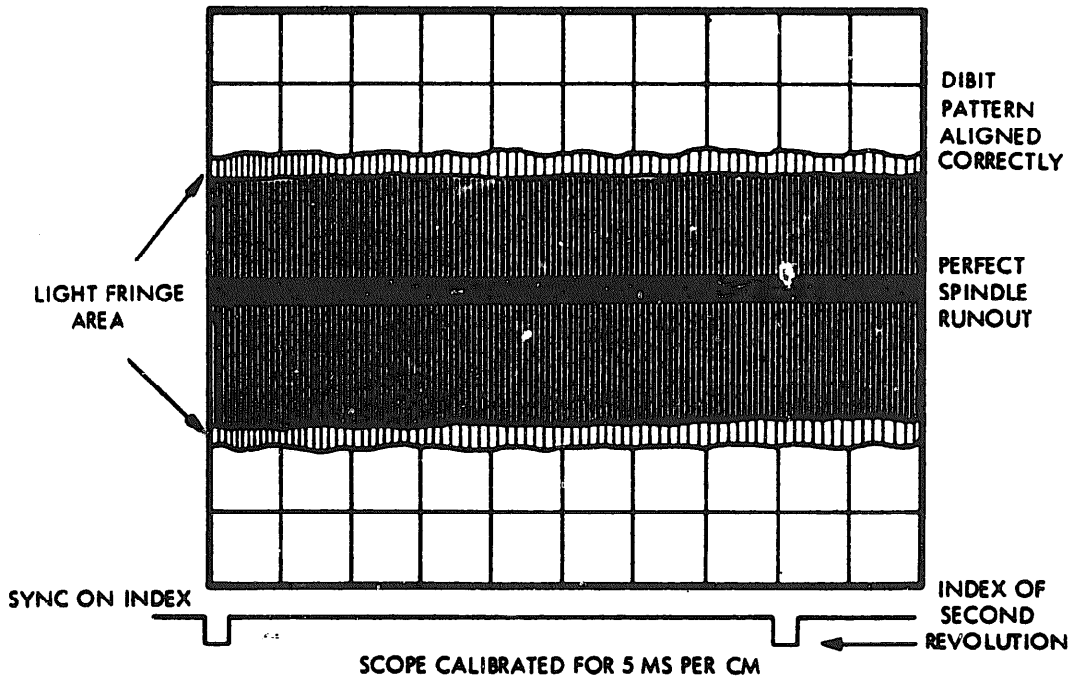


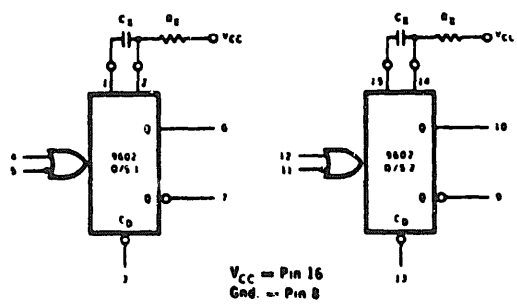
Figure 7-21, Correctly Aligned Dibit Pattern

9602 DC DUAL LEVEL RETRIGGERABLE RESETTABLE MONOSTABLE MULTIVIBRATOR

Description

The 9602 is a DC dual level sensitive retriggerable, resettable monostable multivibrator which provides an output pulse whose duration and accuracy is a function of external timing components only. The 9602 has excellent immunity to noise on the V_{CC} and ground lines. The 9602 used TTμL for high speed and high fanout capability.

LOGIC DIAGRAM



CHARACTERISTICS

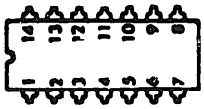
TYPICAL POWER DISSIPATION PER ONE SHOT	125 mW
PULSE WIDTH RANGE	50 ns to ∞
EXT. RESISTOR RANGE	5KΩ to 50KΩ
EXT. CAPACITOR RANGE	0 to any practical value
TYPICAL DELAYS	Trigger Input to Q 25 ns
LOADING	Input 1 UL Output 8 UL

Figure 7-22. Integrated Circuit Logic

MC1035
DUAL SCHMITT TRIGGER TRIPLE DIFFERENTIAL AMPLIFIER

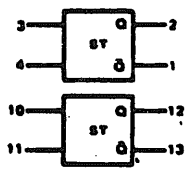
Description

Three differential amplifiers with emitter-follower outputs and a bias driver. This device is designed for use as a dual Schmitt trigger or a level translator, as well as for many linear applications.

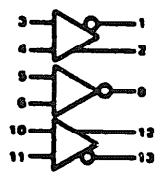


POSITIVE LOGIC

DUAL SCHMITT TRIGGER



TRIPLE DIFFERENTIAL AMPLIFIER



DC Input Loading Factor = 1
DC Output Loading Factor = 25
Power Dissipation = 140 mW typical

The output polarities shown in the logic diagrams above are true only when V_{BB} is applied on Pins 4, 6 and 11.

TRUTH TABLE

Inputs		Outputs	
3	4	1	2
5	6	9	-
10	11	13	12
H	V_{BB}	L	H
L	V_{BB}	L	L
V_{BB}	H	H	L
V_{BB}	L	L	L

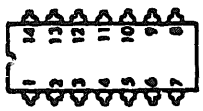
OR NOR

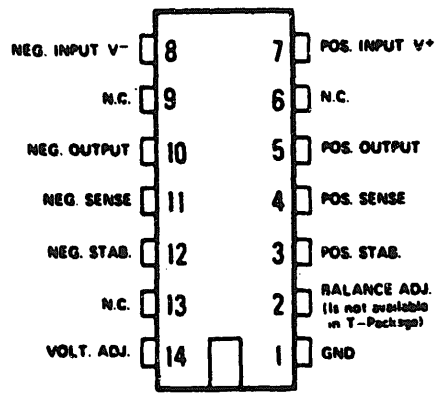
Figure 7-23, Integrated Circuit Logic

SG4051D
DUAL POLARITY TRACKING REGULATOR

Description

This circuit is a dual polarity tracking regulator designed to provide balanced positive and negative output voltages at currents up to 100 m.A. It is internally set for positive and negative 15 volt outputs but a single external adjustment can be used to change both outputs simultaneously from 8 to 23 volts. This device can be used with input voltages of up to + and - 30 volts and also has provision for adjustable current limiting, and utilization at currents in excess of 4 amps with the aid of external power transistors.





SCHEMATIC DIAGRAM

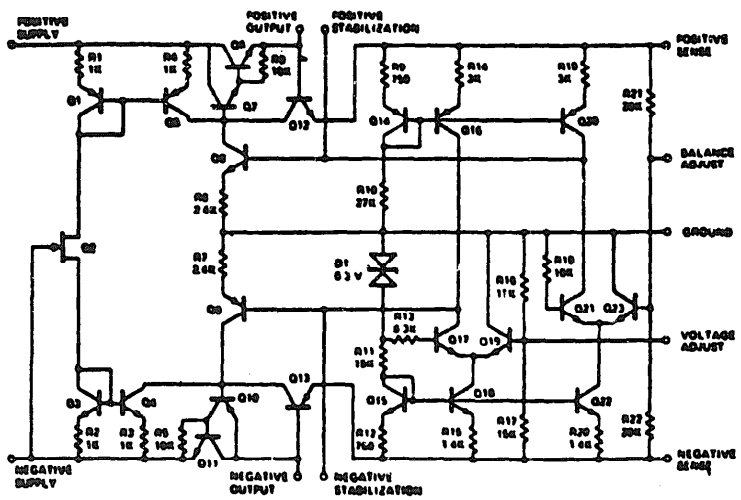
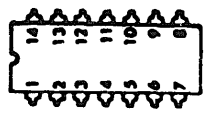


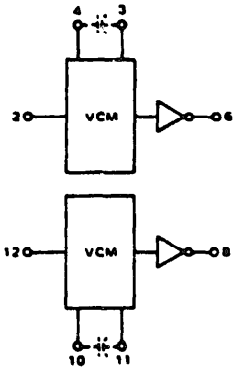
Figure 7-24. **Integrated Circuit Logic**

MC4024
VOLTAGE-CONTROLLED MULTIVIBRATOR



Description

The 4024 voltage-controlled multivibrator provides appropriate level shifting to produce an output compatible with MTTL logic levels. Frequency control is accomplished through the use of voltage-variable current sources which control the slew rate of a single capacitor. Variation of the output frequency over a 3.5 to 1 range is possible with an input dc control voltage of - 1.0 to - 5.0 volts.



V_{CC} VCM = 1, 13
Output Buffer = 14
GND VCM = 5, 9
Output Buffer = 7
External Capacitor for Frequency Range Determination
Output Loading Factor = 7
Power Dissipation = 150 mW typ/pkg
Maximum Operating Frequency = 30 MHz typ

CIRCUIT SCHEMATIC

1/2 OF CIRCUIT SHOWN

(Numbers in brackets are pin numbers for other half.)

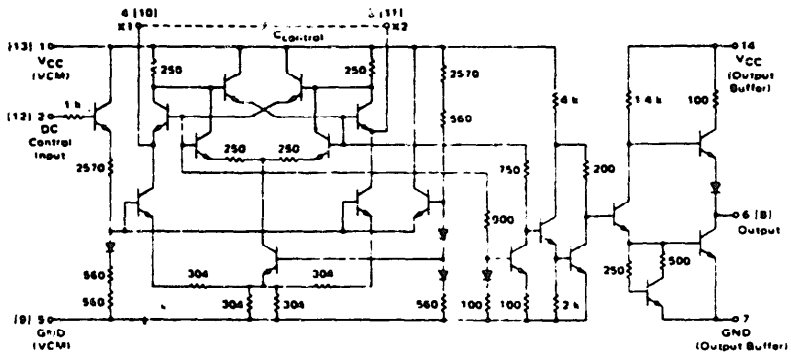
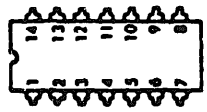


Figure 7-25. Integrated Circuit Logic

74107
DUAL JK MASTER/SLAVE FLIP FLOP

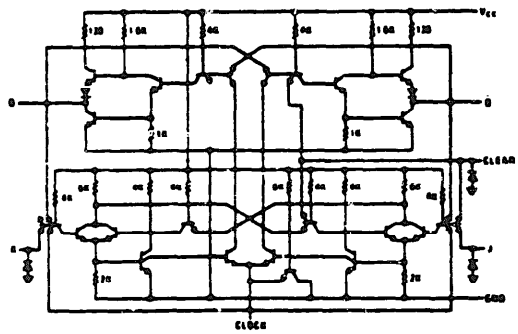


74107
DUAL JK MASTER-SLAVE FLIP FLOP

Description

The 74107 is a JK Master/Slave flip flop. Asynchronous CLEAR inputs are provided on the 74107 flip flop. This device is totally monolithic and designed for use in high speed control and counting applications.

schematic and connection diagrams



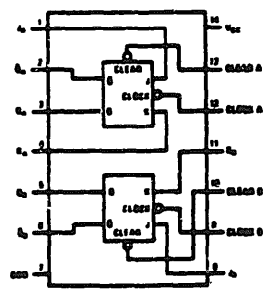


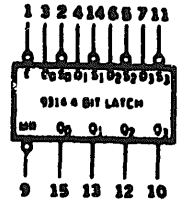
Figure 7-26. **Integrated Circuit Logic**

9314
MSI QUAD LATCH

Description

The 9314 is a multifunctional 4-Bit Latch. The latch is designed for general purpose storage applications in high speed digital systems. All inputs feature diode clamping to reduce negative line transients. All outputs have active pull-up circuitry to provide high capacitance drive and to provide low impedance in both logic states for good A.C. noise immunity.

LOGIC DIAGRAM



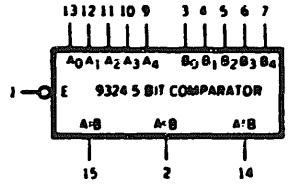
V_{CC} = Pin 16
Gnd = Pin 8

9324
MSI 5-BIT COMPARATOR

Description

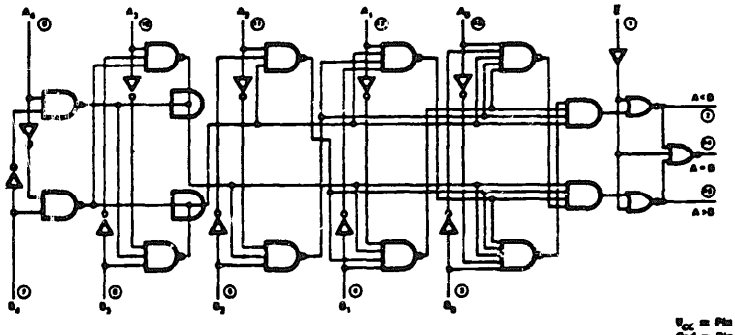
The 9324 is a high speed expandable comparator which provides comparison between two 5 bit words and gives three outputs, "less than," "greater than," and "equal to." A high level on the active low enable input forces all three outputs low.

LOGIC SYMBOL



V_{CC} = Pin 16
Gnd = Pin 8

LOGIC DIAGRAM



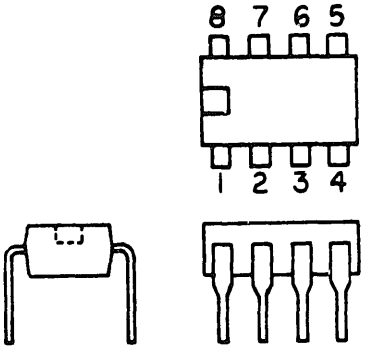
V_{CC} = Pin 16
Gnd = Pin 8

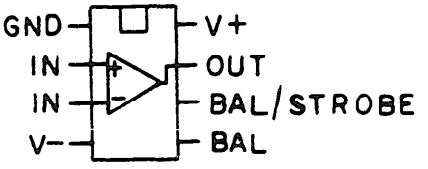
Figure 7-27. Integrated Circuit Logic

LM311
VOLTAGE COMPARATOR

Description

The LM311 is a voltage comparator. It is designed to operate over a wide range of current supply. Voltages: From standard ±15 volts op amp supply down to the single 5 volts supply used for IC logic.





schematic diagram and auxiliary circuits

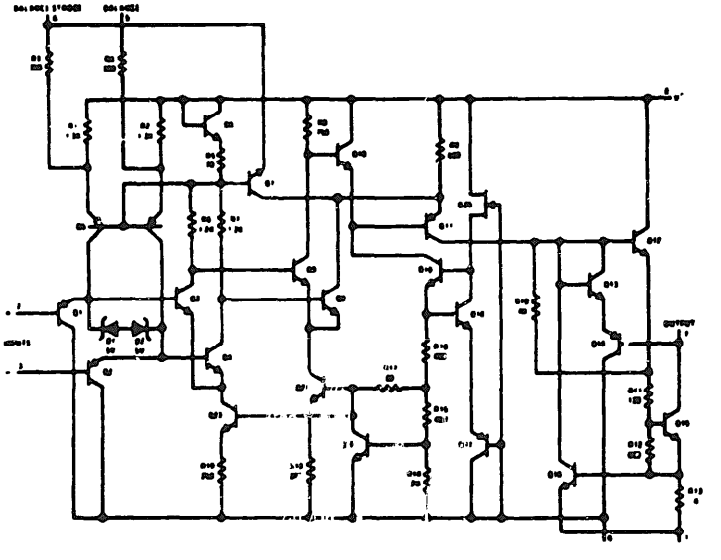


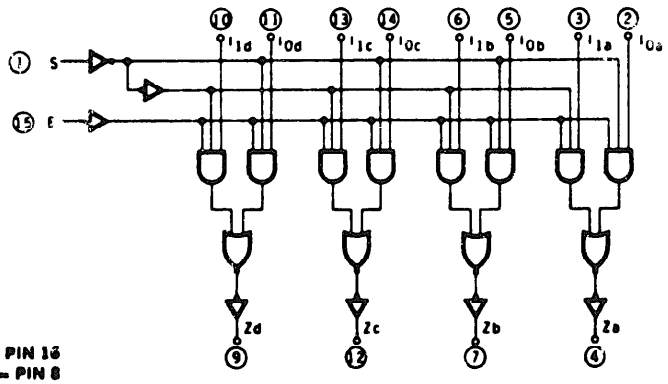
Figure 7-28. Integrated Circuit logic

9322
MSI QUAD TWO-INPUT MULTIPLEXER

Description

The 9322 consists of four 2 input multiplexers with common input select logic, common active low enable and active high outputs. It allows four bits of data to be switched in parallel to the appropriate outputs from four 2 bit data sources. When the enable is not active, all the outputs are held low.

LOGIC DIAGRAM



V_{CC} = PIN 16
GND = PIN 8

PIN NAMES		LOADING
S	Common Select Input	1 UL
$\bar{E}$	Enable (Active Low) Input	1 UL
Multiplexers A, B, C, D		
I_c, I_0	Multiplexer Inputs	1 UL
Z	Multiplexer Output	10 UL

TRUTH TABLE

$\bar{E}$	S	I_{0a}, I_{0b}, I_{0c}, I_{0d}	I_{1a}, I_{1b}, I_{1c}, I_{1d}	Z_a, Z_b, Z_c, Z_d
H	X	X	X	L
L	L	H	X	H
L	L	L	X	L
L	H	X	H	H
L	H	X	L	L

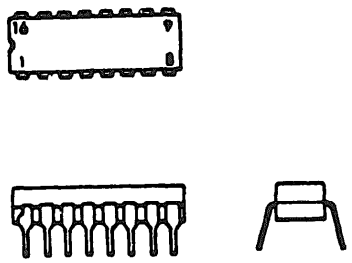
H = High Voltage Level
L = Low Voltage Level
X = Don't Care Condition

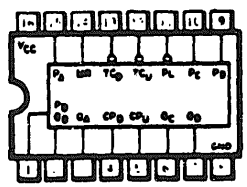
Figure 7-29. Integrated Circuit. Logic

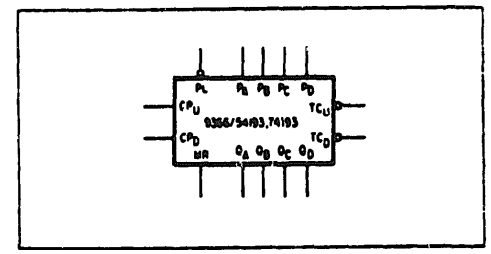
74193
UP/DOWN 4 BIT BINARY COUNTER

Description

The 74193 is a synchronous up/down 4 bit binary counter with separate up/down clocks, parallel load (asynchronous) facility, terminal count outputs for multidecade operation, and an asynchronous overriding master reset.







PIN NAMES		LOADING
$\overline{PL}$	Parallel Load (Active Low) Input	1 UL
P_A, P_B, P_C, P_D	Parallel Data Inputs	1 UL
CP_U	Count Up Clock Pulse Input	1 UL
CP_D	Count Down Clock Pulse Input	1 UL
MR	Master Reset (Clear) Input (Asynchronous)	1 UL
Q_A, Q_B, Q_C, Q_D	Counter Outputs	10 UL
$\overline{TC}_U$	Terminal Count-Up (Carry) Output	10 UL
$\overline{TC}_D$	Terminal Count-Down (Borrow) Output	10 UL

CHARACTERISTICS	
TYPICAL SPEED	30 MHz Counting Frequency
TYPICAL DELAY	CP to Q 30 ns
PACKAGE	16 Pin DIP (7B)
TYPICAL POWER DISSIPATION	300 mW

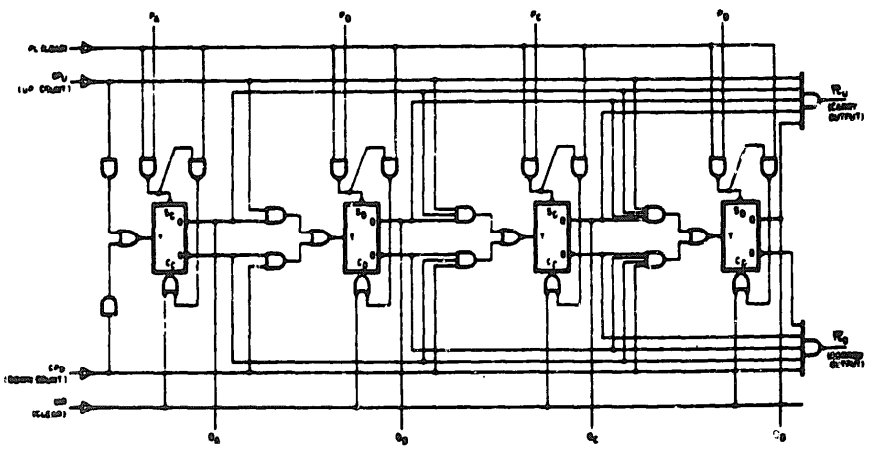
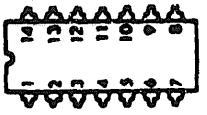


Figure 7-30. Integrated Circuit Logic

7474
DUAL D-TYPE EDGE-TRIGGERED FLIP FLOP

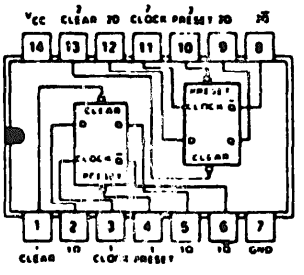


Description

D Flip-flop. Edge-triggered with clear and preset inputs, and complementary Q and $\overline{Q}$ outputs. Input information is transferred to Q output on positive edge of clock pulse.

Clock triggering occurs at a voltage level of the clock pulse and is not directly related to the transition time of the positive-going pulse. After clock input threshold voltage has been passed, the data input "D" is locked out.

LOGIC DIAGRAM



TRUTH TABLE (Each Flip-Flop)

t_n	t_{n+1}	
INPUT	OUTPUT	OUTPUT
D	Q	$\overline{Q}$
0	0	1
1	1	0

NOTES 1. t_n = bit time before clock pulse.
2. t_{n+1} = bit time after clock pulse.

functional block diagram (each flip-flop)

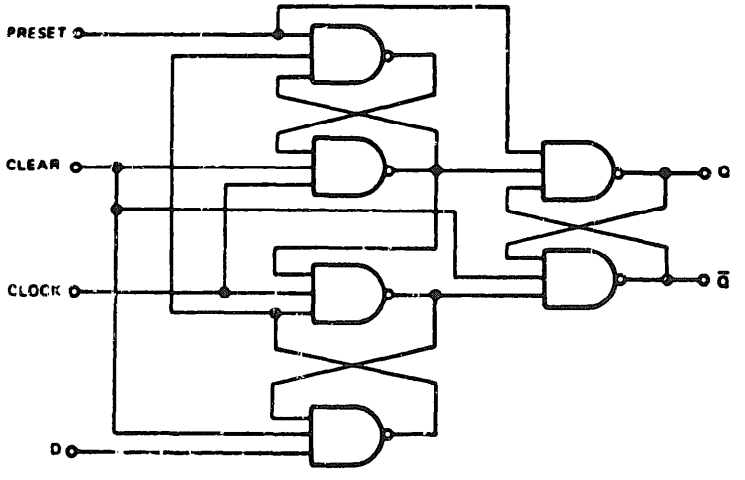
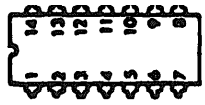


Figure 7-31. Integrated Circuit Logic

SERIES 74 TRANSISTOR-TRANSISTOR LOGIC

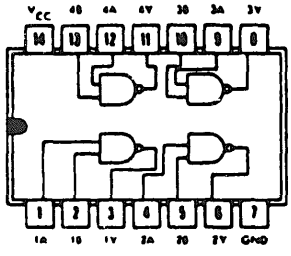


Description

Series 74 integrated circuits are designed and characterized for high-speed, general-purpose digital applications where high DC noise margin and relatively low power dissipation are important system considerations. This logic series includes the basic gates, flip-flop elements, and complex logic and storage elements needed to perform all functions of general-purpose digital systems.

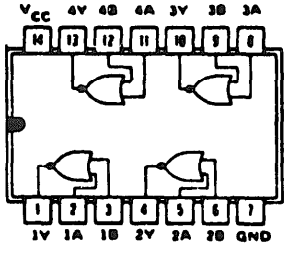
7400
QUAD 2-INPUT NAND GATE

LOGIC DIAGRAM



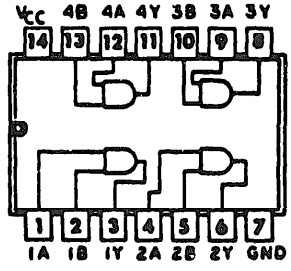
7402
QUADRUPLE 2-INPUT POSITIVE NOR GATE

LOGIC DIAGRAM



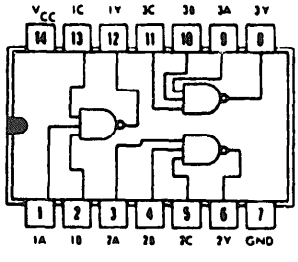
7408
QUADRUPLE 2-INPUT POSITIVE AND GATE

LOGIC DIAGRAM



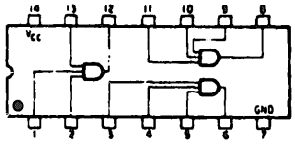
7410
TRIPLE THREE INPUT NAND GATE

LOGIC DIAGRAM



7411
AND GATE

LOGIC DIAGRAM



7438
QUADRUPLE 2-INPUT POSITIVE NAND BUFFERS

LOGIC DIAGRAM

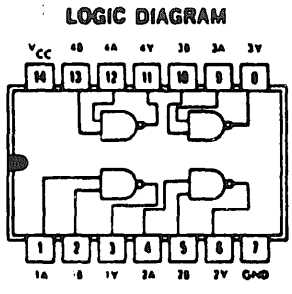


Figure 7-32. Integrated Circuit Logic

SECTION VIII - ILLUSTRATED PARTS LISTS

8.1 INTRODUCTION

This section contains a complete listing of assemblies and detail parts for the Model 303 Disk Cartridge Drives, which is keyed to the accompanying exploded view and line illustrations.

All parts are listed by the Caelus part number.

Depending upon the specific model configuration and options provided in the various versions of the 303 series, some of the components shown in this section may not apply to specific units.

When ordering replacement parts, the unit serial number and model must appear on the spares Purchase Order to assure shipment of correct replacement parts.

Some of the figures in this section show more than one replaceable assembly configuration for the various models offered. In some cases non-field replaceable parts and components of an assembly are shown for illustrative clarity. All attaching hardware; nuts, screws, etc., have been shown and are listed by size, length, and head style.

An asterisk (*) will appear adjacent to the quantity in the Qty. Per Assy. column for all items which are not normally considered field replaceable and for all standard attaching hardware items.

101-5

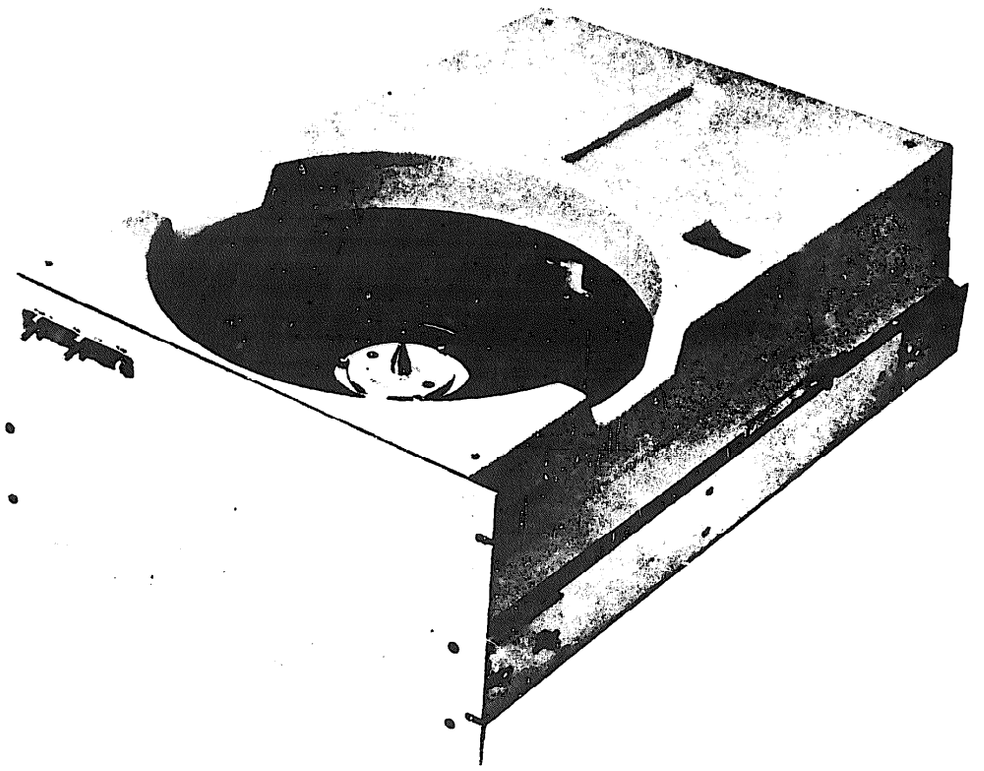


Figure 8-1. Model 303 Caelus Cartridge Disk Drive

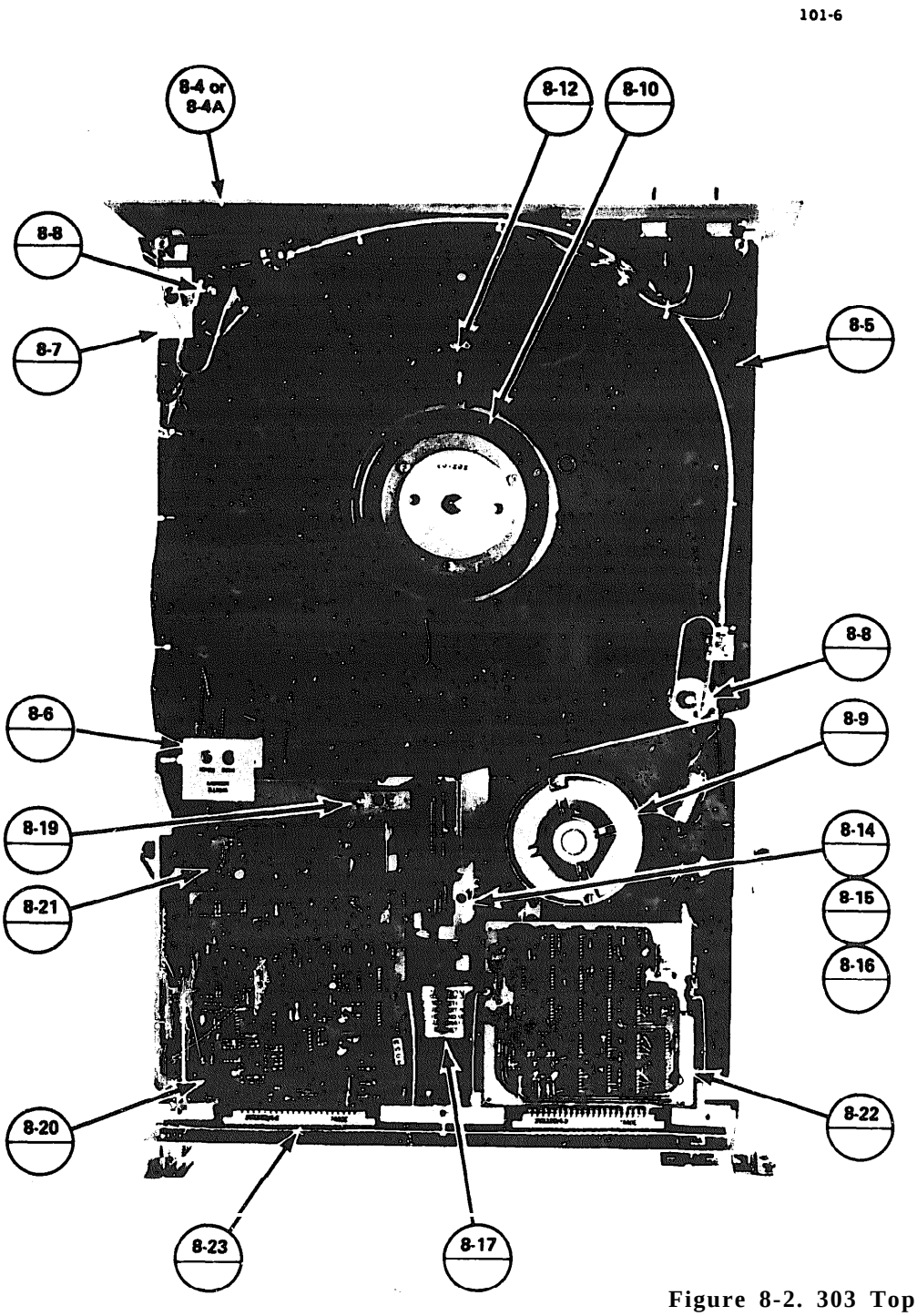


Figure 8-2. 303 Top View

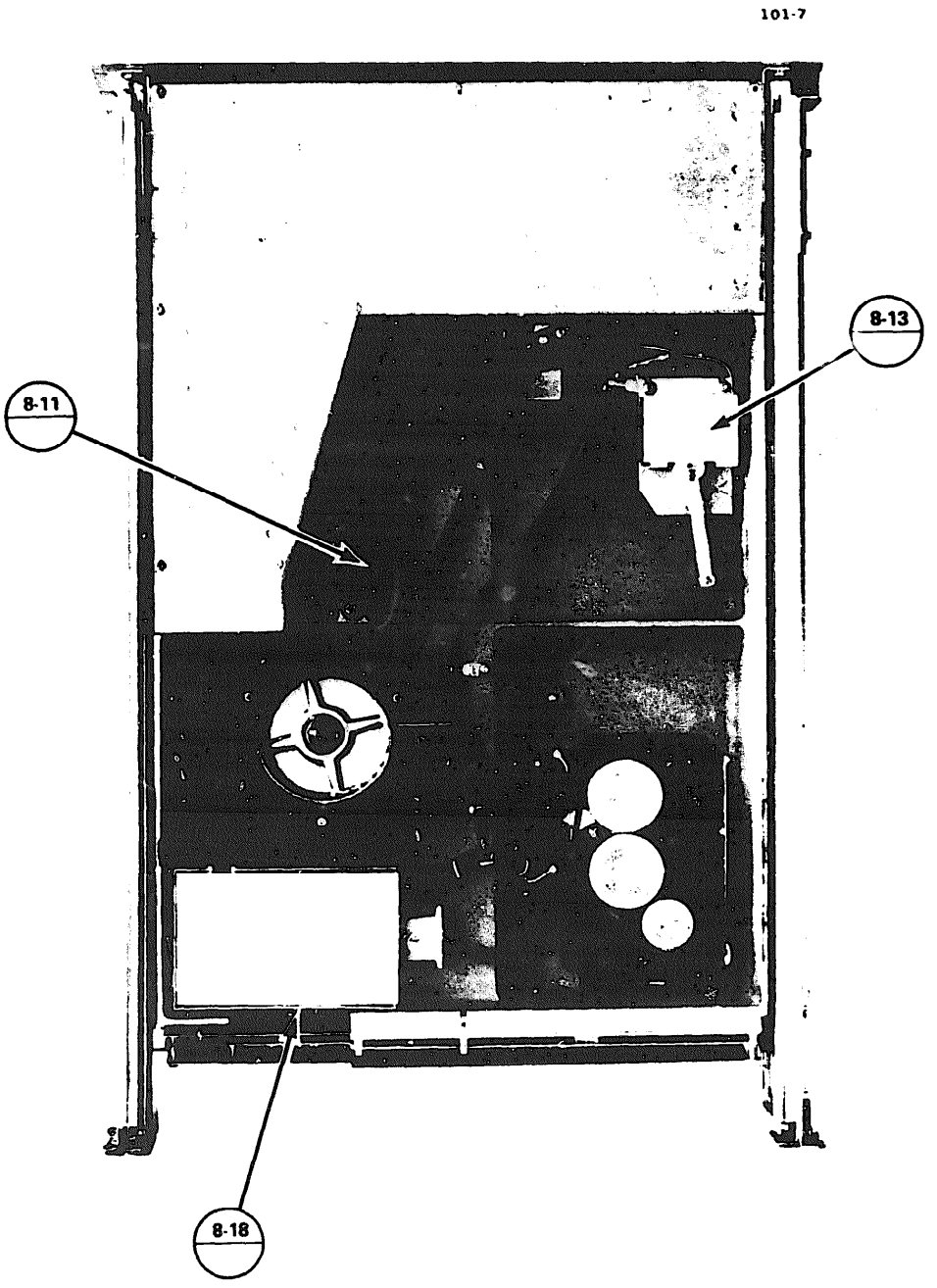


Figure 8-3, 303 Bottom View

Fig. & Item Number	Reference Designation	Part Number	Description	Qty. Per Assy.	
8-1			- Model 303 Disk Cartridge Drive	----	Ref
		301196- **	-- Top Cover	1	
		301344- **	-- Rear Cover	1	
		25-000572-021	-- Screw - Button Head, Socket	*5	
8-2		301000- **	- Model 303 Top View (with covers removed)	----	Ref
8-3			- Model 303 Bottom View	----	Ref
8-4		301127- **	-- Front Face Assembly	*1	
8-5		301245-009	-- Shroud Assembly	*1	
8-6		301051-009	-- Inhibit Switch Assembly	1	
8-7			-- Latch Switch and Solenoid Groups	----	Ref
8-8			-- Latch Assemblies	----	Ref
8-9			-- Spindle Motor, Spindle and Clean Air Group	----	Ref
8-10			-- Spindle, Fixed Disk and Ground Strap Group	----	Ref
8-11		301065-009	-- Idler Assembly - Drive Belt	1	
8-12			-- Index Transducers and Shield Assembly Group	----	Ref
8-13			-- Brushes and Brush Motor Group	----	Ref
8-14		301268-009	-- Carriage Assembly	1	
8-15			-- Read/Write Heads, Head Load Cam and Associated Mounting Hardware	----	Ref
8-16			-- Carriage Guide Shafts, Bearing and Racks	----	Ref
8-17			-- Positioner Motor Group	----	Ref
8-18		301232-009	-- Relay Module (pictured without cover)	----	Ref
8-19			-- Optical Detent Group	----	Ref
8-20		301174	-- Read/Write Amplifier PCB Assy	1	
8-21		301705	-- Power Control Module Assy	1	
8-22		301924	-- Option Board PCB Assy	1	
8-23		301671	--Drive Electronics Module, PCB Assy	1	

* Not normally considered as a replaceable assembly or part.

** Refer to the Top Assembly Control Drawing for specific part number.

*** Used on Daisy Chain Option only.

	301718	-- Front Panel Kit Assembly, 303 Option (See Dwgs 301718 and 301717 for Assembly and Parts List.)	1

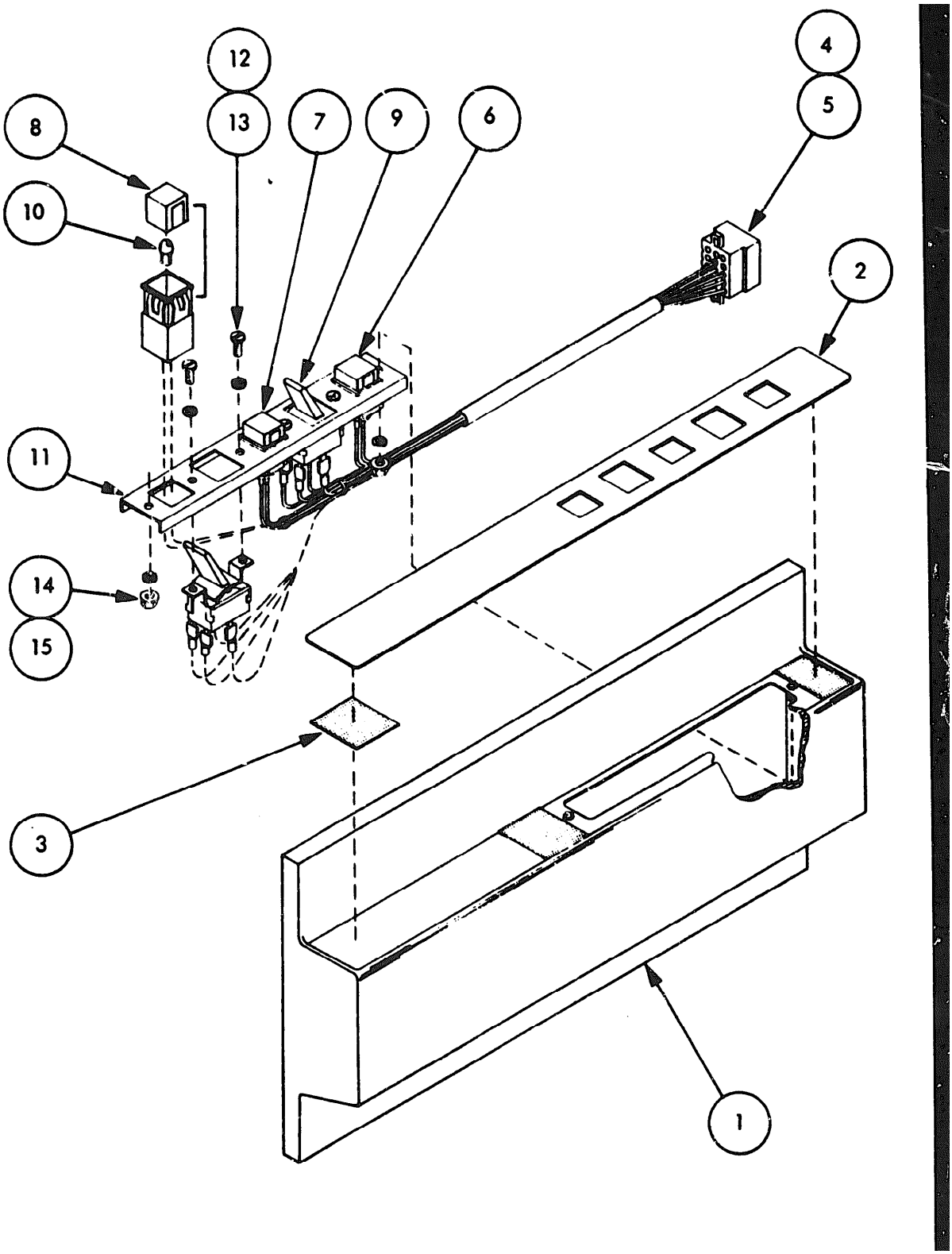
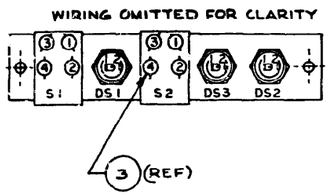
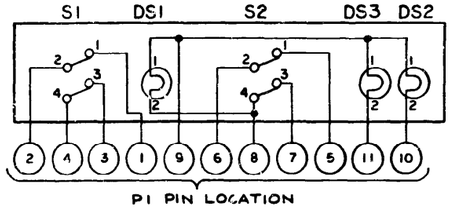


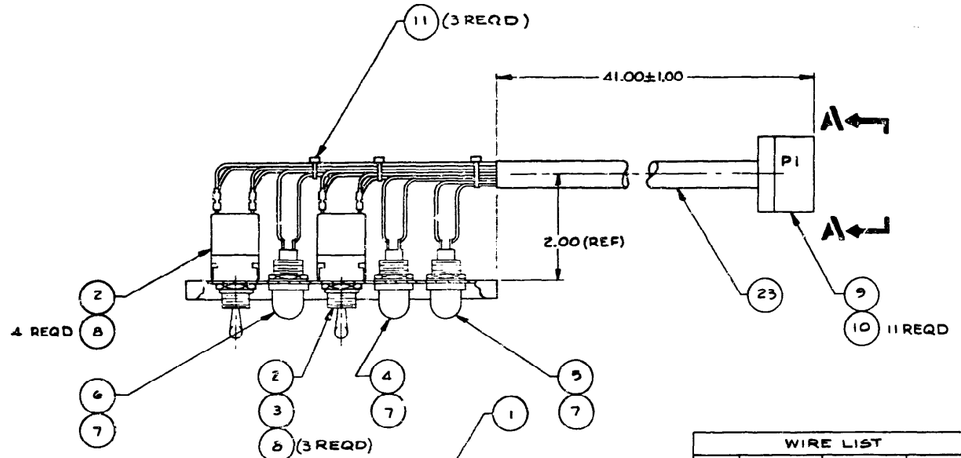
Figure 8-4. Front Face Group

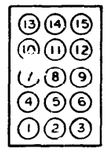
Fig. & Item Number	Reference Designation	Part Number	Description	Qty. Per Assy.	
8-4		3015876-009	- Front Face Assembly	----	Ref
-1		301489-001	- Front Face	*1	
-2		301547-001	- Switch Plate	*1	
-3		01-000357-001	- Tape - Foam, Double Coated	*A/R	
-4		41-000246-001	- Connector (15 Contact)	*1	
-5		35-000252-002	- Pin - Male	*11	
-6		55-000582-001	- Indicator and Receptacle - "Stop"	1	
-7		55-000582-002	- Indicator and Receptacle - "Ready"	1	
-8		55-000582-003	- Indicator and Receptacle - "Power"	1	
-9		37-000565-001	- Switch - DPST	2	
-10		40-050118-001	- Lamp - Minature	3	
-11		301140-001	- Bracket, Switch Mounting	*1	
-12		25-000555-025	- Screw - Pan Head, Slotted (#6-32 X 3/16)	*4	
-13		25-000146-003	- Washer - Lock, Internal Tooth (#6)	*4	
-14		25-000091-008	- Nut - Hex (#6-32)	*2	
-15		25-000065-007	- Washer - Flat (#6)	*2	

TO 31S5-4-519-1









WIRE LIST			
ITEM	FROM	TO	COLOR CODE
12	S1-1	P1-1	GRAY
13	S1-2	P1-2	BLK
14	S1-3	P1-3	BRN
15	S1-4	P1-4	WHT
16	S2-1	P1-5	YEL
17	S2-2	P1-6	BLU
18	S2-3	P1-7	BLK/WHT
19	S2-4	P1-8	GRAY/WHT
19	S2-4	DS1-2	GRAY/WHT
20	DS1-1	DS2-1	BRN/WHT
20	DS1-1	P1-9	BRN/WHT
20	DS2-1	DS3-1	BRN/WHT
21	DS2-2	P1-10	YEL/WHT
22	DS3-2	P1-11	GRN/WHT

A/R	ITEM	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION/MATERIAL	REMARKS
A/R	23	08-000362-005	SLEEVING, HEAT SHRINK, PVC BLK	ALPHA NQ FIT-105-1/2
A/R	22	04-000257-010	WIRE, 20AWG VINYL GRN/WHT	U.L. STYLE 1095
	21	-011	YEL/WHT	
	20	-009	BRN/WHT	
	19	-016	GRAY/WHT	
	18	-007	BLK/WHT	
	17	-017	BLU	
	16	-014	YEL	
	15	-001	WHT	
	14	-002	BRN	
	13	-006	BLK	
A/R	12	04-000257-018	WIRE, 20AWG VINYL GRAY	U.L. STYLE 1095
3	11	25-000109-002	CABLE CLAMP	PANDUIT SST1.5
11	10	35-000252-002	PIN, CONTACT MALE	MOLEX 1380T
1	9	41-000246-001	CONN. PLUG 18PIN	MOLEX 1375-15-P2
7	8	35-000632-001	DISCONNECT, FEMALE SNAP ON	THOM & BETTS RA-257
3	7	40-000118-004	LAMP, MINIATURE	#376
1	6	55-000709-002	INDICATOR LIGHT (GREEN)	VEMALINE #7012-13X-P9
1	5	55-000709-003	INDICATOR LIGHT (AMBER)	VEMALINE #7012-13X-P10
1	4	55-000709-001	INDICATOR LIGHT (RED)	VEMALINE #7012-13X-P8
1	3	35-000632-002	DISCONNECT, FEMALE SNAP ON	THOM & BETTS RB-257
2	2	37-000710-001	SWITCH, TOGGLE DPST	MC GILL 0111-0009
1	1	301714-001	SWITCH PLATE	

DASH NO & QTY PER ASSY									
099	089	079	069	059	049	039	029	019	009

PART NO	NEXT ASSY	USED ON
009 301718		303/M

APPLICATION

REV	STATUS	DATE	APPR
X1	PROTO REL 4-27-72	4-14-72	GH
A	PROD REL PER ENG 5597	4-15-72	GH 4/18/72

UNLESS OTHERWISE SPECIFIED
TOLERANCES
XX ± ANGLES XXX ±
DO NOT SCALE DRAWING
INTERPRET DIMENSIONS AND TOLERANCES PER ANSI Y14.5
DIMENSIONS ARE IN INCHES AND APPLY AFTER HEAT TREAT AND FINISH
COUNTERBORE AND SPOTFACE FALLEY DRILL TO BE
REMOVE ALL BURRS AND BREAK SHARP EDGES .010 MAX
ROUGHNESS OF MACHINED SURFACES 125 PER ANSI B46.1
STANDARD HOLE TOLERANCE PER ANSI B32

DRAWN [illegible] 6-7-72
CHECK [illegible] 4/18/72
PROJ. ENGR
PROD. ENGR
OTHER APPROVALS
THIRD ANGLE PROJECTION
INCH

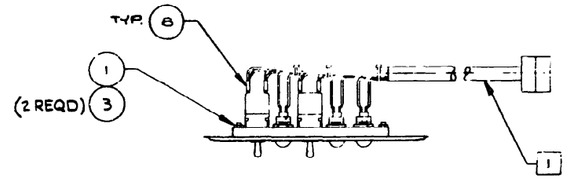
CÆLUS MEMORIES INC.
SAN JOSE, CALIFORNIA

TITLE: SWITCH PLATE ASSEMBLY

SIZE D | SCALE NONE | SHT 1 OF 1 | 301717 | REV A

301717 A

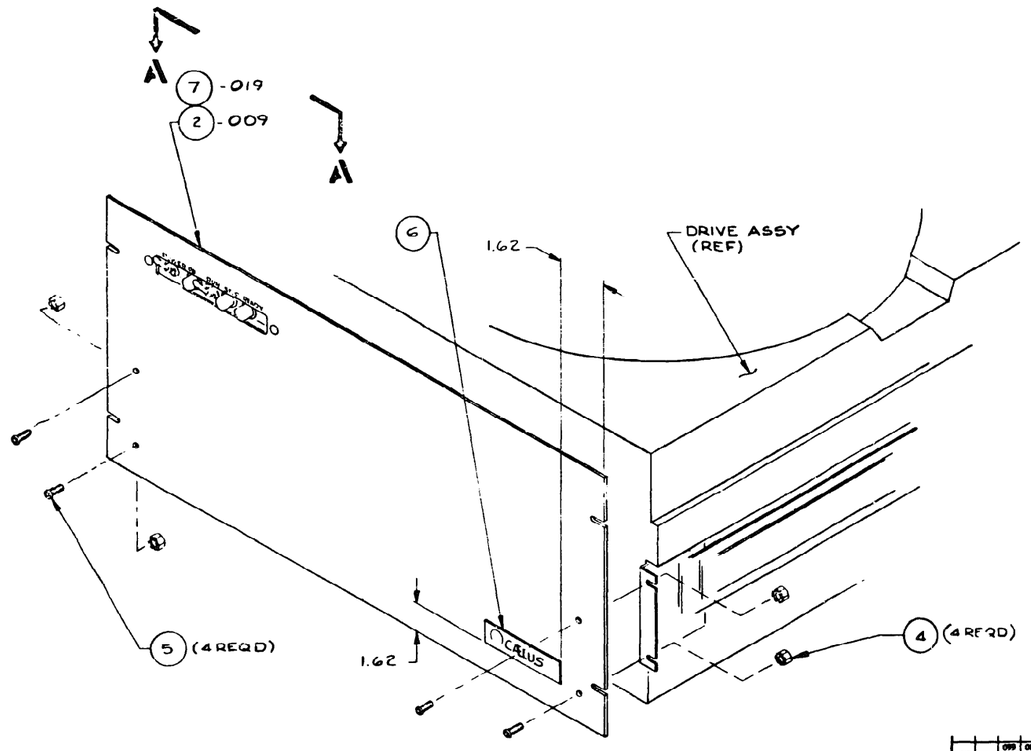
301717



VIEW A-A

NOTES:

1. ROUTE CABLE AS SHOWN ON DRAWING NO 301000 TO 301500
2. SHOWN FOR ASSY REF ONLY SEE TOP ASSY CONTROL DWG. FOR PROPER PART NO.



DASH NO & QTY PER ASSY				ITEM	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION/MATERIAL	REMARKS
				AR	AR 8	08-000362-004	SLEEVING, HEAT SHRINK	
				1	/ 7	301716-003	PANEL, FRONT	
				1	1 6		NAME PLATE	2
				4	4 5	25-000551-028	SCREW, BTN HD SKT	#8-32 x .38 LG
				4	4 4	25-000207-003	NUT, HEX W/LOCKWASHER	#8-32
				2	2 3	25-000207-002	NUT, HEX W/LOCKWASHER	#6-32
				/	1 2	301716-002	PANEL, FRONT	
				1	1 1	301717-009	SWITCH PLATE ASSEMBLY	
099	089	079	069	059	049	039	029	019	009				

REVISIONS			
LTR	ECN	DATE	APPD
A	INITIAL RELEASE	11-27-73	
B	PCN B161	11-18-74	

DEC 4 1974

UNLESS OTHERWISE SPECIFIED
TOLERANCES
XX ± .06 XXX ± ~
ANGLES ~
DO NOT SCALE PRINTING
INTERPRET DIMENSIONS AND TOLERANCES PER MIL-STD-100, PARTS 1 & 2
DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED
COUNTERSINK ARE 90° INCLUSIVE FILLS RADII TO BE AS SHOWN
REMOVE ALL BURRS AND SHARP EDGES
ROUGHNESS OF MACHINED SURFACES PER U.S.A. STD.
STANDARD HOLE TOLERANCE PER ANSI B

PART NO.	NEXT ASSY	USED ON
009	TACO	303/M

APPLICATION

DRAWN Phillip 6-15-72
CHECK 7-6-72
PROJ ENGR
PROD ENGR
OTHER APPROVALS QE

THIRD ANGLE PROJECTION

INCH

CÆLUS MEMORIES INC.
SAN JOSE, CALIFORNIA

TITLE: FRONT PANEL KIT ASSEMBLY 303 OPTION

SIZE D | SCALE NONE | SHT 1 OF 1 | DO 301718 | REV B

301718 B

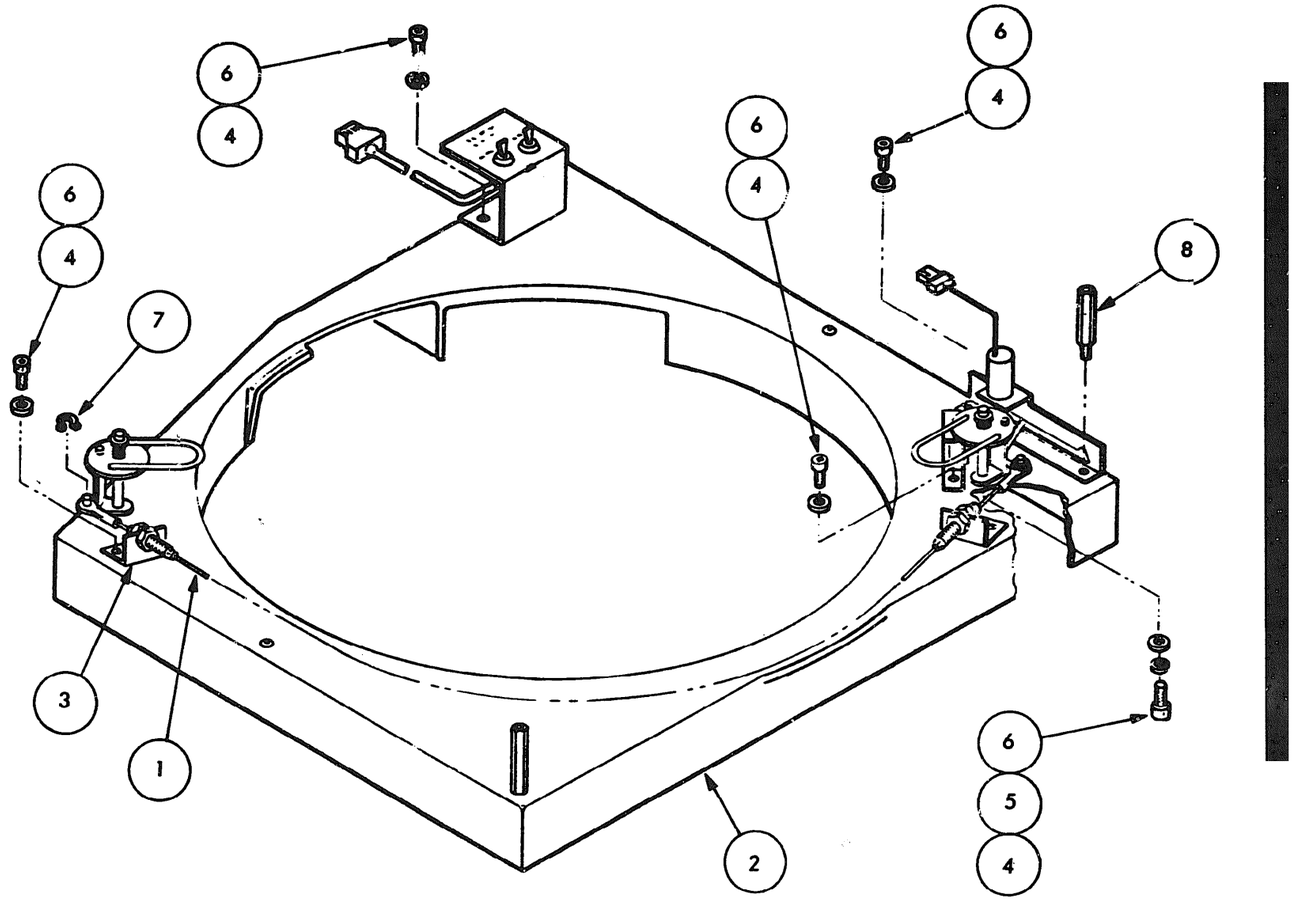


Figure 8-5. Shroud Assembly

Fig. & Item Number	Reference Designation	Part Number	Description	Qty. Per Assy.	Unit Price
8 -5		301248-009	- Shroud Assembly	----	Ref
-1		301249-001	-- Cable Assembly	1	
-2		3011261-001	-- Shroud	1	
-3		301288-001	-- Bracket - Cable Assembly	*2	
-4		25-000065-007	-- Washer - Plain (#6)	*11	
-5		25-030067-005	-- Washer - Split Lock (#6)	*2	
-6		25-000084-019	-- Screw - Cap, Socket Head (#6-32 X 3/8)	*11	
-7		25-000092-006	-- Grip Ring	*2	
-8		25-000602-001	-- Standoff (#6-32 X 1/4 O.D. X 2 Lg)	*1	

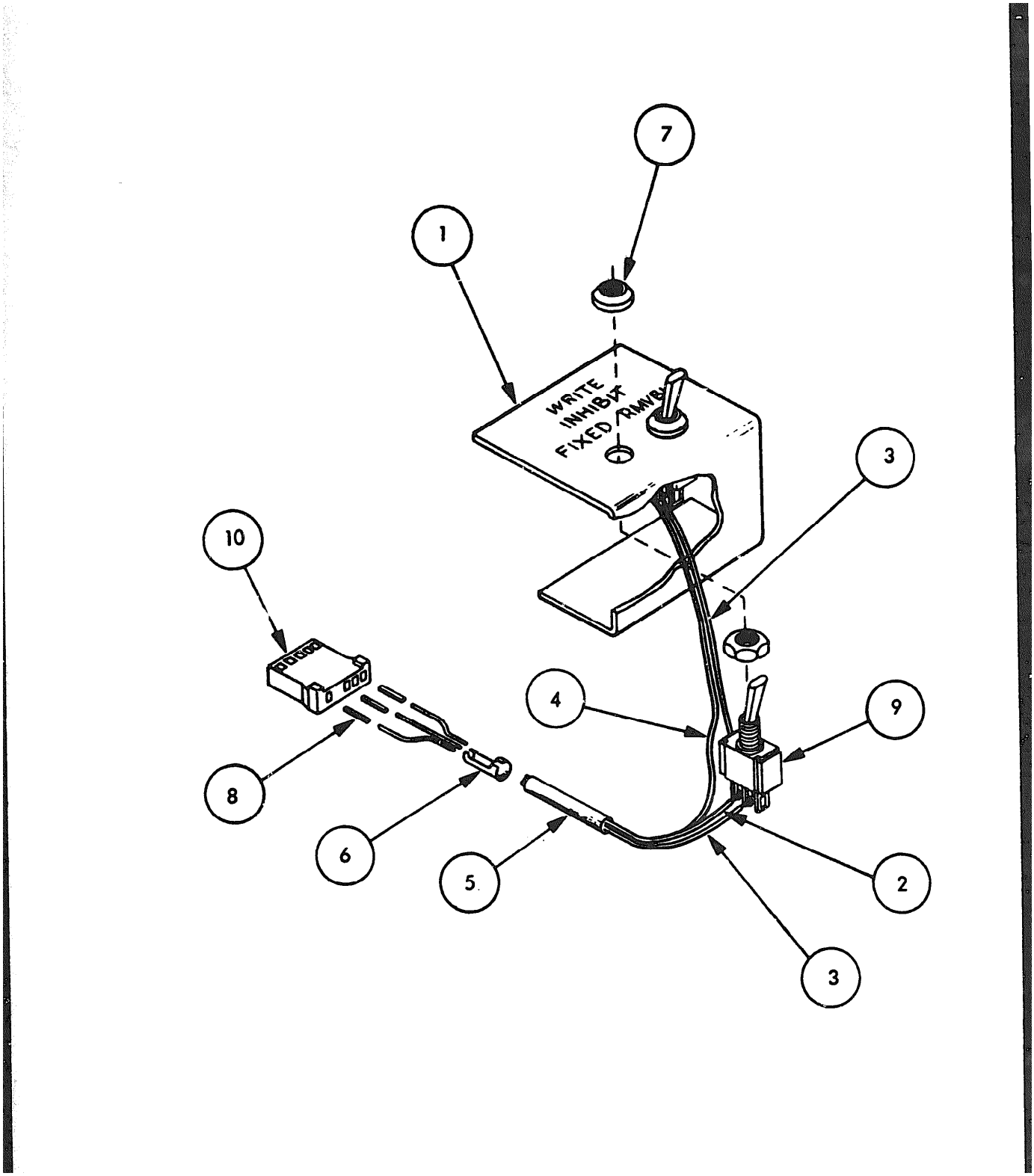


Figure 8-6. Inhibit Switch Assembly

Fig. & Item Number	Reference Designation	Part Number	Description	Qty. Per Assy.	Unit Price
8-6		301051-009	-- Inhibit Switch Assembly	----	Ref
-1		301269-001	--- Bracket - Inhibit Switch	*1	
-2		04-000416-001	--- Wire - White, Teflon	*A/R	
-3		04-000416-002	--- Wire - Black, Teflon	*A/R	
-4		04-000416-003	--- Wire - Red, Teflon	*A/R	
-5		08-000362-032	--- Sleeving - PVC	*A/R	
-6		25-000210-001	--- Strain Relief	*1	
-7		25-000415-001	--- Nut - Dress	*2	
-8		35-00211-001	--- Pin - Contact, Female	*4	
-9		37-000589-001	--- Switch - Toggle (SPDT)	2	
-10		41-000322-001	--- Connector Housing	*1	

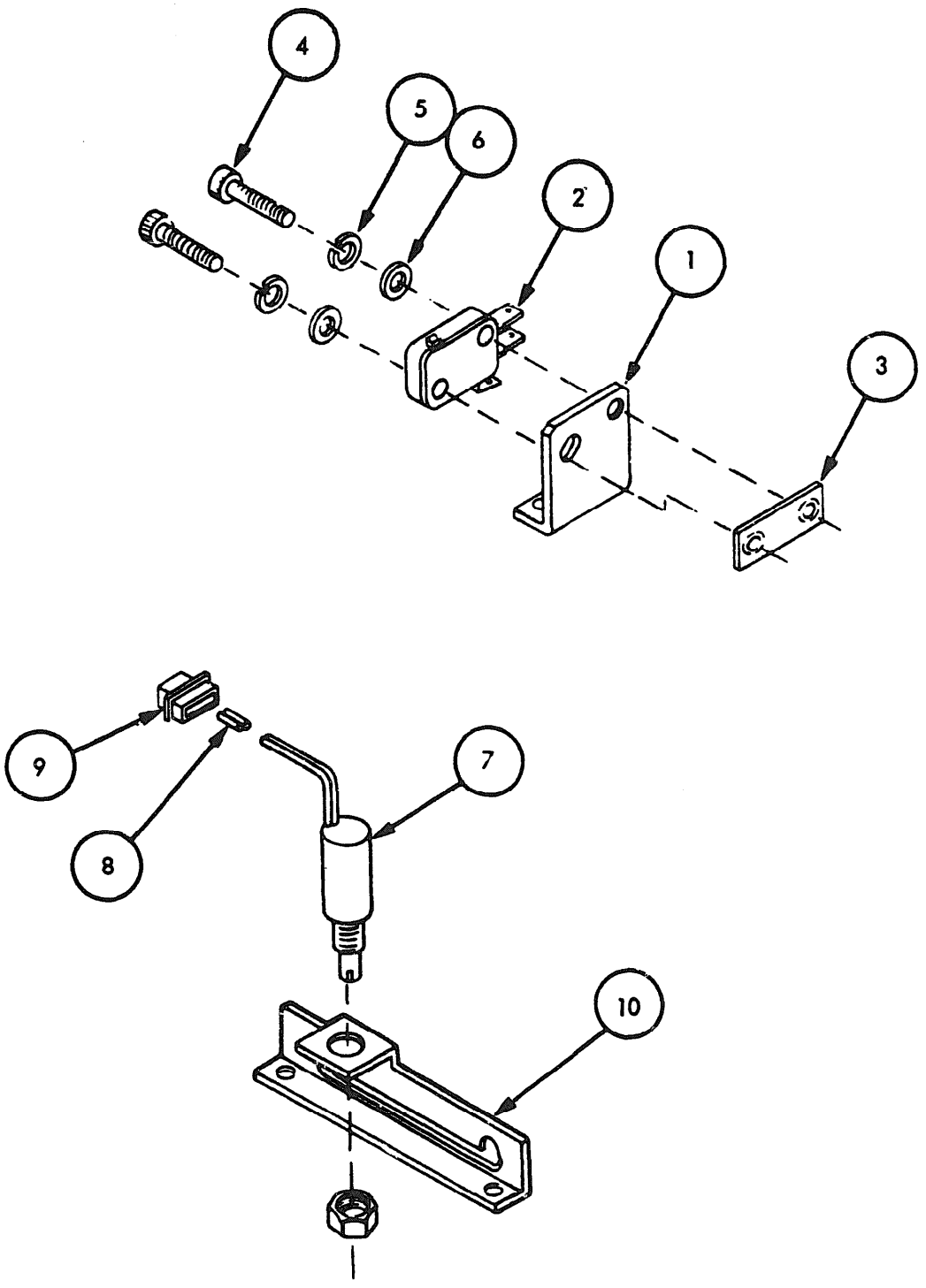


Figure 8-7. Latch Switch and Solenoid Groups

Fig. & Item Number	Reference Designation	Part Number	Description	Qty. Per Assy.	Unit Price
8-7			-- Latch Switch and Solenoid Groups	----	Ref
-1		301201-001	-- Bracket - Switch Mounting	1	
-2		37-000536-001	-- Micro Switch	1	
-3		300822-001	-- Clamp - Strap	*1	
-4		25-000085-018	-- Screw - Phillips, Pan Head (#4-40 X 5/8)	*2	
-5		25-000067-003	-- Washer - Split Lock (#4)	*2	
-6		25-000066-005	-- Washer - Plain, Nylon (#4)	*2	
			-- Solenoid Assembly	----	Ref
-7			--- Solenoid	1	
-8			--- Pin - Contact, Male	*2	
-9			--- Connector Housing	*1	
-10			-- Bracket Solenoid Mounting	*1	

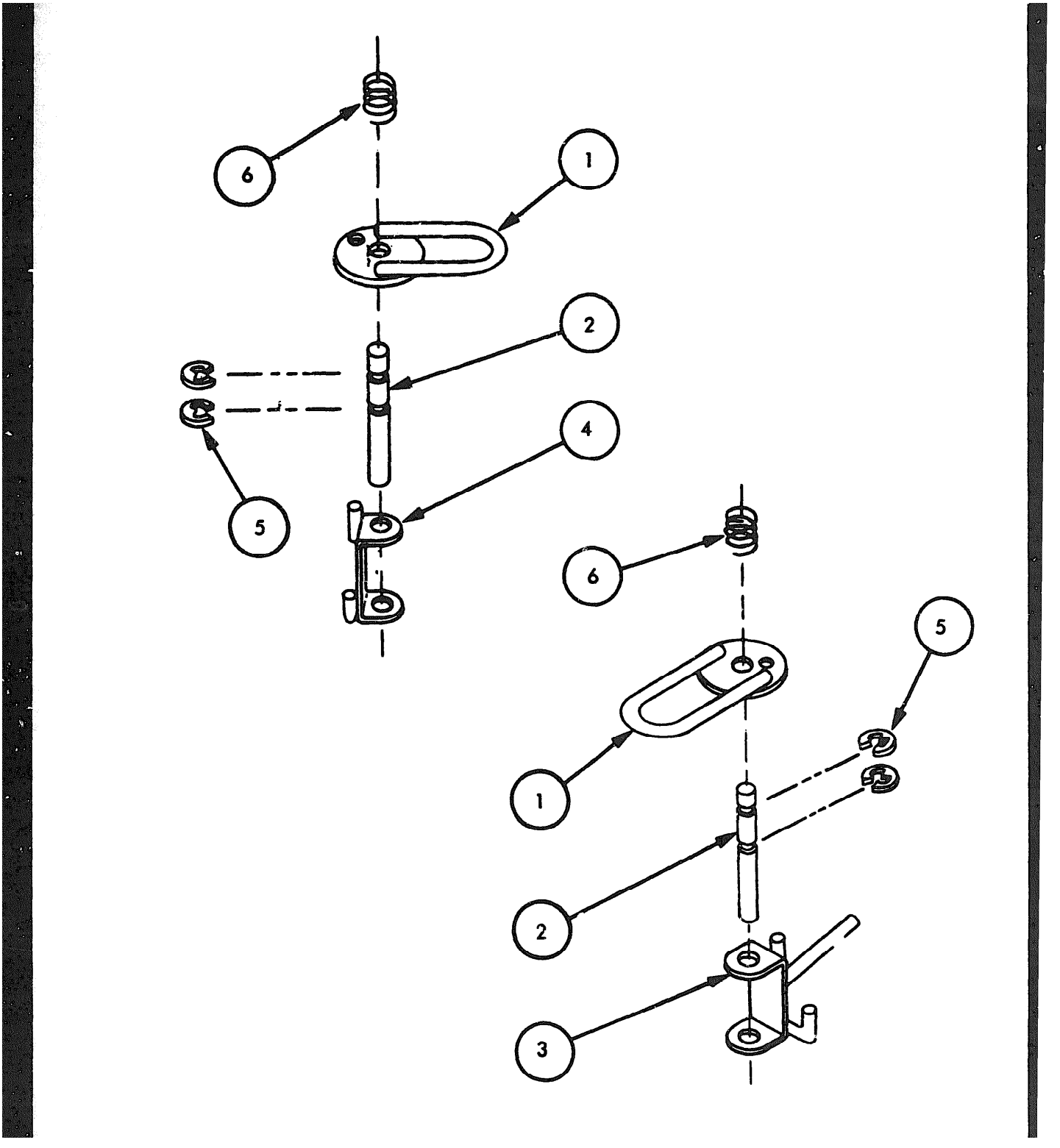


Figure 8-8. Latch Assembly Groups

Fig. & Item Number	Reference Designation	Part Number	Description	Qty. Per Assy.	Unit Price
8-8			-- Latch Assembly Groups	----	Ref
-1		301197-001	-- Latch	2	
-2		301198-001	-- Pivot - Latch	2	
-3		301200-001	-- Actuator - Latch	1	
-4		301202-001	-- Linkage - Latch	1	
-5		25-000396-015	-- Ring - Retaining	4	
-6		25-000460-271	-- Spring	2	

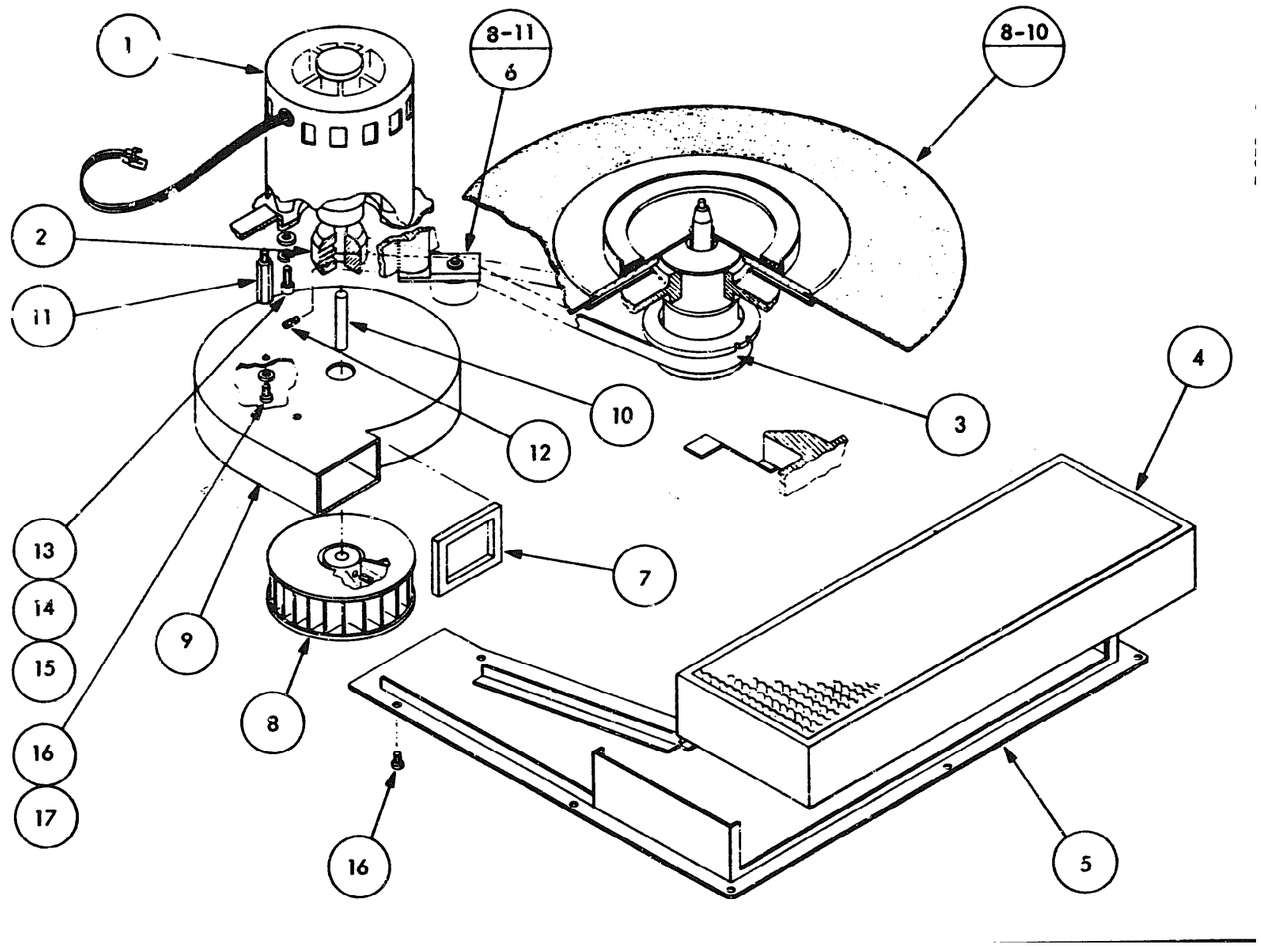


Figure 8-9. Spindle Motor, Spindle and Clean Air Groups

Fig. & Item Number	Reference Designation	Part Number	Description	Qty. Per Assy.	
8-9			- Spindle Motor, Spindle and Clean Air Groups	----	Ref
-1		301432-009	- Motor - Spindle, Assembly	1	
-2		300035-001	- Pulley - 2400 RPM 60 Hz	**1	
		300036-001	- Pulley - 1500 RPM 60 Hz		
		300345-001	- Pulley - 1500 RPM 50 Hz		
		300419-001	- Pulley - 2400 RPM 50 Hz		
-3		26-000096-002	- Belt - 1500 RPM 50/60 Hz	**1	
		26-000096-003	- Belt - 2400 RPM 60 Hz		
		26-000096-004	- Belt - 2400 RPM 50 Hz		
-4		301314-001	- Air Filter Absolute	1	
-5		301095-001	- Cover - Plenum Chamber	*1	
-6		301065-009	- Idler Assembly	1	
-7		301324-001	- Gasket - Blower Discharge	1	
-8		58-000531-001	- Blower Wheel	*1	
-9		58-000586-001	- Blower Housing	*1	
-10		301113-001	- Shaft - Blower	*1	
-11		25-000603-002	- Standoff	*3	
-12		25-000381-018	- Screw - Set Knurl Cup Point	*4	
-13		25-000084-036	- Screw - Socket Head Cap (#8-32 X 3/4)	*4	
-14		25-000067-006	- Washer - Split Lock (#8)	*4	
-15		25-000065-008	- Washer - Flat (#8)	*4	
-16		25-000572-021	- Screw - Button Head Socket (#6-32 X 1/4)	*11	
-17		25-000067-005	- Washer - Split Lock (#6)	*3	

* Part number, RPM and Hz must be specified when ordering replacement part.

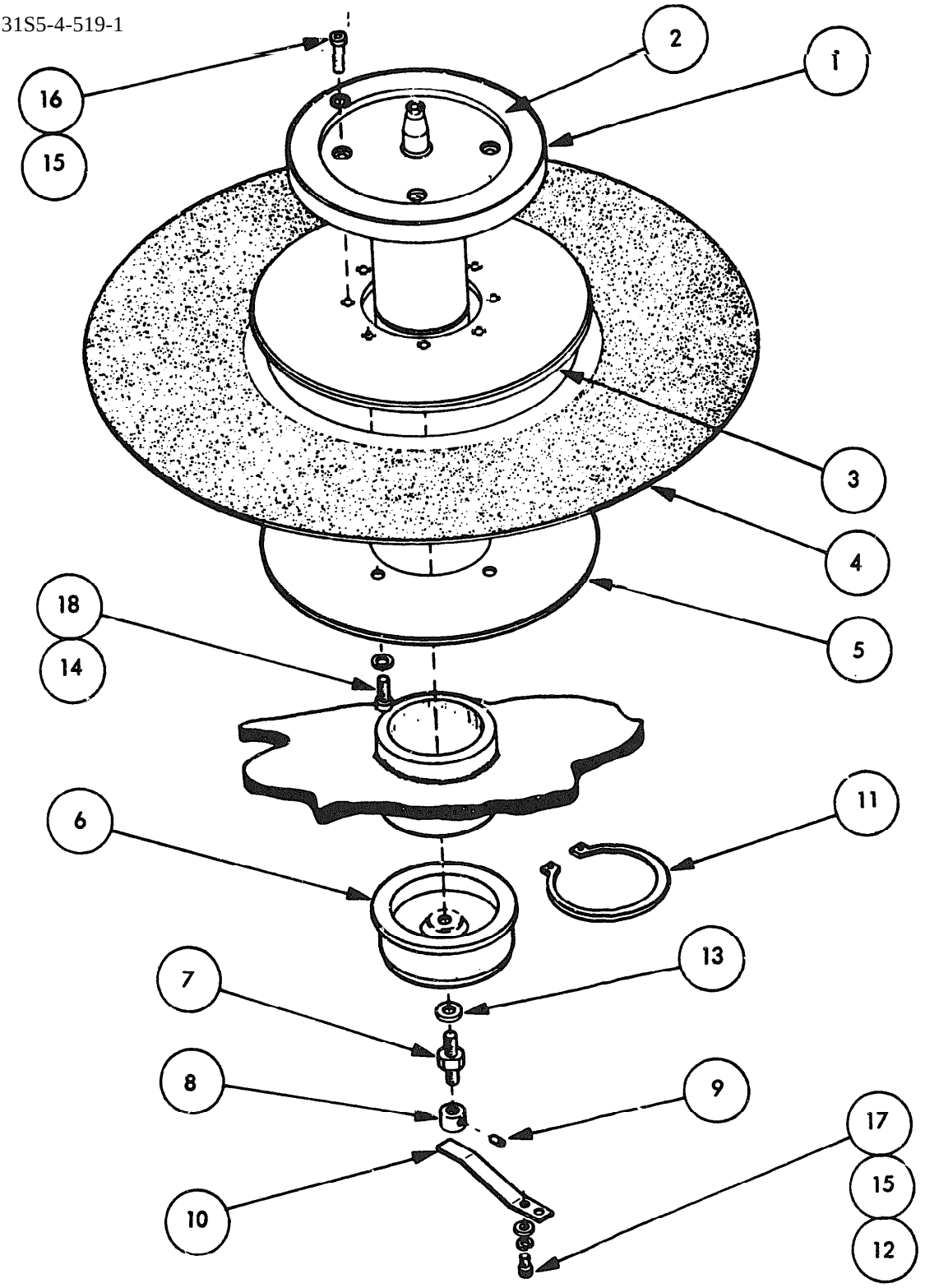


Figure 8-10. Spindle Group

Fig. & Item Number	Reference Designation	Part Number	Description	Qty. Per Assy.	
8-10			- Spindle Group	----	Ref
-1		301447-009	-- Spindle Assembly	1	
-2		300156-001	--- Magnet - Ring	1	
-3		301015-001	-- Hub - Fixed Disk	1	
-4		301505-009	-- Fixed Disk Replacement Kit	1	
-5		11004	-- Clamp Ring - Fixed Disk	1	
-6		**301226	-- Spindle Pulley Assembly	1	
		-009	--- Index Only	----	
		-019	--- 8 Sector	----	
		-029	--- 12 Sector	----	
		-039	--- 24 Sector	----	
		-049	--- 16 Sector	----	
		-059	--- 32 Sector	----	
		-069	--- 14 Sector	----	
-7		300828-001	-- Ground Stud	1	
-8		25-000376-001	-- Contact	1	
-9		25-00038 1-009	--- Screw - Set, Knurled Cup Point (#4-40 X 3/16)	*1	
-10		300827-001	-- Ground Strap	1	
-11		25-000538-019	-- Ring - Retaining	*1	
-12		25-030065-007	-- Washer - Flat (#6)	*2	
-13		25-000065-011	-- Washer - Flat (# 1/4)	*1	
-14		25-000066-009	-- Washer - Flat, Nylon (#10)	*4	
-15		25-003367-005	-- Washer - Split Lock (#6)	*6	
-16		25-000084-018	-- Screw - Cap, Socket Head (#6-32 X 1/4)	*4	
-17		25-000084-020	-- Screw - Cap, Socket Head (#6-32 X 1/2)	*2	
-18		75-000282-061	-- Screw - Phillips, Pan Head (#10-32 X 3/8)	*4	

** Part number and number of sectors required must be specified when ordering a spindle pulley assembly.

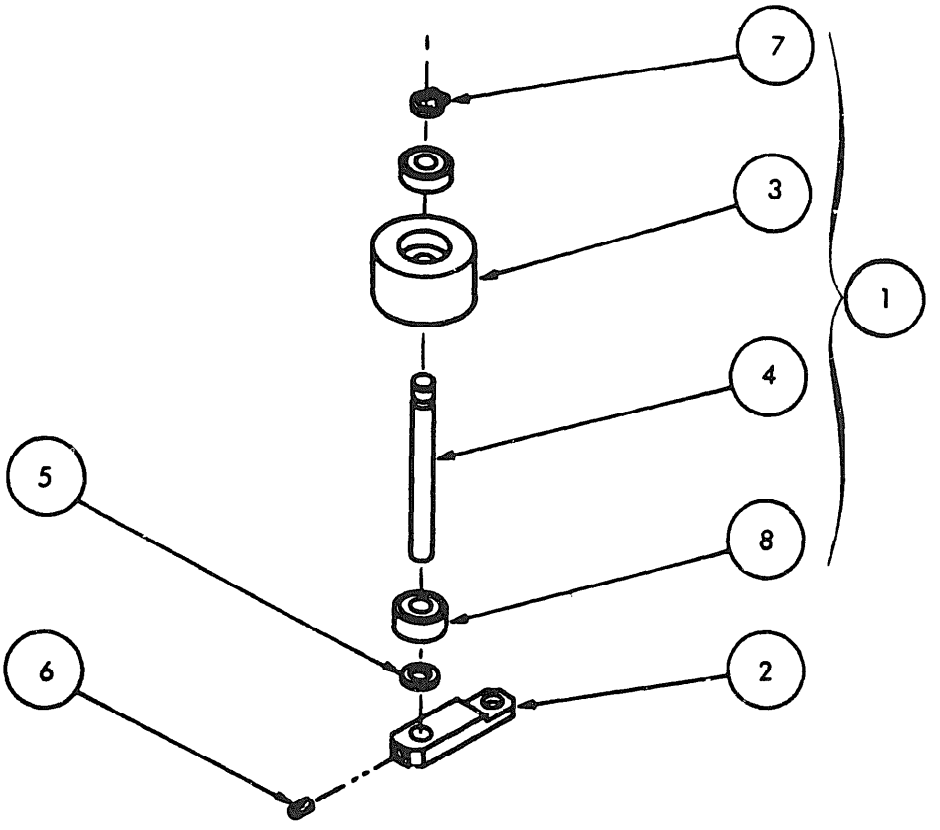


Figure 8-11. Idler Group - Drive Belt

Fig. & Item Number	Reference Designation	Part Number	Description	Qty. per Assy.	
8-11			- Idler Group	-----	Ref
-1		301065-009	- Idler Assembly - Drive Belt	1	
-2		301062-00	-- Idler Arm	1	
-3		301063-001	-- Pulley - Idler	*1	
-4		301064-001	-- Shaft - Idler	*1	
-5		25-000179-007	-- Spacer - Bearing	1	
-6		25-000182-021	--- Screw - Set Cup Point (6-32 X 3/16)	*1	
-7		25-000184-003	-- Retaining Ring	*1	
-8		26-00180-001	-- Bearing	*2	

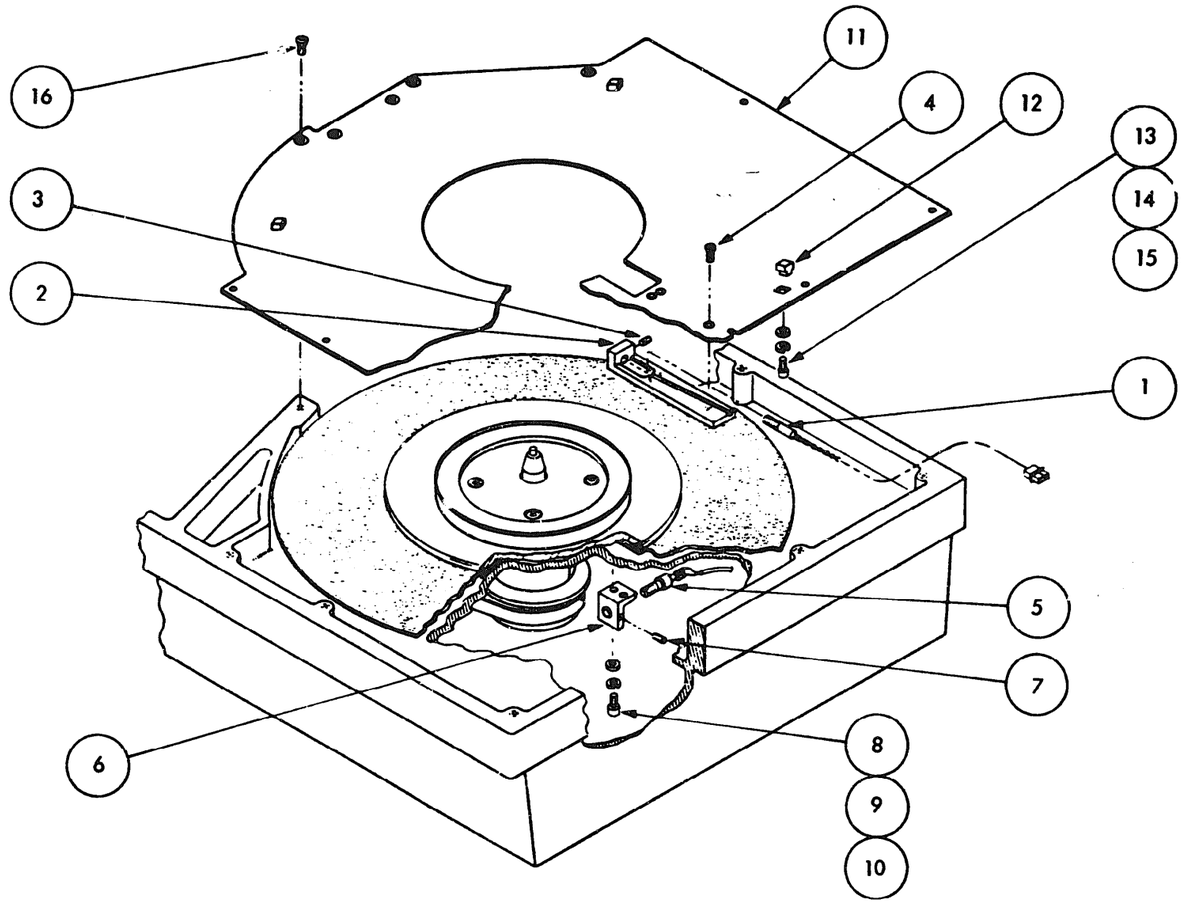


Figure 8-12. Index Transducer and Shield Group

Fig. & Item Number	Reference Designation	Part Number	Description	Qty. Per Assy.	Unit Price
8-12			- Index Transducers and Shield Group	----	Ref
-1		301402-009	- Transducer Assembly (Upper)	1	
-2		301060-001	- Mount - Upper Transducer	*1	
-3		25-000185-020	-- Screw - Set Flat Point (#6-32 X 1/8)	*1	
-4		25-000112-026	- Screw - Flat Head Socket (#6-32 X 1/4)	*3	
-5		68-000583-001	- Transducer (Lower)	1	
-6		301099-001	- Mount - Lower Transducer	*1	
-7		25-000185-002	-- Screw - Set Flat Point (#6-32 X 1/4)	*1	
-8		25-000084-020	- Screw - Socket Head Cap (#6-32 X 1/2)	*2	
-9		25-000067-005	- Washer - Split Lock (#6)	*2	
-10		25-000065-007	- Washer - Flat (#6)	*2	
-11		301061-001	-- Shield	1	
-12		301059-001	-- Pack Locator	4	
-13		25-000084-019	-- Screw - Socket Head, Cap (#6-32 X 3/8)	*4	
-14		25-000067-005	-- Washer - Split Lock (#6)	*4	
-15		25-000065-007	-- Washer - Flat (#6)	*4	
-16		26-000112-026	- Screw - Flat Head Socket (#6-32 X 1/4)	*3	

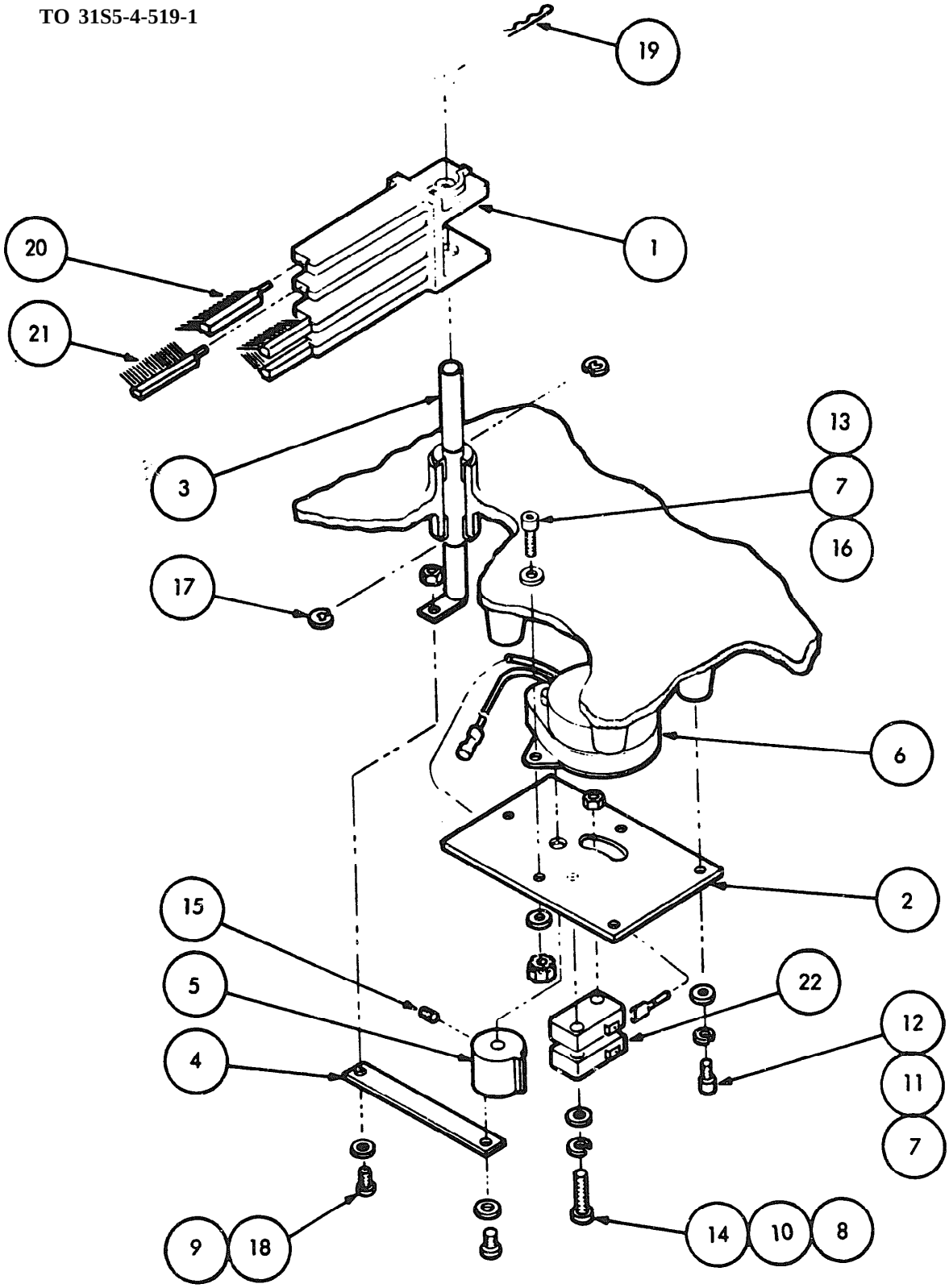


Figure 8-13, Brushes & Brush Motor **Group**

Fig. & Item Number	Reference Designation	Part Number	Description	Qty. per Assy.	Unit Price
8-13			-Brush and Brush Motor Group	----	Ref
-1		301025-001	--Arm-Brush	1	
-2		301034-001	--Plate-Mounting	1	
-3		301040-001	--Shaft-Brush Drive	1	
-4		301042-001	--Linkage	1	
-5		301043-001	--Cam	1	
-6		301396-009	--Motor-Timing, Brush	1	
-7		25-000065-007	--Washer-Flat (#6)	*5	
-8		25-000066-005	--Washer-Plain, Nylon (#4)	*2	
-9		25-000066-007	--Washer-Plain, Nylon (#6)	*2	
-10		25-000067-003	--Washer-Split Lock (#4)	*2	
-11		25-000067-005	--Washer-Split Lock (#6)	*3	
-12		25-000084-019	--Screw-Cap, Socket Hd (#6-32 X 3/8)	*3	
-13		25-000084-020	--Screw-Cap, Socket Hd (#6-32 X 1/2)	*2	
-14		25-000085-021	--Screw-Pan Hd, Cross Recessed (#4-40 X 1)	*2	
-15		25-000185-011	--Screw-Set, Flat Point (#4-40 X 1/4)	*1	
-16		25-000207-002	--Nut-Hex/External Lock Washer (#6-32 X 5/16)	*2	
-17		25-000396-016	--Ring-Retaining	*2	
19		25-000539-001	--Screw-Binder Hd, Self Locking (#6-32 X 3/8)	*2	
-19		25-000587-001	--Pin-Hitch	*1	
-20		26-000585-001	--Brush-RH	2	
-21		26-000585-002	--Brush-LH	2	
-22		37-000536-001	--Switch-Micro	2	

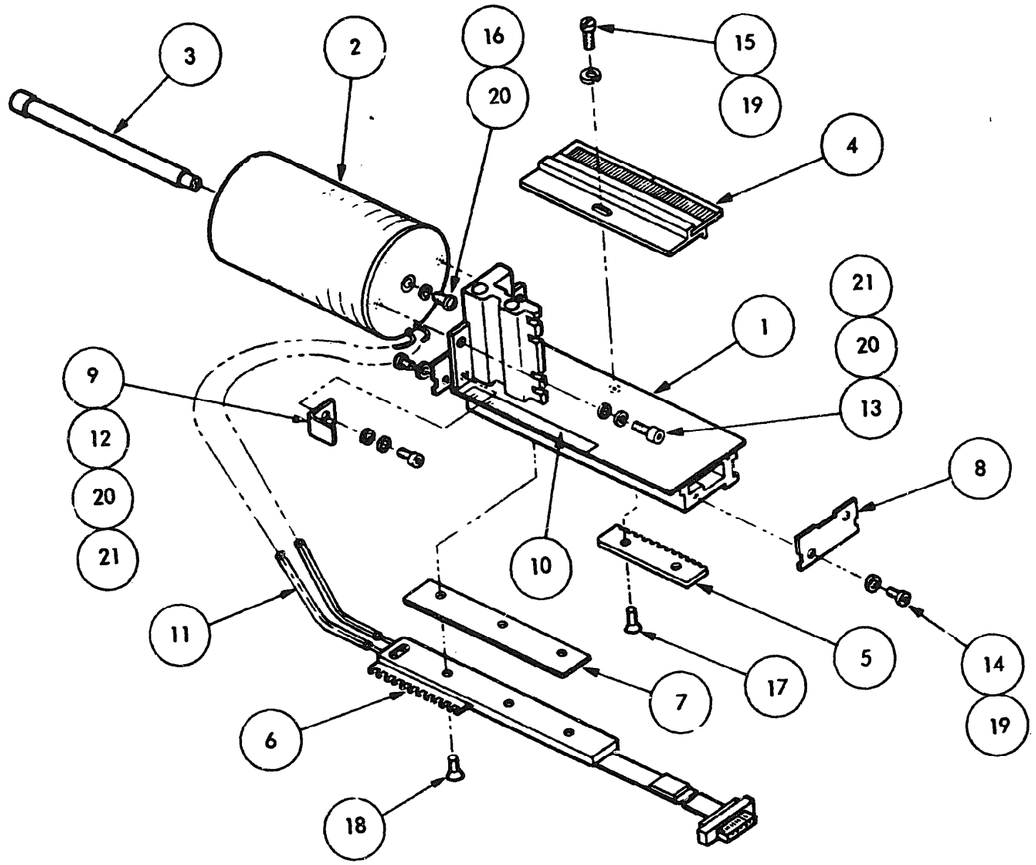


Figure 8-14, Carriage Assembly

Fig. & Item Number	Reference Designation	Part Number	Description	Qty. Per Assy.	
8-14		301268-019	- Carriage Assembly	----	Ref
-1		301391-019	-- Carriage and Head Support Assembly	1	
-2		301058-009	-- Voice Coil Assembly	1	
-3		301237-001	-- Magnet - Voice Coil	1	
-4		301239-009	-- Mask Assembly	1	
-5		301102-001	-- Rack	1	
-6		301243-009	-- Rack Tension Assembly	1	
-7		301108-001	-- Spring	1	
-8		301114-001	-- End Cap	2	
-9		301116-001	-- Cam - Home Switch	1	
-10		301279-001	-- Label Track Marker	1	
-11		08-000338-001	-- Sleeving (#26 GA)	*A/R	
-12		25-000084-018	-- Screw - Socket Head (#6-32 X 1/4)	*1	
-13		25-000084-019	-- Screw - Socket Head (#6-32 X 3/8)	*1	
-14		25-000085-013	-- Screw - Phillips, Pan Head (#4-40 X 1/4)	*4	
-15		25-000539-014	-- Screw - Binder Head, Phillips (#4-40 X 1/4)	*1	
-16		25-000572-022	-- Screw - Socket Button Head (#6-32 X 3/8)	*1	
-17		25-000112-013	-- Screw - Socket, Flat Head (#4-40 X 1/4)	*2	
-18		25-000112-027	-- Screw - Socket, Flat Head (#6-32 X 5/16)	*3	
-19		25-000067-003	-- Washer - Split Lock (#4)	*5	
-20		25-000067-005	-- Washer - Split Lock (#6)	*4	
-21		25-000065-007	-- Washer - Flat (#6)	*2	

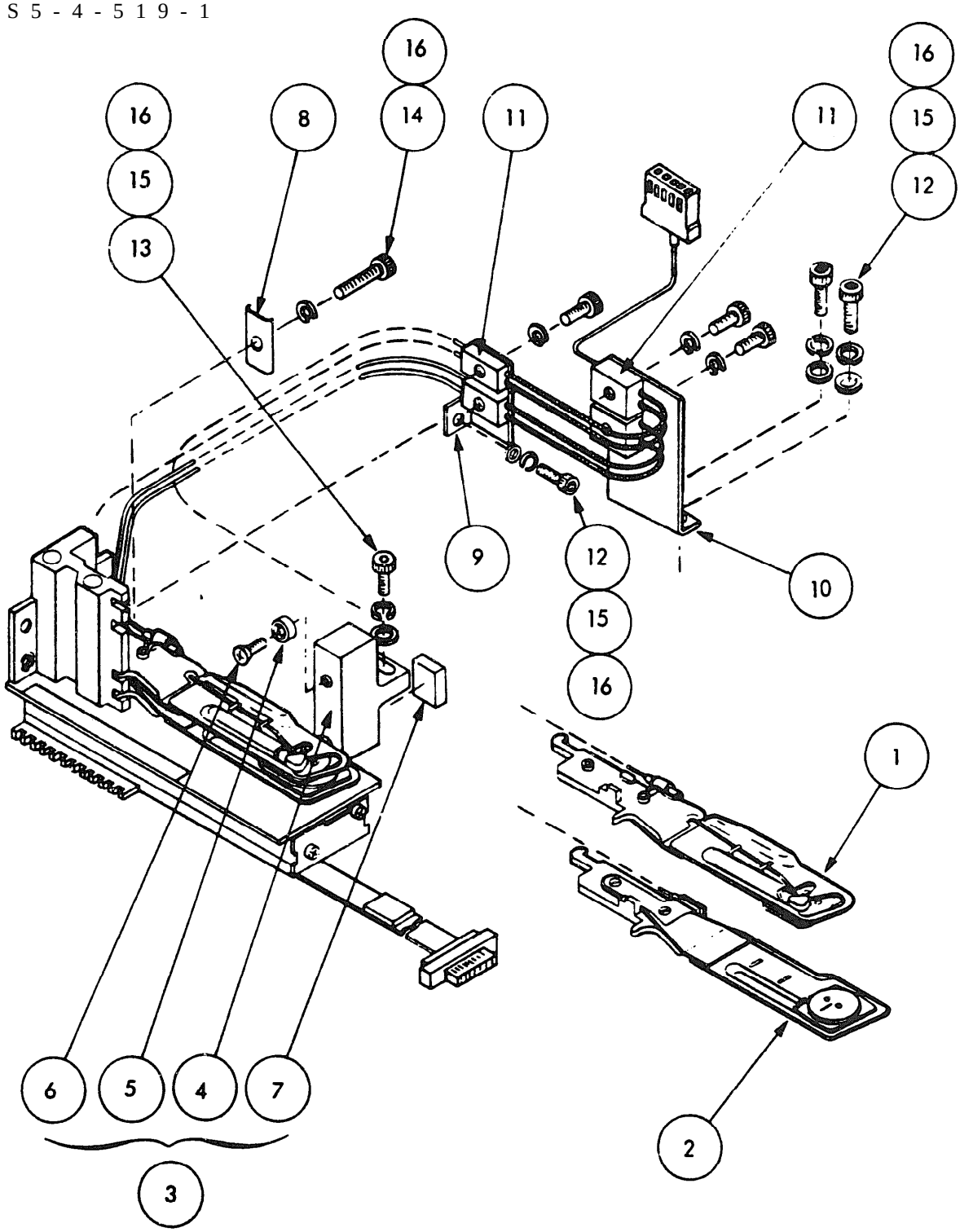


Figure 8-15, Read/Write Heads, Head bad Cam and Associated Mounting Hardware

Fig. & Item Number	Reference Designation	Part Number	Description	Qty. Per Assy.	Unit Price
8-15			- Read/Write Heads, Head Load Cam and Associated Mounting Hardware	----	Ref
-1		20-000606-001	-- Read/Write Head - Upper	2	
-2		20-000606-002	-- Read/Write Head - Lower	2	
-3		301037-009	-- Head Load Cam Assembly	1	
-4		301036-001	--- Support - Head Load Cam	*1	
-5		301035-001	--- Cam - Head Load	2	
-6		25-000111-018	--- Screw - Flat Head 82°, Phillips (#4-40 X 5/8)	*2	
-7		01-000487-001	--- Tape - Foam Coated	*A/R	
-8		301106-001	-- Clamp - Head Arm	2	
-9		301041-001	-- Bracket - Head Lead	*1	
-10		301044-001	-- Support - Head Lead Spring	*1	
-11		300530-001	-- Clamp - Head Lead Spring	4	
-12		25-000084-019	-- Screw - Socket Head, Cap (#6-32 X 1/4)	*7	
-13		25-000084-020	-- Screw - Socket Head, Cap (#6-32 X 1/2)	*1	
-14		25-000084-023	-- Screw - Socket Head, Cap (#6-32 X 7/8)	*2	
-15		25-000065-007	-- Washer - Flat (#6)	*6	
-16		25-000067-005	-- Washer - Split Lock (#6)	*10	

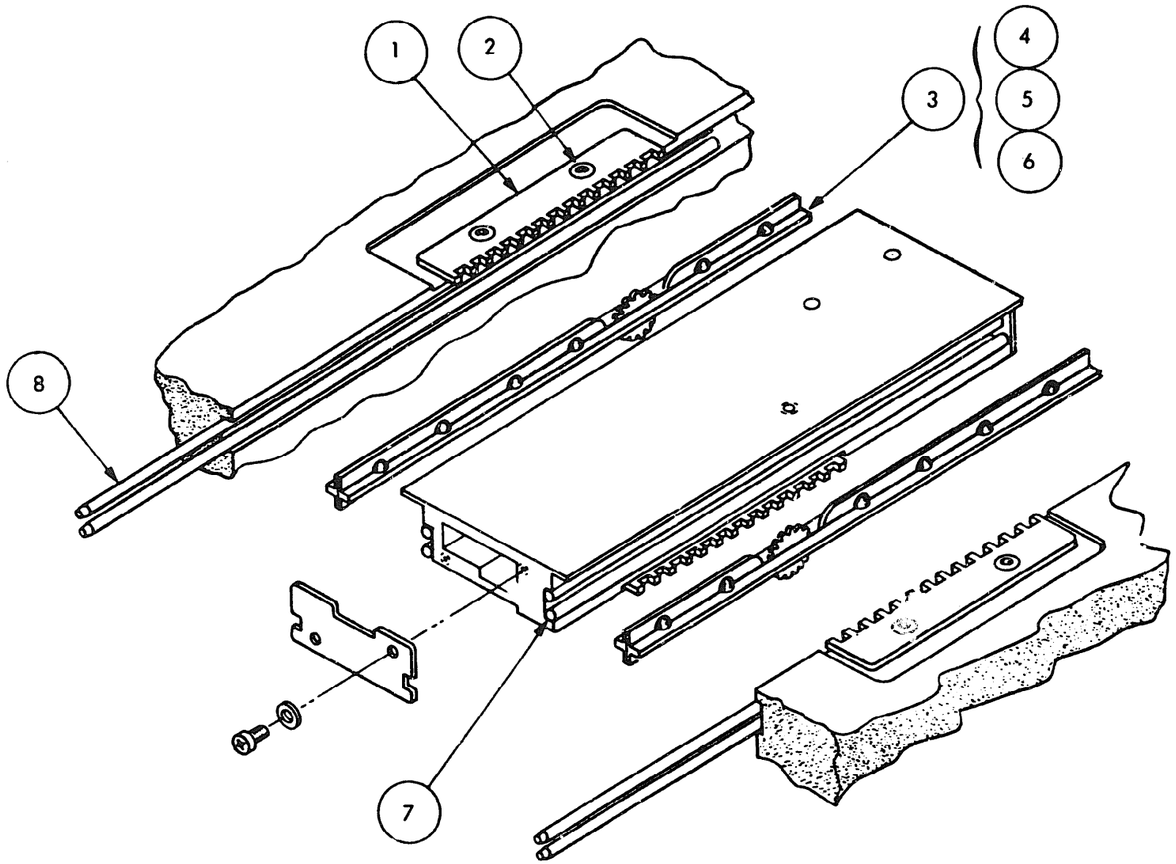


Figure 8-16, Carriage Slide Group

Fig. & Item Number	Reference Designation	Part Number	Description	Qty. Per Assy.	
8-16			- Carriage Slide Group	----	Ref
-1		301102-001	- Rack	2	
-2		25-000112-003	-- Screw - Flat Head, Socket (#4-40 X 1/4)	*4	
-3		301105-001	- Race Assembly	2	
-4		301098-001	-- Cage	*2	
-5		26-000542-005	-- Precision Ball	*6	
-6		301104-001	-- Star Wheel	*1	
-7		301110-001	- Guide Shaft (5.00 Lg)	4	
-8		301110-002	- Guide Shaft (8.00 Lg)	4	

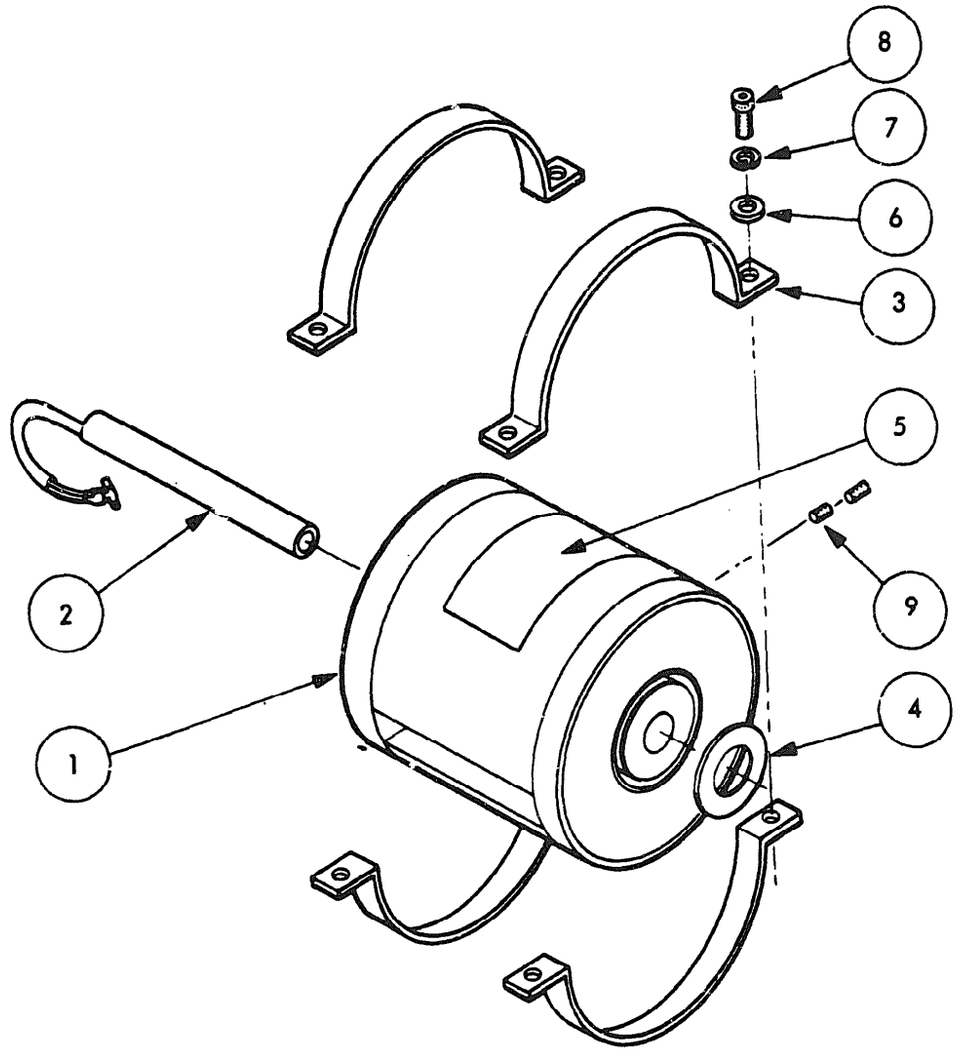


Figure 8-17, Positioner Group

Fig. & Item Number	Reference Designation	Part Number	Description	Qty. per Assy.	Unit
8-17			- Positioner Motor Group	----	Ref
-1			- Positioner Motor Assembly	1	
-2			- Coil - Housing	1	
-3			- Clamp - Positioner Motor	*4	
-4		301021-009	-- Cushion - Carriage	*1	
-5		301236-001	-- Label - Warning	*1	
-6		301045-001	- Washer - Flat (#10)	*4	
-7		301244-001	- Washer - Split, Lock (#10)	*4	
-8		300423-001	- Screw - Socket Head, Cap (#10-32 X 1/2)	*4	
-9		25-000066-011	-- Screw - Set, Flat Point (#6-32 X 1/4)	*2	
		25-000067-007			
		25-000084-061			
		25-000185-022			

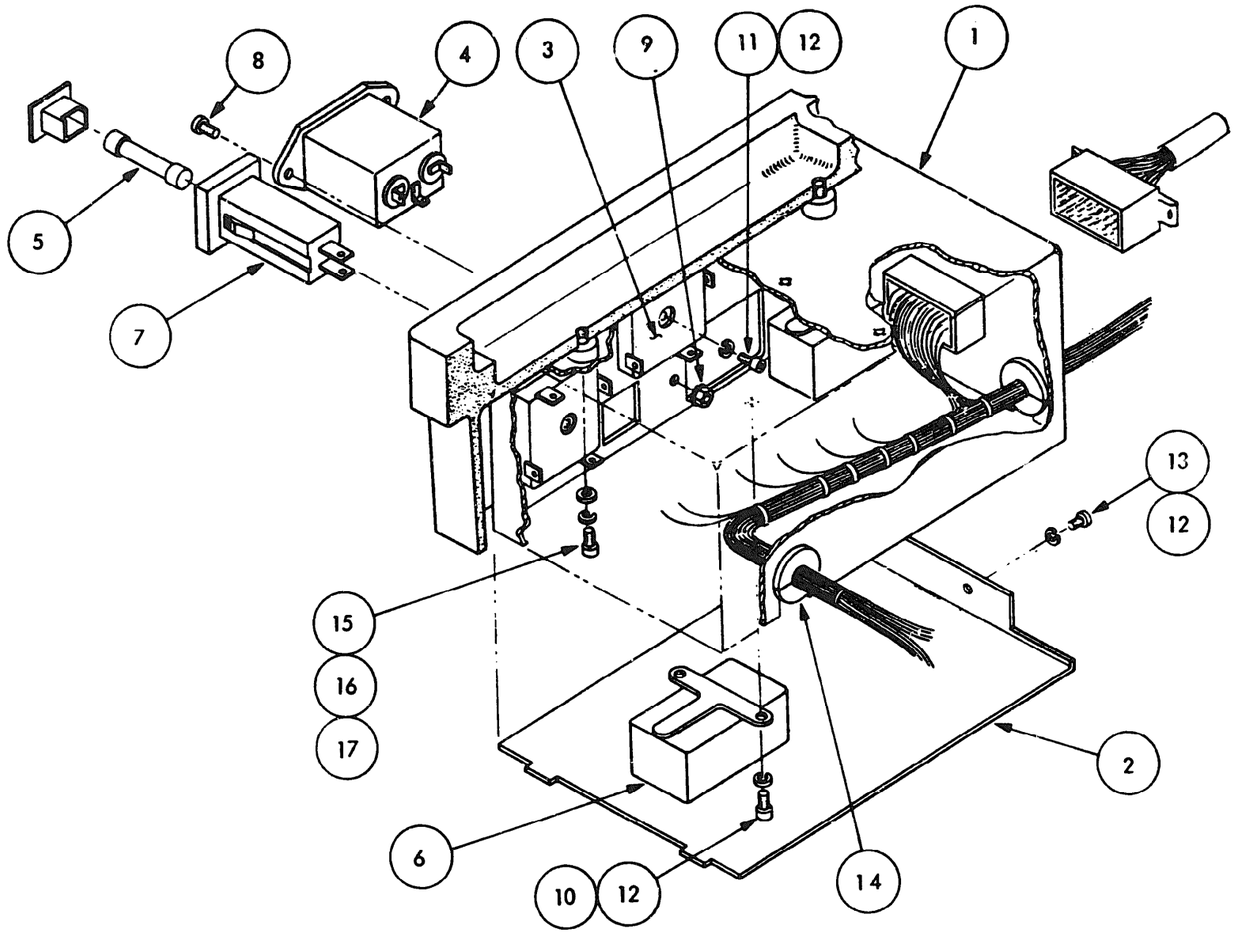


Figure 8-18, Relay Module Assembly

Fig. & Item Number	Reference Designation	Part Number	Description	Qty. Per Assy.	Unit Price
8-18		301232-009	- Relay Module Assembly	----	Ref
-1		301126-001	-- Bracket - Relay Module	*1	
-2		301223-001	-- Cover - Relay Module	*1	
-3		12-000574-001	-- Rectifier	2	
-4		19-000573-001	-- R F Filter	1	
-5		67-000223-004	-- Fuse 4 AMP Slo Blo - Ceramic 250V	1	
-6		75-000152-001	-- Relay - Motor	2	
-7		41-000533-001	-- Holder - Fuse	*1	
-8		25-000085-017	-- Screw - Pan Head Phillips (#4-40 X 1/2)	*2	
-9		25-000207-001	-- Nut - Hex with Lock Washer	*2	
-10		25-000084-018	-- Screw - Socket Head Cap (#6-32 X 1/4)	*4	
-11		25-000084-020	-- Screw - Socket Head Cap (#6-32 X 1/2)	*2	
-12		25-000067-005	-- Washer - Split Lock (#6)	*7	
-13		25-000572-021	-- Screw - Button Head, Socket	*1	
-14		45-000138-006	-- Grommet	*2	
			RELAY MODULE MOUNTING HARDWARE		
-15		25-000084-030	-- Screw - Socket Head, Cap (#6-32 X 1/2)	*4	
-16		25-000067-005	-- Washer - Split Lock (#6)	*4	
-17		25-000065-007	-- Washer - Flat (#6)	*4	

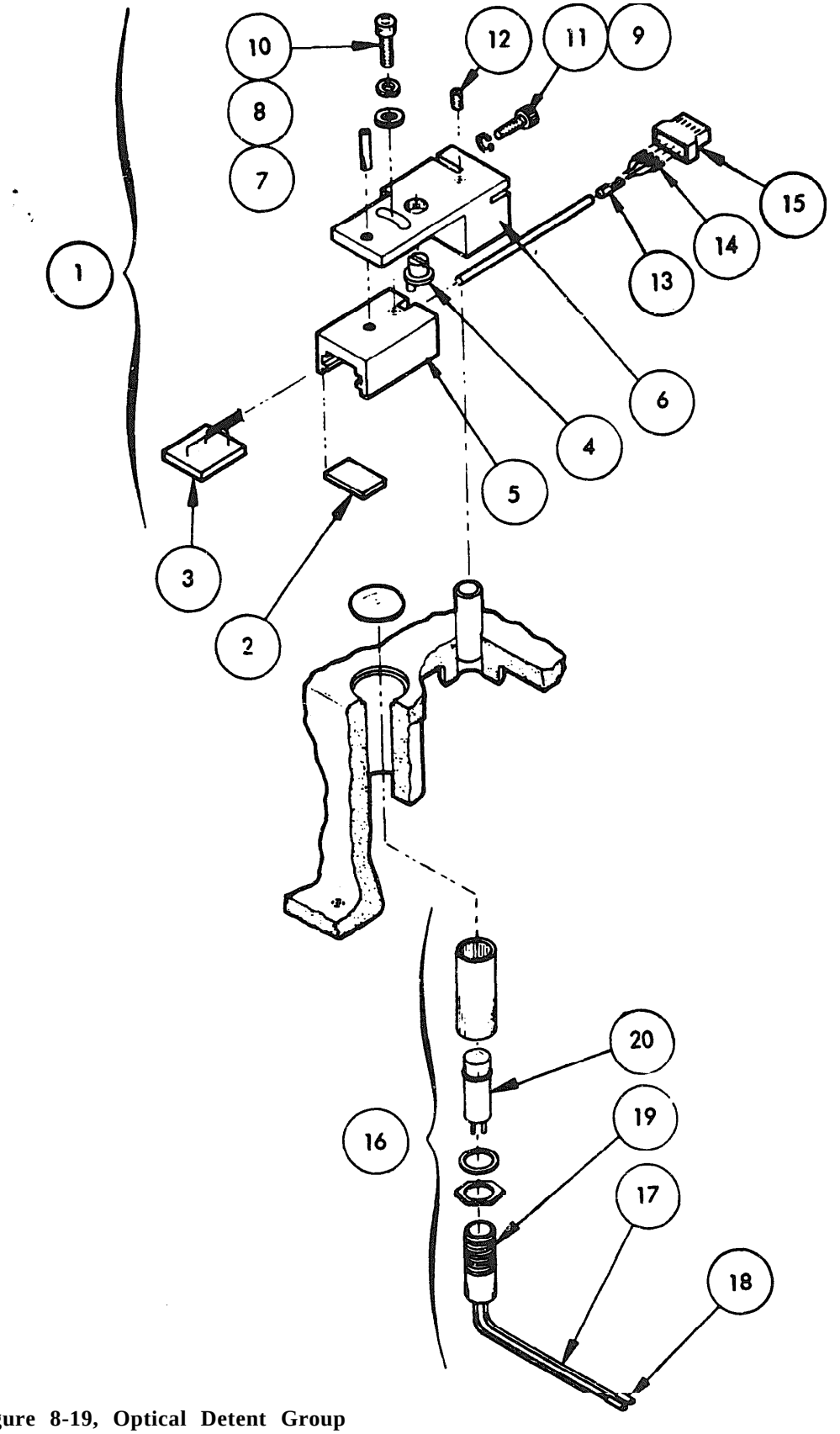


Figure 8-19, Optical Detent Group

Fig. & Item Number	Reference Designation	Part Number	Description	Qty. Per Assy.	
8-19			-Optical Detent Group	----	Ref
-1		302334-009	-Optical Detent Assembly	1	
-2		300959-001	--Reticle	*1	
-3		301029-009	--Optical Detent Module	*1	
-4		302331-001	--Eccentric - Detent	*1	
-5		302332-001	--Housing - Detent	*1	
-6		302333-001	--Support - Detent	*1	
-7		25-000065-005	--Washer - Flat (#4)	*1	
-8		25-000067-003	--Washer - Lock (#4)	*1	
-9		25-030067-007	--Washer - Lock (#10)	*1	
-10		25-000084-015	--Screw - Socket Head (#4-40 X 1/2)	*1	
-11		25-000084-061	--Screw - Socket Head (#10-32 X1/2)		
-12		25-000185-022	--Screw - Set, Flat Point, Locking (#6-32 X 1/4)	*1	
-13		25-000210-001	--Strain Relief	*1	
-14		35-000211-001	--Pin - Insert	*4	
-15		41-000322-001	--Connector Housing	*1	
-16		302246-009	-Lamp Assembly - Detent	1	
-17		04-006258-003	--Wire - Black	*A/R	
-18		35-000158-001	--Receptacle - Pin	*2	
-19		36-001020-001	--Lamp Holder	*1	
-20		40-001021-001	--Lamp	*1	

Figure 8-19 Optical Detent Group

MAINTENANCE DOCUMENTS

The following sections contain the drawings and Engineering Change Notices necessary-to update an assembly to a required revision level. For example, reference to the table in the front of the Drive Electronics Module section indicates that to update a Drive Electronics Module PC Board Assembly (301671) from Rev. P to Rev. V would require incorporation of ECNs 5586, 5597, 5598, and 5618 respectively. The applicable schematic (301672) would then become a Rev. N.

MAINTENANCE DOCUMENT INDEX

Item No.	Part Number	Description
1	301671	Drive Electronics Module PCB Assy
2	301672	Drive Electronics Module Schematic
3	301174	Read/Write Amp Assy
4	301171	Read/Write Amp Schematic
5	301705	Power Control Module Assy
6	301706	Power Control Module Schematic
7	301924	Option Board PCB Assy
8	301925	Option Board Schematic
9	301308	Termination Board Assy
10	301309	Termination Board Schematic

Part Number	Base Line Rev.	Engineering Change Notice/Revision									Curr. Dwg. Rev.	Remarks
301671	H	3487 J	3963 K	5007 L	5010 M	5190 N	5490 P	5586 R	5597 S	5598 T	V	
		5618 V										
301672	F	3487 G	4989 RC1	5193 H	5491 J	5587 RC2	5586 K	5597 L	5598 M	5617 RC3		
		5618 N										
301174	M	4731 RC2	4775 RC3	4919 N	5028 RC4	4803 P					P	
301171	K	4918 L	4802 M								M	ECN 4802 N/A -009 config.
301705	J	4760 K	4860 L	4927 M	5003 N	5024 RC3	5201 P	5580 R			R	
301706	F	4926 G	5580 H								H	
301924	F										F	
301925	D										D	
301308	D										D	
301309	B										B	

ENGINEERING DRAWING CONFIGURATIONS

Assembly: Drive Electronics Module

PC Board Assembly P/N 301671		Applicable Schematic Dwg No. 301672	
Rev	**ECN**	**Rev**	**ECN**
H - Baseline		F - Baseline	
J	3487	G	3487
			4989
K	3963	H	5193
L	5007	H	5193
M	5010	H	5193
N	5190	H	5193
P	5490	J	5491
			5587
R	5586	K	5586
S	5597	L	5597
T	5598	M	5598
			5617
V	5618	N	5618

NOTE:
1. ATTACH 302258 ASSEMBLY BOARD TO DIM WITH ZIP GRIP PART NUMBER 02-000881-001

		104				
		103				
		102				
1	1	101	80-000628 -001	INDUCTOR 33uH	L1	
1	1	100	11-000021 -001	2N6852	Q9	
3	3	99	11-000060 -001	2N2222A	Q7 10,11	
3	3	98	11-000610 -001	2N5639	Q3,4,12	
3	3	97	11-000275 -001	2N2907A	Q2,5,6	
3	3	96	11-000301 -001	2N2369A	Q1,8,13	
		95				
2	2	94	12-000031 -001	DIO 1N5234B 6.2V	CR13,14	
2	2	93	12-000027 -001	DIO 1N4001	CR9,10	
14	14	92	12-000028 -001	DIO 1N4448	CR1-8,11,12,15-18	
		91				
		90				
		89				
1	1	88	13-000041 -017	.047MF	C84	
2	2	87	13-000041 -009	.01MF 80V	C83, C5	
1	1	86	13-000244 -010	.22MF 50V	C81	
3	3	85	13-000264 -012	.47MF 50V	C77,78,79	
1	1	84	13-000042 -007	.0015MF 200V	C80	
8	8	83	13-000037 -033	2.2MF 20V	C69 - 72, 73-76	
1	1	82	13-000036 -023	15MF 15V	C38	
1	1	81	13-000041 -013	.022MF 80V	C32	
1	1	80	13-000043 -016	30PF 500V	C30	
1	1	79	13-000043 -008	10PF 500V	C29	
1	1	78	13-000041 -005	.004MF 80V	C17	
3	3	77	13-000244 -014	1MF 50V	C16,33,34	
1	1	76	13-000043 -056	1000PF 500V	C15	
2	2	75	13-000034 -030	56MF, 6V	C40, 28	
2	2	74	13-000041 -019	.068MF 80V	C22, 23	
2	2	73	13-000043 -041	270PF 500V	C20,21	
2	2	72	13-000043 -038	220PF 500V	C14,35	
1	1	71	13-000034 -021	10MF 6V	C13	
14	14	70	13-000034 -019	CAP 6.8MF 6V	C11,12,27,37 59-68	

1	1	117	302258 -009	POWER DIS-CHARGE CIR		
1	1	116	31-000814 -002	SWITCH STOP		
1	1	115	31-000816 -001	SWITCH	S1	SIEMAN
50		114	35-000599 -001	CONTACT, FEMALE		
1		113	41-000633 -001	CONN. HOUSING		50 PIN
4	2	112	25-000644 -001	SCREW, LOCK ASSY FEMALE		ITT D20418-2
2	2	111	41-000615 -010	CONN	J8, J9	VIKING 22 PIN
3	3	110	35-000162 -002	POST FEED THRU	J20	
1	1	109	41-000838 -001	CONNECTOR	J7	
46	46	108	35-000162 -001	POST, MOD II		
50	50	107	35-000309 -001	CONTACT, MALE		
1	1	106	41-000838 -001	CONN. HOUSING		50 PIN
1	2	105	35-000276 -001	PIN	J16, 17	

3	3	69	13-000038 -029	CAP 1MF 35V	C9,10 B5	
1	1	68	13-000041 -015	.033MF 80V	C7	
19	19	67	13-000521 -001	.01MF 100V	C81-88	
1	1	66	13-000043 -004	5PF 500V	C6	
7	7	65	13-000041 -001	.0022MF 80V	C24,25,36,86, 87,88,89	
1	1	64	13-000043 -047	470PF 500V	C4	
1	1	63	13-000043 -032	120PF 500V	C3	
1	1	62	13-000043 -030	CAP 100PF 500V	C2	
		61				
1	1	60	53-000054 -051	RES 12K 1/4W 2%	R157	
5	5	59	53-000054 -068	RES 5100Ω 1/4W, 2%	R28,33,52, 88,151	
1	1	58	14-000522 -012	RES 50K POT	R129	
4	4	57	14-000522 -013	100K POT	R72,84,122, 147	
2	2	56	14-000522 -011	20K POT	R53,87	
2	2	55	14-000522 -010	10K POT	R23,145	
1	1	54	17-000052 -152	RES 1MEG 1/4W, 5%	R154	
1	1	53	17-000052 -135	1MEG	R123	
1	1	52	14-000522 -030	200K POT	R135	
		51				
2	2	50	17-000052 -122	300K 1/4W 5%	R25,109	
4	4	49	17-000052 -118	200K	R35,36,79,121	
2	2	48	17-000052 -123	22Ω	R105,107	
2	2	47	17-000052 -142	2MEG	R82,83	
2	2	46	17-000052 -128	51OK	R78,119	
1	1	45	17-000052 -167	RES 20MEG 1/4W 5%	R61	
2	2	44	53-000054 -038	RES 1800Ω 1/4W, 2%	R126, 139	
1	1	43	53-000054 -018	270Ω	R112	
2	2	42	53-000054 -001	51Ω	R110, 138	
1	1	41	53-000054 -040	2400Ω	R108	
1	1	40	53-000054 -049	5600Ω	R101	
1	1	39	53-000054 -047	4700Ω	R70	
2	2	38	53-000054 -013	150Ω	R150, 102	
2	2	37	53-000054 -051	6800Ω	R93,94	
3	3	36	53-000054 -063	22K	R51,149,171	
4	4	35	53-000054 -069	RES 39K 1/4W 2%	R56,95,96,131,	

15	15	34	53-000054 -025	RES 10Ω 1/4W, 2%	R50,57,62,64,69,86 91,97,116,120,143,150	
3	3	33	53-000054 -045	3900Ω	R47,49,136	
4	4	32	53-000054 -015	200Ω	R41,65,98,168	
2	2	31	53-000054 -029	750Ω	R34,144	
3	3	30	53-000054 -079	100Ω	R55,143,58	
5	5	29	53-000054 -062	20Ω	R29,37,54 99, 124	
4	4	28	53-000054 -036	1500Ω	R73,74,90, 146	
2	2	27	53-000054 -042	3K	R27,64	
8	8	26	53-000054 -039	2K	R26,31,39,42,44, 45,133	
2	2	25	53-000054 -077	82K	R12, 137	
4	4	24	53-000054 -089	15K	R24,71,123,127	
9	9	23	53-000054 -055	10K	R38,43,45,135, 148,155,16 [illegible]	
5	5	22	53-000054 -071	47K	R21,30,40, 89,92	
2	2	21	53-000054 -008	100Ω	R20,111	
1	1	20	53-000054 -035	1300Ω	R19	
30	30	19	53-000054 -032	RES 1K 1/4W, 2%	R22,32,46,48,75,76,77,80, 81,85,103,141,130,152,140, 142,153,156,158,159,160,161 162,164,165,166 (TO 172,)11	
1	1	18	53-000054 -043	RES 3300 1/4W, 2%	R116	
	2	17	52-000893 -020	DIGITAL SIGNAL TERMINATOR	IC1,53	
1	1	16	10-000626 -001	4024	IC58	
1	1	15	10-000302 -001	9322	IC37	
4	4	14	10-000624 -001	74193	IC48,49,61,62	
4	4	13	10-000418 -001	9324	IC39,40,54,55	
2	2	12	10-000625 -001	9314	IC 31,32	
3	3	11	10-000058 -001	7411	IC 16,25,35	
5	5	10	10-000637 -001	380A	IC 23,22,23, 70	
3	3	9	10-000012 -001	7410	IC 6,33,63	
8	8	8	10-000011 -001	7402	IC 4 10 18 21 34 51 57 68	
6	6	7	10-000759 -001	5558	IC 2,44A,44B,60,67A, 67B	
7	7	6	10-000621 -001	LM311	IC 13A, 13F 45A, 45B, 59 [illegible] 61	
6	6	5	10-000264 -001	9602	IC 15 30 38 [illegible] 56,71	
2	2	4	10-000623 -001	7438	IC 11,29	
8	8	3	10-000517 -001	74107	IC 5,7,19,24,28, 36,41,64	
14	14	2	10-000009 -001	7400	IC 8,9,12,14,17,20 2142,43,46,50,52 65,69	
1	1	1	301669 -001	PC BD DETAIL		

ITEM	PART NO	DESCRIPTION	MATERIAL	REMARKS

CÆLUS MEMORIES INC.

	PC BD ASSY DRIVE ELECTRONICS MODULE	
301000	301671	H

DRAWING INCOMPLETE WITH RESPECT TO ITEMS 3487, 3963, 5001, 5010

5190 5490

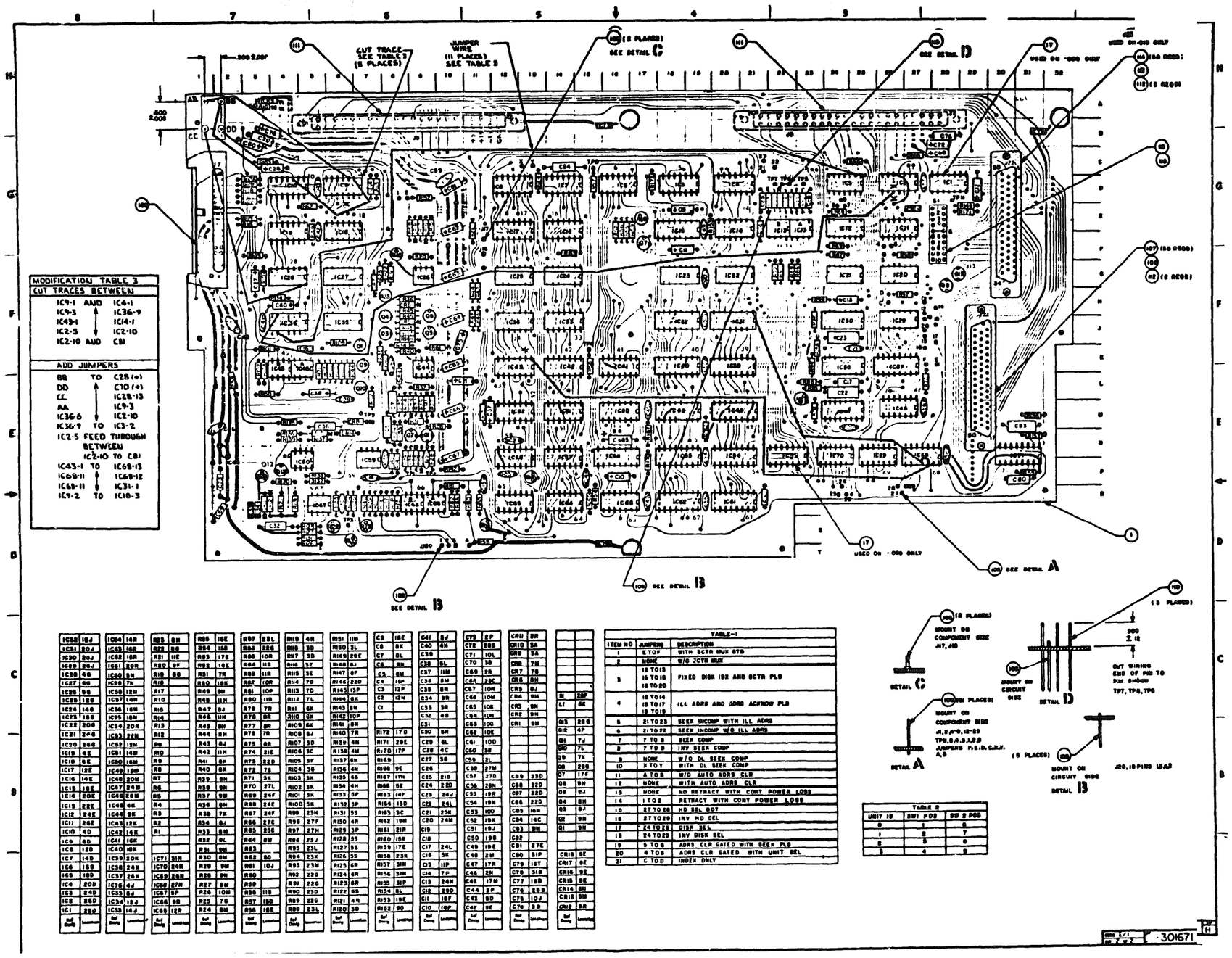


TABLE-1		
ITEM NO	JUMPERS	DESCRIPTION
1	E TO F	WITH SCTR SIZE STD
2	NONE	W/O SCTR SIZE
3	12 TO 13 15 TO 16 18 TO 20	FIXED DISK IDX AND SCTR PLS
4	12 TO 14 13 TO 17 19 TO 18	ILL ADRS AND ADRS ACKNOW PLS
5	21 TO 23	SEEK INCOMP WITH ILL ADRS
6	21 TO 22	SEEK INCOMP W/O ILL ADRS
7	7 TO 8	SEEK COMP
8	7 TO 9	INV SEEK COMP
9	NONE	W/O DL SEEK COMP
10	X TO Y	WITH DL SEEK COMP
11	A TO B	W/O AUTO ADRS CLR
12	NONE	WITH AUTO ADRS CLR
13	NONE	NO RETRACT WITH CONT POWER LOSS
14	1 TO 2	RETRACT WITH CONT POWER LOSS
15	27 TO 28	HD SEL BOT
16	27 TO 29	INV HD SEL
17	24 TO 26	DISK SEL
18	24 TO 25	INV DISK SEL
19	5 TO 6	ADRS CLR GATED WITH SEEK PLS
20	4 TO 6	ADRS CLR GATED WITH UNIT SEL
21	C TO D	INDEX ONLY

TABLE 2		
UNIT ID	SW1 POS	SW 2 POS
0	1	6
1	2	7
2	3	8
3	4	9

NOTE:
ATTACH 302258 ASSEMBLY BOARD TO DIM WITH ZIP GRIP PART NUMBER 02-000881 001
[2] BOTH ENDS OF JUMPERS TO BE WIRE WRAPPED USING 28 AWG WIRE (ITEM 118)

		104				
		103				
		102				
	1	101	80-000628 -001	INDUCTOR 33UH	L1	
	1	100	11-000021 -001	2N4852	Q9	
3	3	99	11-000060 -001	2N2222A	Q7 10,11	
3	3	98	11-000610 -001	2N5639	Q3,4,12	
3	3	97	11 000275 -001	2N2907A	Q2,5,6	
3	3	96	11 000301 -001	2N2369A	Q1,8,13	
		95				
2	2	94	12-000031 -001	DIO 1N5234B 6.2V	CR13,14	
2	2	93	12 000027 -001	DIO 1N4001	CR9,10	
14	14	92	12-000028 -001	DIO 1N1446B	CR1-8,11 12,15-18	
		91				
		90				
		89				
1	1	88	13-000041 -017	.047MF	C84	
2	2	87	13-000041 -009	.01MF 80V	C83,85	
1	1	86	13-000244 -010	.22MF 50V	C81	
3	3	85	13-000244 -012	.47MF 50V	C77,78,79	
1	1	84	13-000042 -007	.0015MF 200V	C80	
8	8	83	13-000037 -023	2.2MF 20V	C69 72,73-76	
1	1	82	13-000036 -023	15MF 15V	C38	
1	1	81	13-000041 -013	.022MF 80V	C82	
1	1	80	13-000043 -016	30PF 500V	C30	
1	1	79	13-000043 -008	10PF 500V	C29	
1	1	78	13-000041 -005	.0047MF 80V	C71	
3	3	77	13-000246 -014	1MF 50V	C16,33,34	
1	1	76	13-000043 056	1000PF 500V	C15	
2	2	75	13-000034 -030	56MF 6V	C40, 28	
2	2	74	13-000041 -019	.068MF 80V	C22 23	
2	2	73	13-000043 -041	270PF 500V	C20,21	
2	2	72	13-000043 -038	220PF 500V	C14,35	
1	1	71	13-000034 -021	10MF 6V	C13	
14	14	70	13-000034 -019	CAP6.8MF [illegible]	C11 12 27,37 59-68	

3	3	69	13-000038 -029	CAP 1MF 35V	C9,10 85	
1	1	68	13-000041 -015	.033MF 80V	C7	
19	19	67	13-000521 -001	.01MF 100V	C8 41-58	
1	1	66	13-000043 -004	5PF 500V	C6	
7	7	65	13-000041 -001	.0022MF 80V	C24,25,36,86, 87,88,89	
1	1	64	13-000043 -047	470PF 500V	C4	
1	1	63	13-000043 -032	120PF 500V	C3	
1	1	62	13-000043 -030	CAP 100PF 500V	C2	
		61				
1	1	60	53-000054 -057	RES 1.2K 1/4W, 2%	R157	
5	5	59	53-000054 -048	RES 5100Ω 1/4W, 2%	R28,33,52, 88,151	
1	1	58	14-000522 -012	RES 50K POT	R129	
4	4	57	14-000522 -013	100K POT	R72,84,122, 147	
2	2	56	14-000522 -011	20K POT	R53,87	
2	2	55	14 000522 -010	10K POT	R23,145	
1	1	54	17-000052 -152	RES 1 MEG 1/4W, 5%	R154	
1	1	53	17-000052 -135	1MEG	R123	
1	1	52	14-000522 -014	200K POT	R135	
		51				
2	2	50	17-000052 -122	300K 1/4W 5%	R25,109	
4	4	49	17-000052 -118	200K	R35,36 79 121	
2	2	48	17-000052 -103	22Ω	R105,107	
2	2	47	17-000052 -142	2MEG	R82,83	
2	2	46	17-000052 -128	510K	R78,119	
1	1	45	17-000052 -167	RES 20MEG 1/4W 5%	R61	
2	2	44	53-000054 -038	RES 18001Ω 1/4W 2%	R126 139	
1	1	43	53-000054 -018	270Ω	R112	
2	2	42	53-000054 -001	51Ω	R110,138	
1	1	41	53-000054 -040	2400Ω	R108	
1	1	40	53-000054 -049	5600Ω	R101	
1	1	39	53-000054 -047	4700Ω	R70	
2	2	38	53-000054 -013	160Ω	R100,102	
2	2	37	53-000054 -051	6800Ω	R93,94	
3	3	36	53-000054 -063	22K	R51,149,171	
4	4	35	53-000054 -069	RES 39K 1/4W 2%	R56,95,96,131	

15	15	34	53 000054 -025	RES 510Ω 1/4W, 2%	R50,57,62,66,69,86, 91,97,114,118,120,163,150	
3	3	33	53-000054 -045	500Ω	R47,49,136	
4	4	32	53-000054 -015	200Ω	R4,65,98,168	
2	2	31	53-000054 -029	750Ω	R34,144	
3	3	30	53-000054 -079	100K	R55,143,158	
5	5	29	53-000054 -062	20K	R29,37,54,99, 124	
4	4	28	53-000054 -036	1500Ω	R73,74,75, 146	
2	2	27	53-000054 -042	3K	R27,64	
9	9	26	53-000054 -039	2K	R26,31,39,42,44, 113,125,133	
2	2	25	53-000054 -077	82K	R128 137	
4	4	24	53-000054 -059	15K	R24,71,103,127	
9	9	23	53-000054 -055	10K	R38,43 45,115,174 148,155,167 106	
5	5	22	53-000054 -071	47K	R21,30,40, 89,92	
2	2	21	53-000054 -008	100Ω	R20,111	
1	1	20	53-000054 -035	1300Ω	R19	
30	30	19	53-000054 -032	RES 1K 1/4W, 2%	R22,24,47,[illegible] 58 of 10 14 61,130,132,140,142 152,153,157,159,160,161 162,164,165,166,170,172,177	
1	1	19	53,000054 -063	RES 3300 1/4W, 2%	R116	
1	2	17	52 000893 -020	DIGITAL SIGNAL TERMINATOR	IC1,53	
1	1	16	10-000626 -001	4024	IC58	
1	1	15	10-000302 -001	9322	IC37	
4	4	14	10-000624 -001	74193	IC48,49,61 62	
4	4	13	10 000418 -001	9324	IC39,40,54,55	
2	2	12	10-000625 -001	9314	IC31,32	
3	3	11	10 000058 -001	7411	IC16,25,35	
5	5	10	10 000637 -001	380A	IC23,[illegible]3, 70	
3	3	9	10 000012 -001	7410	IC6,33,63	
8	8	8	10-000011 -001	7402	IC4 10 18 21 34 51 57 68	
6	6	7	10-000759 001	5558	IC2, 44A 44R 67A 67B	
7	7	6	10 000627 -001	LM311	IC 3A, 35, 45A 58 59 [illegible]A 66B	
6	6	5	10-000264 -001	9602	IC 5,36,38 47, 56,71	
2	2	4	10-000623 -001	7438	IC 11,29	
8	8	3	10-000517 -001	74107	IC 8,7,19,24,28, 36,41,64	
13	14	2	10-000009 -001	7400	IC 8,9,12,14,17,20 27,42,43,46,50,52,65,69	
	1	1	301669 -001	PC BD DETAIL		

ITEM	PART NO	DESCRIPTION	SPEC	STOCK SIZE	MATERIAL	REMARKS

CÆLUS MEMORIES INC.
SAN JOSE, CALIFORNIA

		PC BD ASSY DRIVE ELECTRONICS MODULE	
301000		SCALE 2/1 SHT 1 OF 2	301671

REV	DESCRIPTION	DATE	APPROVED
A	PROD REL PER ECN 3428 DTD 6-2-75		
B	PER ECN 2692 DTD [illegible]		
C	PER ECN 2795 DTD 9-3-75		
D	ECN 3101 DTD 11-4-75		
E	PER ECN 3156 DTD 11-19-75		
F	ECN 3101 DTD 11-4-75		
G	PER ECN 3428 DTD 6-2-75		
H	PER ECN 3255 DTD 8-13-75		
J	PER ECN 3487 DTD 9-16-75		
K	PER ECN 3625 DTD 11-19-75		
L	PER ECN 3607 DTD 12-5-75		
M	PER ECN 3690 DTD 1-7-76		
N	PER ECN 3690 DTD 1-7-76		
P	PER ECN 3690 DTD 1-7-76		

THIS DOCUMENT INCOMPLETE WITHOUT ECN's [illegible]

HISTORY COPY

Sht 2 of 2 301671

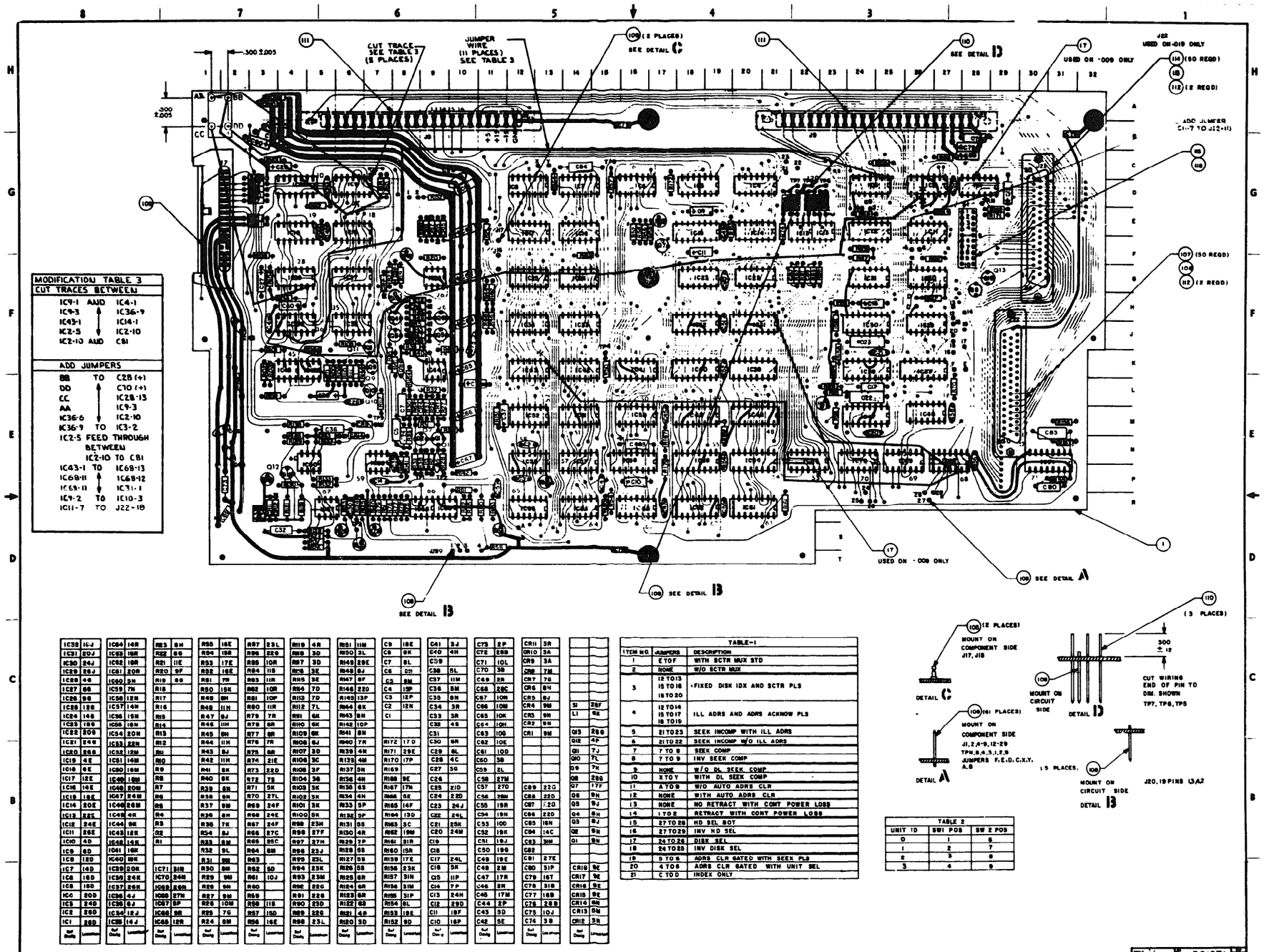


TABLE-1		
ITEM NO.	JUMPERS	DESCRIPTION
1	E TO F	WITH SCTR MUX STD
2	NONE	W/O SCTR MUX
3	12 TO 13 15 TO 16 18 TO 20	FIXED DISK IDX AND SCTR PLS
4	12 TO 14 15 TO 17 18 TO 19	ILL ADRS AND ADRS ACKNOW PLS
5	21 TO 23	SEEK INCOMP WITH ILL ADRS
6	21 TO 22	SEEK INCOMP W/O ILL ADRS
7	7 TO 8	SEEK COMP
8	7 TO 9	INV SEEK COMP
9	NONE	W/O DL SEEK COMP
10	X TO Y	WITH DL SEEK COMP
11	A TO B	W/O AUTO ADRS CLR
12	NONE	WITH AUTO ADRS CLR
13	NONE	NO RETRACT WITH CONT POWER LOSS
14	1 TO 2	RETRACT WITH CONT POWER LOSS
15	27 TO 28	HD SEL BOT
16	27 TO 29	INV HD SEL
17	24 TO 26	DISK SEL
18	24 TO 25	INV DISK SEL
19	5 TO 6	ADRS CLR GATED WITH SEEK PLS
20	4 TO 6	ADRS CLR GATED WITH UNIT SEL
21	C TO D	INDEX ONLY

TABLE 2		
UNIT ID	SW1 POS	SW 2 POS
0	1	5
1	2	7
2	3	8
3	4	9

PREFERRED VALUES FOR R

3	RES	P/N
	270K	17-000052-121
	100K	122
	330K	123
	360K	124
	390K	125
	430K	126
	470K	127
	510K	128
	560K	17-000052-129

V 29671

NOTE:

ATTACH 302258 ASSEMBLY BOARD TO DIM WITH ZIP GRIP PART NUMBER 02-000881 001

2 BOTH ENDS OF JUMPERS TO BE WIRE WRAPPED USING 28 AWG WIRE (ITEM 118)

3 REWORK INSTRUCTIONS REQUIRED BY MANUFACTURING TEST. MEASURE TIME CONSTANT (T SECONDS) OF THE UNIJUNCTION TIMER CIRCUIT WITH R109 AT 300K BY OBSERVING THE WAVE FORM AT Q11 COLLECTOR. CHANGE R109 TO A PREFERRED VALUE AS CLOSE AS POSSIBLE TO R CALCULATED BELOW

$R = \frac{10 \times 300}{T}$ K OHMS

THE TIME CONSTANT AFTER MODIFICATION SHOULD BE 10 ±.5 SECONDS THE STOP TIME SHOULD NOT BE LESS THAN 55 SECONDS OR GREATER THAN 65 SECONDS

		104				
		103				
		102				
1	1	101	80-000628-001	INDUCTOR 33uH	L1	
		100	11-000021-001	2N4852	Q9	
3	3	99	11-000060-001	2N2222A	Q7,10,11	
3	3	98	11-000610-001	2N5639	Q3,4,12	
3	3	97	11-000275-001	2N2907A	Q2,5,6	
3	3	96	11-000301-001	2N2369A	Q1,8,13	
		95				
2	2	94	12-000031-001	DIO 1N5234B 6.2V	CR13,14	
2	2	93	12-000027-001	DIO 1N4001	CR9,10	
14	14	92	12-000028-001	DIO 1N4448	CR1-8,11,12,15-18	
		91				
		90				
		89				
1	1	88	13-000041-017	.047MF	C84	
2	2	87	13-000041-009	.01MF 80V	C83,85	
1	1	86	13-000244-010	.22MF 50V	C81	
3	3	85	13-000244-012	.47MF 50V	C77,78,79	
1	1	84	13-000042-001	.0015MF 200V	C80	
8	8	83	13-000037-033	2.2MF 20V	C69 72,73-76	
1	1	82	13-000036-023	15MF 15V	C38	
1	1	81	13-000041-013	.022MF 80V	C32	
1	1	80	13-000043-016	30PF 500V	C30	
1	1	79	13-000043-008	10PF 500V	C29	
1	1	78	13-000041-005	.0047MF 80V	C17	
3	3	77	13-000243-014	1MF 50V	C16,33,34	
1	1	76	13-000043-056	1000PF 500V	C15	
2	2	75	13-000034-030	56MF 6V	C40, 28	
2	2	74	13-000041-019	.068MF 80V	C22 23	
2	2	73	13-000043-041	270PF 500V	C20 21	
2	2	72	13-000043-038	220PF 500V	C14,35	
1	1	71	13-000034-021	10MF 6V	C13	
14	14	70	13-000034-019	CAP6.8MF	C11,12,27,37 59-68	

3	3	69	13-000038-029	CAP 1MF 35V	C9,10 85	
1	1	68	13-000041-015	.033MF 80V	C7	
19	19	67	13-000521-001	.01MF 100V	CB 41-58	
1	1	66	13-000043-004	5PF 500V	C6	
5	5	65	13-000041-001	.0022MF 80V	C36,86, 87,88,89	
1	1	64	13-000043-047	470PF 500V	C4	
1	1	63	13-000043-032	120PF 500V	C3	
1	1	62	13-000043-030	CAP 100PF 500V	C2	
		61				
1	1	60	53-000054-051	RES 12K 1/4W 2%	R157	
5	5	59	53-000054-048	RES 5100Ω 1/4W 2%	R28,33,52, 88,151	
1	1	58	14-000522-012	RES 50K POT	R129	
4	4	57	14-000522-013	100K POT	R72,84,122, 147	
2	2	56	14-000522-011	20K POT	R53,87	
2	2	55	14-000522-010	10K POT	R23,145	
1	1	54	17-000052-152	RES 5 MEG 1/4W,5%	R154	
1	1	53	17-000052-135	1MEG	R123	
1	1	52	14-000522-014	200K POT	R135	
		51				
2	2	50	17-000052-122	300K 1/4W 5%	R25,109	
4	4	49	17-000052-118	200K	R35,36,79,121	
2	2	48	17-000052-023	22Ω	R105,107	
2	2	47	17-000052-142	2MEG	R82,83	
2	2	46	17-000052-128	510K	R78,119	
1	1	45	17-000052-167	RES 20MEG 1/4W,5%	R61	
2	2	44	53-000054-038	RES 180K 1/4W 2%	R126,139	
1	1	43	53-000054-018	27Ω	R112	
4	4	42	53-000054-001	51Ω	R110,138,118,120	
1	1	41	53-000054-040	2400Ω	R108	
1	1	40	53-000054-049	5600Ω	R101	
1	1	39	53-000054-047	4700Ω	R75	
2	2	38	53-000054-013	160Ω	R100,102	
2	2	37	53-000054-051	6800Ω	R93,94	
3	3	36	53-000054-063	22K	R51,149,171	
4	4	35	53-000054-069	RES 39K 1/4W 2%	R56,95,96,131	

15	15	34	53-000054-025	RES 510Ω 1/4W,2%	R50,57,62,66,69,86, 91,97,114, 163,150	
3	3	33	53-000054-045	390Ω	R47,49,136	
4	4	32	53-000054-015	200Ω	R41,65,98,168	
2	2	31	53-000054-029	750Ω	R34,144	
3	3	30	53-000054-079	100K	R55,143,58	
5	5	29	53-000054-062	20K	R29,37,54,99 124	
4	4	28	53-000054-036	1500Ω	R73,74,90, 146	
2	2	27	53-000054-042	3K	R27,64	
8	8	26	53-000054-039	2K	R26,31,39,42,44, 113,125,133	
2	2	25	53-000054-077	82K	R128 137	
4	4	24	53-000054-059	15K	R24,71,103,127	
9	9	23	53-000054-055	10K	R38,43,45,113,174 148,155,167,106	
5	5	22	53-000054-071	47K	R21,30,40, 89,92	
2	2	21	53-000054-008	100Ω	R20,111	
1	1	20	53-000054-035	1300Ω	R19	
30	30	19	53-000054-032	RES 1K 1/4W,2%	R22,34,44,[illegible] 58,100,101,130,[illegible],140,162 [illegible] 162 164 165 166 170 172 173	
1	1	18	53-000054-043	RES 3300 1/4W, 2%	R116	
1	2	17	52-000893-020	DIGITAL SIGNATERMINATOR	IC1 53	
1	1	16	10-000625-001	4024	IC58	
1	1	15	10-000302-001	9322	IC37	
4	4	14	10-000624-001	74193	IC48,49,61 62	
4	4	13	10-000418-001	9324	IC32,50,54,55	
2	2	12	10-000625-001	9314	IC 31,32	
3	3	11	10-000058-001	7411	IC 16,25,35	
5	5	10	10-000637-001	380A	IC2,3,[illegible] 70	
3	3	9	10-000012-001	7410	IC 6,33,63	
8	8	8	10-000011-001	7402	IC 4,10,18,21,36 51,57,68	
6	6	7	10-000759-001	5558	IC 2,44A,44B,60,67A, 67B	
7	7	6	10-000627-001	LM311	IC 3A,13B,45A,58, 59 59A,59B	
6	6	5	10-000264-001	9602	IC 5,35,36,47, 56,71	
2	2	4	10-000623-001	7438	IC 11,29	
8	8	3	10-000517-001	74107	IC 5,7,19,24,28, 36,64	
14	14	2	10-000009-001	7400	IC 8,9,12,14,17,20 27,42,43,46,50,52,65,69	
1	1	1	31669-031	PC BD DETAIL		

ITEM	PART NO	DESCRIPTION	MATERIAL SPEC	MATERIAL STOCK SIZE	REMARKS

CÆLUS MEMORIES INC.
SAN JOSE, CALIFORNIA

PC BD ASSY
DRIVE ELECTRONICS MODULE

301000 | 301671 | V

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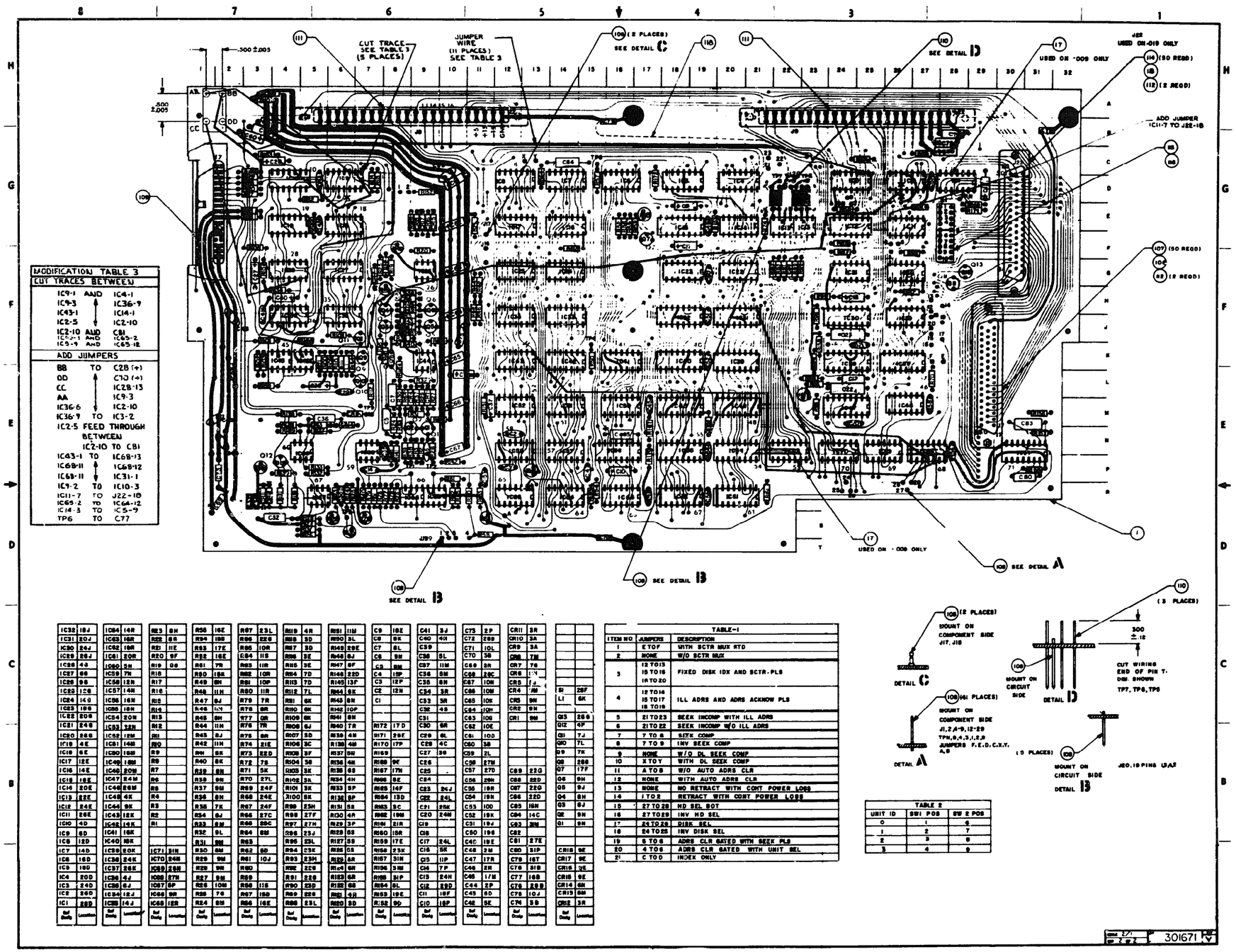
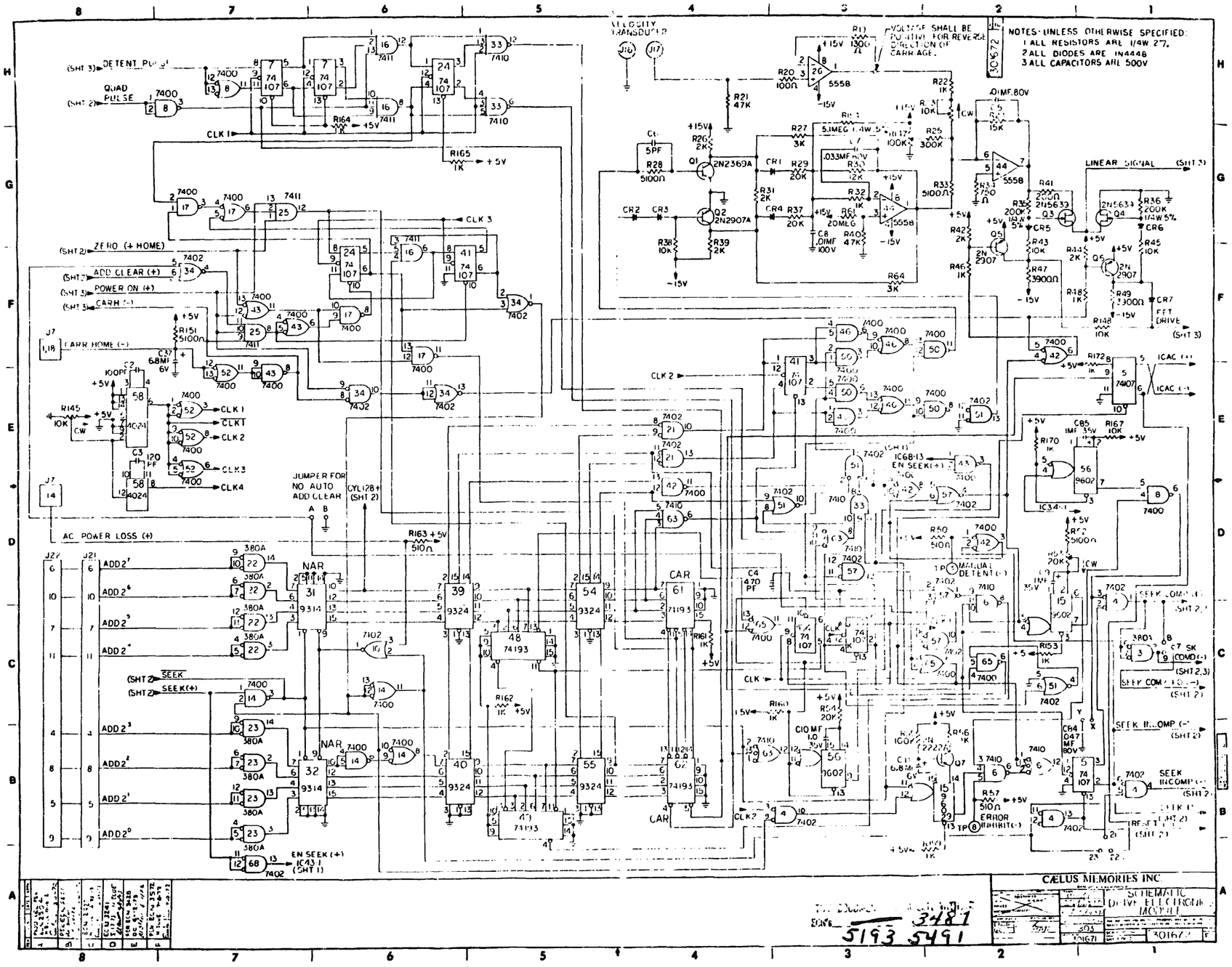
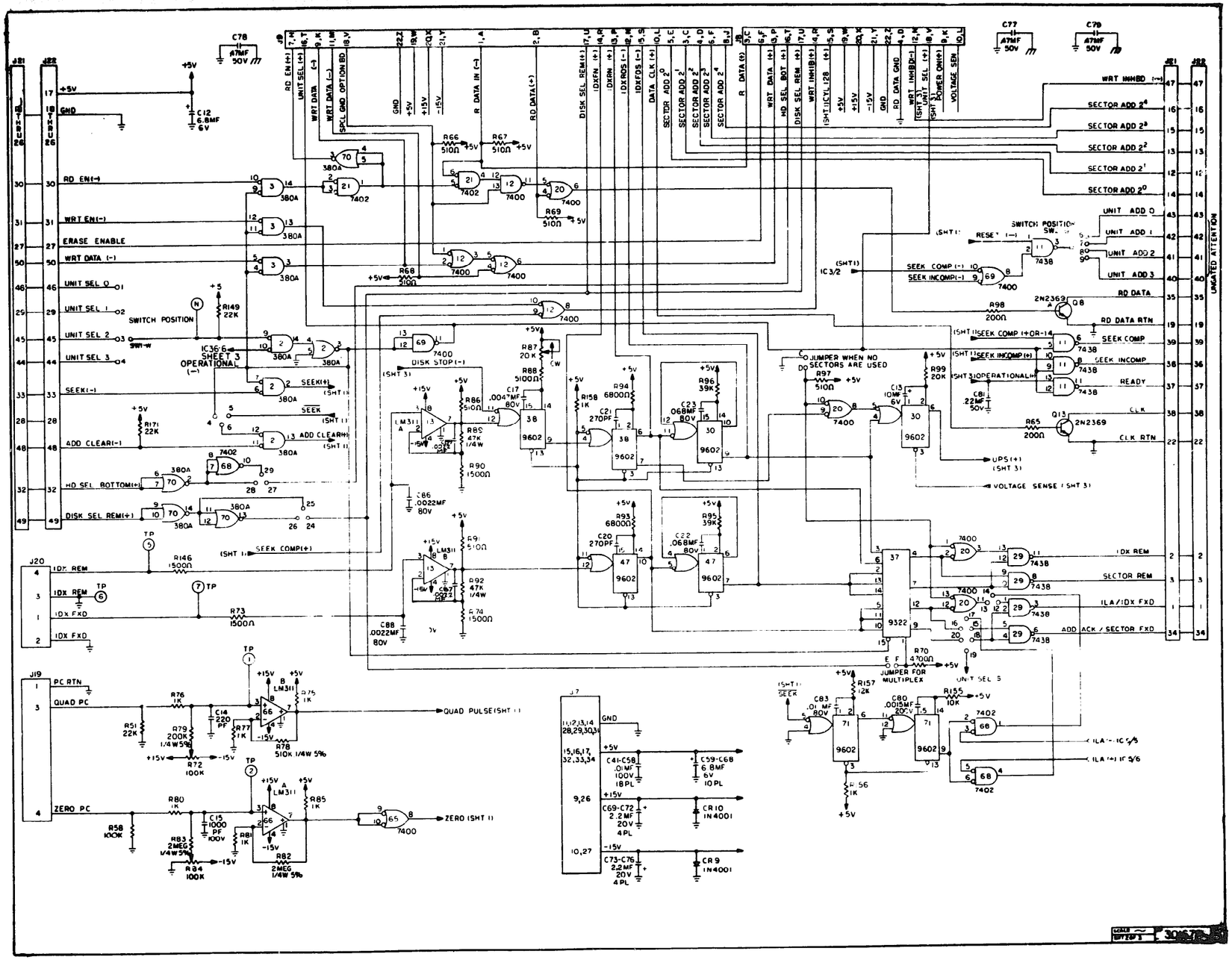
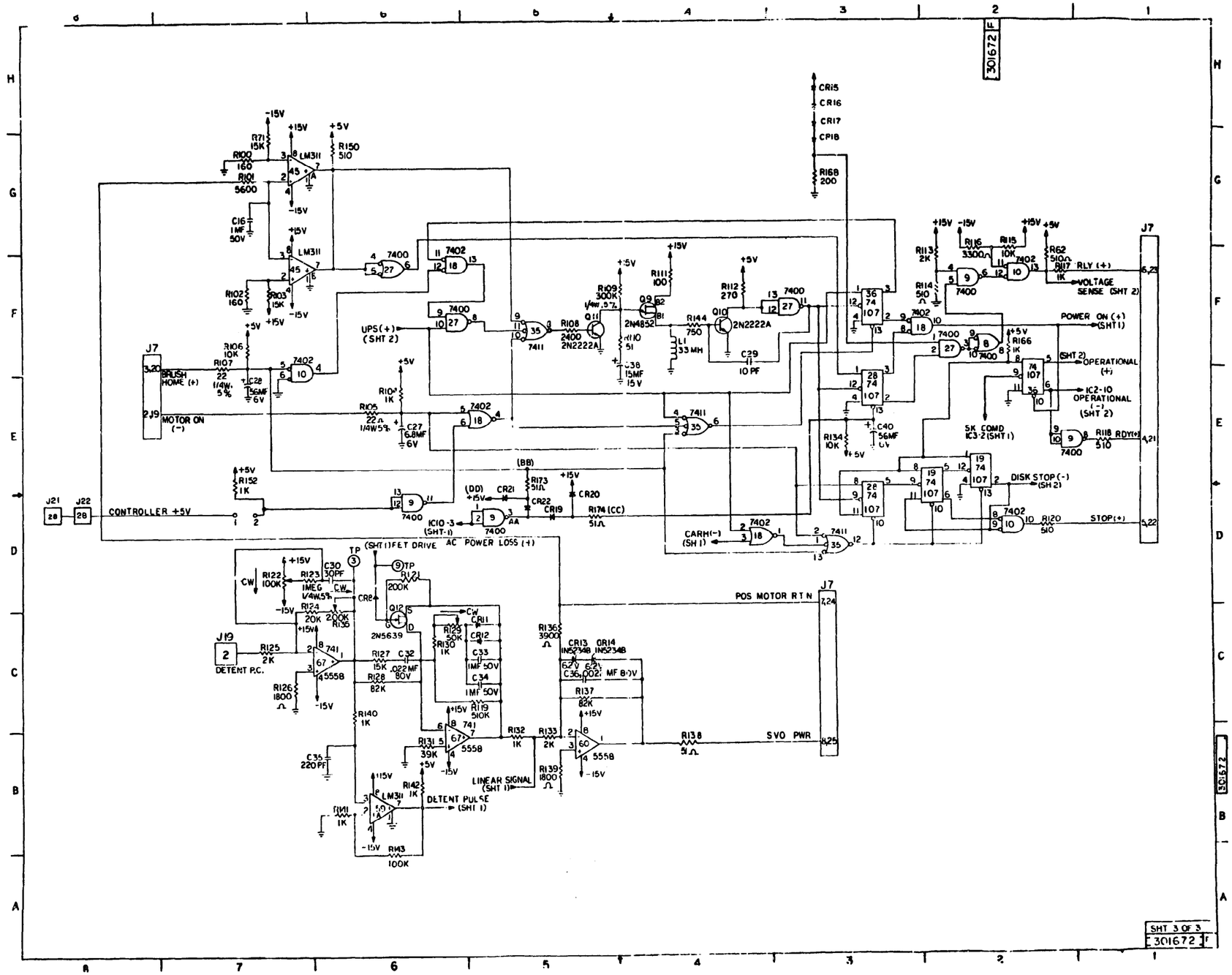
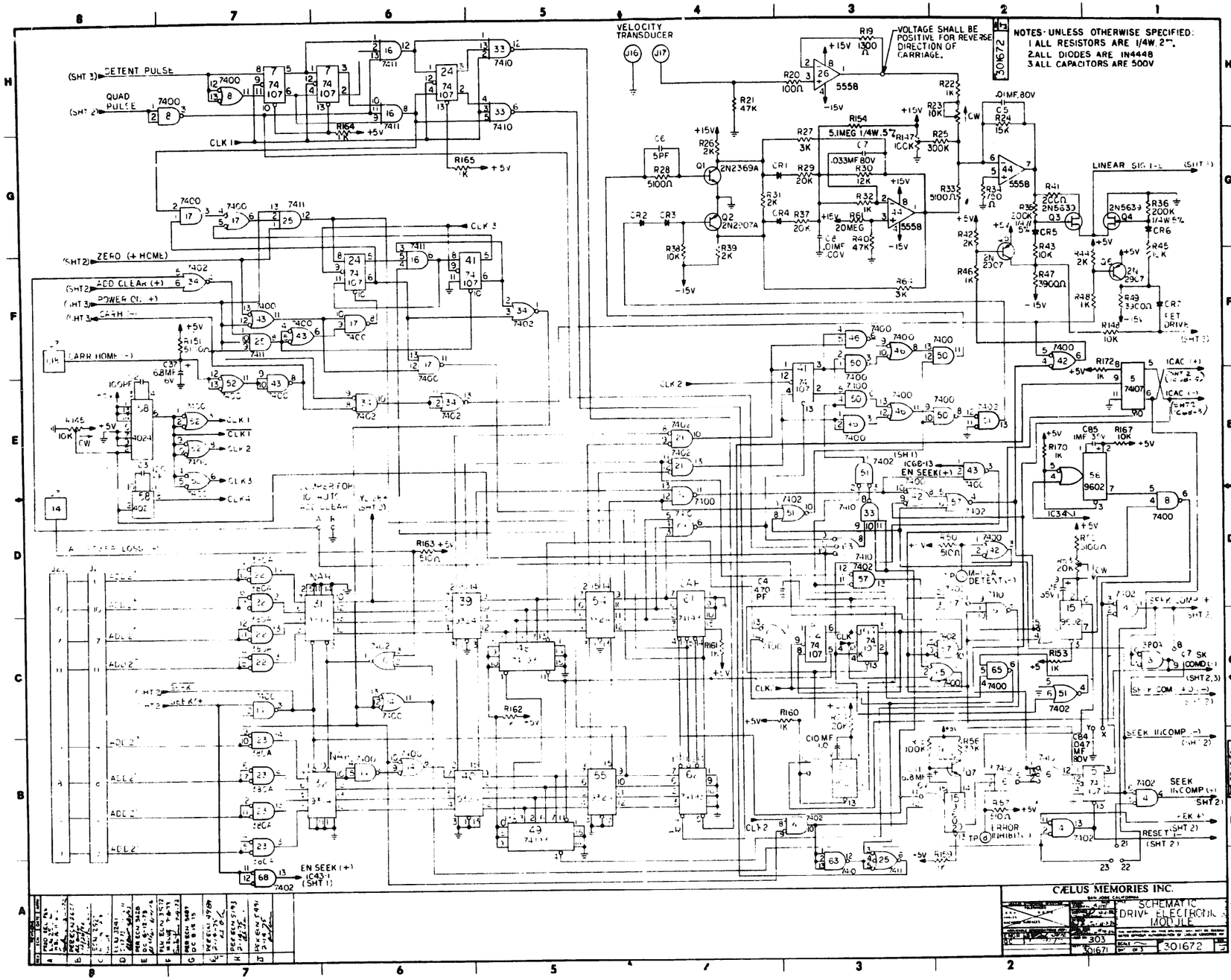
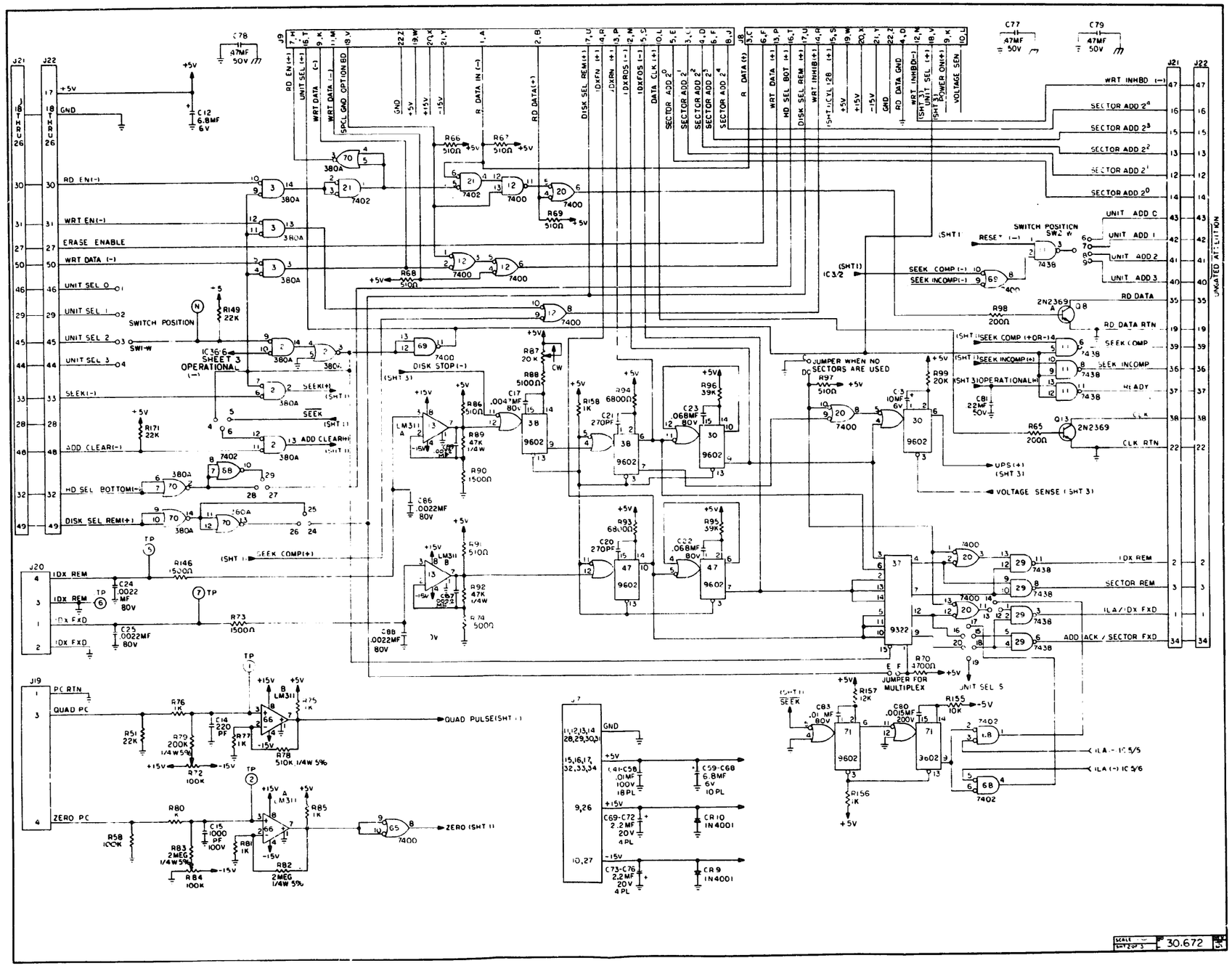

CUT TRACE SEE TABLE 3 (5 PLACES)
JUMPER WIRE (11 PLACES) SEE TABLE 3
SEE DETAIL C
SEE DETAIL D
USED ON -009 ONLY
ADD JUMPER IC11-7 TO J22-18
USED ON -009 ONLY
SEE DETAIL B
SEE DETAIL B
SEE DETAIL A
MODIFICATION TABLE 3
CUT TRACES BETWEEN
IC9-1 AND IC4-1
IC9-3 IC36-9
IC43-1 IC14-1
IC2-5 IC2-10
IC2-10 AND C81
IC5-1 AND C65-2
IC5-9 AND C65-12
ADD JUMPERS
BB TO C28 (+)
DD C10 (+)
CC IC28-13
AA IC9-3
IC36-6 IC2-10
IC36-9 TO IC3-2
IC2-5 FEED THROUGH BETWEEN IC2-10 TO C81
IC43-1 TO IC68-13
IC68-11 IC68-12
IC68-11 IC31-1
IC9-2 TO IC10-3
IC11-7 TO J22-10
IC65-2 TO IC64-12
IC14-3 TO IC5-9
TP6 TO C77
TABLE-1
ITEM NO. JUMPERS DESCRIPTION
1 E TO F WITH SCTR MUX STD
2 NONE W/O SCTR MUX
3 12 TO 13, 15 TO 16, 18 TO 20 FIXED DISK IDX AND SCTR-PLS
4 12 TO 14, 15 TO 17, 18 TO 19 ILL ADRS AND ADRS ACKNOW PLS
5 21 TO 23 SEEK INCOMP WITH ILL ADRS
6 21 TO 22 SEEK INCOMP W/O ILL ADRS
7 7 TO 8 SEEK COMP
8 7 TO 9 INV SEEK COMP
9 NONE W/O DL SEEK COMP
10 X TO Y WITH DL SEEK COMP
11 A TO B W/O AUTO ADRS CLR
12 NONE WITH AUTO ADRS CLR
13 NONE NO RETRACT WITH CONT POWER LOSS
14 1 TO 2 RETRACT WITH CONT POWER LOSS
15 27 TO 28 HD SEL 807
16 27 TO 29 INV HD SEL
17 24 TO 26 DISK SEL
18 24 TO 25 INV DISK SEL
19 5 TO 6 ADRS CLR GATED WITH SEEK PLS
20 4 TO 6 ADRS CLR GATED WITH UNIT SEL
21 C TO D INDEX ONLY
TABLE 2
UNIT ID SW1 POS SW 2 POS
0 1 6
1 2 7
2 3 8
3 4 9
DETAIL C
DETAIL D
DETAIL A
DETAIL B
J20, 19 PINS 1,9,12
301671

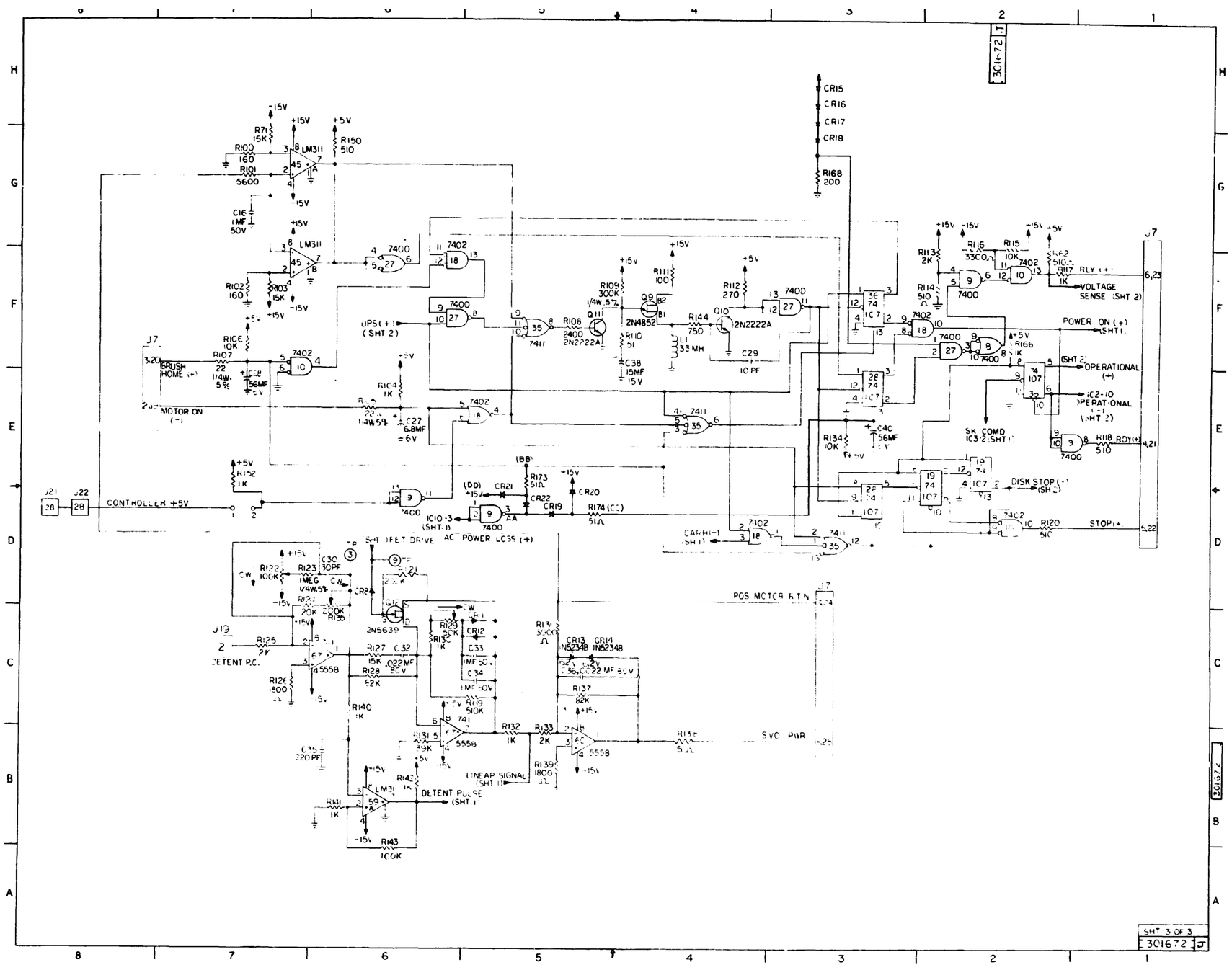

NOTES: UNLESS OTHERWISE SPECIFIED:
1 ALL RESISTORS ARE 1/4W 2%.
2 ALL DIODES ARE 1N4448
3 ALL CAPACITORS ARE 50OV
VELOCITY TRANSDUCER
J16
J17
VOLTAGE SHALL BE POSITIVE FOR REVERSE DIRECTION OF CARRIAGE.
LINEAR SIGNAL (SHT 3)
(SHT 3) DETENT PULSE
QUAD PULSE (SHT 2)
CLK 1
CLK 2
CLK 3
CLK4
(SHT 2) ZERO (+ HOME)
(SHT 3) ADD CLEAR (+)
(SHT 3) POWER ON (+)
(SHT 3) CARR (-)
J7 1,18 CARR HOME (-)
JUMPER FOR NO AUTO ADD CLEAR
CYL 128+ (SHT 2)
AC POWER LOSS (+)
J22
J21
ADD2^7
ADD2^6
ADD2^5
ADD2^4
ADD2^3
ADD2^2
ADD2^1
ADD2^0
(SHT 2) SEEK
(SHT 2) SEEK(+)
NAR
CAR
EN SEEK(+) IC43 (SHT 1)
IC68-13 EN SEEK(+)
MANUAL DETENT(-)
ERROR INHIBIT(-)
SEEK INCOMP(-) (SHT 2)
SEEK COMP(-) (SHT 2,3)
SEEK COMP(+) (SHT 2)
FET DRIVE (SHT 3)
ICAC(+)
ICAC(-)
CÆLUS MEMORIES INC.
SCHEMATIC DRIVE ELECTRONICS ASSY
30167

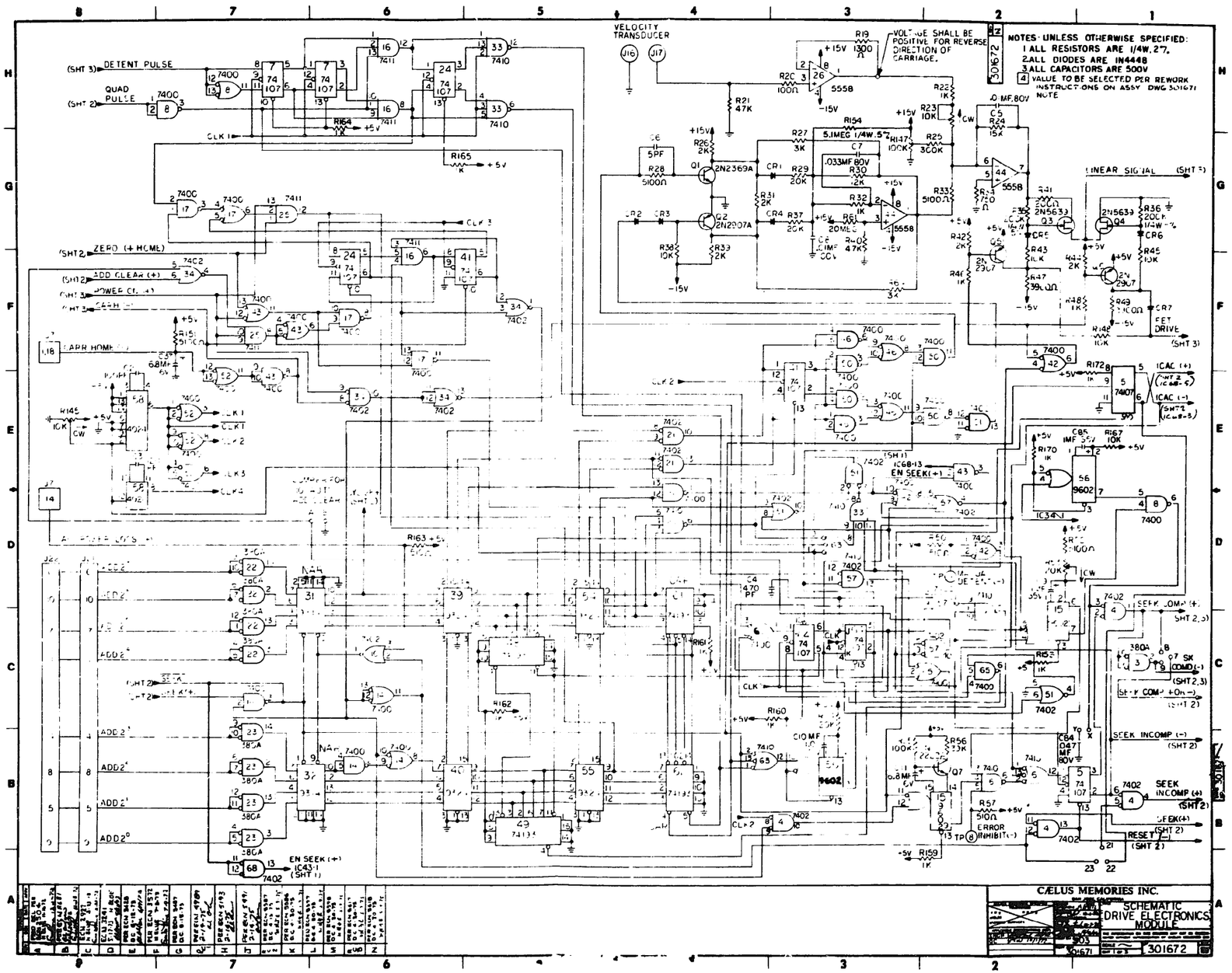

J31
J32
RD EN(-)
WRT EN(-)
ERASE ENABLE
WRT DATA (-)
UNIT SEL 0
UNIT SEL 1
UNIT SEL 2
UNIT SEL 3
SEEK(-)
ADD CLEAR(-)
HD SEL BOTTOM(+)
DISK SEL REM(+)
+5V
GND
C78 .47MF 50V
C12 6.8MF 6V
SWITCH POSITION
SW-W
R149 22K
IC36-6 SHEET 3 OPERATIONAL (-)
R171 22K
SEEK
ADD CLEAR
R146 1500Ω
R73 1500Ω
J20
IDX REM
IDX FXD
R66 510Ω
R67 510Ω
R68 510Ω
R69 510Ω
R86 510Ω
R87 20K CW
R88 5100Ω
R89 47K 1/4W
R90 1500Ω
R91 510Ω
R92 47K 1/4W
R74 1500Ω
C17 .0047MF 80V
C86 .0022MF 80V
C87 .0022MF 80V
C88 .0022MF 80V
DISK STOP(-)
SEEK COMP(+)
R93 68000Ω
R94 68000Ω
C20 270PF
C21 270PF
C22 .068MF 80V
C23 .068MF 80V
R95 39K
R96 39K
R158 1K
RD EN(+)
UNIT SEL(+)
WRT DATA(-)
WRT DATA(+)
SPCL GND OPTION RD
GND
R DATA IN(-)
RD DATA(+)
DISK SEL REM(+)
IDXFN(+)
IDXFN(-)
IDXROS(-)
IDXFOS(-)
DATA CLK(+)
SECTOR ADD 2^0
SECTOR ADD 2^1
SECTOR ADD 2^2
SECTOR ADD 2^3
SECTOR ADD 2^4
R DATA(+)
WRT DATA(+)
HD SEL BOT(+)
DISK SEL REM(+)
WRT INHIB(+)
(SHT 1)CYL 128(+)
+5V
-15V
GND
RD DATA GND
WRT INHIB(-)
(SHT 1)UNIT SEL(+)
(SHT 3)POWER ON(+)
VOLTAGE SEN
C77 .47MF 50V
C76 .47MF 50V
WRT INHIBD
SECTOR ADD 2^4
SECTOR ADD 2^3
SECTOR ADD 2^2
SECTOR ADD 2^1
SECTOR ADD 2^0
UNIT ADD 0
UNIT ADD 1
UNIT ADD 2
UNIT ADD 3
RD DATA
RD DATA RTN
SEEK COMP
SEEK INCOMP
READY
CLK
CLK RTN
UPS(+) (SHT 3)
VOLTAGE SENSE (SHT 3)
IDX REM
SECTOR REM
ILA/IDX FXD
ADD ACK / SECTOR FXD
UNGATED ATTENTION
SWITCH POSITION
RESET (-)
SEEK COMP (-)
SEEK INCOMP(-)
IC3/2
R98 200Ω
Q8 2N2369
R97 510Ω
JUMPER WHEN NO SECTORS ARE USED
R99 20K
C81 .22MF 50V
R65 200Ω
Q15 2N2369
SEEK COMP (+OR-14)
SEEK INCOMP(+)
OPERATIONAL
R70 4700Ω
JUMPER FOR MULTIPLEX
UNIT SEL 5
R157 12K
R155 10K
C83 .01MF 80V
C80 .0015MF 20V
R56 1K
ILA(-) IC 5/6
ILA(+) IC 5/6
J19
PC RTN
QUAD PC
ZERO PC
R76 1K
R79 200K 1/4W 5%
R51 22K
R72 100K
C14 220 PF
R77 1K
R78 510K 1/4W 5%
R75 1K
QUAD PULSE(SHT 1)
R80 1K
R58 100K
R83 2MEG 1/4W 5%
R84 100K
C15 1000 PF 100V
R81 1K
R82 2MEG 1/4W 5%
R85 1K
ZERO (SHT 1)
J7
GND
+5V
-15V
C41-C58 .01MF 100V 18PL
C59-C68 6.8MF 6V 10PL
C69-C72 2.2MF 20V 4PL
C73-C76 2.2MF 20V 4PL
CR10 1N4001
CR9 1N4001


301672F
-15V
+15V
+5V
R71 15K
R100 160
R101 5600
R150 510
LM311
C16 1MF 50V
R102 160
R103 15K
7400
7402
7411
J7
BRUSH HOME (+)
MOTOR ON (-)
R106 10K
R107 22 1/4W 5%
C28 56MF 6V
R108 2400 2N2222A
R109 300K 1/4W 5%
R110 51
R111 100
R112 270
R144 750
L1 33 MH
C38 15MF 15V
C29 10 PF
Q9 2N4852
Q10 2N2222A
Q11
UPS(+) (SHT 2)
R105 22Ω 1/4W 5%
C27 6.8MF 6V
R104 1K
R152 1K
CONTROLLER +5V
J21
J22
CR15
CR16
CR17
CR18
R168 200
R113 2K
R116 3300
R115 10K
R62 510Ω
R117 1K
RLY (+)
VOLTAGE SENSE (SHT 2)
R114 510
POWER ON (+) (SHT1)
R166 1K
(SHT 2) OPERATIONAL (+)
IC2-10 OPERATIONAL (-) (SHT 2)
5K COMD IC3-2 (SHT 1)
R118 RDY(+) 510
C40 56MF 6V
R134 10K
DISK STOP (-) (SH 2)
STOP(+)
R120 510
CARH(-) (SH 1)
(BB)
(DD)
CR21
CR22
CR19
CR20
R173 51Ω
R174 (CC) 51Ω
IC10-3 (SHT-1)
AA
(SHT 1) FET DRIVE
AC POWER LOSS (+)
TP
R122 100K
CW
R123 IMEG 1/4W 5%
C30 30PF
R124 20K
R135 200K
R121 200K
Q12 2N5639
CR8
CR11
CR12
R125 50K
R130 1K
C33 1MF 50V
C34 1MF 50V
J19
DETENT P.C.
R125 2K
R126 1800
R127 15K
C32 .022MF 80V
R128 82K
R140 1K
R119 510K
741
5558
C35 220PF
R131 39K
R132 1K
R133 2K
R142 1K
LM311
R141 1K
R143 100K
DETENT PULSE (SHT 1)
LINEAR SIGNAL (SHT 1)
POS MOTOR RTN
R136 3900Ω
CR13 IN5234B 6.2V
CR14 IN5234B 6.2V
C36 .002 MF 80V
R137 82K
R139 1800Ω
R138 5Ω
SVO PWR
SHT 3 OF 3
301672 F




J21
J22
CONN
+5V
GND
C12 6.8MF 6V
C78 47MF 50V
C77 47MF 50V
C79 47MF 50V
RD EN(-)
WRT EN(-)
ERASE ENABLE
WRT DATA (-)
UNIT SEL 0
UNIT SEL 1
UNIT SEL 2
UNIT SEL 3
SEEK(-)
ADD CLEAR(-)
HD SEL BOTTOM(-)
DISK SEL REM(+)
SWITCH POSITION
SW1-W
R149 22K
R171 22K
IC3/6 SHEET 3 OPERATIONAL (-)
SEEK(+)
ADD CLEAR(+)
SEEK
DISK STOP(-)
R87 20K CW
R88 5100
R89 47K 1/4W
R90 1500Ω
R91 510Ω
R92 47K 1/4W
R94 68000
R96 39K
R97 510Ω
R98 200Ω
R99 20K
R65 200Ω
R66 510Ω
R67 510Ω
R68 510Ω
R69 510Ω
C17 .0047MF 80V
C20 270PF
C21 270PF
C22 .068MF 80V
C23 .068MF 80V
C81 22MF 50V
C86 .0022MF 80V
C87 .0022MF 80V
C88 .0022MF 80V
C3 10MF 6V
Q13 2N2369
Q18 2N2369
SEEK COMP(+)
SEEK INCOMP(+)
OPERATIONAL(+)
RD DATA
RD DATA RTN
SEEK COMP
SEEK INCOMP
READY
CLK
CLK RTN
UPS(+) (SHT 3)
VOLTAGE SENSE (SHT 3)
SEEK COMP(+OR-)
SEEK COMP (-)
SEEK INCOMP(-)
RESET (-)
SWITCH POSITION SW2-W
UNIT ADD 0
UNIT ADD 1
UNIT ADD 2
UNIT ADD 3
JUMPER WHEN NO DC SECTORS ARE USED
WRT INHBD (-)
SECTOR ADD 2^4
SECTOR ADD 2^3
SECTOR ADD 2^2
SECTOR ADD 2^1
SECTOR ADD 2^0
UNGATED ATTENUATION
J20
IDX REM
IDX FXD
R146 1500Ω
R73 1500Ω
C24 .0022 MF 80V
C25 .0022MF 80V
TP
J19
PC RTN
QUAD PC
ZERO PC
R76 1K
R51 22K
R79 200K 1/4W 5%
R72 100K
R77 1K
C14 220 PF
R78 510K 1/4W 5%
R80
R58 100K
R83 2MEG 1/4W 5%
R84 100K
R81 1K
C15 1000 PF 100V
R82 2MEG 1/4W 5%
R85 1K
QUAD PULSE(SHT 1)
ZERO (SHT 1)
J7
GND
+5V
-15V
C41-C58 .01MF 100V 18PL
C59-C68 6.8MF 6V 10PL
C69-C72 2.2MF 20V 4PL
C73-C76 2.2MF 20V 4PL
CR10 IN4001
CR9 IN4001
R70 4700Ω
JUMPER FOR MULTIPLEX
UNIT SEL 5
R157 12K
R155 10K
R156 1K
C83 .01 MF 80V
C80 .0015MF 200V
ILA-IC 5/5
ILA(-) IC 5/6
IDX REM
SECTOR REM
ILA/IDX FXD
ADD ACK / SECTOR FXD
SCALE —
SHT 3 OF 3
30.672


CR15
CR16
CR17
CR18
R168 200
R71 15K
R100 160
R101 5600
LM311
R150 510
C16 1MF 50V
R102 160
R103 15K
R104 10K
R107 22 1/4W 5%
C26 56MF
BRUSH HOME (+)
MOTOR ON (-)
UPS(+) (SHT 2)
R108 2400 2N2222AL
Q11
R109 300K 1/4W 5%
Q9 2N4852
R111 100
R110 51
L1 33 MH
C38 15MF 15V
R144 750
Q10 2N2222A
R112 270
C29 10 PF
R113 2K
R114 510
R116 330
R115 10K
R117 1K
RLY (+)
VOLTAGE SENSE (SHT 2)
POWER ON (+) (SHT 1)
R166 1K
(SHT 2) OPERATIONAL (+)
IC2-10 OPERATIONAL (-) (SHT 2)
SK COMD IC3-2 (SHT 1)
R134 10K
C40 56MF
R118 510
RDY(+)
DISK STOP(-) (SHT 2)
R120 510
STOP(+)
CARH(-) (SHT 1)
R104 20K
R106 1K
C27 6.8MF =6V
R152 1K
CONTROLLER +5V
J21
J22
(BB)
R173 510
(DD)
CR21
CR22
CR19
CR20
IC10-3 (SHT 1)
R174 (CC) 510
AC POWER LOSS (+)
SHT 1 FEET DRIVE
R122 100K
R123 1MEG 1/4W 5%
C30 30PF
R124 20K
R136 100K
R135 2K
CR24
Q12 2N5639
R129 50K
R130 1K
CR12
C33 1MF 50V
C34 1MF 50V
R119 510K
R125 2K
DETENT P.C.
R126 1800
R127 15K
C32 .022MF 50V
R128 52K
R140 1K
C35 220PF
R131 5 39K
R132 1K
R133 2K
R135 5.1K
R139 1800
LINEAR SIGNAL (SHT 1)
R137 82K
CR13 CR14 IN5234B IN5234B
C36 .022 MF 50V
R138 510K
POS MOTOR RTN
SVC PWR
R142 1K
DETENT PULSE (SHT 1)
R141 1K
R143 100K
J7
301672
SHT 3 OF 3



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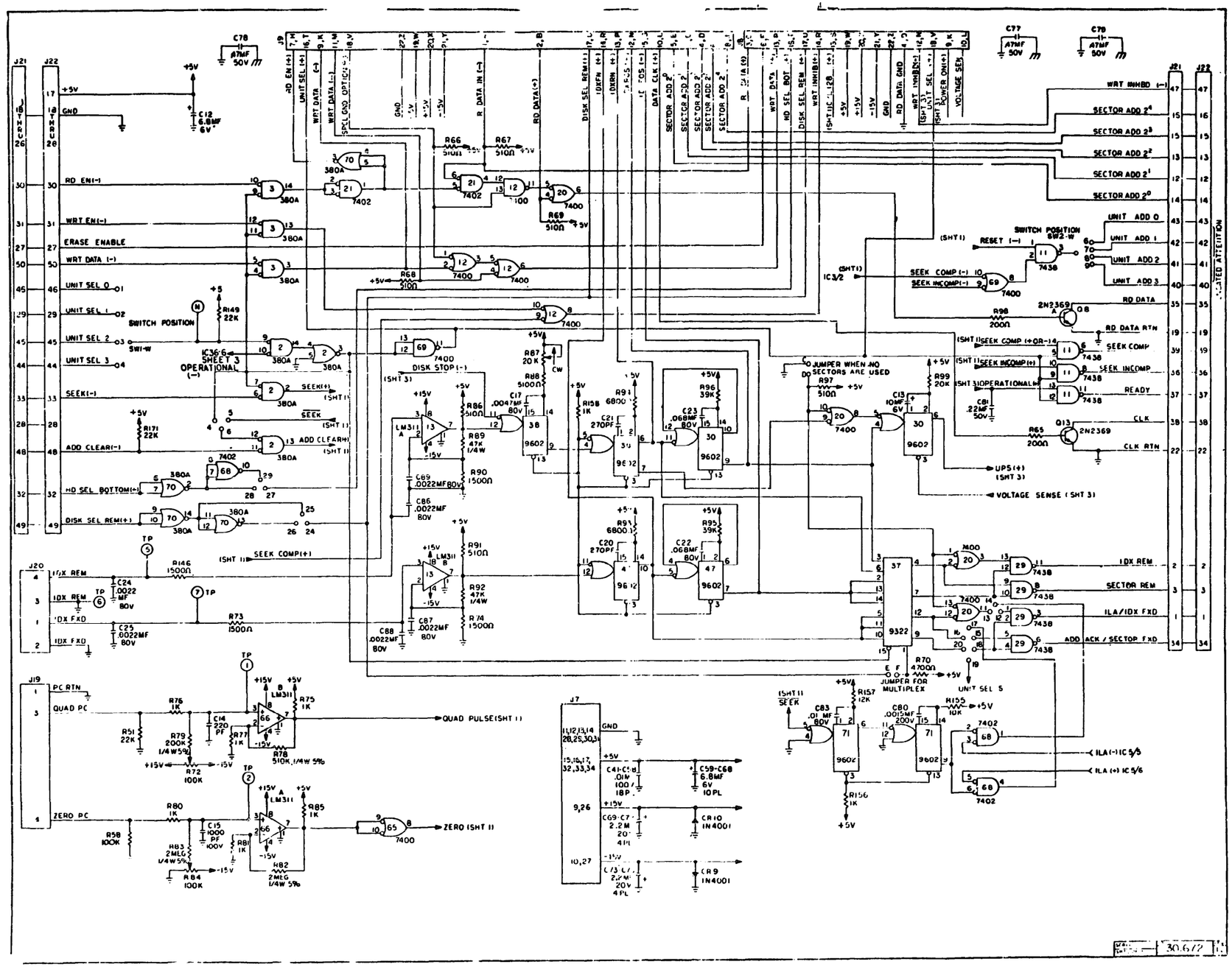
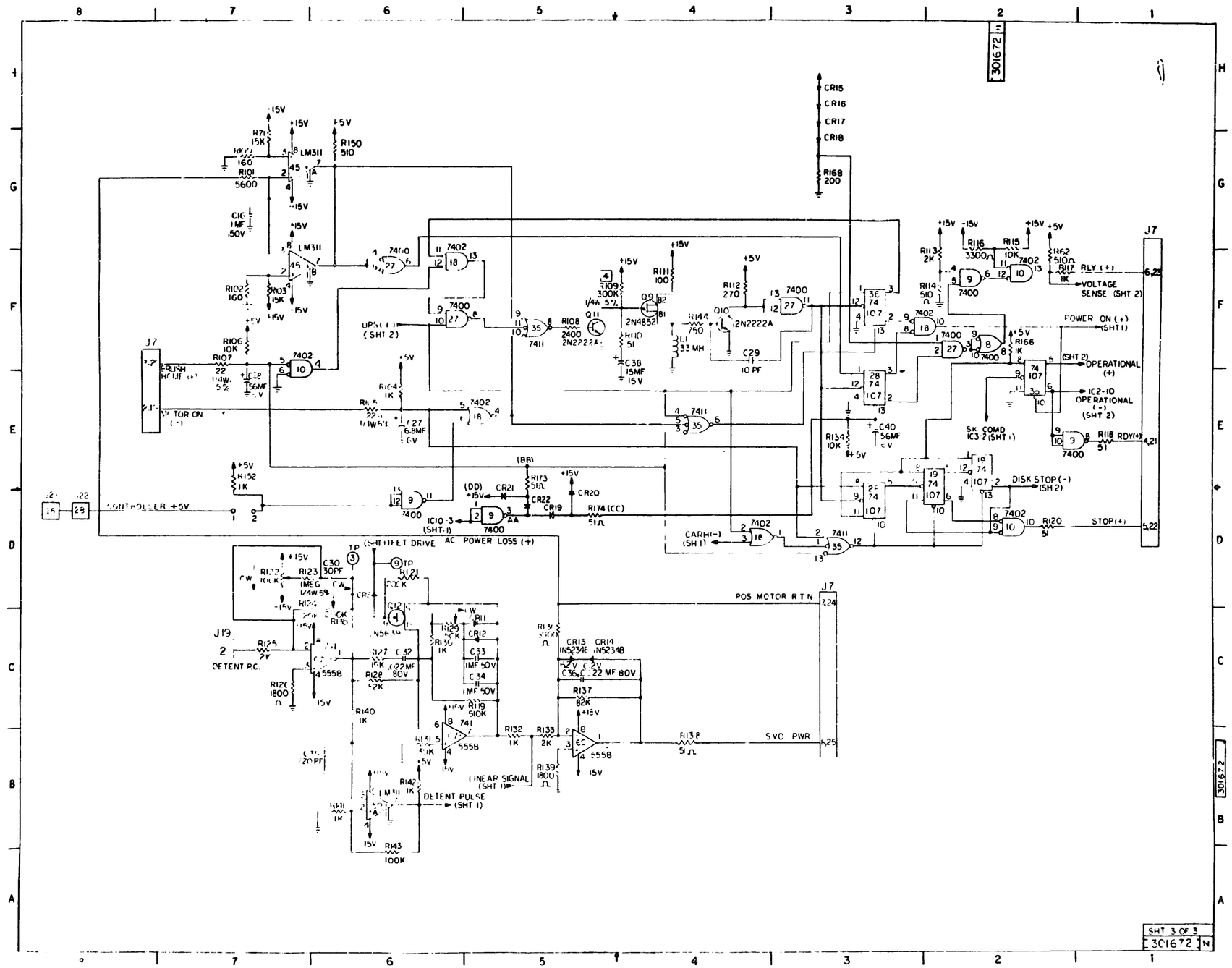

J21
J22
+5V
GND
C12 6.8MF 6V
C78 .47MF 50V
C77 .47MF 50V
C76 .47MF 50V
RD EN(-)
WRT EN(-)
ERASE ENABLE
WRT DATA (-)
UNIT SEL 0
UNIT SEL 1
UNIT SEL 2
UNIT SEL 3
SEEK(-)
ADD CLEAR(-)
HD SEL BOTTOM(+)
DISK SEL REM(+)
SWITCH POSITION
SW1-W
R149 22K
R171 22K
IC36-6 SHEET 3 OPERATIONAL (-)
SEEK(+) (SHT 1)
SEEK (SHT 1)
ADD CLEAR(+) (SHT 1)
DISK STOP(-) (SHT 3)
SEEK COMP(+) (SHT 1)
IDX REM
IDX FXD
R146 1500Ω
R73 1500Ω
C24 .0022 MF 80V
C25 .0022MF 80V
R66 510Ω
R67 510Ω
R68 510Ω
R69 510Ω
R87 20K CW
R88 5100Ω
C17 .0047MF 80V
R86 510Ω
R89 47K 1/4W
R90 1500Ω
C86 .0022MF 80V
C69 .0022MF 80V
R91 510Ω
R92 47K 1/4W
R74 1500Ω
C87 .0022MF 80V
C88 .0022MF 80V
R91 6800
R158 1K
C21 270PF
C20 270PF
C23 .068MF 80V
C22 .068MF 80V
R96 39K
R95 39K
JUMPER WHEN NO DO SECTORS ARE USED
R97 5100Ω
R99 20K
C13 10MF 6V
C81 .22MF 50V
SWITCH POSITION SW2-W
RESET (-)
UNIT ADD 0
UNIT ADD 1
UNIT ADD 2
UNIT ADD 3
SEEK COMP (-)
SEEK INCOMP(-)
IC3/2
R98 200Ω
2N2369 Q8
RD DATA
RD DATA RTN
SEEK COMP
SEEK INCOMP
READY
CLK
CLK RTN
Q13 2N2369
R65 200Ω
UP5(+) (SHT 3)
VOLTAGE SENSE (SHT 3)
WRT INHBD (-)
SECTOR ADD 2^4
SECTOR ADD 2^3
SECTOR ADD 2^2
SECTOR ADD 2^1
SECTOR ADD 2^0
IDX REM
SECTOR REM
ILA/IDX FXD
ADD ACK / SECTOR FXD
R70 4700Ω
JUMPER FOR MULTIPLEX
UNIT SEL 5
R157 12K
R155 10K
R156 1K
C83 .01 MF 80V
C80 .0015MF 200V
ILA(-)IC 5/5
ILA(+) IC 5/6
J19
PC RTN
QUAD PC
ZERO PC
R76 1K
R79 200K 1/4W 5%
R51 22K
R72 100K
C14 220 PF
R77 1K
R78 510K 1/4W 5%
QUAD PULSE(SHT 1)
R80 1K
R58 100K
R83 2MEG 1/4W 5%
R84 100K
C15 1000 PF 100V
R81 1K
R82 2MEG 1/4W 5%
R85 1K
ZERO (SHT 1)
J7
GND
C41-C58 .01M 100 / 18P
C59-C68 6.8MF 6V 10PL
C69-C77 2.2M 20V 4PL
CR10 IN4001
CR9 IN4001
ALTERED ATTENTION


301672 N
CR15
CR16
CR17
CR18
R168 200
+15V
-15V
+5V
R150 510
LM311
R101 5600
R102 160
R103 15K
R106 10K
R107 22 1/4W 5%
BRUSH HOME (+)
MOTOR ON (-)
7400
7402
7410
7411
UPSET (-) (SHT 2)
R108 2400
2N2222A
Q11
2N4852
Q9
Q10
R111 100
R112 270
R114 750
L1 33 MH
C29 10 PF
C38 15MF 15V
R110 51
R113 2K
R114 510
R115 10K
R116 3300
R117 1K
R162 510
RLY (+)
VOLTAGE SENSE (SHT 2)
J7
POWER ON (+) (SHT1)
OPERATIONAL (+) (SHT 2)
IC2-10 OPERATIONAL (-) (SHT 2)
5K COMD IC3-2 (SHT 1)
R118 51
RDY(+)
R134 10K
C40 56MF
DISK STOP(-) (SHT 2)
STOP(+)
R120 51
CARH(-) (SH 1)
CONTROLLER +5V
R152 1K
R173 51Ω
R174 (CC) 51Ω
CR20
CR21
CR22
CR19
IC10-3 (SHT-1)
AC POWER LOSS (+)
FET DRIVE (SHT 1)
R122 10K CW
R123 1MEG CW
C30 30PF
R124 20K
R125 2K
R126 1800Ω
R127 16K
C32 .022MF 80V
R128 62K
R129 10K
R130 1K
R131 1K
R132 1K
R133 2K
R135 1K
R136 100K
R137 82K
R138 5Ω
R139 1800Ω
R140 1K
R141 1K
R142 1K
R143 100K
C33 1MF 50V
C34 1MF 50V
C36 .22 MF 80V
C37 20PF
CR12
CR13 IN5234E
CR14 IN5234B
Q12 IN5639
741
5558
LINEAR SIGNAL (SHT 1)
DETENT PULSE (SHT 1)
DETENT P.C.
POS MOTOR RTN
SVO PWR
SHT 3 OF 3
301672 N

ENGINEERING CHANGE REQUEST / NOTICE

NO. 3487

EFFECTS	Y	N	PART/MATL DISPOSITION: USE AS IS	REWORK	SCRAP
INTERCHANGEABILITY		X			
TOOLING		X			
FIXTURES		X			
TEST EQUIPMENT		X			
PARTS IN STOCK		X			
PARTS IN PROCESS		X			
PARTS ON ORDER		X			
PARTS @ CUST DEPOTS		X			

REQUESTOR/DATE: M. Ferrell 7/4/73
QUALITY ASSURANCE: Jerri 6/26/73
DEPT SUPERVISOR:
TEST EQUIPMENT:
MANUFACTURING:
CONF. CONT. BOARD: 7-12-73
PRODUCT ENG.:
CUSTOMER:
PRODUCTION CONTROL: 7/5/73
END ITEM EFFECTIVITY: 7/5/73

DOCUMENT NO / REV.

301669	302085	302086
301670	302271	301672
301671	302104	302272
	302105	

DOCUMENT TITLE
ARTMASTER Dem.
P.C. Detail Dem.

CHANGE TYPE
CLASS 1 ☐
CLASS 2 ☒
RECORD ☐
ACCEPTED ☐
REJECTED ☐

REASON FOR CHANGE:
P.C. Tooling

REASON FOR FUNCTION:
Next Mtl Buy after 7/5/73

DESCRIPTION OF CHANGE:

302086 ARTMASTER Dem.

Change the artwork so that the attached revised changes are incorporated.

THIS ECN WILL MAKE THIS DRAWING REV.
301669-B
301670 C
301671-D
302085-H
302104-E
302271-B
302105 D
302086-F
301672-G
302272-B

ISSUED
AUG 8 1973

302669 P.C. Detail Dem.

Incorporate above artmaster into the Detail.
To silk screen as required.

* May require Customer approval.

NEXT ASSY. DWG. NO.(S)	PROGRAM (S)
	203/303

SHEET 1 OF 5

ENGINEERING CHANGE REQUEST / NOTICE NO 3487

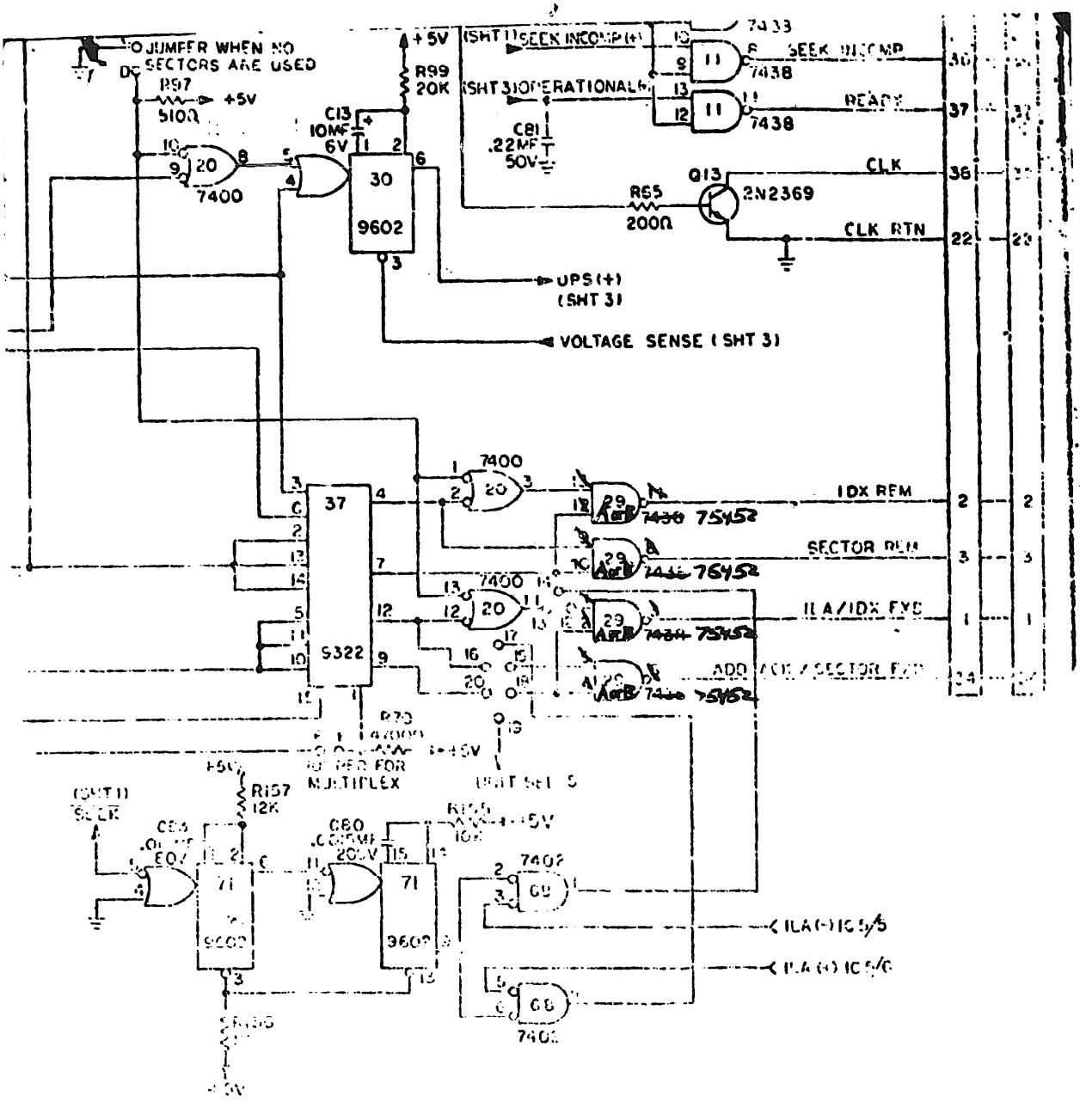
The following changes are to be implemented and IC numbers/pin numbers to be assigned when board is layed out.

1) CHANGE ASSY DWG's 302271, 301671, 302085 & 302104 PER NEW COMPONENT LAYOUT.

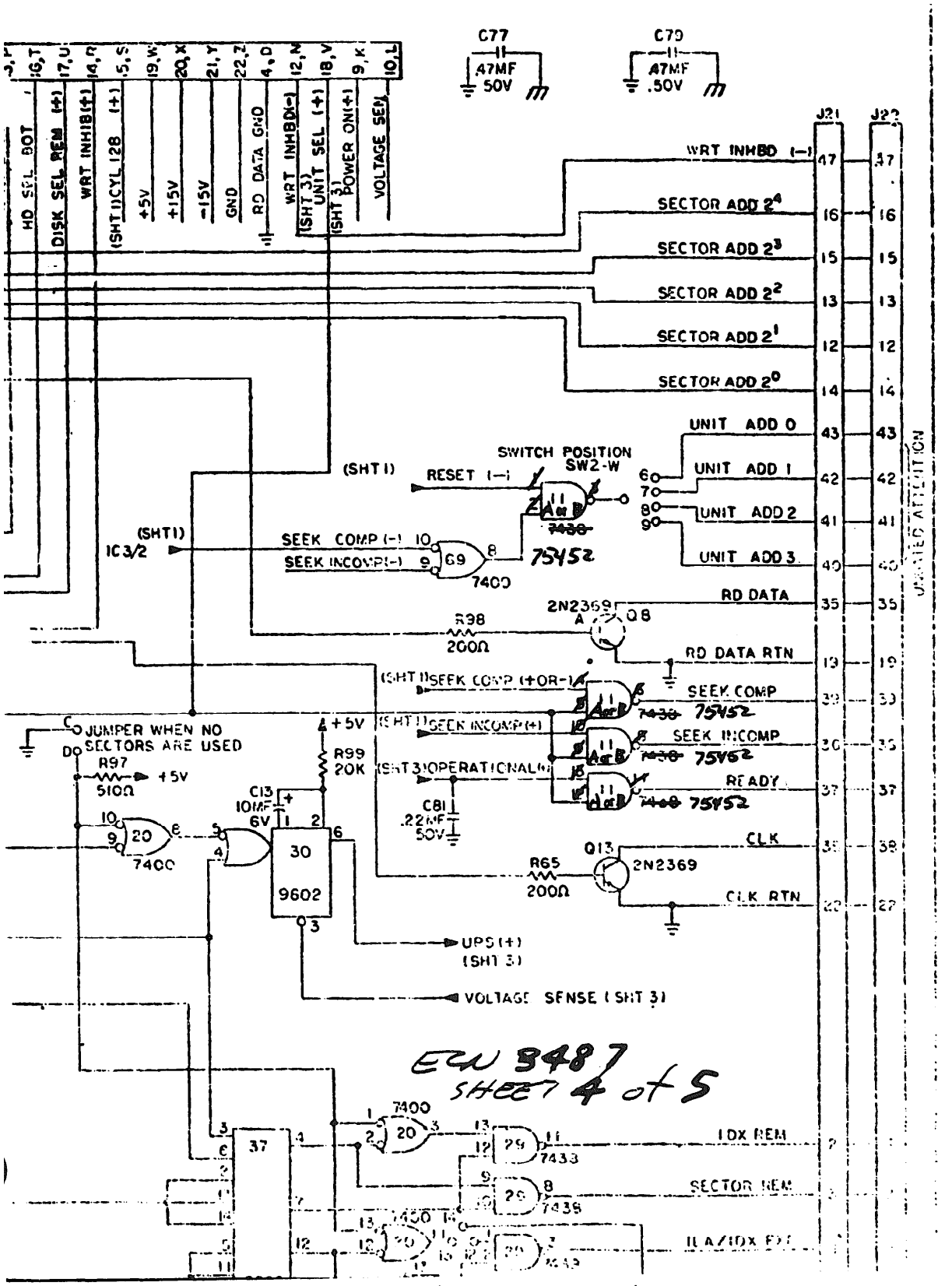
2) CHANGE SCHEMATIC'S 302105, 302086, 301672 & 302272 PER SHT OR THIS ECN.

SHEET 2 OF 5

ENG 023-1



ECI 3487
Page 3 of 5



ECN 9487
SHEET 4 of 5

2	2	S_	-000522 -010	10K POT	R23,145
1	1	54	17-000052 -152	RES 5.1MEG 1/4W,5%	R154
1	1	53	17-000052 -135	1MEG	R123
1	1	52	53-000054 -065	210K 1/4W 2%	R121
		51			
2	2	50	17-000052 -122	300K 1/4W 5%	R25,109
3	3	49	17-000052 -118	200K	R35,36 79
2	2	48	17-000052 -023	22Ω	R105,107
2	2	47	17-000052 -142	2MEG	R82,83
2	2	46	17-000052 -128	510K	R78,119.
1	1	45	17-000052 -167	RES 20MEG 1/4W,5%	R61
2	2	44	53-000054 -038	RES 1800Ω 1/4W,2%	R126,139
1	1	43	53-000054 -018	270Ω	R112
2	2	42	53-000054 -001	51Ω	R110,138
1	1	41	53-000054 -040	2400Ω	R108
1	1	40	53-000054 -049	5600Ω	R101
1	1	39	53-000054 -047	4700Ω	R70
2	2	38	53-000054 -013	160Ω	R100,102
2	2	37	53-000054 -051	6800Ω	R93,94
3	3	36	53-000054 -063	22K	R51,149,171
4	4	35	53-000054 -067	RES 39K 1/4W 2%	R56,95,96,131

on assy:
301671
302271
302085,
302164

1	1	20	53-000054 -035	1300Ω	R19	
32	32	19	53-000054 -032	RES 1K 1/4W,2%	R22 32 46 48 75 76 77 80 84 85 104 106 130 132 140 142 152 153 156 158 159 160 161 162 164 165 166 170 172 JIT	
1	1	18	53-000054 -043	RES 3300 1/4W, 2%	R116	
	2	17	52-000584 -001	DIGITAL SIGNAL TERMINATOR	IC1,53	
1	1	16	10-000625 -001	4024	IC58	
1	1	15	10-000302 -001	9322	IC37	
4	4	14	10-000624 -001	74193	IC48,49,61,62	
4	4	13	10-000418 -001	9324	IC39,40,54,55	
2	2	12	10-000625 -001	9314	IC 31,32	
3	3	11	10-000058 -001	7411	IC 16,25,35	
5	5	10	10-000637 -001	380A	IC2,3 22,23, 70	
3	3	9	10-000012 -001	7410	IC6,33,63	
8	8	8	10-000011 -001	7402	IC 4 10 18 21 34 51 57 68	
6	6	7	10-000759 -001	5558	IC 26,44A,44B,60,67A, 67B	
7	7	6	10-000667 -001	LM311	IC 13A,138,45A,45B, 59,66A,65B	
6	6	5	10-000264 -001 840	9602	IC 15,30,38,47, 56,71	
4	4	4	10-000438 -001	7438 75452	~~IC 11,29~~ 11A, 11B, 29A, 29B	
8	8	3	10-000517 -001	74107	IC 5,7,19,24,28, 36,41,64	
14	14	2	10-000003 -001	7400	IC 8,9,12,14,17,20 27,42,43,45,52 & 69	
1	1	1	301669 -001	PC BD DETAIL		
		ITEM	PART NO	DESCRIPTION	SPEC / MATERIAL	REMARKS

CÆLUS MEMORIES INC.
SAN JOSE CALIFORNIA

PC BD ASSY
DRIVE ELECTRONICS
MODULE

301671

SCALE 2/1 SIZE B
SHT 1 OF 2

THIS DOCUMENT INCOMPLETE WITHOUT
ECNs ALL

ECN 3487 Pg 5 of 5 FEB 28 1973

4 3 2 1

ENGINEERING CHANGE REQUEST / NOTICE NO. 39

CHANGE EFFECTS	Y	N	PART/MATL DISPOSITION: USE AS IS	REWORK	SCRAP
INTERCHANGEABILITY		X			
TOOLING		X			
FIXTURES		X			
TEST EQUIPMENT		X			
PARTS IN STOCK		X			
PARTS IN PROCESS		X			
PARTS ON ORDER		X			
PARTS @ CUST DEPOTS		X			

REQUESTOR/DATE: JoAnn Brengard 9/27/73

QUALITY ASSURANCE: Rew 10/10/73

DEPT. SUPERVISOR: 9/27

TEST EQUIPMENT:

MANUFACTURING: 10/10/73

CONF. CONT. BOARD: 10/10

PRODUCT ENG.: 10/9/73

CUSTOMER: 10/22

PRODUCTION CONTROL: 10/10/73

END ITEM EFFECTIVITY: 12/17/73

DOCUMENT NO: 302104, 301671, 302085, 302271

REV:

DOCUMENT TITLE: Assy, DEM Board Sanders

CHANGE TYPE: CLASS 1 ☐ CLASS 2 ☒ RECORD ☐

ACCEPTED ☒ REJECTED ☐

REASON FOR CHANGE: Documentation Error PAR 967

REASON FOR REJECTION: THIS ECN WILL MAKE THIS DRAWING REV 302104 E, 302085 J, 301671 K, 302271 E

DESCRIPTION OF CHANGE: Wrong quantity called out in bill of materials for -019,

		Qty	P/N	Des.
CHANGE FROM:	1	35-000276-001		Pin
TO:	2	35-000276-001		Pin

ISSUED
OCT 26 1973

EXT ASSY. DWG. NO.(S)	PROGRAM (S)
	Sanders 303/2

SHEET 1 OF 1

NO 5007

CHANGE EFFECTS	Y	N	PART/MATL DISPOSITION: USE AS IS	REWORK	SCRAP
		X			
		X			
		X			
		X			
		X			
	X	X		X	
		X			

REQUESTOR/DATE	QUALITY ASSURANCE
Ed Rosmarin	
DEPT SUPERVISOR	TEST EQUIPMENT
MANUFACTURING	CONF. CONT. BOARD 9/4/74
PRODUCT ENG. 9/4/74	CUSTOMER

DOCUMENT NO	REV
301671	H

DOCUMENT TITLE
P.C. Bd Assembly Drive Electronics Module.

CHANGE TYPE
CLASS 1 ☐
CLASS 2 ☒
RECORD ☐

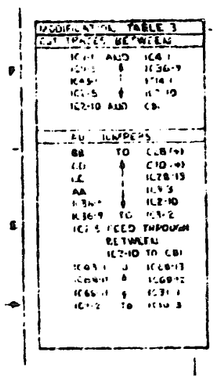
ACCEPTED ☒

THIS ECN WILL MAKE DRAWING REV L

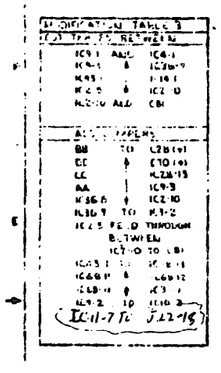
P.A.R. 1467

1. On 301671 Sheet 2 of 2, add to add jumper column "IC11-7 to J22-18" as follows:
2. Physically add jumper to D.E.M. Board as indicated on Sheet 2 this E.C.N.

FROM:



TO:

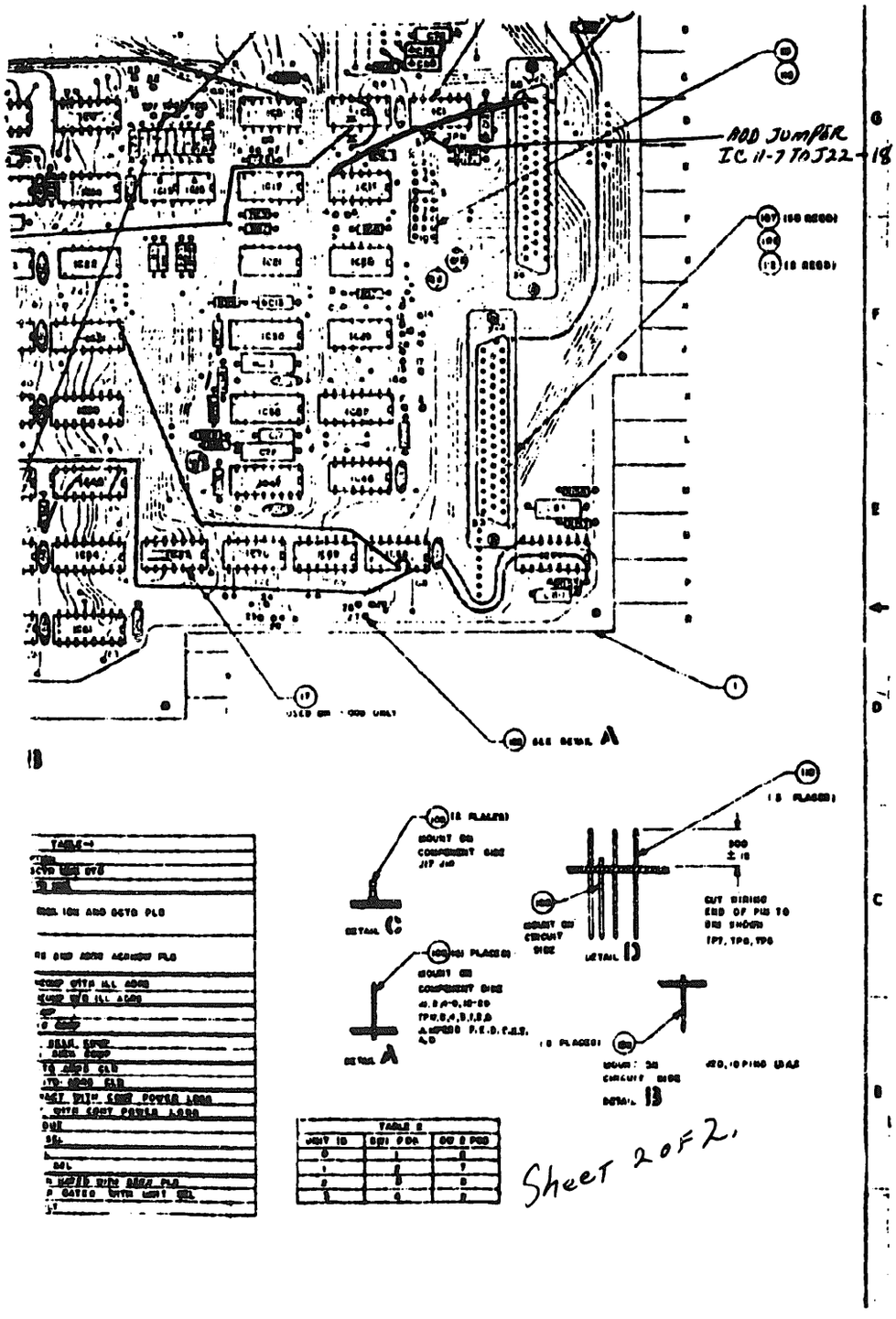


SEP 5 1974

NEXT ASSY. DWG. NO.(S)	PROGRAM (S)

SHEET 1 OF 2

NG 023



ECN# 5007
Sht 2 of 2

ENGINEERING CHANGE REQUEST / NOTICE

NO 5010

CHANGE EFFECTS	Y	N	PART/MATL DISPOSITION: USE AS IS	REWORK	SCRAP
INTERCHANGEABILITY		X			
TOOLING		X			
FIXTURES		X			
TEST EQUIPMENT		X			
PARTS IN STOCK		X			
PARTS IN PROCESS		X			
PARTS ON ORDER	X				
PARTS @ CUST DEPOTS		X			

REQUESTOR/DATE: Hal Masamori 7/31/74

DEPT' SUPERVISOR

MANUFACTURING

PRODUCT ENG.

PRODUCTION CONTROL

ITEM EFFECTIVITY: 1-15-5

QUALITY ASSURANCE

TEST EQUIPMENT

CONF. CONT. BOARD

CUSTOMER

DOCUMENT NO: 301671 REV: H

DOCUMENT TITLE: ASSEMBLY, DRIVE ELECTRONICS MODULE 203/303

CHANGE TYPE: CLASS 1 ☐ CLASS 2 ☑ RECORD ☐

ACCEPTED ☑ REJECTED ☐

REASON FOR CHANGE: PAR #1928

REASON FOR REJECTION: THIS ECN WILL MAKE THIS DRAWING REV 1-1

DESCRIPTION OF CHANGE:

CHANGE ITEM 52 FROM: 14-000522-030 200K Pot R135 QTY 1 (-009 & 019)

TO: 14-000522-014 200K Pot R135 QTY 1 (-009 & 019)

TACD	203/303
NEXT ASSY. DWG. NO.(S)	PROGRAM (S)

SUEL

SEP 5 1974

SHEET 1 OF 1

ENG 823

ENGINEERING CHANGE REQUEST / NOTICE

NO 5190

CHANGE EFFECTS	Y	N	PART/MATL. DISPOSITION: USE AS IS	REWORK	SCRAP
INTERCHANGEABILITY		X			
TOOLING		X			
FIXTURES		X			
TEST EQUIPMENT		X			
PARTS IN STOCK		X			
PARTS IN PROCESS		X			
PARTS ON ORDER		X			
PARTS @ CUST DEPOTS		X			

REQUESTOR/DATE: H. Robinson 9/5/74

DEPT. SUPERVISOR

MANUFACTURING

PRODUCTION CONTROL

QUALITY ASSURANCE

TEST EQUIPMENT

CONF. CONT. BOARD

CUSTOMER

END ITEM EFFECTIVITY:

DOCUMENT NO: 301671 REV:

DOCUMENT TITLE: P.C. Board Assembly Drive Electronic Module

CHANGE TYPE: CLASS 1 ☐ CLASS 2 ☑ RECORD ☐

ACCEPTED ☒ REJECTED ☐

REASON FOR CHANGE:
PAR 2193
Elimination of 3487

REASON FOR REJECTION:

DESCRIPTION OF CHANGE:

CHANGE ITEM 4	FROM:	4 019	4 009	4 ITEM	10-000840-001 P/N	75452 DES.	11 A, 11 B, 29 A, 29 B
	TO:	2 019	2 009	4 ITEM	10-000623-001 P/N	7438 DES	IC11, 29

TACDs	203/303
NEXT ASSY. DWG. NO.(S)	PROGRAM (S)

SHEET 1 OF 1

ENG 023

ENGINEERING CHANGE REQUEST / NOTICE

NO 5490

CHANGE EFFECTS	Y	N	PART/MATL DISPOSITION: USE AS IS	REWORK	SCRAP
INTERCHANGEABILITY		X			
TOOLING		X			
FIXTURES		X			
TEST EQUIPMENT		X			
PARTS IN STOCK	X			X	
PARTS IN PROCESS	X			X	
PARTS ON ORDER		X			
PARTS @ CUST DEPOTS	X			X	

REASON FOR CHANGE:
PAR 2538 (Ref: TE 026)

REQUESTOR/DATE	QUALITY ASSURANCE	DOCUMENT NO	REV
Mike Ranger 2/5/75		301671	
DEPT' SUPERVISOR	TEST EQUIPMENT	DOCUMENT TITLE	
MANUFACTURING	CONF. CONT. BOARD	DRIVE ELECTRONIC MODULE ASSEMBLY	
PRODUCT ENG.	CUSTOMER	CHANGE TYPE	
PRODUCTION CONTROL		CLASS 1 ☐ CLASS 2 ☑ RECORD ☐	
END ITEM EFFECTIVITY:		ACCEPTED ☑ REJECTED ☐	

REASON FOR REJECTION:

DESCRIPTION OF CHANGE:

ON SHEET 2 OF DRAWING CHANGE ZONE G-3

FROM: C25, R73, C88, C87, C84, R46, C86, R90, C89

TO: C25, R73, C88 / C84, R46, C86, R90

ON SHEET 2 OF DRAWING CHANGE ZONE F-3

FROM: R92, R91 / R89, R86

TO: C87, R92, R91 / C89, R89, R86

VOID

TACD	203/303 1500 RPM
NEXT ASSY. DWG. NO.(S)	PROGRAM (S)

SHEET 1 OF 2

ENG 023

ENGINEERING CHANGE REQUEST / NOTICE NO 5490

REWORK INSTRUCTIONS FOR CHANGES IN SHEET 1:

a) Remove capacitors C87 and C89 (0.0022 μf capacitors) from present location.
b) Connect C87 in parallel across R92.
c) Connect C89 in parallel across R89.

ENG 023-1

ENGINEERING CHANGE REQUEST / NOTICE

NO. 5586

CHANGE EFFECTS	Y	N	PART/MATL DISPOSITION: USE AS IS	REWORK	SCRAP
INTERCHANGEABILITY		/			
TOOLING					
FIXTURES					
TEST EQUIPMENT					
PARTS IN STOCK	\			/	
PARTS IN PROCESS	.			/	
PARTS ON ORDER	.			.	
PARTS @ CUST DEPOTS		/			

REQUESTOR/DATE	QUALITY ASSURANCE	DOCUMENT NO: NOTED / REV
DEPT' SUPERVISOR	TEST EQUIPMENT	DOCUMENT TITLE: NOTED
MANUFACTURING	CONF. CONT. BOARD	
PRODUCT ENG.	CUSTOMER	CHANGE TYPE: CLASS 1 ☐ / CLASS 2 ☒ / RECORD ☐
PRODUCTION CONTROL		ACCEPTED ☒ / REJECTED ☐
END ITEM EFFECTIVITY:		

REASON FOR CHANGE: PAR's 1997/1721/2083 — To eliminate intermittent illegal address

REASON FOR REJECTION:

DESCRIPTION OF CHANGE:

NOTED:

R 1.	301671	Rev.	Drive Electronic Module Assembly
K 2.	301672	Rev.	Drive Electronic Module Schematic
N 3.	302085	Rev.	Drive Electronic Module Assembly
J 4.	302086	Rev.	Drive Electronic Module Schematic
M 5.	302104	Rev.	Drive Electronic Module Assembly
H 6.	302105	Rev.	Drive Electronic Module Schematic
K 7.	302271	Rev.	Drive Electronic Module Assembly
G 8.	302272	Rev.	Drive Electronic Module Schematic

1. 301671, 302085, 302104, & 302271 DEM Assembly:

   a) ADD to MODIFICATION TABLE 3: " Cut trace between IC65-1 and IC65-2
   Cut trace between IC5-9 and IC65-12
   Add jumpers from IC65-2 to IC64-12
   from IC14-3 to IC5-9

   b) Show jumpers called out in 1a above on assy drawing board layout

ISSUED APR 14 1975

TACD	203/303 1500 REM
NEXT ASSY DWG. NO.(S)	PROGRAM (S)

SHEET 1 OF 2

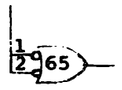
ENG 023

ENGINEERING CHANGE REQUEST / NOTICE

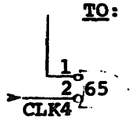
NO 5586

2. 301672, 302086, 302105 & 302272 DEM Schematic:

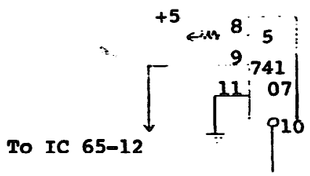
a) CHANGE Zone C-2 FROM:



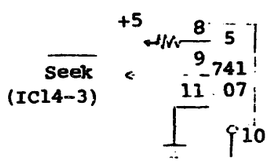
TO:



b) CHANGE Zone E-1 FROM:



TO:



ENGINEERING CHANGE REQUEST / NOTICE

NO 5397

CHANGE EFFECTS	Y	N	PART/MATL DISPOSITION: USE AS IS	REWORK	SCRAP
INTERCHANGEABILITY		X			
TOOLING		X			
FIXTURES		X			
TEST EQUIPMENT		X			
PARTS IN STOCK					
PARTS IN PROCESS					
PARTS ON ORDER		X			
PARTS @ CUST DEPOTS					

REQUESTOR/DATE: Jo Ann Brengard 3/21/75
QUALITY ASSURANCE:
DEPT' SUPERVISOR:
TEST EQUIPMENT:
MANUFACTURING:
CONF. CONTROL BOARD:
PRODUCT ENG.:
CUSTOMER:
PRODUCTION CONTROL:
END ITEM EFFECTIVITY:

DOCUMENT NO: NOTED
REV:
DOCUMENT TITLE: NOTED

CHANGE TYPE
CLASS 1 ☐
CLASS 2 ☑
RECORD ☐

ACCEPTED ☑
REJECTED ☐

REASON FOR CHANGE: PAR 2675 Change to a longer life bulb and correct driver circuitry

REASON FOR REJECTION: X Superseded Dwg. Continued

DESCRIPTION OF CHANGE:

Page 2 of 5

FACILITIES PRODUCTION RELEASE

1.	301186 Rev E	Switch Plate Assembly (Ref: Item 7)
2.	301717 Rev X1	Switch Plate Assembly (Ref: Item 7)
3.	302899 Rev B	Honeywell Spares Kit (Ref: Item 1)
4.	302900 Rev C	Honeywell Spares Kit (Ref: Item 19)
5.	302902 Rev B	Honeywell Spares Kit (Ref: Item 31)
6.	40-000118 Rev A	Lamp - Miniature Incandescent
7.	301671 Rev H	Drive Electronic Module Assembly
8.	301672 Rev J	" " " Schematic
9.	302085 Rev M	" " " Assembly
10.	302086 Rev H	" " " " Schematic
11.	302104 Rev D	" " " Assembly
12.	302105 Rev C	" " " Schematic
13.	302271 Rev D	" " " Assembly
14	302272 Rev F	" " " Schematic
15.	302484 Rev A	" " " Assembly
16.	302485 Rev A	" " " Schematic
17.	302120 Rev N	" " " Assembly
18.	302121 Rev H	" " " Schematic
19.	302820 Rev D	" " " Assembly
20	E302820 Rev F	" " " Schematic

continued on sheet 2

200/300

ISSUED
APR 1 1975

NEXT ASSY. DWG. NO.(S)
PROGRAM (S)

SHEET 1 OF 5

ENG 823

ENGINEERING CHANGE REQUEST / NOTICE NO 5597

X4 21. 302466 Drive Control Board Assembly Rev X3
X4 22. 302465 " " " Schematic Rev X3
X 23. 302470 Control Sector Board Schematic Rev X1
X 24. 302469 " " " Assembly Rev X1
C 25. 302794 Drive Control Board Assembly Rev A
C 26. E302794 Drive Control Board Schematic Rev A

1. 301186, 301717, 302900, 302899 & 302902 In Parts List Change:

FROM: 40-000118-001 Lamp, Miniature Chicago CM - 387
TO: 40-000118-004 Lamp, Miniature #376

2. 40-000118- ADD DASH 004:

Caelus P/N	Volts	Amps	Hours	Mean Spherical Candle Power M.S.C.P. (Approx.)	Industry Std P/N
-004	28.0	.06	25,000	.34	376

3. 301671, 302085, 302104, 302271, & 302484 Assemblies (all dash numbers)

a) In parts list Change Item 34 (all dash numbers)
FROM: 15 Req'd, 53-000054-025, Res 510Ω 1/4w, 2% R50,57,62,66-69,86,91,97 114,118,120,163,150
TO: 13 Req'd, 53-000054-025, Res 510Ω 1/4w, 2% R50,57,62,66-69,86,91,97 114, 163,150

b) In parts list Change Item 42 (all dash numbers)
FROM: 2 Req'd, 53-000054-001, Res 51Ω, 1/4w, 2% R110,138
TO: 4 Req'd, 53-000054-001, Res 51Ω, 1/4w, 2% R110,138,118,120

4. 301672, 302086, 302105, 302272 & 302485 Schematics: Sheet 3

a) Change Zone E-1

FROM:
R118
510
RDY (+)

TO:
R118
510
RDY (+)

b) Change Zone D-2

FROM:
R120
510
STOP (+)

TO:
R120
510
STOP (+)

ENG 023-1

ENGINEERING CHANGE REQUEST / NOTICE NO 5597

5. 302120 Assembly:

a) In part list Change Item 62 (all dash numbers)

FROM:	38 Req'd, 17-000052-063, Res 1K, 1/4w, 5%	R63,3,15,16,17,20,26,27,28,57,38, 42,45,46,194,66,145,62,67,68,69, 70,75,85,151,146,111,124,134,136, 137,195,190,191,192,193,196,197,
TO:	36 Req'd, 17-000052-063, Res 1K, 1/4w, 5%	R63,3,15,16,17,20,26,27,28,57,38, 42,45,46, 66,145,62,67,68,69, 70,75,85,151,146,111,124,134,136, 137, 190,191,192,193,196,197,

b) In part list Change Item 72: (all dash numbers)

FROM:	2 Req'd, 17-000052-033, Res 51Ω, 1/4w, 5%	R205,204
TO:	3 Req'd, 17-000052-033, Res 51Ω, 1/4w, 5%	R205,204,194

6. 302820 Assembly:

a) In parts list Change Item 62 (all dash numbers)

FROM:	39 Req'd, 17-000052-063, Res 1K, 1/4w, 5%	R63,3,15,16,17,20,26,27,28,57,38, 42,45,46,194,66,145,62,67,68,69, 70,75,85,151,146,111,124,134,136, 137,195,190,191,192,193,196,197, 72
TO:	37 Req'd, 17-000052-063, Res 1K, 1/4w, 5%	R63,3,15,16,17,20,26,27,28,57,38, 42,45,46, 66,145,62,67,68,69, 70,75,85,151,146,111,124,134,136, 137, 190,191,192,193,196,197, 72

b) In Parts list Change Item 72 (all dash numbers)

FROM:	2 Req'd, 17-000052-033, Res 51Ω, 1/4w,5%	R205,204,
TO:	3 Req'd, 17-000052-033, Res 51Ω, 1/4w,5%	R205,204,194

7. 302120 & 302820 Assemblies:

a) Delete R195 from Reference Designation Chart
b) Delete R195 from Sht 2, Zone D-3

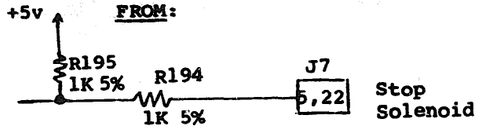
SHEET 3 OF 5

ENG 0229-1

ENGINEERING CHANGE REQUEST / NOTICE NO 5597

8. 302121 and E302820 Schematics: Change Sht 3, Zone E-2:

FROM:



TO:

9. 302121 and E302820 Schematics:

a) Add R195 to Reference Designation Not Used Chart

10. 302469 CSB Assembly:

a) In parts list Change Item 36: (all dash numbers)
FROM: 13 Req'd, 17-000052-063, Res 1K, 1/4w, 5% R7,8,9,12,13,14,15,18,19,21, 22,23,26

TO: 12 Req'd. 17-000052-063, Res 1K, 1/4w, 5% R7,8,9,12, 14,15,18,19,21,= 22,23,26

b) In parts list Change Item 35: (all dash numbers)
FROM: 1 Req'd, 17-000052-057, Res 560Ω 1/4w, 5% R25

TO: 1 Req'd, 17-000052-033, Res 51Ω, 1/4, 5% R25

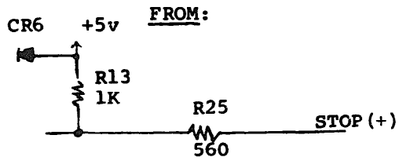
c) Delete R13 from Reference Designation Table

d) Delete R13 from Zone B-10

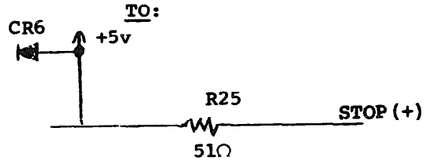
e) Change Modification Note 2 FROM: Add R25 between Pin 13 & R13
TO: Add R25 between Pin 13 & R13 location

11. 302470 CSB Schematic: Change Zone F-3

FROM:



TO:



12. 302470 CSB Schematic: Add R13 to Reference Designation Not Used

ENG 023-1

SHEET 4 OF 5

ENGINEERING CHANGE REQUEST / NOTICE NO 5597

13. 302794 DCB Assembly:

a) In Parts List change Item 44 (all dash numbers)

FROM: 9 Req'd, 17-000052-063, Res 1K, 1/4w, 5% R12,24,20,21,25,28,33,40,41
TO: 8 Req'd, 17-000052-063, Res 1K, 1/4w, 5% R12,24,20,21,25,28,33, ,41

14. 302465 DCD Assembly:

a) In Parts List change Item 43 (all dash numbers)

FROM: 9 Req'd, 17-000052-063, Res 1K, 1/4w, 5% R12,19,22,24,25,28,33,40,41
TO: 8 Req'd, 17-000052-063, Res 1K, 1/4w, 5% R12,19,22,24,25,28,33, ,41

15. 302465 & 302794 Assemblies:

a) In Parts List Change Item 42 (all dash numbers)

FROM: 3 Req'd, 17-000052-056, Res 510Ω, 1/4w, 5% R3,6,16
TO: 4 Req'd, 17-000052-056, Res 510Ω, 1/4w, 5% R3,6,16,40

16. 302466 & E302794 Schematics:

a) Change callout of value for R40 in Zone E-3 FROM R40 1K 5% TO R40 510Ω 5%

ENG 0-23-1

ENGINEERING CHANGE REQUEST / NOTICE

NO. 5698

CHANGE EFFECTS	Y	N	PART/MATL DISPOSITION: USE AS IS	REWORK	SCRAP
INTERCHANGEABILITY					
TOOLING					
FIXTURES					
TEST EQUIPMENT					
PARTS IN STOCK		X			
PARTS IN PROCESS		X			
PARTS ON ORDER					
PARTS @ CUST DEPOTS		X			

REASON FOR CHANGE: PAR 2763 — Increase timer resistor value

REQUESTOR/DATE: Mike Ranger 3/27/75	QUALITY ASSURANCE	DOCUMENT NO: NOTED	REV
DEPT' SUPERVISOR	TEST EQUIPMENT	DOCUMENT TITLE: NOTED	
MANUFACTURING	CONF. CONT. BOARD 4/9/75		
PRODUCT ENG.	CUSTOMER	CHANGE TYPE: CLASS 1 ☐ CLASS 2 ☒ RECORD ☐	
PRODUCTION CONTROL			
END ITEM EFFECTIVITY:		ACCEPTED ☒ REJECTED ☐	
REASON FOR REJECTION:			

DESCRIPTION OF CHANGE:

*T 301671 Rev Drive Electronics Module Assembly
M 301672 Rev " " " Schematic
R 302085 Rev " " " Assembly
L 302086 Rev " " " Schematic
P 302104 Rev " " " Assembly
K 302105 Rev " " " Schematic
M 302271 Rev " " " Assembly
J 302272 Rev Drive Electronics Module Schematic

APR 10 1975

1. 301671, 302085, 302104 & 302271 Assemblies and 301672, 302086, 302105 & 302272 Schematics:

a) ADD NOTE: Rework instructions required by Manufacturing Test: Measure time constant (T seconds) of the uni-junction timer circuit with R109 at 300K by observing the wave form at Q11 collector. Change R109 to a preferred value as close as possible to R (calculated below).

$$R = \frac{10 \times 300}{T} \text{ K ohms}$$

The time constant after modification should be 10 $\pm$ .5 seconds. The stop time should not be less than 55 seconds or greater than 65 seconds.

TACD	203/303 1500
NEXT ASSY. DWG. NO.(S)	PROGRAM (S)

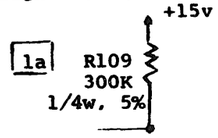
SHEET 1 OF 2

ENG 023

ENGINEERING CHANGE REQUEST / NOTICE NO 5698

b) Add Note reference designation (1a above) to remarks column of item 50 on all above assemblies drawings.

c) Add Note reference designation (1a above) to sheet 3, Zone F-5, shown below on schematics



2. Preferred values for "R" chosen from the following:

Res.	270K	17-000052-121
"	300K	" 122
"	330K	" 123
"	360K	" 124
"	390K	" 125
"	430K	" 126
"	470K	" 127
"	510K	" 128
Res	560K	17-000052-129

ENG 023-1

ENGINEERING CHANGE REQUEST / NOTICE

NO 5618

CHANGE EFFECTS	Y	N	PART/MATL DISPOSITION: USE AS IS	REWORK	SCRAP
INTERCHANGEABILITY	✓				
TOOLING		✓			
FIXTURES		✓			
TEST EQUIPMENT		✓			
PARTS IN STOCK	✓		✓	✓	
PARTS IN PROCESS	✓		✓		
PARTS ON ORDER	✓				
PARTS @ CUST DEPOTS		✓			

REQUESTOR/DATE: Jo Ann Brengard 4/17/75
QUALITY ASSURANCE:
DEPT' SUPERVISOR:
TEST EQUIPMENT:
MANUFACTURING:
CONF. CONT. BOARD:
PRODUCT ENG.:
CUSTOMER:
PRODUCTION CONTROL:
END ITEM EFFECTIVITY:

DOCUMENT NO: NOTED
REV:
DOCUMENT TITLE: NOTED

CHANGE TYPE
CLASS 1 ☑
CLASS 2 ☐
RECORD ☐

ACCEPTED ☑
REJECTED ☐

REASON FOR REJECTION:

REASON FOR CHANGE: PAR 2790 2236 To eliminate extra sector transducer pulses

DESCRIPTION OF CHANGE:

* SLFFVNSIRLNKBAAVCHAAAA

302120	Rev R	Drive Electronics Module Assembly		
302121	Rev K	" " "	Schematic	
302820	REV E	" " "	Assembly	
E302820	Rev E	" " "	Schematic	
301671	Rev T	" " "	Assembly	
301672	Rev M	" " "	Schematic	
302085	Rev R	" " "	Assembly	
302086	Rev L	" " "	Schematic	
302104	Rev P	" " "	Assembly	
302105	Rev K	" " "	Schematic	
302271	Rev M	" " "	Assembly	
302272	Rev J	" " "	Schematic	
301000	Rev AZ	Disk Drive Assembly 303/2		
301500	Rev AT	Disk Drive Assembly 303/1		
302819	Rev B	Disk Drive Assembly 303FA/1		
302525	Rev G	Disk Drive Assembly 303FA/2		
302999	Rev "New"	Harness Assembly 303 (Next Assy: 301000,301500,302819 & 302525)		
303000	Rev "New"	Shield Assembly (Next Assy: " " " ")		
303001	Rev "New"	Transducer Assy, Upper (Next Assy: 303000)		

K INACTIVATE 301386 Harness Assembly
F INACTIVATE 301245 Shield Assembly
E INACTIVATE 301402 Transducer Assembly Upper
E 302900 Rev B Honeywell Spares Kit 3 DIST
C 302901 Rev B " " " 2 FSC
V 302902 Rev B Honeywell Spares Kit 1 CLD

ISSUED

1 1975

NEXT ASSY. DWG. NO.(S)	PROGRAM (S)	SHEET 1 OF 5
	303 & Fast Access	

ENG 023

ENGINEERING CHANGE REQUEST / NOTICE NO 5648

2. 302120 Assembly DEM: (All dash numbers)

a) Change qty of Item 97 FROM: 7 Req'd, 13-000041-001, Cap. .0022MF 80v C30,31,34,39,106 110,111

TO: 5 Req'd, 13-000041-001, Cap. .0022MF 80v C 34,39,106 110,111

2. 302820 Assembly DEM: (all dash Numbers)

a) Change qty of Item 97 FROM: 8 Req'd, 13-000041-001, Cap. .0022MF 80v C30,31,34,30,105, 36,110,111

TO: 6 Req'd, 13-000041-001, Cap. .0022MF 80v C 34,30,106 36,110,111

3. 302120 & 302820 Assemblies DEM:

a) Add Note: Add jumper on circuit side of board from TP6 to end of C46 where trace comes from R/W connector. Use Item 131

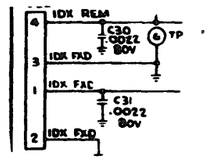
b) On sheet 2, board layout: show jumper 3a above

c) Delete C30 & C31 from reference designation chart

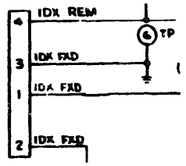
4. 302121 & E302820 Schematics DEM:

a) Change Sheet 2, Zone D-8:

FROM:



TO:



b) Add C30 & C31 to "Not Used Chart"

END 022-1

ENGINEERING CHANGE REQUEST / NOTICE NO 5618

5. 301671, 302104, 302271 & 302085 Assemblies DEM: (Cap. .0022MF, 80v) all dash numbers

   a) Change qty of Item 65 FROM: 7 Req'd, 13-000041-001, C24,25,36,86,87,88,89

   TO: 5 Req'd, 13-000041-001, C 36,86,87,88,89

6. 302484 DEM Assembly: (all dash numbers) (Cap. .0022MF, 80v)

   a) Change qty of Item 65 FROM: 8 Req'd, 13-000041-001, C24,25,36,86,87,88,89,17

   TO: 6 Req'd, 13-000041-001, C 36,86,87,88,89,17

7. 301671, 302104, 302271, 302085 & 302484 DEM Assemblies:

a) ADD TO MODIFICATION TABLE: Add jumper on circuit side of board from TP6 to end of C77 where trace comes from R/W connector. Use item (*) *(Note: Use proper item number for 28 awg wire 04-000429-001, call out on each DEM assembly)

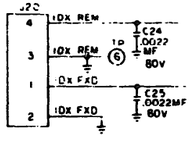
   b) DELETE C24 & C25 from "Reference Designation Table"

   c) On sheet 2, board layout: show jumper 7a above

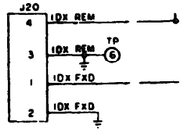
8. 301672, 302105, 302272, 302806 & 302485 DEM Schematics:

   a) CHANGE SHEET 2, ZONE D8:

FROM:



TO:



   b) ADD C24 & C25 to "Not Used Chart"

ENG 023-1

ENGINEERING CHANGE REQUEST / NOTICE NO 5618

9. 301000, 301500, 302819 & 302525 Drive Assemblies (all dash numbers):

a) CHANGE ITEM 9 FROM: 1 Req'd, 301245-019, Shield Assembly
TO: 1 Req'd, 303000-019, Shield Assembly

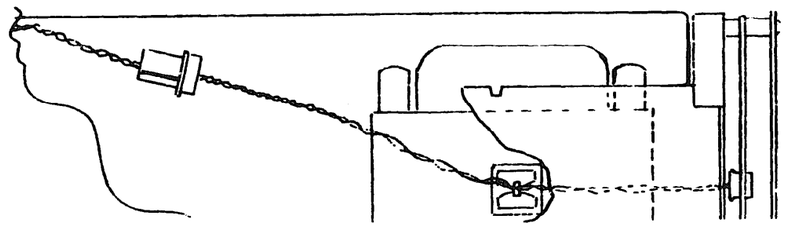
b) CHANGE ITEM 71 FROM: 1 Req'd, 301386-009, HARNESS Assembly
TO: 1 Req'd, 302999-009, Harness Assembly

c) ADD ITEM: 2 Req'd, 25-000080-004, Clamp, Cable

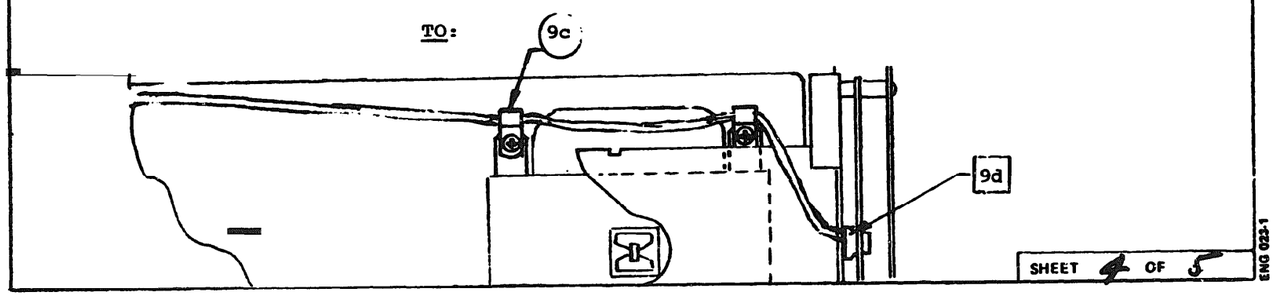
d) ADD NOTE: Connect white wire to pin 4 of P20 and black wire to pin 3.

e) CHANGE Sheet 3, Zone 3,4,5-F:

FROM:



TO:



SHEET 4 OF 5

ENG 022-1

ENGINEERING CHANGE REQUEST / NOTICE NO 5618

10. 302900 (Ref: Item 29), 302901 (Ref: Item 8), & 302902 (Ref: Item 13)

a) CHANGE FROM: 301402-009 Transducer Assembly (Quantities remain the same)
TO: 303001-009 Transducer Assembly

ENG 022-1

ENGINEERING CHANGE REQUEST / NOTICE

NO 4989

CHANGE EFFECTS	Y	N	PART/MATL DISPOSITION: USE AS IS	REWORK	SCRAP
INTERCHANGEABILITY		X			
TOOLING		X			
FIXTURES		X			
TEST EQUIPMENT		X			
PARTS IN STOCK		X			
PARTS IN PROCESS		X			
PARTS ON ORDER		X			
PARTS @ CUST DEPOTS		X			

REQUESTOR/DATE: JoAnn Brengard 8/6/74 JB

DEPT' SUPERVISOR

MANUFACTURING

PRODUCT ENG. Bokan

PRODUCTION CONTROL

QUALITY ASSURANCE

TEST EQUIPMENT

CONF. CONT. BOARD RW 9/9/74

CUSTOMER

DOCUMENT NO: 301672 — REV: E

DOCUMENT TITLE: Schematic Drive Electronics Module

CHANGE TYPE: CLASS 1 ☐ CLASS 2 ☐ RECORD ☒

ACCEPTED ☒ REJECTED ☐

END ITEM EFFECTIVITY:

REASON FOR CHANGE:
PAR #1734 & 1733

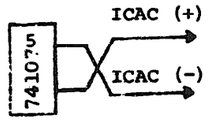
REASON FOR REJECTION:

THIS ECN WILL MAKE THIS DRAWING REV. RC 1

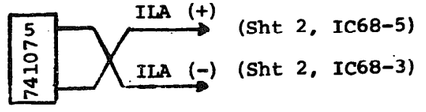
DESCRIPTION OF CHANGE

CHANGE ZONE E-1, PAGE 1

FROM:



TO:



ISSUED SEP 5 1974

301671	303/203
NEXT ASSY. DWG. NO.(S)	PROGRAM (S)

SHEET 1 OF 2

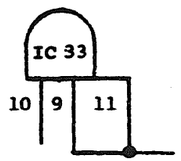
ENG 023

ENGINEERING CHANGE REQUEST / NOTICE

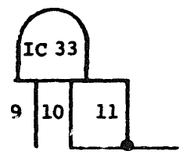
NO 4989

CHANGE ZONE D-3, PAGE 1, IC33

FROM:



TO:



SHEET 1 OF 2

ENG 023-1

ENGINEERING CHANGE REQUEST / NOTICE

NO 5193

CHANGE EFFECTS	Y	N	PART/MATL DISPOSITION: USE AS IS	REWORK	SCRAP
INTERCHANGEABILITY		X			
TOOLING		X			
FIXTURES		X			
TEST EQUIPMENT		X			
PARTS IN STOCK		X			
PARTS IN PROCESS		X			
PARTS ON ORDER		X			
PARTS @ CUST DEPOTS		X			

REQUESTOR/DATE: H. Robinson 9/5/74	QUALITY ASSURANCE	DOCUMENT NO: 301672	REV
DEPT SUPERVISOR	TEST EQUIPMENT	DOCUMENT TITLE: SCHEMATIC DRIVE ELECTRONICS MODULE	
MANUFACTURING	CONF. CONT. BOARD		
PRODUCT ENG.	CUSTOMER	CHANGE TYPE: CLASS 1 ☐ CLASS 2 ☑ RECORD ☐	
PRODUCTION CONTROL		ACCEPTED ☑ REJECTED ☐	
END ITEM EFFECTIVITY:			

REASON FOR CHANGE:
PAR 2193 (Elimination of ECN 3487)

REASON FOR REJECTION:

THIS CHANGE MAKES THIS DRAWING REV. 1

DESCRIPTION OF CHANGE:

CHANGE FROM: IC11 A, IC11 B 75452
IC29 A, IC29 B 75452

TO: IC11 7438
IC29 7438

ISSUED

NEXT ASSY. DWG. NO.(S)	PROGRAM (S)	SHEET 1 OF 1
301671	203/303	

ENG 023

ENGINEERING CHANGE REQUEST / NOTICE

NO 5491

CHANGE EFFECTS	Y	N	PART/MATL DISPOSITION: USE AS IS	REWORK	SCRAP
INTERCHANGEABILITY					
TOOLING					
FIXTURES					
TEST EQUIPMENT					
PARTS IN STOCK					
PARTS IN PROCESS					
PARTS ON ORDER					
PARTS @ CUST DEPOTS					

REQUESTOR/DATE	QUALITY ASSURANCE	DOCUMENT NO	REV
Mike Ranger 2/5/75		301672	F
DEPT' SUPERVISOR	TEST EQUIPMENT	DOCUMENT TITLE	
MANUFACTURING	CONF. CONT. BOARD	DRIVE ELECTORNIC MODULE SCHEMATIC	
PRODUCT ENG.	CUSTOMER	CHANGE TYPE	
PRODUCTION CONTROL		CLASS 1 ☐ CLASS 2 ☒ RECORD ☐	
END ITEM EFFECTIVITY:		ACCEPTED ☒ REJECTED ☐	

REASON FOR CHANGE:

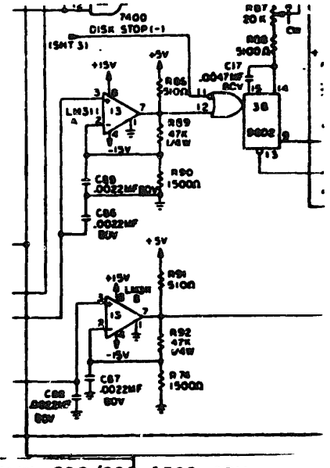
PAR 2538 (Ref: TEA 026)

REASON FOR REJECTION:

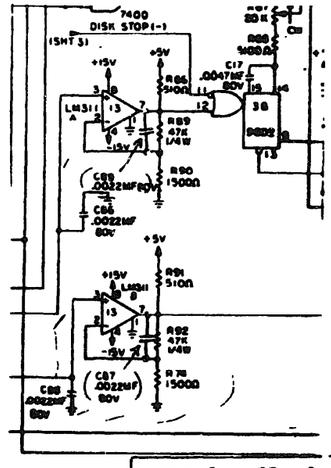
DESCRIPTION OF CHANGE:

CHANGE SHEET 2, ZONE D-6

FROM:



TO:



301671

NEXT ASSY. DWG. NO.(S)	PROGRAM (S) 203/303 1500 RPM	SHEET 1 OF 1

ENG 023

ENGINEERING CHANGE REQUEST / NOTICE

NO 5587

CHANGE EFFECTS	Y	N	PART/MATL DISPOSITION: USE AS IS	REWORK	SCRAP
INTERCHANGEABILITY		X			
TOOLING		X			
FIXTURES		X			
TEST EQUIPMENT		X			
PARTS IN STOCK		X			
PARTS IN PROCESS		X			
PARTS ON ORDER		X			
PARTS @ CUST DEPOTS		X			

REQUESTOR/DATE: 3/18/75
QUALITY ASSURANCE: 4/9/75
DEPT' SUPERVISOR:
TEST EQUIPMENT:
MANUFACTURING: 4/9/75
CONF. CONT. BOARD: 4/9/75
PRODUCT ENG.:
CUSTOMER:
PRODUCTION CONTROL:
END ITEM EFFECTIVITY: Next Bldg - open P.O. if possible

DOCUMENT NO: NOTED
REV:
DOCUMENT TITLE: NOTED

CHANGE TYPE
CLASS 1 ☐
CLASS 2 ☐
RECORD ☒
ACCEPTED ☒
REJECTED ☐

REASON FOR CHANGE: PAR 2761 Documentation Error

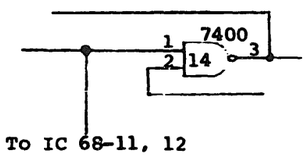
REASON FOR REJECTION:

DESCRIPTION OF CHANGE:

1 RC1 302485 Rev A Drive Electronic Module Schematic
2 RC2 302272 Rev F Drive Electronic Module Schematic
3 RC2 301672 Rev J Drive Electronic Module Schematic
4 RC1 302747 Rev X2 Temperature Compensation Board, Schematic

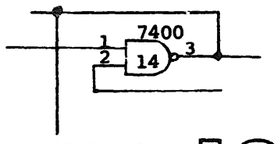
CHANGE ZONE C-7, SHT 1, ON DRAWINGS 302485, 302272 & 301672

FROM:



To IC 68-11, 12

TO:



To IC68-11, 12

CHANGE ZONE H-5 ON DRAWING 302747 FROM:

R12
20K
1%

TO:

R12
2K
1%

ISSUED
APR 10 1975

TACD	203/303 1500/2400 RPM
NEXT ASSY. DWG. NO.(S)	PROGRAM (S)

SHEET 1 OF 1

ENG 023

ENGINEERING CHANGE REQUEST / NOTICE

NO. 5617

CHANGE EFFECTS	Y	N	PART/MATL DISPOSITION: USE AS IS	REWORK	SCRAP
INTERCHANGEABILITY		X			
TOOLING		X			
FIXTURES		X			
TEST EQUIPMENT		X			
PARTS IN STOCK					
PARTS IN PROCESS					
PARTS ON ORDER					
PARTS @ CUST DEPOTS					

REQUESTOR/DATE: Mike Ranger 4/16/75

DEPT' SUPERVISOR:

MANUFACTURING:

PRODUCT ENG.:

PRODUCTION CONTROL:

END ITEM EFFECTIVITY: RECORD

QUALITY ASSURANCE:

TEST EQUIPMENT:

CONF. CONT. BOARD: 4/16/75

CUSTOMER:

REASON FOR REJECTION:

DOCUMENT NO: Noted

REV:

DOCUMENT TITLE: Noted

CHANGE TYPE
- CLASS 1 ☐
- CLASS 2 ☐
- RECORD ☒

- ACCEPTED ☒
- REJECTED ☐

REASON FOR CHANGE: PAR #2773 — Drawing error made when incorporating ECN 3487

DESCRIPTION OF CHANGE:

301672 Rev J Schematic, Drive Electronic Module (1500 RPM)
302485 Rev A Schematic, Drive Electronic Module (2400 RPM)

SEE SHEET 2 OF ECN FOR CHANGES:

ISSUED

APR 16 1975

NEXT ASSY. DWG. NO.(S)	PROGRAM (S)
301671 302484	203/303 1500 & 2400 RPM

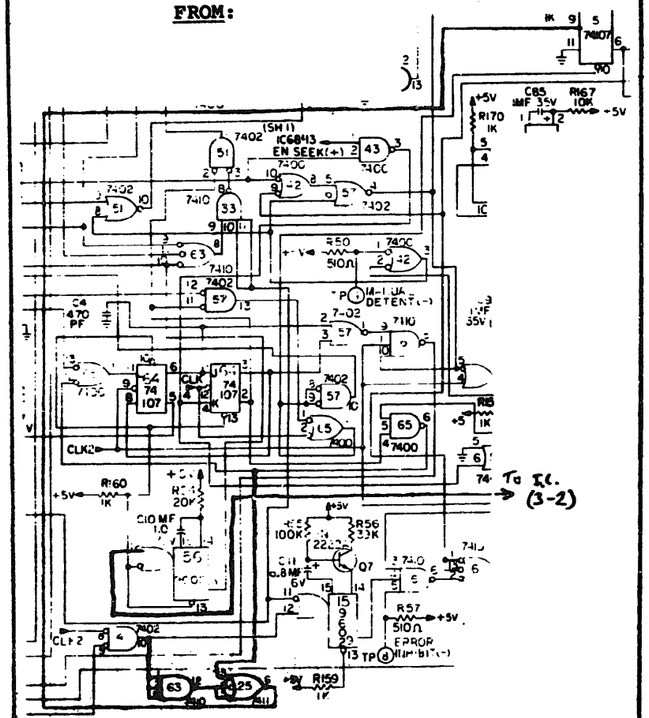
SHEET 1 OF 2

ENG 023

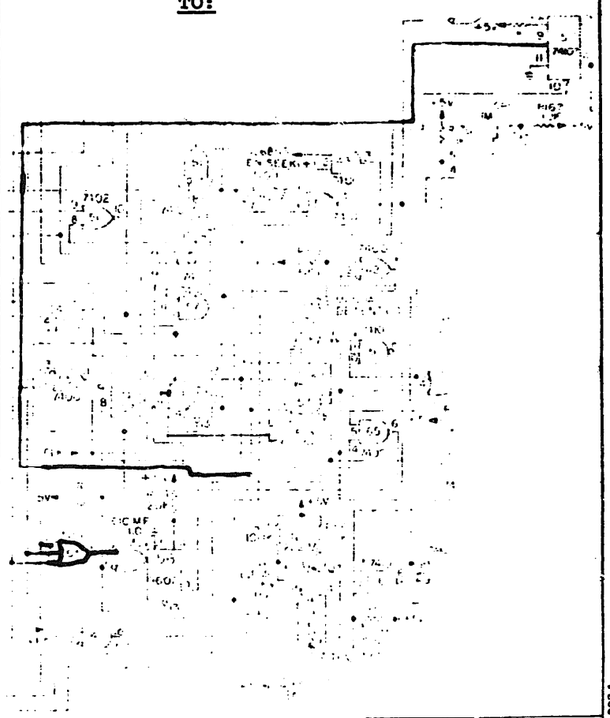
ENGINEERING CHANGE REQUEST / NOTICE NO 5617

CHANGE SHEET 1, ZONES 1,2,3 & 4 - A,B,C,D & E:

FROM:



TO:



SHEET 2 OF 2

ENG 023-1

ENGINEERING DRAWING CONFIGURATIONS

Assembly: Read/Write Amplifier

PC Board Assembly P/N 301174		Applicable Schematic Dwg No. 301171		
Rev	ECN	Rev	ECN	
M - Baseline		K - Baseline		
	4731			
	4775			
N	4919	L	4918	
	5028			
P	4803	M	4802	(N/A -009 Configuration only)

NOTES: UNLESS OTHERWISE SPECIFIED,
1. BOTH ENDS OF JUMPERS TO BE WIRE WRAPPED USING 28AWG WIRE (ITEM 60).

301174 M

26	26	55	12-000028 -001	DIO IN4448	CR1 THRU 19, 24 THRU 30	
2	2	54	12-000270 -001	DIO IN753A 6.2 V	CR 20,21	
2	2	53	12-000618 -001	DIO IN5230B 4.7 V	CR22,23	
9	9	52	13-000521 -001	CAP .01MF 100V	C [illegible]28,30, [illegible] THRU	
13	13	51	13-000037 -033	2.2MF 20V	C [illegible]10,13,14, 15,[illegible]19,21,24, 29,31	
2	2	50	13-000041 -013	.022MF 80V	C11,23	
4	4	49	13-000034 -019	6.8MF 6V	C25,27,33,34	
6	6	47	13-000043 -054	820PF 500 V	C2,3,4,5,9	
1	1	46	13-000043 -051	620PF 500 V	C16	
1	1	45	13-000043 -030	CAP 100PF 500 V	C 26	
1	1	44	14-000045 -004	POT 100Ω	R21	
2	2	43	53-000054 -071	RES 47K 1/4W 2%	R77, 78	
2	2	42	16-000307 -056	POT 270Ω .3 W 3%	R 31, R20	
1	1	41	16-000307 -145	RES 240Ω .3 W 3%	R35	
1	1	40	17-000052 -026	27Ω 1/4W 5%	R53	
2	2	39	17-000052 -023	22Ω	R 1,4	
2	2	38	17-000052 -017	12Ω	R36,39	
3	3	37	17-000052 -015	10Ω 1/4W 5%	R25,26,30	
1	1	36	53-000054 -052	7500Ω 1/4W 2%	R65	
2	2	35	53-000054 -051	6800Ω	R27, R76	
1	1	34	53-000054 -050	6200Ω	R46	
3	3	33	53-000054 -042	3K	R13, R74, R75	
1	1	32	53-000054 -046	5100Ω	R 71	
4	4	31	53-000054 -047	4700Ω	R14,17 13,34	
1	1	30	53-000054 -043	3300Ω	R28	
9	9	29	53-000054 -040	2400Ω	R5 THPU 12, ,70	
2	5	28	53-000054 -039	2K	R15,18,67,68,69	
2	2	27	53-000054 -036	1500Ω	R 42,43	
2	2	26	53-000054 -034	RES 1200Ω 1/4W 2%	R57,60	

1	1	25	53-000054 -019	RES 300Ω 1/4W 2%	R73	
3	3	24	53-000054 -032	RES 1K 1/4W 2%	R2,3,29	
		23				
4	4	22	53-000054 -030	820Ω	R47,48,49,50	
1	1	21	53-000054 -028	680Ω	R54	
2	2	20	53-000054 -027	620Ω	R44,45	
2	2	19	53-000054 -023	430Ω	R63,64	
9	9	18	53-000054 -001	51Ω	R22,32,33,37, 38,51,52,66	
1	1	17	53-000054 -010	120Ω	R58	
4	4	16	53-000054 -008	100Ω	R40,41,61,62	
1	1	15	53-000054 -005	75Ω	R59	
1		14	53-000054 -048	RES 5100Ω 1/4W 2%	R72	
1	1	13	53-000054 -029	RES 750Ω 1/4W 2%	R24	
3	3	12	11-000301 -001	XSTR 2N2369A	Q16,17,	
7	7	11	11-000275 -001	XSTR 2N2907A	Q6,8,9,10,11,14, 15	
8	8	10	11-000060 -001	XSTR 2N2222A	Q1,2,3,4,5,7, 12,13	
1		9	11-000060 -001	XSTR 2N2222A	Q18	
1		8	25-000166 -001	=AD-XSTR		
1	1	7	10-000274 -002	IC 733	IC 4	
1	1	6	10-000517 -001	74107	IC 3	
2	2	5	10-000621 -001	1035	IC 5,6	
2	2	4	10-000011 001	7402	IC 1,2	
1	1	3	10-000009 -001	IC 7400	IC 7	
		2				
1	1	1	301172 -001	R/W AMPLIFIER P.C. BOARD		

A/R	A/R	64	08-000338 -002	SLEEVING TEFLON	18 GA	
1	1	63	13-000043 -036	CAP 180PF 500V	C12	
2	2	62	53-000054 -012	RES 150 1/4W 2%	R55, R56	
22	22	61	35-000162 -001	POST MOD II		
A/P	A/R	60	04-000429 -001	WIRE, WIRE WRAP		UL STYLE 1422
1	1	59	80-000153 -001	XFMR IZPHA	T2	
1	1	58	80-000153 002	XFMR IZSHA	T1	
2	2	57	80-000150 -004	.33 μH. COIL	L1, L2	
1	1	56	40-000161 -001	DL 150NS	DL1	

QTY 019 009 | ITEM | PART NO | DESCRIPTION | REF DESIGNATION | REMARKS

QTY | ITEM | PART NO. | DESCRIPTION | REF DESIGNATION | REMARKS

QTY 019 009 | ITEM | PART NO | DESCRIPTION | REF DESIGNATION | REMARKS

REVISIONS REV	ECN	DATE	APPV
A	1162	12/3	[illegible]
B	1350	12/7 [illegible]	[illegible]
C	ECN 1556	4/11/72	[illegible]
D	PER ECN 1770	[illegible]	[illegible]
E	PER ECN 1885	[illegible]	[illegible]
F	PER ECN 2094	[illegible]	[illegible]
G	PER ECN 2123	[illegible]	[illegible]
H	ECN 2123	[illegible]	[illegible]
J	ECN 2282	[illegible]	[illegible]
K	ECN 2724	[illegible]	[illegible]
L	PER ECN 3650	[illegible]	[illegible]
M	ECN 4431	[illegible]	[illegible]

CÆLUS MEMORIES INC.
SAN JOSE CALIFORNIA

UNLESS OTHERWISE SPECIFIED TOLERANCES .X ± .XX ANGLES ± MACHINED SURF. APPLICABLE SPECIFICATIONS REF

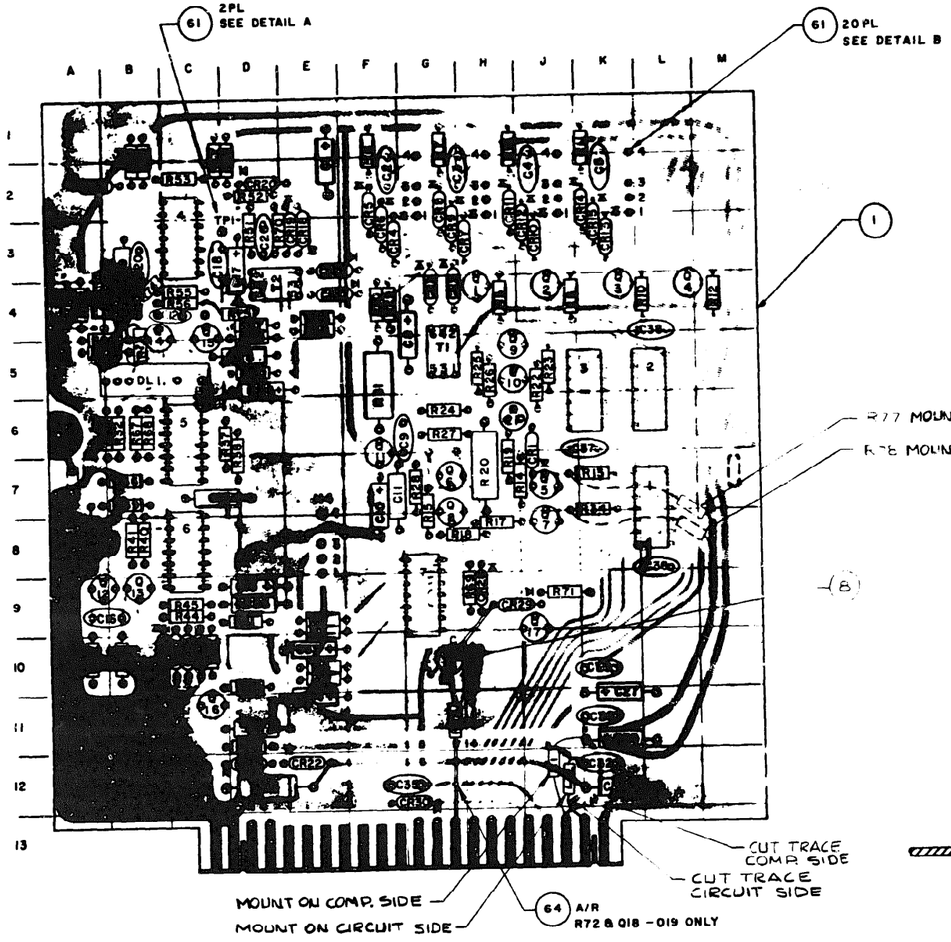
Drawing [illegible] DATE 11/11/71
CHECKED [illegible] 4/5/72
DESIGN [illegible] 7/1/71
PROJ. ENG. [illegible] 1/31/72
NEXT ASSY 303
NEXT HIGH ASSY [illegible]

TITLE ASSEMBLY READ/WRITE AMP

THE INFORMATION ON THIS DRAWING MAY NOT BE DISSEMINATED WITHOUT AUTHORIZATION OF CÆLUS MEMORIES, INC.

SCALE 2/1 SHT 1 OF 2 | DO 301174 | REV M

B 301174



Q18	10G
Q17	9J
Q16	11C
Q15	4C
Q14	4B
Q13	9B
Q12	8A
Q11	6F
Q10	5H
Q9	5H
Q8	8G
Q7	8J
Q6	7G
Q5	7J
Q4	4L
Q3	4K
Q2	4J
Q1	4H
DL1	5B
IC7	9G
IC6	8C
IC5	6C
IC4	3C
IC3	5K
IC2	5L
IC1	7L

CR30	12B
CR29	9H
CR28	9H
CR27	10C
CR26	10C
CR25	10C
CR24	10B
CR23	12D
CR22	12E
CR21	2A
CR20	2D
CR19	3E
CR18	3E
CR17	4E
CR16	3E
CR15	3K
CR14	2K
CR13	3K
CR12	3J
CR11	2H
CR10	3J
CR9	3G
CR8	2G
CR7	3H
CR6	3F
CR5	2F
CR4	3F
CR3	4G
CR2	4G
CR1	7J

R32	6B
R31	5F
R30	4F
R29	4F
R28	7G
R27	6G
R26	5H
R25	5H
R24	6G
R23	5J
R22	5J
R21	6H
R20	7H
R19	7H
R18	9G
R17	8H
R16	—
R15	7G
R14	7H
R13	7K
R12	4M
R11	1K
R10	4L
R9	3G
R8	4J
R7	1G
R6	1F
R5	4H
R4	10E
R3	10E
R2	9E
R1	9E

R64	4B
R63	5B
R62	11D
R61	9D
R60	5D
R59	4D
R58	4E
R57	4D
R56	4C
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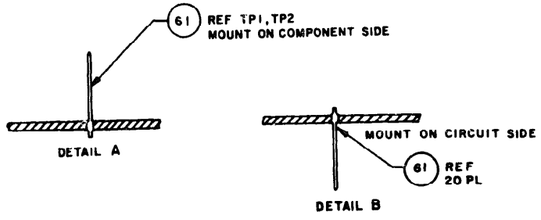
R54	4A
R53	2C
R52	2D
R51	3D
R50	1B
R49	1B
R48	1D
R47	1C
R46	4E
R45	9C
R44	9C
R43	10B
R42	10A
R41	8B
R40	8B
R39	7B
R38	6D
R37	6D
R36	7B
R35	12D
R34	7K
R33	6A

C15	9D
C14	8A
C13	7C
C12	4C
C11	7F
C10	7F
C9	6G
C8	4G
C7	11D
C5	2K
C4	2J
C3	2H
C2	2F
C1	1E
R78	8K
R77	7K
R76	4A
R75	4C
R74	4B
R73	5B
R72	11G
R71	9J
R70	3D
R69	9H
R68	6B
R67	6B
R66	10C
R65	10D

T2	4D
T1	5G
L2	12J
L1	12J
C38	4L
C37	6K
C36	8L
C35	12F
C34	11E
C33	10E
C32	12K
C31	12K
C30	11K
C29	11K
C28	10K
C27	11K
C26	3D
C25	9D
C24	5D
C23	5D
C22	4B
C21	4A
C20	3B
C19	3B
C18	3C
C17	3D
C16	9A



SCALE 2/1 SHT 2 OF 2 — 301174 — REV M

NOTES: UNLESS OTHERWISE SPECIFIED,
1. BOTH ENDS OF JUMPERS TO BE WIRE WRAPPED USING 28AWG WIRE (ITEM 60).

QTY	ITEM	PART NO.	DESCRIPTION	REF DESIGNATION	REMARKS
A/R	64	08-000338-002	SLEEVING TEFLON	18 GA	
1	63	13-000043-036	CAP 180PF 500V	C12	
2	62	53-000054-012	RES 150Ω 1/4W 2%	R55, R56	
2	61	35-000162-001	POST MOD II		
A/R	60	04-000429-001	WIRE, WIRE WRAP		UL STYLE 1422
1	59	80-000153-001	XFMR IZPHA	T2	
1	58	80-000153-002	XFMR IZSHA	T1	
2	57	80-000150-004	.33 μH. COIL	L1, L2	
1	56	40-000161-001	DL 150NS	DL1	
26	55	12-000028-001	DIO IN4448	CR1 THRU 19, 24 THRU 30	
2	54	12-000270-001	DIO IN753A 6.2 V	CR20,21	
2	53	12-000618-001	DIO IN5230B 4.7 V	CR22,23	
9	52	13-000521-001	CAP .01MF 100V	C18,20,28,30, 32,35 THRU 38	
13	51	13-000037-033	2.2MF 20V	C1,7,8,10,13,14, 15,17,19,21,24, 29,31	
2	50	13-000041-013	.022MF 80V	C11,23	
4	49	13-000034-019	6.8MF 6V	C25,27,33,34	
6	47	13-000043-054	820PF 500V	C2,3,4,5,9	
1	46	13-000043-051	620PF 500V	C16	
1	45	13-000043-030	CAP 100PF 500V	C26	
1	44	14-000045-004	POT 100Ω	R21	
2	43	53-000054-07[illegible]	RES 4[illegible] 1/4W 2%	R[illegible],78	
2	42	16-000307-056	270Ω 2.5W 5%	R31,R20	
1	41	16-000307-145	240Ω 2.5W 5%	R35	
1	40	17-000052-026	27Ω 1/4W 5%	R53	
2	39	17-000052-023	22Ω	R1,4	
2	38	17-000052-017	12Ω	R36,39	
3	37	17-000052-015	10Ω 1/4W 5%	R25,26,30	
1	36	53-000054-052	7500Ω 1/4W 2%	R65	
2	35	53-000054-051	6800Ω	R27,R76	
1	34	53-000054-050	6200Ω	R46	
3	33	53-000054-042	3K	R13,R74,R75	
1	32	53-000054-046	5100Ω	R71	
4	31	53-000054-047	4700Ω	R14,17,13,34	
1	30	53-000054-043	3300Ω	R28	
9	29	53-000054-040	2400Ω	R5 THRU 12, ,70	
2	28	53-000054-039	2K	R15,18,67,68,69	
2	27	53-000054-036	1500Ω	R42,43	
2	26	53-000054-034	RES 1200Ω 1/4W 2%	R57,60	
1	25	53-000054-019	RES 300Ω 1/4W 2%	R73	
3	24	53-000054-032	RES 1K 1/4W 2%	R2,3,29	
	23				
4	22	53-000054-030	820Ω	R47,48,49,50	
1	21	53-000054-028	680Ω	R54	
2	20	53-000054-027	620Ω	R44,45	
2	19	53-000054-023	430Ω	R63,64	
9	18	53-000054-001	51Ω	R22,32,33,37, 38,51,52,66	
1	17	53-000054-010	120Ω	R58	
4	16	53-000054-008	100Ω	R40,41,61,62	
1	15	53-000054-005	75Ω	R59	
1	14	53-000054-048	RES 5100Ω 1/4W 2%	R72	
1	13	53-000054-029	RES 750Ω 1/4W 2%	R24	
4	12	11-000301-001	XSTR 2N2369A	Q16,17,5,7	
7	11	11-000275-001	XSTR 2N2907A	Q6,8,9,10,11,14, 15	
6	10	11-000060-001	XSTR 2N2222A	Q1,2,3,4, 12,13	
1	9	11-000060-001	XSTR 2N2222A	Q18	
1	8	25-000165-00	PAD [illegible]		
1	7	10-000274-002	IC 733	IC 4	
1	6	10-000517-001	74107	IC 3	
2	5	10-000621-001	1035	IC 5,6	
2	4	10-000011-001	7402	IC 1,2	
1	3	10-000009-001	IC 7400	IC 7	
	2				
1	1	301172-001	R/W AMPLIFIER P.C. BOARD		

ITEM	PART NO	DESCRIPTION	REF DESIGNATION	REMARKS

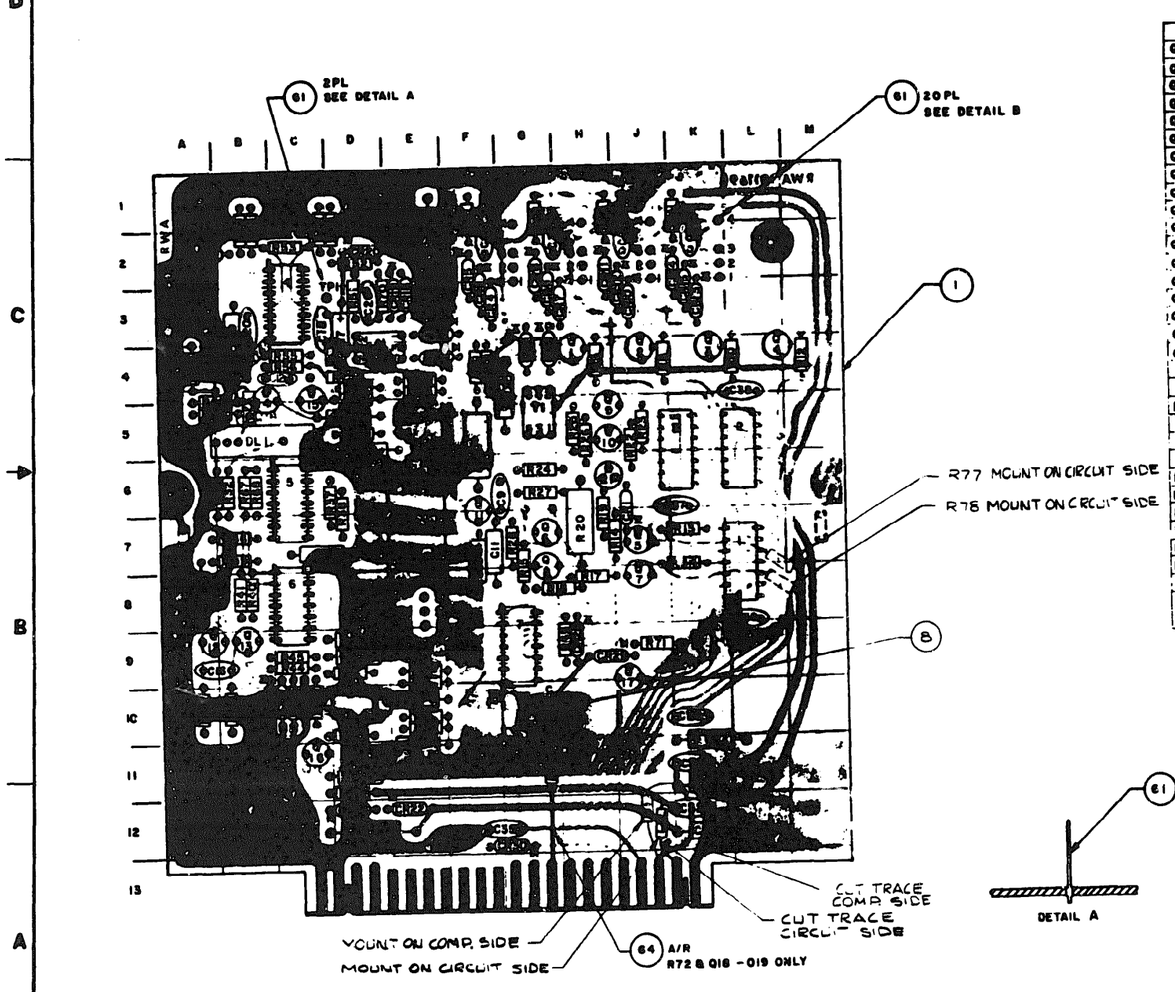
HISTORY

CÆLUS MEMORIES INC.
SAN JOSE CALIFORNIA

ASSEMBLY
READ/WRITE AMP

SCALE 2/1
SHT 1 OF 2
301174

301174



Ref Desig	Location
Q16	10G
Q17	9J
Q16	11C
Q15	4C
Q14	4B
Q13	9B
Q12	9A
Q11	8F
Q10	8H
Q9	8H
Q8	8G
Q7	8J
Q6	7G
Q5	7J
Q4	4L
Q3	4K
Q2	4J
Q1	4H
DL1	6B
IC7	9G
IC6	8C
IC5	6C
IC4	3C
IC3	5K
IC2	5L
IC1	7L

Ref Desig	Location
CR30	12B
CR29	9H
CR28	9H
CR27	10C
CR26	10C
CR25	10C
CR24	10B
CR23	12D
CR22	12E
CR21	2A
CR20	2D
CR19	3E
CR18	3E
CR17	4E
CR16	3E
CR15	3K
CR14	2K
CR13	3K
CR12	3J
CR11	2H
CR10	3J
CR9	3G
CR8	2G
CR7	3H
CR6	3F
CR5	2F
CR4	3F
CR3	4G
CR2	4G
CR1	7J

Ref Desig	Location
R32	6B
R31	6F
R30	4F
R29	4F
R28	7G
R27	6G
R26	8H
R25	8H
R24	6G
R23	5J
R22	5J
R21	6H
R20	7H
R19	7H
R18	8G
R17	8H
R16	—
R15	7G
R14	7H
R13	7K
R12	4M
R11	1K
R10	4L
R9	3G
R8	4J
R7	1G
R6	1F
R5	4H
R4	10E
R3	10E
R2	9E
R1	9E

Ref Desig	Location
R64	4B
R63	5B
R62	11G
R61	9J
R60	8D
R59	4D
R58	4E
R57	4D
R56	4C
R55	4C
R54	4A
R53	2C
R52	2D
R51	3D
R50	1B
R49	1B
R48	1D
R47	1C
R46	4E
R45	9C
R44	9C
R43	10B
R42	10A
R41	8B
R40	8B
R39	7B
R38	6D
R37	6D
R36	7B
R35	12D
R34	7K
R33	6A

Ref Desig	Location
C16	9D
C14	8A
C13	7C
C12	4C
C11	7F
C10	7F
C9	6B
C8	4G
C7	11D
C6	2K
C4	2J
C3	2H
C2	2F
C1	1E
R78	2K
R77	7K
R76	4A
R75	4C
R74	4B
R73	5B
R72	11G
R71	9J
R70	3D
R69	9H
R68	6B
R67	6B
R66	10C
R65	10D

Ref Desig	Location
-2	4D
T1	3G
-2	2-
-1	-C-
C38	4L
C37	6K
C36	8L
C35	12F
C34	11E
C33	10E
C32	12K
C31	12K
C30	11K
C29	11K
C28	10K
C27	11K
C26	3D
C25	9D
C24	9D
C23	9D
C22	4B
C21	4A
C20	3B
C19	3B
C18	3C
C17	3D
C16	9A

61 REF TP1, TP2 MOUNT ON COMPONENT SIDE

DETAIL A

MOUNT ON CIRCUIT SIDE

61 REF 20 PL

DETAIL B

SCALE 2/1 — SHT 2 OF 2 — 301174

NOTES: UNLESS OTHERWISE SPECIFIED,
1. BOTH ENDS OF JUMPERS TO BE WIRE WRAPPED USING 28AWG WIRE (ITEM 60).

A/P	A/R	ITEM	PART NO.	DESCRIPTION	REF DESIGNATION	REMARKS
		64	08-000336-002	SLEEVING TEFLON	18 GA	
1	1	63	13-000043-036	CAP 180PF 500V	C12	
2	2	62	53-000054-012	RES 150Ω 1/4W 2%	R55, R56	
22	2	61	35-000162-001	POST MOD II		
A/P	A/R	60	04-000429-001	WIRE, WIRE WRAP		UL STYLE 1422
1	1	59	80-000153-001	XFMR IZPHA	T2	
1	1	58	80-000153-002	XFMR IZSHA	T1	
2	2	57	80-000150-004	.33 μH. COIL	L1, L2	
1	1	56	40-000161-001	DL 150NS	DL1	
26	26	55	12-000028-001	DIO IN4448	CR1 THRU 19, 24 THRU 30	
2	2	54	12-000270-001	DIO IN753A 6.2V	CR 20,21	
2	2	53	12-000618-001	DIO IN5230B 4.7V	CR22,23	
9	9	52	13-000521-001	CAP .01MF 100V	C18,20,28,30, 32,35 THRU 38	
13	13	51	13-000037-033	2.2MF 20V	C1,7,8,10,13,14, 15,17,19,21,24, 29,31	
2	2	50	13-000041-013	.022MF 80V	C11,23	
4	4	49	13-000034-019	6.8MF 6V	C25,27,33,34	
6	6	47	13-000043-054	820PF 500V	C2,3,4,5,9	
1	1	46	13-000043-051	620PF 500V	C16	
2	1	45	13-000043-030	CAP 100PF 500V	C26 / C39 -019 ONLY	
1	1	44	14-000045-004	POT 100Ω	R21	
2	2	43	53-000054-017	RES 4 1.4W 2%	R77, 78	
2	2	42	16-000307-056	270Ω 2.5W 5%	R 31, R20	
1	1	41	16-000307-145	240Ω 2.5W 5%	R35	
1	1	40	17-000052-026	27Ω 1/4W 5%	R53	
2	2	39	17-000052-023	22Ω	R1,4	
2	2	38	17-000052-017	12Ω	R36,39	
3	3	37	17-000052-015	10Ω 1/4W 5%	R25,26,30	
1	1	36	53-000054-052	7500Ω 1/4W 2%	R65	
2	2	35	53-000054-051	6800Ω	R27, R76	
1	1	34	53-000054-050	6200Ω	R46	
3	3	33	53-000054-042	3K	R13, R74, R75	
1	1	32	53-000054-046	5100Ω	R 71	
4	4	31	53-000054-047	4700Ω	R14,17,13,34	
1	1	30	53-000054-043	3300Ω	R28	
9	9	29	53-000054-040	2400Ω	R5 THRU 12, 70	
2	5	28	53-000054-039	2K	R15,18,67,68,69	
2	2	27	53-000054-036	1500Ω	R 42,43	
2	2	26	53-000054-034	RES 1200Ω 1/4W 2%	R57,60	
1	1	25	53-000054-019	RES 300Ω 1/4W 2%	R73	
3	3	24	53-000054-032	RES 1K 1/4W 2%	R2,3,29	
		23				
4	4	22	53-000054-030	820Ω	R47,48,49,50	
1	1	21	53-000054-028	680Ω	R54	
2	2	20	53-000054-027	620Ω	R44,45	
2	2	19	53-000054-023	430Ω	R63,64	
9	9	18	53-000054-001	51Ω	R22,23,32,33,37, 38,51,52,66	
1	1	17	53-000054-010	120Ω	R58	
4	4	16	53-000054-008	100Ω	R40,41,61,62	
1	1	15	53-000054-005	75Ω	R59	
1		14	53-000054-049	RES 5100Ω 1/4W 2%	R72	
1	1	13	53-000054-029	RES 750Ω 1/4W 2%	R24	
4	4	12	11-000301-001	XSTR 2N2369A	Q16,17,[illegible]	
7	7	11	11-000275-001	XSTR 2N2907A	Q6,8,9,10,11,14, 15	
6	5	10	11-000060-001	XSTR 2N2222A	Q1,2,3,4, 12,13	
1		9	11-000060-001	XSTR 2N2222A	Q18	
1		8	25-000165-00	PACKETER		
1	1	7	10-000274-002	IC 733	IC 4	
1	1	6	10-000517-001	74107	IC 3	
2	2	5	10-000621-001	1035	IC 5,6	
2	2	4	10-000011-001	7402	IC 1,2	
1	1	3	10-000009-001	IC 7400	IC 7	
		2				
1	1	1	301172-001	R/W AMPLIFIER P.C. BOARD		

REVISIONS REV	ECO	DATE	APPR
A	1162	12/8/71	JN
B	ECN 1350	12/8/71	JN
C	ECN 1556	6/2/72	JN
D	ECN 1313	10/19/72	JN

CÆLUS MEMORIES INC.
SAN JOSE CALIFORNIA

UNLESS OTHERWISE SPECIFIED TOLERANCES: X ±.03, ANGLES ±1°, MACHINED ±.005

APPLICABLE SPECIFICATIONS REF:

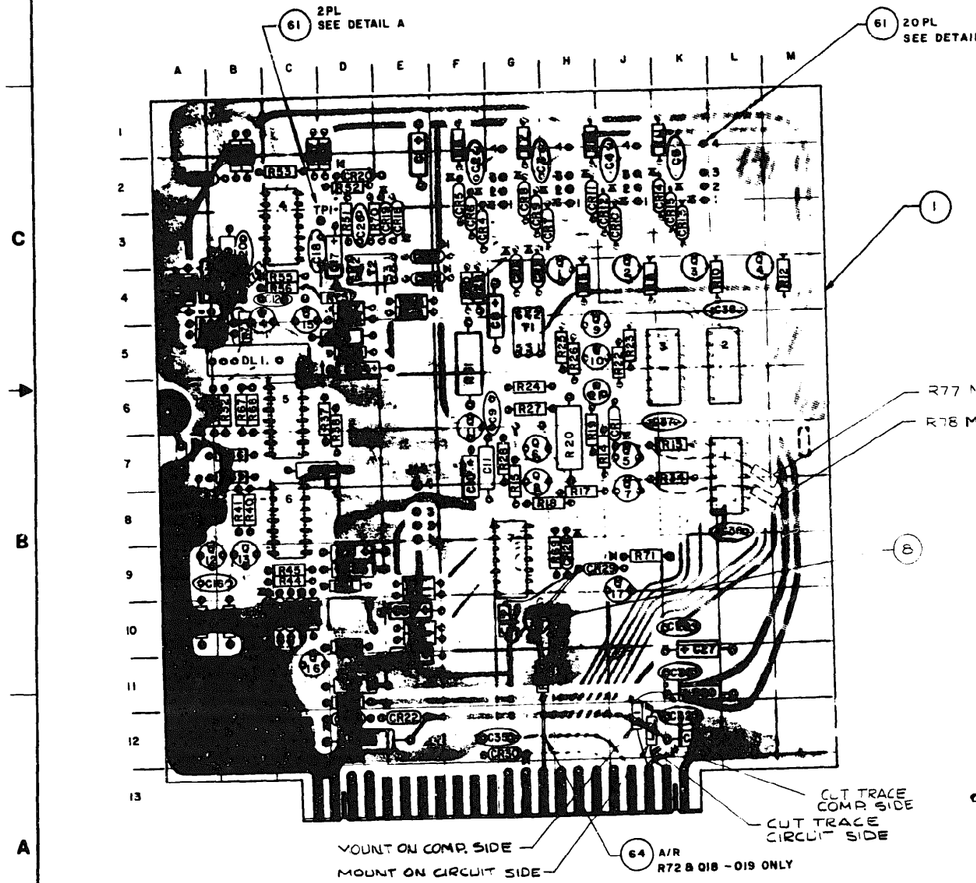
DRAWING DATE: 11/6/70
DESIGN: [illegible]
CHECKED: 4/6/71
ENGR APPR: [illegible]
MFG APPR: 1-19-71
PROJ 303
NEXT ASSY 301000

TITLE: ASSEMBLY READ/WRITE AMP

THE INFORMATION ON THIS DRAWING MAY NOT BE DISSEMINATED WITHOUT AUTHORIZATION OF CÆLUS MEMORIES INC.

SCALE 2/1 SHT 1 OF 2 — 301174 — REV D

301174



Ref Desig	Location
Q18	10G
Q17	9J
Q16	11C
Q15	4C
Q14	4B
Q13	9B
Q12	9A
Q11	6F
Q10	5H
Q9	5H
Q8	8G
Q7	8J
Q6	7G
Q5	7J
Q4	4L
Q3	4K
Q2	4J
Q1	4H
DL1	5B
IC7	9G
IC6	8C
IC5	6C
IC4	3C
IC3	5K
IC2	5L
IC1	7L

Ref Desig	Location
CR30	12G
CR29	9H
CR28	9H
CR27	10C
CR26	10C
CR25	10C
CR24	10B
CR23	12D
CR22	12E
CR21	2A
CR20	2D
CR19	3E
CR18	3E
CR17	4E
CR16	3E
CR15	3K
CR14	2K
CR13	3K
CR12	3J
CR11	2H
CR10	3J
CR9	3G
CR8	2G
CR7	3H
CR6	3F
CR5	2F
CR4	3F
CR3	4G
CR2	4G
CR1	7J

Ref Desig	Location
R32	6B
R31	5F
R30	4F
R29	4F
R28	7G
R27	6G
R26	5H
R25	5H
R24	6G
R23	5J
R22	5J
R21	6H
R20	7H
R19	7H
R18	8G
R17	8H
R16	—
R15	7G
R14	7H
R13	7K
R12	4M
R11	1K
R10	4L
R9	3G
R8	4J
R7	1G
R6	1F
R5	4H
R4	10E
R3	10E
R2	9E
R1	9E

Ref Desig	Location
R64	4B
R63	5B
R62	11D
R61	9D
R60	5D
R59	4D
R58	4E
R57	4D
R56	4C
R55	4C
R54	4A
R53	2C
R52	2D
R51	3D
R50	1B
R49	1B
R48	1D
R47	1C
R46	4E
R45	9C
R44	9C
R43	10B
R42	10A
R41	8B
R40	8B
R39	7B
R38	6D
R37	6D
R36	7B
R35	12D
R34	7K
R33	6A

Ref Desig	Location
C15	9D
C14	8A
C13	7C
C12	4C
C11	7F
C10	7F
C9	6G
C8	4G
C7	11D
C6	2K
C4	2J
C3	2H
C2	2F
C1	1E
R76	8K
R77	7K
R76	4A
R75	4C
R74	4B
R73	5B
R72	11G
R71	9J
R70	3D
R69	9H
R68	6B
R67	6B
R66	10C
R65	10D

Ref Desig	Location
T2	4D
T1	3G
L2	12C
L1	12C
C39	0 G
C38	4L
C37	6K
C36	8L
C35	12F
C34	11E
C33	10E
C32	12K
C31	12K
C30	11K
C29	11K
C28	10K
C27	11K
C26	3D
C25	9D
C24	5D
C23	5D
C22	4B
C21	4A
C20	3B
C19	3B
C18	3C
C17	3D
C16	9A

61 REF TP1, TP2 MOUNT ON COMPONENT SIDE

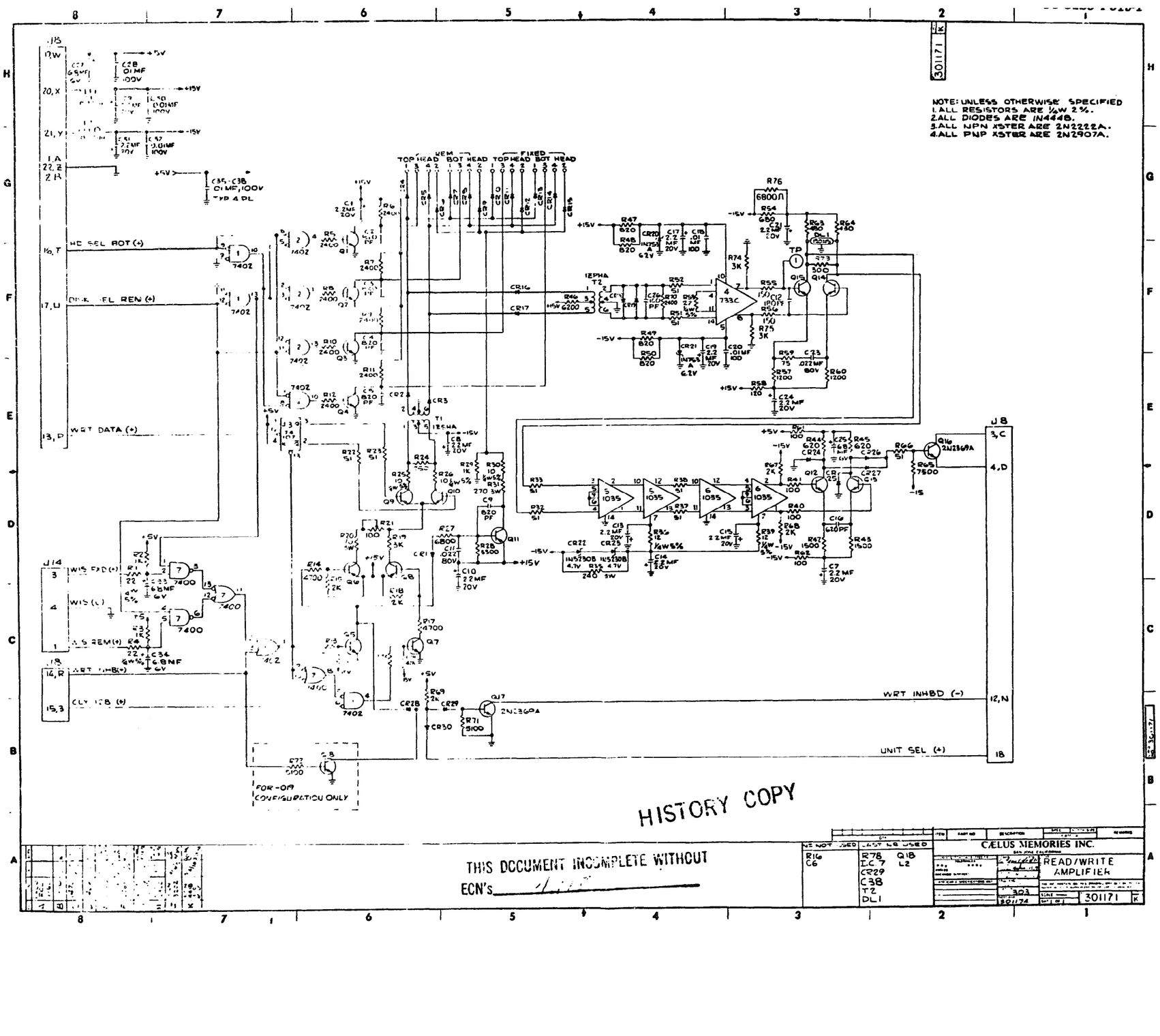
DETAIL A

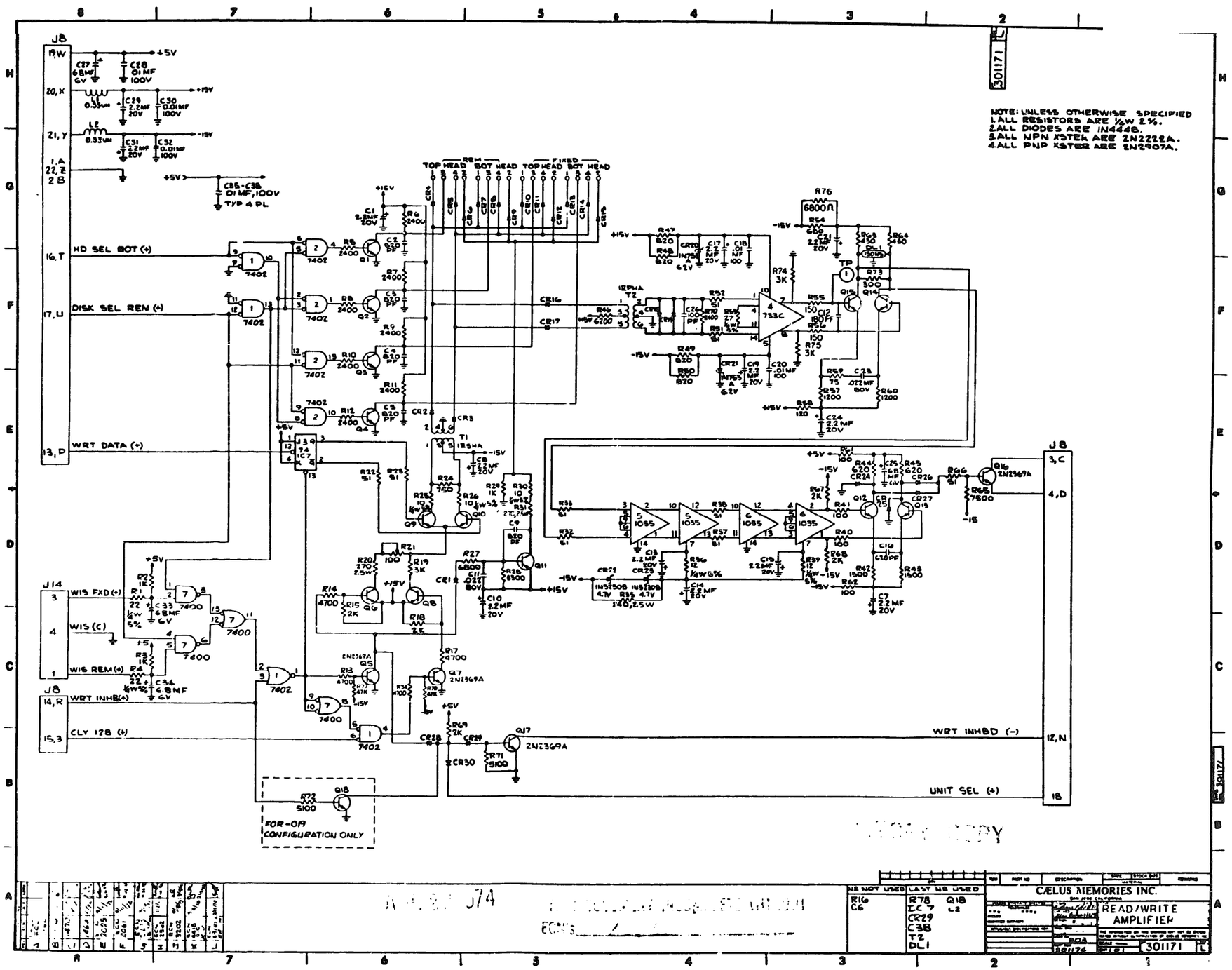
MOUNT ON CIRCUIT SIDE

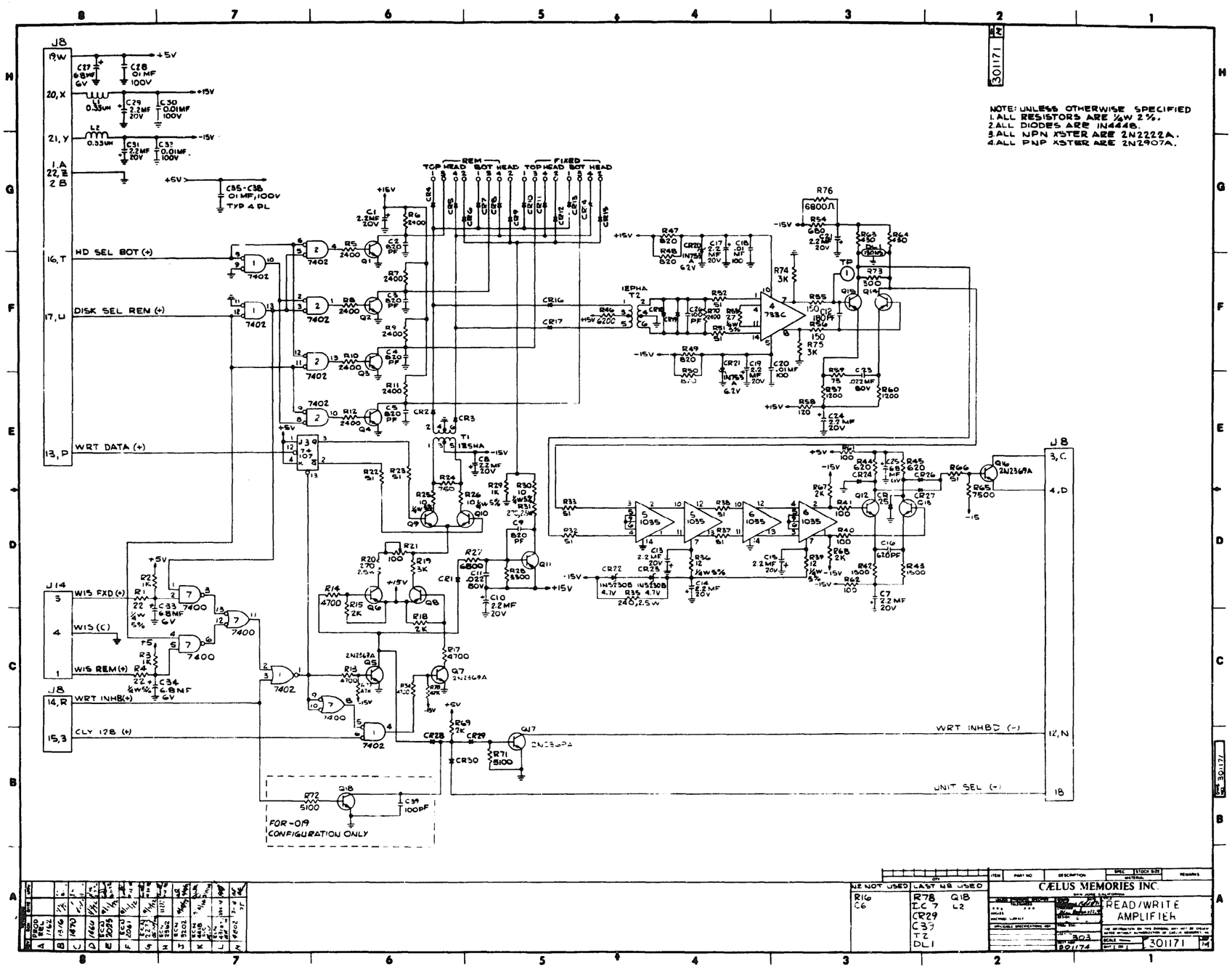
61 REF 20 PL

DETAIL B

SCALE 2/1 | SHT 2 OF 2 | 301174 | REV D


NOTE: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE ¼W 2%.
2. ALL DIODES ARE IN4448.
3. ALL NPN XSTR ARE 2N2222A.
4. ALL PNP XSTR ARE 2N2907A.
HC SEL ROT (+)
DISK SEL REN (+)
WRT DATA (+)
WIS FAD (+)
WIS (-)
A.S REM (+)
WRT INHB (+)
CLK RCB (+)
WRT INHBD (-)
UNIT SEL (+)
FOR -019 CONFIGURATION ONLY
HISTORY COPY
THIS DOCUMENT INCOMPLETE WITHOUT ECN's
CÆLUS MEMORIES INC.
READ/WRITE AMPLIFIER
301171


NOTE: UNLESS OTHERWISE SPECIFIED
1.ALL RESISTORS ARE ¼W 2%.
2.ALL DIODES ARE IN4448.
3.ALL NPN XSTRS ARE 2N2222A.
4.ALL PNP XSTRS ARE 2N2907A.
J8
19,W
20,X
21,Y
1,A
22,Z
2,B
+5V
+15V
-15V
C27 68MF 6V
C28 .01MF 100V
L1 0.33uH
C29 2.2MF 20V
C30 .01MF 100V
L2 0.33uH
C31 2.2MF 20V
C32 .01MF 100V
C85-C88 .01MF,100V TYP 4 PL
HD SEL BOT (+)
DISK SEL REN (+)
WRT DATA (+)
REN
TOP HEAD
BOT HEAD
FIXED
TOP HEAD
BOT HEAD
CR1
CR2
CR3
CR4
CR5
CR6
CR7
CR8
CR9
CR10
CR11
CR12
CR13
CR14
CR15
CR16
CR17
CR18
CR19
CR20
CR21
CR22
CR23
CR24
CR25
CR26
CR27
CR28
CR29
CR30
7402
7400
7404
7438
7400
1035
1085
7533
T1 135HA
T2 135HA
Q1
Q2
Q3
Q4
Q5
Q6
Q7 2N2369A
Q8
Q9
Q10
Q11
Q12
Q13
Q14
Q15
Q16 2N2369A
Q17 2N2369A
Q18
R76 6800Ω
TP
J14
WIS FXD (+)
WIS (C)
WIS REM (+)
J8
14,R
15,S
WRT INHB(+)
CLY 128 (+)
WRT INHBD (-)
UNIT SEL (+)
12,N
18
FOR-09 CONFIGURATION ONLY
301171
CÆLUS MEMORIES INC.
SAN JOSE, CALIFORNIA
READ/WRITE AMPLIFIER
301171



THIS DOCUMENT INCOMPLETE WITHOUT ECN's

ENGINEERING CHANGE REQUEST / NOTICE

NO 4731

CHANGE EFFECTS	Y	N	PART/MATL DISPOSITION: USE AS IS	REWORK	SCRAP
INTERCHANGEABILITY		X			
TOOLING		X			
FIXTURES		X			
TEST EQUIPMENT		X			
PARTS IN STOCK		X			
PARTS IN PROCESS		X			
PARTS ON ORDER		X			
PARTS @ CUST DEPOTS		X			

REQUESTOR/DATE: Fernando Gonzalez 4/22/74 E.d.G.
QUALITY ASSURANCE: 5/9/74
DEPT. SUPERVISOR:
TEST EQUIPMENT:
MANUFACTURING:
CONF. CONT. BOARD: 5/8
PRODUCT ENG.:
CUSTOMER: 5-8
PRODUCTION CONTROL: E. 2-4
ITEM EFFECTIVITY: 5-15-4
REASON FOR REJECTION:

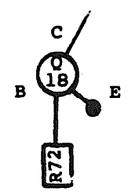
DOCUMENT NO: 301174 REV: K
DOCUMENT TITLE: Assembly, R/W Amp (Standard)
CHANGE TYPE: CLASS 1 ☐ CLASS 2 ☐ RECORD ☒ ACCEPTED ☒ REJECTED ☐

REASON FOR CHANGE:
PAR #1593

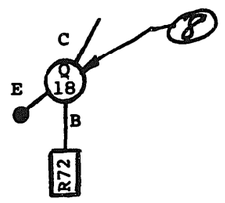
N.S ECN WILL MAKE N.S DRAWING REV. RC 2

DESCRIPTION OF CHANGE:

FROM:



TO:



ADD:

019	009	ITEM	PART NUMBER	DESCRIPTION
1		8	25-000160-001	PAD-Xstr

TACD	203/303
NEXT ASSY. DWG. NO.(S)	PROGRAM (S)

ISSUED

MAY 13 1974

SHEET 1 OF 1

ENGINEERING CHANGE REQUEST / NOTICE

NO 4775

CHANGE EFFECTS	Y	N	PART/MATL DISPOSITION: USE AS IS	REWORK	SCRAP
INTERCHANGEABILITY		X			
TOOLING		X			
FIXTURES		X			
TEST EQUIPMENT		X			
PARTS IN STOCK		X			
PARTS IN PROCESS		X			
PARTS ON ORDER		X			
PARTS @ CUST DEPOTS		X			

REASON FOR CHANGE:
PAR #1805

REQUESTOR/DATE: JoAnn Brengard 5/9/74	QUALITY ASSURANCE	DOCUMENT NO: 301174	REV: K
DEPT' SUPERVISOR	TEST EQUIPMENT	DOCUMENT TITLE: ASSEMBLY READ/WRITE AMP 203/303	
MANUFACTURING	CONF. CONT. BOARD		
PRODUCT ENG.	CUSTOMER	CHANGE TYPE	
PRODUCTION CONTROL		CLASS 1 ☐ CLASS 2 ☐ RECORD ☒	
END ITEM EFFECTIVITY:		ACCEPTED ☒ REJECTED ☐	

REASON FOR REJECTION:
[illegible] WILL MAKE
[illegible] DRAWING REV. C3

DESCRIPTION OF CHANGE:

CHANGE BILL OF MATERIALS:

FROM:

2	2	12	11-000301-001	XSTR 2N2369A	Q 16, 17, 5
019	009	ITEM	PART NUMBER	DESCRIPTION	REF DESIGNATION

TO:

3	3	12	11-000301-001	XSTR 2N2369A	Q 16, 17, 5
019	009	ITEM	PART NUMBER	DESCRIPTIONN	REF DESIGNATION

ISSUED
MAY 17 1974

TACD	203/303
NEXT ASSY. DWG. NO.(S)	PROGRAM (S)

SHEET 1 OF 1

ENGINEERING CHANGE REQUEST / NOTICE

NO. 4919

CHANGE EFFECTS	Y	N	PART/MATL DISPOSITION: USE AS IS	REWORK	SCRAP
INTERCHANGEABILITY		X			
TOOLING		X			
FIXTURES		X			
TEST EQUIPMENT		X			
PARTS IN STOCK		X			
PARTS IN PROCESS	X			✓	
PARTS ON ORDER		X			
PARTS @ CUST DEPOTS		X			

REQUESTOR/DATE: Fernando Gonzalez 6/26/74
QUALITY ASSURANCE
DEPT. SUPERVISOR
TEST EQUIPMENT
MANUFACTURING 6-26-74
CONF. CONT. BOARD
PRODUCT ENG.
CUSTOMER 6-26
PRODUCTION CONTROL 6-26-74
ITEM EFFECTIVITY: 6-28-74

DOCUMENT NO: 301174
REV: M
DOCUMENT TITLE: READ/WRITE BOARD ASSEMBLY 203/303

CHANGE TYPE
CLASS 1 ☐
CLASS 2 ☒
RECORD ☐

ACCEPTED ☒
REJECTED ☐

REASON FOR CHANGE: PAR's # 1895 & #1900

REASON FOR REJECTION:

IN-3 Existing REV. N

DESCRIPTION OF CHANGE:

CHANGE BILL OF MATERIALS FROM:

2	2	42	16-000307-056	POT 270 ohms, 3w, 3%	R31, R20
1	1	41	16-000307-145	POT 240 ohms, 3w, 3%	R35
3	3	12	11-000301-001	XSTR 2N2369A	Q16,17
8	8	10	11-000060-001	XSTR 2N2222A	Q1,2,3,4,7,12,13,5
019	009	ITEM	PART NUMBER	DESCRIPTION	REF DESIGNATION

TO:

2	2	42	16-000307-056	~~POT~~ 270 ohms, 2.5w, 5%	R31, R20
1	1	41	16-000307-145	~~POT~~ 240 ohms, 2.5w, 5%	R35
4	4	12	11-000301-001	XSTR 2N2369A	Q16,17,5,7
6	6	10	11-000060-001	XSTR 2N2222A	Q1,2,3,4, ,12,13
019	009	ITEM	PART NUMBER	DESCRIPTION	REF DESIGNATION

ISSUED

TACD	203/303
NEXT ASSY. DWG. NO.(S)	PROGRAM (S)

SHEET 1 OF 1

ENG 023

ENGINEERING CHANGE REQUEST / NOTICE

NO 5028

CHANGE EFFECTS	Y	N	PART/MATL DISPOSITION: USE AS IS	REWORK	SCRAP
INTERCHANGEABILITY		X			
TOOLING		X			
FIXTURES		X			
TEST EQUIPMENT		X			
PARTS IN STOCK		X			
PARTS IN PROCESS		X			
PARTS ON ORDER		X			
PARTS @ CUST DEPOTS		X			

REQUESTOR/DATE: JoAnn Brengard 8/5/74

QUALITY ASSURANCE:

DEPT' SUPERVISOR:

TEST EQUIPMENT:

MANUFACTURING:

CONF. CONT. BOARD: RW 9/4/74

PRODUCT ENG.:

CUSTOMER:

PRODUCTION CONTROL:

END ITEM EFFECTIVITY:

DOCUMENT NO: 301174

REV:

DOCUMENT TITLE: P.C. Board Assembly Read/Write 1500 RPM

CHANGE TYPE: CLASS 1 ☐ CLASS 2 ☐ RECORD ☒

ACCEPTED ☒ REJECTED ☐

REASON FOR CHANGE: PAR #1797

REASON FOR REJECTION: THIS ECN WILL MAKE RC4 THIS DRAWING REV.

DESCRIPTION OF CHANGE:

ADD NOTE TO DRAWING: NOTE — Both ends of jumpers to be wire wrapped using 28 Awg [redacted] wire (Item # *)

ADD TO BILL OF MATERIALS: (All dash numbers) — 04-000429-001 Wire, Wire Wrap UL Style 1422 QTY A/R

(*Note fill-in item number for wire 04-000429-001)

ISSUED SEP 5 1974

NEXT ASSY. DWG. NO. (S)	PROGRAM (S)	SHEET 1 OF 1
TACD	203/303 1500 RPM	

END 023

ENGINEERING CHANGE REQUEST / NOTICE NO 4803

CHANGE EFFECTS	Y	N	PART/MATL DISPOSITION: USE AS IS	REWORK	SCRAP
INTERCHANGEABILITY		X			
TOOLING		X			
FIXTURES		X			
TEST EQUIPMENT		X			
PARTS IN STOCK		X			
PARTS IN PROCESS		X			
PARTS ON ORDER		X			
PARTS @ CUST DEPOTS		X			

REASON FOR CHANGE: PAR #1884 — Eliminate glitch on write inhibit line

REQUESTOR/DATE	QUALITY ASSURANCE	DOCUMENT NO	REV
Mel Feintuch 5/23/74		301174	N
DEPT' SUPERVISOR	TEST EQUIPMENT	DOCUMENT TITLE	
MANUFACTURING	CONF. CONT. BOARD	Read/Write Board Assembly 203/303	
PRODUCT ENG.	CUSTOMER	CHANGE TYPE	
PRODUCTION CONTROL		CLASS 1 ☐ CLASS 2 ☒ RECORD ☐	
END ITEM EFFECTIVITY:		ACCEPTED ☒ REJECTED ☐	

REASON FOR REJECTION: THIS WILL HAVE THIS DRAWING REV. P

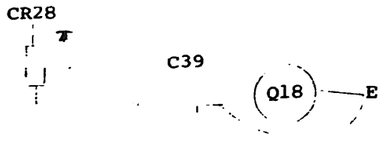
DESCRIPTION OF CHANGE:

CHANGE BILL OF MATERIALS FROM:

1	1	45	13-000043-030	Cap 100 pf 500 V	C26
019	009	Item	Part Number	Description	Ref: Designation

2	1	45	13-000043-030	Cap 100 pf 500 V	C26 C39 -019 only
019	009	Item	Part Number	Description	Ref: Designation

add C39:



ISSUED MAR 12 1975

TACD	203/303 (Sanders)
NEXT ASSY. DWG. NO.(S)	PROGRAM (S)

SHEET 1 OF 1

ENG 823

ENGINEERING CHANGE REQUEST / NOTICE

NO 4918

CHANGE EFFECTS	Y	N	PART/MATL DISPOSITION ✓ USE AS IS	REWORK	SCRAP
INTERCHANGEABILITY		X			
TOOLING		X			
FIXTURES		X			
TEST EQUIPMENT		X			
PARTS IN STOCK		X			
PARTS IN PROCESS	X			✓	
PARTS ON ORDER		X			
PARTS @ CUST DEPOTS		X			

REASON FOR CHANGE:
PAR's #1895 & #1900

REQUESTOR/DATE: F. Gonzalez 6/26/74
QUALITY ASSURANCE:
DEPT' SUPERVISOR:
TEST EQUIPMENT:
MANUFACTURING:
CONF. CONT. BOARD:
PRODUCT ENG:
CUSTOMER:
PRODUCTION CONTROL: 6-26
ITEM EFFECTIVITY: 6-28-4
REASON FOR REJECTION:

DOCUMENT NO: 301171 REV: K

DOCUMENT TITLE: READ/WRITE AMP SCHEMATIC 203/303

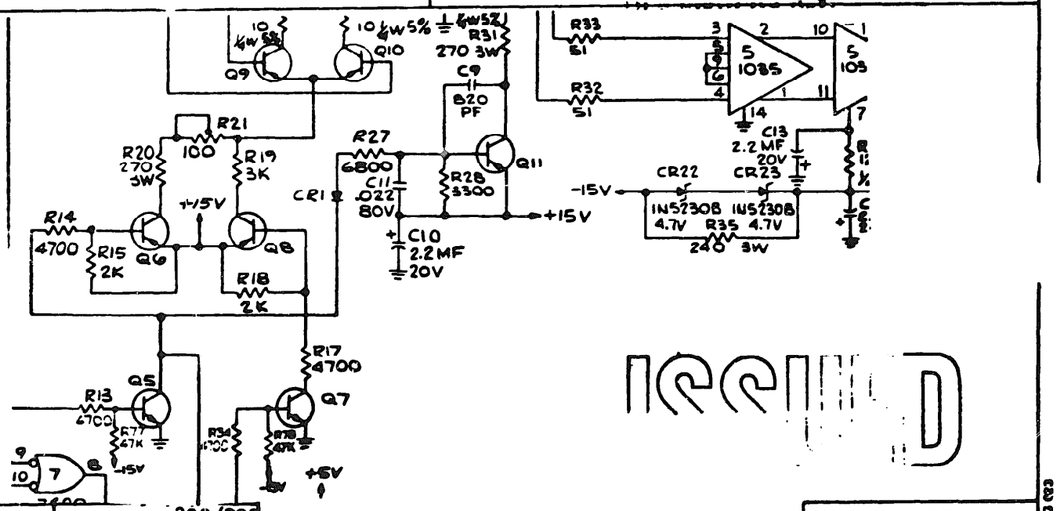
CHANGE TYPE
CLASS 1 ☐
CLASS 2 ☒
RECORD ☐

ACCEPTED ☒
REJECTED ☐

THIS ECN WILL MAKE L

DESCRIPTION OF CHANGE:

CHANGE FROM:



301174
NEXT ASSY. DWG. NO.(S)

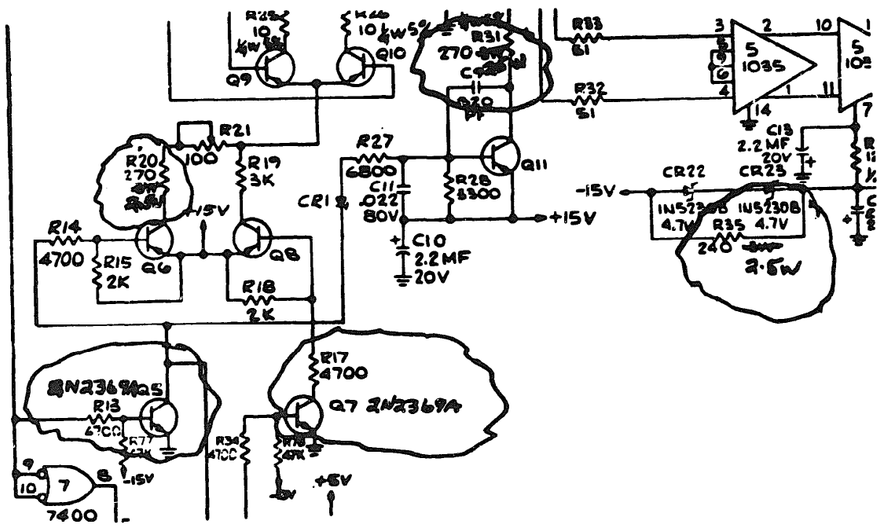
PROGRAM (S) 203/303

SHEET 1 OF 2

ENG 023

ENGINEERING CHANGE REQUEST / NOTICE NO 4918

CHANGE TO:



SHEET 2 OF 2

ENG 623-1

ENGINEERING CHANGE REQUEST / NOTICE PT. 060 NO. 4802

CHANGE EFFECTS	Y	N	USE AS IS	REWORK	SCRAP
INTERCHANGEABILITY		X			
TOOLING		X			
FIXTURES		X			
TEST EQUIPMENT		X			
PARTS IN STOCK		X			
PARTS IN PROCESS		X			
PARTS ON ORDER		X			
PARTS @ CUST DEPOTS		X			

REASON FOR CHANGE: PAR #1884 Eliminate glitch on write inhibited line

REQUESTOR/DATE: Mel Feintuch 5/23/74	QUALITY ASSURANCE	DOCUMENT NO: 301171	REV: L
DEPT. SUPERVISOR: P.T.	TEST EQUIPMENT	DOCUMENT TITLE: Schematic Read/ Write Board 203/303	
MANUFACTURING: 3/14/75	CONF. CONT. BOARD: 3/12/75	CHANGE TYPE: CLASS 1 ☐ CLASS 2 ☒ RECORD ☐	
PRODUCT ENG.: 2-75	CUSTOMER		
PRODUCTION CONTROL	END ITEM EFFECTIVITY: 3-30-5.	ACCEPTED ☒ REJECTED ☐	

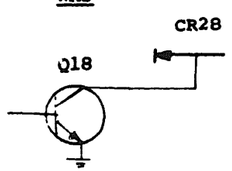
REASON FOR REJECTION:

THIS ECN WILL MAKE THIS DRAWING REV. M
COORDINATE WITH ECN 4803

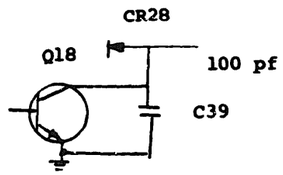
DESCRIPTION OF CHANGE:

CHANGE ZONE B-6:

WAS



IS



ISSUED MAR 12 1975

NEXT ASSY. DWG. NO.(S)	PROGRAM (S)	SHEET 1 OF 1
301174	203/303 (Sanders)	

ENGINEERING DRAWING CONFIGURATION

Assembly: Option Board 1500 RPM

PC Board Assembly P/N 301924	Applicable Schematic Dwg. No. 301925
Rev	Rev
F	D

NOTES:
1. BOTH ENDS OF JUMPERS TO BE WIRE WRAPPED USING 28 AWG WIRE (ITEM 57)

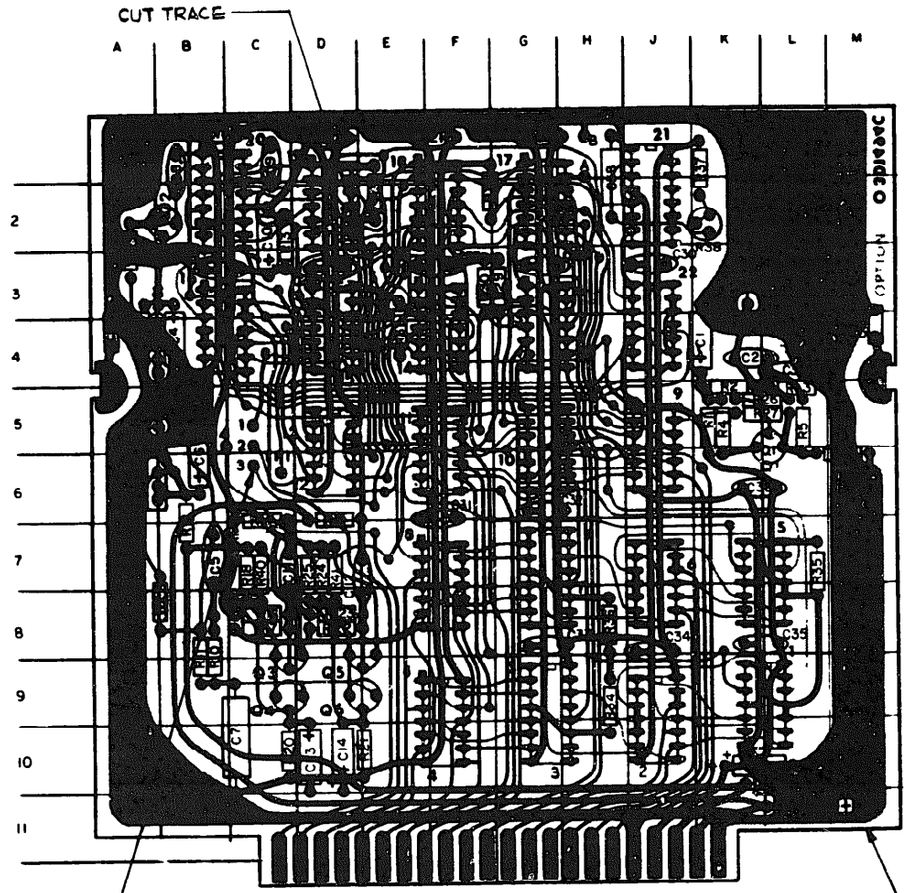
QTY	ITEM	PART NO.	DESCRIPTION	REF DESIGNATION	REMARKS
A/R	57	04-000429-001	WIRE SOLID	28 GA	1
	55				
7	54	35-000162-001	POST MOD II	JUMPERS 1,2,3,4, A,B, TP1	
	53				
	52				
1	51	12-000617-003	XTAL 6.200MHZ	XTAL 1	
1	50	12-000617-001	XTAL 6.354MHZ	XTAL 1	
	49				
1	48	12-000028-001	DIO IN4448	CR2	
1	47	12-000030-001	DIO IN5231B	CR1	
	46				
2	45	53-000054-015	200Ω 1/4W,2%	R40, R41	
1	44	13-000043-014	CAP 24PF 500V	C9	
	43				
1	42	13-000041-007	.0068MF 80V	C38	
1	41	13-000043-018	36PF 500V	C8	
1	40	13-000043-045	390PF 500V	C5	
2	39	13-000043-034	150PF 500V	C11,12	
2	38	13-000043-025	62PF 500V	C2,3	
14	37	13-000521-001	.01MF 100V	C19 THRU 26 & C30 THRU 36	
1	36	13-000041-019	.068MF 80V	C7	
2	35	13-000244-014	1 MF 50V	C18,37	
6	34	13-000037-033	2.2MF 20V	C4,6,13,14,15,16	
3	33	13-000034-019	CAP 6.8MF 6V	C1,10,17	
1	32	17-000052-015	RES 10Ω 1/4 5%	R6	
2	31	53-000054-071	RES 47K 1/4W2%	R2,3	
2	30	53-000054-043	RES 3300Ω 1/4W2%	R17,22	
2	29	53-000054-048	RES 5100Ω 1/4W2%	R13, R37	
1	28	53-000054-047	RES 4700Ω 1/4W2%	R28	
1	27	53-000054-057	12K	R7	
2	26	53-000054-040	2400Ω	R20,21	
2	25	53-000054-038	1800Ω	R19,25	
2	24	53-000054-046	4300Ω	R16,23	
1	23	53-000054-066	30K	R11	
6	22	53-000054-032	1K	R31 THRU 36	
2	21	53-000054-022	390Ω	R14,15	
3	20	53-000054-025	510Ω	R5,29,30	
1	19	53-000054-020	330Ω	R12	
3	18	53-000054-019	300Ω	R9,18,24	
1	17	53-000054-017	240Ω	R27	
3	16	53-000054-008	RES 100Ω 1/4W 2%	R1,4,26	
1	15	14-000650-007	POT 10K	R8	
1	14	53-000054-042	RES 3K	R10	
3	13	11-000275-001	XSTR 2N2907A	Q 2,3,4	
3	12	11-000060-001	XSTR 2N2222A	Q 1,5,6	
1	11	14-000045-010	POT 10K	R38	
2	10	10-000264-001	IC 9602	IC 1,20,21	
2	9	10-000624-001	IC 74193	IC 3,7	
3	8	10-000517-001	IC 74107	IC 1,5,17	
3	7	10-000013-001	IC 7474	IC 14,15,19	
3	6	10-000623-001	IC 7438	IC 4,8,11	
1	5	10-000516-006	IC 74H10	IC 12	
2	4	10-000622-001	IC 7408	IC 9,22	
5	3	10-000009-001	IC 7400	IC 2,6,10,13,16	
1	2	10-000516-004	IC 74H00	IC 18	
1	1	301493-001	PC BD DETAIL		

REV	ECN	DATE	APPV
A	PROB REL PER ECN 2295 HAROLD BLUE		
B	ECN 2453	11-29-72	
C	ECN 3181 H BLUE	12-21-73	
D	PER ECN 2934	4-30-74	
E	ECN 4390	6-26-74	
F	ECN 4736	12-6-74	
R	ECN 5036	4-9-75	
S		4-15-75	

CÆLUS MEMORIES INC.
SAN JOSE CALIFORNIA

PC BD ASSY
OPTION BD

MFG ENG: R.B.J. 11-8-72
QA: Tom Mc 11-14-72
MATL SPEC: SC3/2C2
NEXT ASSY: 301000
SCALE: 2/2
SHT 1 OF 2
SIZE: F
DWG NO: 301924



DETAIL A

		R35	7L	C25	3F						
		R34	9M	C24	3D						
		R33	2F	C23	3B						
		R32	2E	C22	1G						
		R31	4E	C21	1F						
		R30	3F	C20	1D						
Q6	9D	R29	3G	C19	1B						
Q5	8D	R28	6M	C18	4A						
Q4	9C	R27	5K	C17	10K						
Q3	8C	R26	5K	C16	10L						
Q2	2B	R25	7D	C15	11L						
Q1	5L	R24	7D	C14	10D						
		R23	8D	C13	10D						
		R22	8D	C12	7D	XTAL	3L				
IC21	2J	R21	10D	C11	7C						
IC20	2C	R20	10C	C10	2C						
IC19	2D	R19	7C	C9	1C	CR2	4A				
IC18	2F	R18	7C	C8	1B	CR1	5A				
IC17	2G	R17	8C	C7	10C						
IC16	4C	R16	8C	C6	6B						
IC15	4D	R15	6D	C5	7B						
IC14	4F	R14	6C	C4	4B						
IC13	4G	R13	2C	C3	4L	C38	2M				
IC12	5D	R12	6B	C2	4K	C37	4M				
IC11	5F	R11	8B	C1	4K	C36	6L				
IC10	5G	R1C	8B			C35	8K				
IC9	5J	R9	4A			C34	8J				
IC8	7F	R8	6A			C33	8G				
IC7	7G	R7	8A			C32	6G				
IC6	7J	R6	2A			C31	6F				
IC5	7K	R5	5L			C30	3J				
IC4	9F	R4	5K			C29					
IC3	9G	R3	5L			C28					
IC2	9J	R2	5K	R37	1K	C27					
IC1	9K	R1	5K	R36	8M	C26	3G				
Ref Desig	Location	Ref Desig	Location	Ref Desig	Location	Ref Desig	Location				

DASH NO	DESCRIPTION						JUMPER	
	INPUT DATA	OUTPUT DATA	RPM	XTAL MHZ			DATA FORMAT	WRT DATA FORMAT
009	DBL FREQ	C FORMAT	1500				3 – 4	A – B
019	NRZ	C FORMAT	1500	6 354			3 – 4	NONE
029	DBL FREQ	D FORMAT	1500				2 – 4	A – B
039	NRZ	D FORMAT	1500	6 354			2 – 4	NONE
049	DBL FREQ	I FORMAT	1500				1 – 4	A – B
059	NRZ	I FORMAT	1500	6 354			1 – 4	NONE
069	NRZ	C FORMAT	1500	6 200			3 – 4	NONE

MODIFICATIONS

IT TRACE FROM
IC14 3 ON COMP SIDE

JUMPER ADDED FROM
CR4 3 TO IC20-6 ON CKT SIDE

DASH NO & QTY PER ASSY										ITEM	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION/MATERIAL	REMARKS
099	089	079	069	059	049	039	029	019	009				

PART NO	REV ASSY	USED ON

APPLICATION

UNLESS OTHERWISE SPECIFIED
TOLERANCES
XX ± ANGLES
XXX ±

DO NOT SCALE DRAWING

INTERPRET DIMENSIONS AND TOLERANCES PER USAS Y14.5

DIMENSIONS ARE IN INCHES AND APPLY AFTER HEAT TREAT AND FINISH

COUNTERSINKS AND SPOTFACE PILOT HOLES TO BE 90° INCLUSIVE

REMOVE ALL BURRS AND BREAK SHARP EDGES EQUIVALENT TO .5

ROUGHNESS OF MACHINED SURFACES 125 PER USAS B46.1

STANDARD M.X.T. TOLERANCE PER ANSI

DRAWN
CHECK
PROD. ENGR
PROD. ENGR
OTHER APPROVALS

THIRD ANGLE PROJECTION

INCH

CÆLUS MEMORIES INC.
SAN JOSE, CALIFORNIA

TITLE
PC BD ASSY
OPTION BD

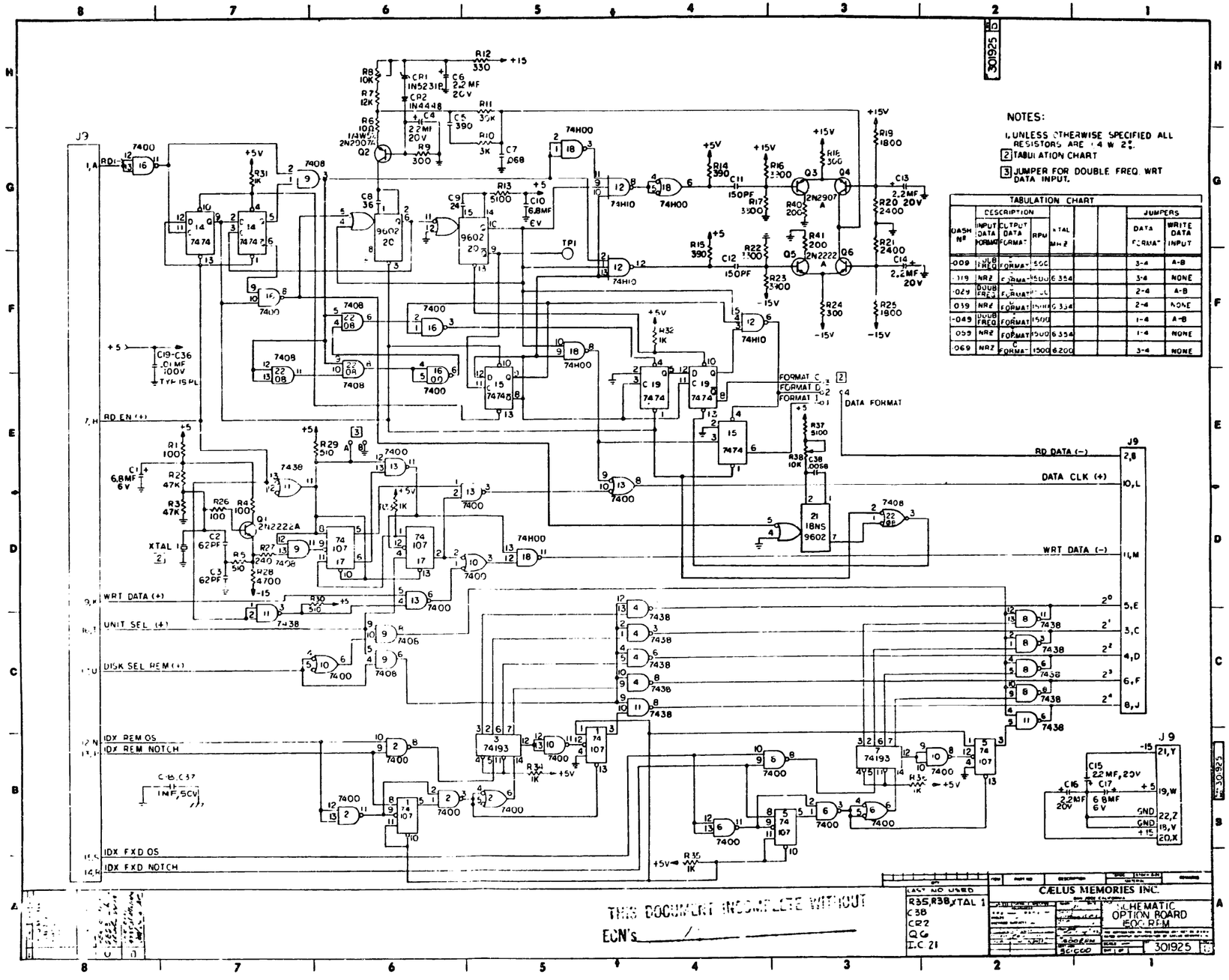
SIZE D

THE INFORMATION ON THIS DRAWING MAY NOT BE DISSEMINATED WITHOUT AUTHORIZATION OF CAELUS MEMORIES INC.

SCALE 2/1
SHT 2 OF 2

301924

301924


NOTES:
1. UNLESS OTHERWISE SPECIFIED ALL RESISTORS ARE 1/4 W 2%.
2 TABULATION CHART
3 JUMPER FOR DOUBLE FREQ WRT DATA INPUT.
TABULATION CHART
DASH NR
DESCRIPTION
INPUT DATA FORMAT
OUTPUT DATA FORMAT
RPM
XTAL MHZ
JUMPERS
DATA FORMAT
WRITE DATA INPUT
-009 DUB FREQ FORMAT C 1500
3-4 A-B
-019 NRZ FORMAT C 1500 6.336
3-4 NONE
-029 DUBB FREQ FORMAT C 1500
2-4 A-B
-039 NRZ FORMAT C 1500 6.336
2-4 NONE
-049 DUBB FREQ FORMAT C 1500
1-4 A-B
-059 NRZ FORMAT C 1500 6.336
1-4 NONE
-069 NRZ FORMAT C 1500 6.200
3-4 NONE
FORMAT C
FORMAT D
FORMAT E
C4 DATA FORMAT
RD DATA (-)
DATA CLK (+)
WRT DATA (-)
WRT DATA (+)
UNIT SEL (+)
DISK SEL REM (+)
IDX REM OS
IDX REM NOTCH
IDX FXD OS
IDX FXD NOTCH
RD EN (+)
THIS DOCUMENT INCOMPLETE WITHOUT
ECN's
LAST NO USED
R35,R36,XTAL 1
C38
CR2
Q6
I.C 21
CÆLUS MEMORIES INC.
SCHEMATIC
OPTION BOARD
ISOL REM
301925

ENGINEERING DRAWING CONFIGURATIONS

Assembly: Power Control Module

PC Board Assembly P/N 301705		Applicable Schematic Dwg No. 301706	
Rev	ECN	Rev	ECN
J - Baseline		F - Baseline	
K	4760	F	
L	4860	F	
M	4927	G	4926
N	5003	G	4926
	5024		
P	5201	G	4926
R	5580	H	5580

NOTES:

1. INSTALL INSULATOR SUPPLIED WITH TRANSISTOR (ITEM 8 THRU 11). INSULATOR TO BE MOUNTED BETWEEN TRANSISTOR AND HEAT SINK AND COATED WITH GREASE (ITEM 70) BOTH SIDES.
2. CUT TRACE BETWEEN IC1 PIN 7 & R24. CUT TRACE BETWEEN IC1 PIN 8 & R25. ADD DIODE CR10 BETWEEN IC1 PIN 7 & R24 (CATHODE FACING R24). ADD DIODE CR11 BETWEEN IC1 PIN 8 & R25 (CATHODE FACING IC1 PIN 8) MOUNT ON BACK SIDE.

QTY	ITEM	PART NO.	DESCRIPTION	SPEC MATERIAL	STOCK SIZE	REMARKS
1	75					
1	74	12-000045-011	RES 20K POT	R59		
1	73	53-000054-052	RES 20K 1/4W 2%	R58		
1	72	53-000054-059	RES 15K 1/4W 2%	R57		
2	71	12-000402-001	DIO IN746A 3.3V	CR10,11		
A/R	70	06-000471-001	THERMAL CMPD.			
2	69	35-000435-002	WASHER SHLDR	NYLON	#4	
2	68	35-000111-013	SCR,FLH 82°		#4-40 x .25	
6	67	25-000146-005	WASHER,INTR LK		#10	
6	66	25-000067-007	WASHER,SPLIT LK		#10	
15	65	35-000608-001	PIN-CONTACT		MOLEX 02-09-2133	
9	64	26-000024-011	SCREW,SOC HD		4-40 x .38	
1	63	36-000619-001	RELAY-KI		GUARDIAN 1305PC-2C-12D	
1	62	301711-001	HEAT SINK			
1	61	41-000673-003	CONNECTOR	J3		
1	60	41-000246-001	CONNECTOR	J2	15 PIN	
4	59	35-000276-001	PIN	J1,5,6,7	AMP 60599-3	
7	58	35-000162-001	POST MOD II	J4 (REF)		
1	57	12-000043-001	820Ω 1/2 W 5%	R56		
4	56	25000748-001	FUSE CLIP	F1,F2		
2	55	67000747-001	FUSE 8A AGC	F1,F2		
1	54	13000037-035	CAP 3.3MF 20V	C3		
1	53	12-000705-001	DIO-IN752A 5.6V	CR7		
1	52	12-000067-001	DIO-MR751	CR2		
	51	12-000027-001	DIO-IN4001	CR1,3,4,5,6,9		

QTY	ITEM	PART NO.	DESCRIPTION	SPEC MATERIAL	STOCK SIZE	REMARKS
1	50	13-000043-043	CAP 330PF 500V	C15		
1	49	13-000629-003	68MF 16V	C21		
1	48	13-000244-014	1MF 50V	C20		
1	47	13-000070-007	22000MF 15V	C16		
1	46	13-000041-001	.0022MF 80V	C2		
1	45	13-000042-005	.001MF 200V	C1		
4	44	13-000521-001	.01MF 100V	C9,10,17,19		
1	43	13-000036-011	.68MF 15VDC	C4		
2	42	13-000216-010	2700MF 40V	C5,6		
2	41	13-000037-033	2.2MF 20V	C7,8		
1	40	13-000034-019	CAP-6.8MF 6V	C13		
1	39	53-000054-032	RES 3K 1/4W 2%	R48		
1	38	53-000054-034	RES 1200Ω 1/4W 2%	R55		
1	37	16-000307-047	RESITOR 3W 5%	R11		
1	36	14-000522-001	500Ω POT	R30		
1	35	16-000277-001	RES 1Ω 5W 1%	R20		
1	34	16-000307-086	2K 3W 5%	R12		
2	33	16-000307-077	1K	R23,26		
1	32	16-000307-011	4Ω	R45		
1	31	16-000307-018	10Ω 3W 5%	R41,		
1	30	16-000307-111	.33Ω 3W 10%	R35		
1	29	16-000307-004	.5Ω 3W 10%	R16,19,21,28		
4	28	16-000307-001	.1Ω 3W 10%	R49,51,52,54		
3	27	17-000052-019	150 1/4W 5%	R22,27,44		
4	26	17-000052-015	RES 10Ω 1/4W 5%	R17,19,50,53		

QTY	ITEM	PART NO.	DESCRIPTION	SPEC MATERIAL	STOCK SIZE	REMARKS
4	25	53-000054-055	RES 10K 1/4W 2%	R4,37,40,46		
4	24	53-000054-048	5100Ω	R1,2,6,47		
1	23	53-000054-047	4700Ω	R34		
1	22	53-000054-084	2200Ω	R31		
3	21	53-000054-032	1K	R3,36,38		
1	20	53-000054-030	820Ω	R33		
1	19	53-000054-029	750Ω	R29		
1	18	53-000054-0[illegible]	330Ω	R5		
2	17	53-000054-0[illegible]	75Ω 1/4W 2%	R14,15		
1	16	53-000055-015	200Ω 1/2W 2%	R10		
3	15	53-000054-008	100Ω 1/4W 2%	R7,24,25		
2	14	53-000054-001	51Ω 1/4W 2%	R6,32		
2	13	53-000054-079	RES 2K 1/4W 2%	R2,43		
2	12	17-000052-028	RES 33Ω 1/4W 5%	R9,13		
2	11	11-000614-002	XSTR-TIP36C	Q11		
3	10	11-000613-002	-TIP35C	Q4,15,16		
2	9	11-000612-001	TIP34B	Q8,10		
2	8	11-000611-001	-TIP33B	Q211		
5	7	11-000018-001	2N4238	Q4,12,13,14,15		
2	6	11-000017-001	2N4036	Q3,5		
3	5	11-000060-001	XSTR-2N2222A	Q1,2,17		
1	4	12-000003-001	IN5278A ZENER DIODE (10%)	CR2		
1	3	10-000001-002	IC-723	I.C.2		
1	2	10-000002-001	I.C.-SG450D	I.C.1		
1	1	301703-001	POWER CONTROL MODULE BOARD			

REV	ECN	DATE	APPV	
P	[illegible]	[illegible]	[illegible]	C
	[illegible]	[illegible]	[illegible]	D
	PER ECN 3671 DC 6-25-75	[illegible]	[illegible]	E
	PER ECN 3653 DC 8-7-75	[illegible]	[illegible]	F
	PER ECN 3739 DC 10-9-75	[illegible]	[illegible]	G
	PER ECN 3744 DC 10-24-75	[illegible]	[illegible]	H
	ECN 3[illegible]	[illegible]	[illegible]	I

CÆLUS MEMORIES INC.
SAN JOSE CALIFORNIA

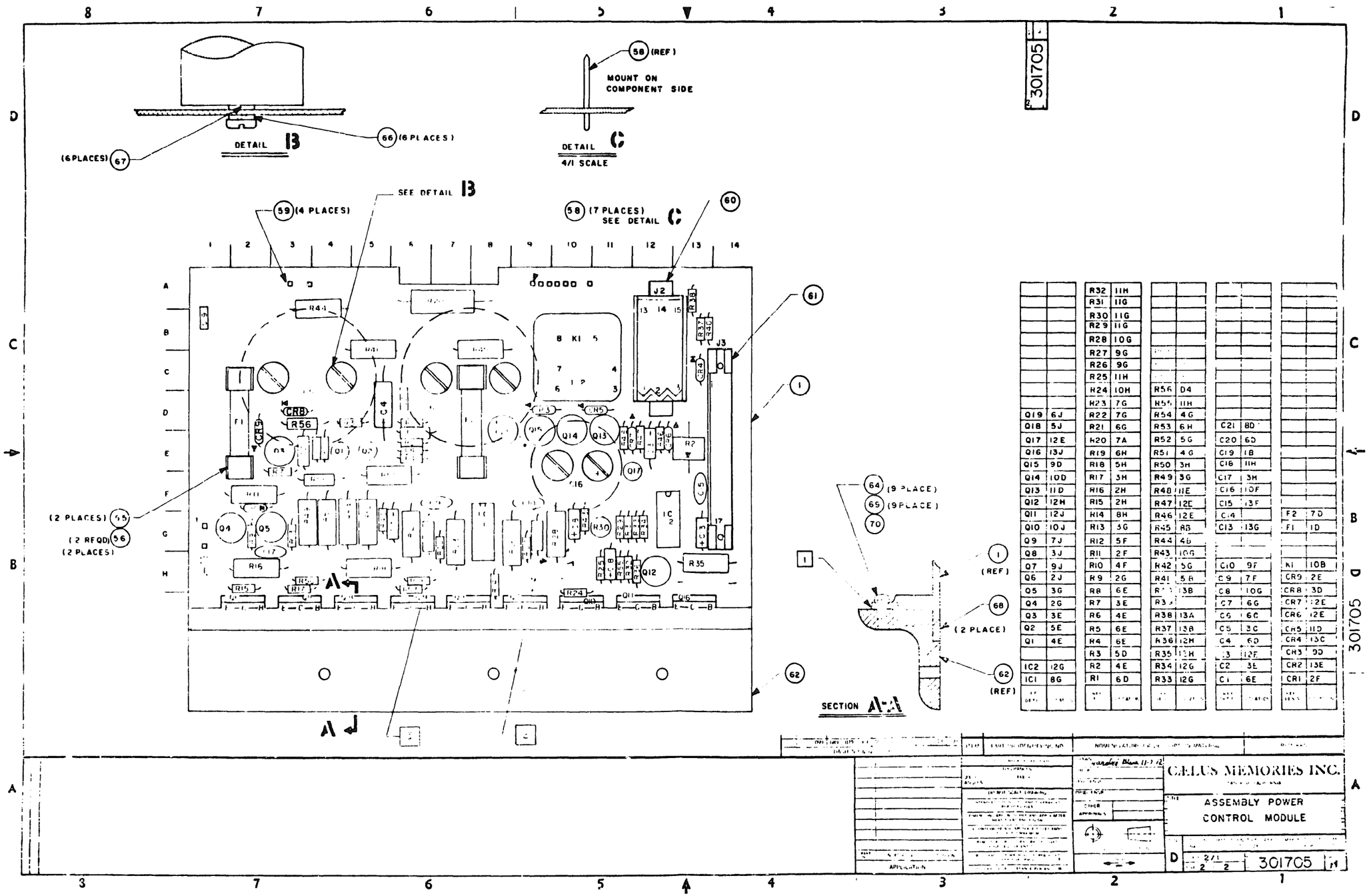
UNLESS OTHERWISE SPECIFIED TOLERANCES: X ±.1, XX ±.02, XXX ±.005, ANGLES ±1°, MACHINED SURFACES

DRAWN [illegible] DATE [illegible]
SPECIFIED [illegible] DATE [illegible]
DESIGN [illegible] DATE [illegible]
PROJ ENG [illegible] DATE [illegible]
MFG ENGR [illegible] DATE [illegible]
QA [illegible] DATE [illegible]
MFG ON 303
REVIEW [illegible]

TITLE: ASSEMBLY POWER CONTROL MODULE

SCALE [illegible] SIZE H 301705
SHT 1 OF 2

301705 H


DETAIL B
66 (6 PLACES)
67 (6PLACES)
58 (REF)
MOUNT ON COMPONENT SIDE
DETAIL C
4/1 SCALE
SEE DETAIL B
59 (4 PLACES)
58 (7 PLACES) SEE DETAIL C
60
61
1
62
63 (2 PLACES)
56 (2 REQD) (2 PLACES)
64 (9 PLACE)
65 (9PLACE)
70
68 (2 PLACE)
SECTION A-A
J2
J3
R56
R44
R16
R35
Q12
IC2
IC1
CR8
CR5
CR9
CR4
C4
C5
C3
R2
Q17
Q16
Q15
Q14
Q13
Q4
Q5
Q11
Q6
R30
R24
R15
R17
R25
R32 11H
R31 11G
R30 11G
R29 11G
R28 10G
R27 9G
R26 9G
R25 11H
R24 10H
R23 7G
R22 7G
R21 6G
R20 7A
R19 6H
R18 5H
R17 3H
R16 2H
R15 2H
R14 8H
R13 3G
R12 5F
R11 2F
R10 4F
R9 2G
R8 6E
R7 3E
R6 4E
R5 6E
R4 6E
R3 5D
R2 4E
R1 6D
Q19 6J
Q18 5J
Q17 12E
Q16 13J
Q15 9D
Q14 10D
Q13 11D
Q12 12H
Q11 12J
Q10 10J
Q9 7J
Q8 3J
Q7 9J
Q6 2J
Q5 3G
Q4 2G
Q3 3E
Q2 5E
Q1 4E
IC2 12G
IC1 8G
R56 D4
R55 11H
R54 4G
R53 6H
R52 5G
R51 4G
R50 3H
R49 3G
R48 11E
R47 12E
R46 12E
R45 8B
R44 4B
R43 10G
R42 5G
R41 5B
R38 13A
R37 13B
R36 12H
R35 13H
R34 12G
R33 12G
C21 8D
C20 6D
C19 1B
C16 11H
C17 3H
C16 10F
C15 13F
C13 13G
C10 9F
C9 7F
C8 10G
C7 6G
C6 6C
C5 3C
C4 6D
C3 12F
C2 3E
C1 6E
F2 7D
F1 1D
K1 10B
CR9 2E
CR8 3D
CR7 12E
CR6 12E
CR5 11D
CR4 13C
CR3 9D
CR2 13E
CR1 2F
CELUS MEMORIES INC.
ASSEMBLY POWER CONTROL MODULE
D
301705
SCALE 2/1
SHEET 2 OF 2
301705 D

[3] DELETED

[4] DELETED

[5] FOR SUBSTITUTE PARTS USE 36-000619-002.

[6] TO BE USED AS SPACERS FOR C5 & C6 WHEN REQUIRED.

[7] BOTH ENDS OF JUMPERS TO BE WIRE WRAPPED USING 28AWG WIRE (ITEM 72).

[8] FOR SUBSTITUTE VALUES. SEE DWG 302678

P 301705

NOTES:

[1] INSTALL INSULATOR (ITEM 79) WITH TRANSISTOR (ITEM 8 THRU 11). INSULATOR TO BE MOUNTED BETWEEN TRANSISTOR AND HEAT SINK AND COATED WITH GREASE (ITEM 70) BOTH SIDES.

[2] DELETED

QTY	ITEM	PART NO.	DESCRIPTION	MATERIAL SPEC	MATERIAL STOCK SIZE	REMARKS
9	79	45-000911-001	TRANSISTOR INSULATOR			
1	78	17-000052-017	RESISTOR 12Ω, 1/4W, 5%	R44		
6	77	25-000086-063	SCREW, PAN HD			10-32-.80 LG
A/R	76	04-000429-001	WIRE, WIRE WRAP UL STYLE 1422			[7]
8	75	25-000065-008	WASHER, FLAT			[6]
	74					
1	73					
	72					
	71					
A/R	70	06-000471-001	THERMAL CMPD.			
9	69	45-001112-006	INSULATOR, SCREW (SHLDR WASHER)	NYLON		#4
2	68	25-000111-013	SCR, FLH 82°			#4-40 x .25
6	67	25-000146-005	WASHER, INT LK			#10
6	66	25-000067-007	WASHER, SPLIT LK			#10
15	65	35-000608-001	PIN-CONTACT			MOLEX 02-09-2133
9	64	25-000084-014	SCR, CAPSOC HD			#4-40 x .38
1	63	36-000619-001	RELAY-K1			[5]
1	62	301711-001	HEAT SINK			
1	61	41-000673-003	CONNECTOR	J3		
1	60	41-000246-001	CONNECTOR	J2		15 PIN
4	59	35-000276-001	PIN	J1 thru 7		AMP #60599-3
7	58	35-000162-001	POST MOD II	J4 (REF)		
	57					
4	56	25000748-001	FUSE CLIP	F1, F2		
2	55	67000747-001	FUSE 8A AGC	F1, F2		
1	54	13000037-035	CAP 3.3MF 20V	C3		
1	53	12-000305-001	DIO-IN752A 5.6V	CR7		
1	52	12-000652-001	DIO-MR751	CR2		
5	51	12-000037-001	DIO IN4001	CR1,3,4,5,6		

QTY	ITEM	PART NO.	DESCRIPTION	MATERIAL SPEC	MATERIAL STOCK SIZE	REMARKS
1	50	13-000043-056	CAP 1000PF 100V	C15		
1	49	13-000029-003	68MF 16V	C21		
1	48	13-000244-014	1MF 50V	C20		
1	47	13-000070-007	22000MF 15V	C16		
1	46	13-000041-001	.0022MF 80V	C2		
1	45	13-000042-005	.001MF 200V	C1		
4	44	13-000521-001	.01MF 100V	C9,10,17,19		
	43					
2	42	13-000216-010	2*000MF 40V	C5,6		[8]
2	41	13-000037-033	2.2MF 20V	C7,8		
1	40	13-000034-019	CAP 6.8MF 6V	C13		
1	39	53-000054-042	RES 3K 1/4W 2%	R48		
	38					
1	37	16-000307-047	RESISTOR 3W 5%	R11		
1	36	14-000522-002	500Ω POT	R30		
1	35	16-000277-006	RES .1Ω 5W 1%	R20		
1	34	16-000307-086	2K 3W 5%	R12		
2	33	16-000307-077	1K	R23,26		
1	32	16-000307-011	Ω	R45		
1	3	16-000307-018	10Ω 3W 5%	R41,		
1	30	16-000307-140	.33Ω 3W 10%	R35		
4	29	16-000307-004	.5Ω 3W 10%	R16,18,21,28		
4	28	16-000307-001	.1Ω 3W 10%	R49,51,52,54		
2	27	17-000052-019	150Ω 1/4W 5%	R22,27		
4	26	17-000052-015	RES 10Ω 1/4W 5%	R17,19,50,53		

QTY	ITEM	PART NO.	DESCRIPTION	MATERIAL SPEC	MATERIAL STOCK SIZE	REMARKS
4	25	53-000054-055	RES 10K 1/4W 2%	R4,37,40,46		
4	24	53-000054-048	5100Ω	R1,2,8,47		
1	23	53-000054-047	4700Ω	R34		
1	22	53-000054-084	2200Ω	R31		
3	21	53-000054-032	1K	R3,36,38		
1	20	53-000054-030	820Ω	R33		
1	19	53-000054-029	750Ω	R29		
1	18	53-000054-020	330Ω	R5		
2	17	53-000054-005	75Ω 1/4W 2%	R14,15		
1	16	53-000055-015	200Ω 1/2W 2%	R10		
3	15	53-000054-008	100Ω 1/4W 2%	R7,24,25		
2	14	53-000054-001	51Ω 1/4W 2%	R6,32		
2	13	53-000054-039	RES 2K 1/4W 2%	R42,43		
2	12	17000052-028	RES 33Ω 1/4W 5%	R9,13		
2	11	11-000614-002	XSTR-TIP36C	Q9,14		
3	10	11-000613-002	-TIP35C	Q8,18,16		
2	9	11-000612-001	TIP34B	Q6,10		
2	8	11-000611-001	-TIP33B	Q7,11		
5	7	11-000018-001	2N4238	Q4,12,13,14,15		
2	6	11-000017-001	2N4036	Q3,5		
3	5	11-000060-001	xSTR-2N2222A	Q1,2,17		
	4					
1	3	10-000001-002	I.C. -723	I.C. 2		
1	2	10-000620-001	I.C. -SG4501D	I.C. 1		
1	1	301703-001	POWER CONTROL MOD PC BOARD			

REVISIONS REV	ECO	DATE	APPV	DESCRIPTION
A	(PROD RELEASE)			
B	A REV REPLACED BY REV P PER ECN 3274 DATED 6-14-74 AND ECN 3794 DATED 12-27-74			
C	ECN 2424 DATED 2-8-73			
D	PER ECN 2676 DATED 4-24-73			
E	PER ECN 3357 DATED 6-21-74			
F	PER ECN 3653 DATED 9-7-73			
RC	PER ECN 3977 DATED 10-15-73			
J	PER ECN 3794 DATED 12-27-74			
RC 2	PER ECN 4148 DATED 3-19-74			
H	PER ECN 4303 DATED 4-26-74			
J	4276	3/4/74	JW	1/4
K	4760	8/31/74	JW	1/8
L	4864	10/31/74	JW	1/8
M	4927	10/31/74	JW	1/8
N	5003	3/3/75	JW	1/8
RC 3	5024	10/31/74	JW	1/8
P	5201	4/1/75	JC	1/8

THIS DOCUMENT INCOMPLETE WITHOUT ECN'S _____ HISTORY COPY

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CÆLUS MEMORIES INC.
SAN JOSE CALIFORNIA

UNLESS OTHERWISE SPECIFIED TOLERANCES
ANGLES ±0°30'
MACHINED SURFACES 63

	NAME	DATE
DRAWN		
CHECKED		6-24-74
DESIGN		
PROJ ENG		
MFG ENGR		
QA		

USED ON 303
NEXT ASSY

TITLE: ASSEMBLY POWER CONTROL MODULE

SCALE 2/1 | SHT 1 OF 2 | DWG 301705 | REV P

P 301705

301705 P

DETAIL B

(6 PLACES) 67

66 (6 PLACES)
77 6PL

DETAIL C
4/1 SCALE

68 (REF)
MOUNT ON COMPONENT SIDE

SEE DETAIL B

59 (4 PLACES)

58 (7 PLACES)
SEE DETAIL C

60

61

1

64 (9 PLACE)
69 (9PLACE)
70
79 1

1 (REF)

68 (2 PLACE)

62 (REF)

SECTION A-A

(2 PLACES) 55

(2 REQD) 56
(2 PLACES)

62

		R32	11H						
		R31	11G						
		R30	11G						
		R29	11G						
		R28	10G						
		R27	9G						
		R26	9G						
		R25	11H						
		R24	10H						
		R23	7G						
Q19	6J	R22	7G	R54	4G				
Q18	5J	R21	6G	R53	6H	C21	8D		
Q17	12E	R20	7A	R52	5G	C20	6D		
Q16	13J	R19	6H	R51	4G	C19	1B		
Q15	9D	R18	5H	R50	3H	C18	11H		
Q14	10D	R17	3H	R49	3G	C17	3H		
Q13	11D	R16	2H	R48	11E	C16	10F		
Q12	12H	R15	2H	R47	12E	C15	13F		
Q11	12J	R14	8H	R46	12E	C14		F2	7D
Q10	10J	R13	3G	R45	8B	C13	13G	F1	1D
Q9	7J	R12	5F	R44	4B				
Q8	3J	R11	2F	R43	10G			K1	10B
Q7	9J	R10	4F	R42	5G	C10	9F		
Q6	2J	R9	2G	R41	5B	C9	7F		
Q5	3G	R8	6E	R40	13B	C8	10G		
Q4	2G	R7	3E	R39		C7	6G	CR7	12E
Q3	3E	R6	4E	R38	13A	C6	6C	CR6	12E
Q2	5E	R5	6E	R37	13B	C5	3C	CR5	11D
Q1	4E	R4	6E	R36	12H			CR4	13C
		R3	5D	R35	13H	C3	12E	CR3	9D
IC2	12G	R2	4E	R34	12G	C2	3E	CR2	13E
IC1	8G	F1	6D	R33	12G	C1	6E	CR1	2F
REF DESIG	LOCATION	REF DESIG	LOCATION	REF DESIG	LOCATION	REF DESIG	LOCATION	REF DESIG	LOCATION

DASH NO & QTY PER ASSY									
099	089	079	069	059	049	039	029	019	009

ITEM	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION/MATERIAL	REMARKS

PART NO	NEXT ASSY	USED ON
APPLICATION		

UNLESS OTHERWISE SPECIFIED
TOLERANCES
XX ±
XXX ±
ANGLES
DO NOT SCALE DRAWING
INTERPRET DIMENSIONS AND TOLERANCES PER USAS Y14.5
DIMENSIONS ARE IN INCHES AND APPLY AFTER HEAT TREAT AND FINISH
COUNTERSINK AND SPOTFACE FULLY DASH TO BE 82 MAXIMUM
REMOVE ALL BURRS AND BREAK SHARP EDGES (EQUIVALENT TO .010)
ROUGHNESS OF MACHINED SURFACES MIL PER USAS B46.1
STANDARD HOLE TOLERANCE PER AND MS87

DRAWN Harold Blue 11-7-72
CHECK
PROD. ENGR
PROD. ENGR
OTHER APPROVALS
THIRD ANGLE PROJECTION
INCH

CÆLUS MEMORIES INC.
SAN JOSE, CALIFORNIA

TITLE
ASSEMBLY POWER CONTROL MODULE

SIZE D
THE INFORMATION ON THIS DRAWING MAY NOT BE DISSEMINATED WITHOUT AUTHORIZATION OF CAELUS MEMORIES INC.
SCALE 2/1
SHT 2 OF 2
DWG 301705
REV P

301705 P

	9	79	45-000911-001	TRANSISTOR INSULATOR		
	1	78	17-000052-017	RES STOR 12Ω, 1/4W, 5%	R44	
	6	77	25-000086-063	SCREW, PAN HD		10-32-.50 LG
	A/R	76	04-000429-001	WIRE, WIRE WRAP UL STYLE 1422		[7]
	8	75	25-000065-008	WASHER, FLAT		[6]
	AR	74	04-000549-005	WIRE, BUS BAR 22 AWG		
	AR	73	08-000989-001	TUBING, PVC		
		72				
		71				
	A/R	70	06-000471-001	THERMAL CMPD.		
	9	69	45-001112-005	INSULATOR, SCREW (SHLDR WASHER)	NYLON	#4
	2	68	25-000111-013	SCR, FLH 82°		#4-40 x .25
	6	67	25-000146-005	WASHER, INTR LK		#10
	6	66	25-000067-007	WASHER, SPLIT LK		#10
	15	65	35-000608-001	PIN-CONTACT		MOLEX 02-09-2133
	9	64	25-000084-014	SCR, CAP, SOC HD		#4-40 x .38
	1	63	36-000619-001	RELAY-K1		[5]
	1	62	301711-001	HEAT SINK		
	1	61	41-000673-003	CONNECTOR	J3	
	1	60	41-000246-001	CONNECTOR	J2	15 PIN
	4	59	35-000276-001	PIN	J1,5,6,7	AMP #60599-3
	7	58	35-000162-001	POST MOD II	J4 (REF)	
		57				
	4	56	25-000748-001	FUSE CLIP	F1,F2	
	2	55	67-000747-001	FUSE 8A AGC	F1,F2	
	1	54	13-000037-035	CAP 3.3MF 20V	C3	
	1	53	12-000305-001	DIO-IN752A 5.6V	CR7	
	1	52	12-000652-001	DIO-MR751	CR2	
	5	51	12-000687-001	DIO-IN4001	CR1,3,4,5,6	
QTY	ITEM	PART NO.	DESCRIPTION	MATERIAL SPEC	MATERIAL STOCK SIZE	REMARKS

1	50	13-000043-056	CAP 1000PF 100V	C15	
1	49	13-000629-003	68MF 16V	C21	
1	48	13-000244-014	1MF 50V	C20	
1	47	13-000070-007	22000MF 15V	C16	
1	46	13-000041-001	.0022MF 80V	C2	
1	45	13-000042-005	.001MF 200V	C1	
4	44	13-000521-001	.01MF 100V	C9,10,17,19	
	43				
2	42	13-000216-010	23000MF 40V	C5,6	[8]
2	41	13-000037-033	2.2MF 20V	C7,8	
1	40	13-000034-019	CAP-6.8MF 6V	C13	
1	39	53-000054-042	RES 3K 1/4W 2%	R48	
2	38	16-000307-005	RES .75Ω 2.5W 10%	R21,28	
1	37	16-000307-047	RESIST 3W 5%	R11	
1	36	14-000522-005	500Ω POT	R30	
1	35	16-000277-001	RES .1Ω 5W 1%	R20	
1	34	16-000307-086	2K 3W 5%	R12	
	33	DETEDED	1K		
1	32	16-000307-011	4Ω	R45	
1	31	16-000307-018	10Ω 3W 5%	R41,	
1	30	16-000307-14U	.33Ω 3W 10%	R35	
2	29	16-000307-004	.5Ω 3W 10%	R16,19	
4	28	6-000307-001	.1Ω 3W 10%	R43,5,52,54	
	27	DELETED			
4	26	17-000052-015	RES 10Ω 1/4W 5%	R17,13,50,53	
QTY	ITEM	PART NO.	DESCRIPTION	MATERIAL SPEC	MATERIAL STOCK SIZE	REMARKS

4	25	53-000054-055	RES 10K 1/4W 2%	R4,37,40,46	
4	24	53-000054-048	5100Ω	R1,2,8,47	
1	23	53-000054-047	4700Ω	R34	
1	22	53-000054-084	2200Ω	R31	
3	21	53-000054-032	1K	R3,36,38	
1	20	53-000054-030	820Ω	R33	
1	19	53-000054-029	750Ω	R29	
1	18	53-000054-020	330Ω	R5	
2	17	53-000054-005	75Ω 1/4W 2%	R14,15	
1	16	53-000055-015	200Ω 1/2W 2%	R10	
3	15	53-000054-008	100Ω 1/4W 5%	R7,24,25	
2	14	53-000054-001	51Ω 1/4W 2%	R6,32	
2	13	53-000054-039	RES 2K 1/4W 2%	R42,43	
2	12	17-000052-028	RES 33Ω 1/4W 5%	R9,13	
2	11	11-000614-002	XSTR-TIP36C	Q9,17	
2	10	11-000613-002	XSTR-TIP35C	Q6,16	
2	9	11-000612-001	XSTR-TIP34B	Q,10	
2	8	11-000611-001	XSTR-TIP33B	Q7,11	
5	7	11-000018-001	2N4238	Q4,12,13,14,15	
2	6	11-000017-001	2N4036	Q3,5	
3	5	11-000080-001	XSTR-2N2222A	Q1,2,17	
	4				
1	3	10-000001-002	IC-723	IC,2	
1	2	10-000050-001	IC-SG3501D	IC,1	
1	1	301705-2-001	POWER CONTROL MOD PC BOARD		
QTY	ITEM	PART NO	DESCRIPTION	MATERIAL SPEC	MATERIAL STOCK SIZE	REMARKS

[3] DELETED

[4] DELETED

[5] FOR SUBSTITUTE PARTS USE 36-000619-002.

[6] TO BE USED AS SPACERS FOR C5 & C6 WHEN REQUIRED.

[7] BOTH ENDS OF JUMPERS TO BE WIRE WRAPPED USING 28AWG WIRE (ITEM 72).

[8] FOR SUBSTITUTE VALUES. SEE DWG 302678

[9] INSTALL JUMPER AS SHOWN USING ITEMS 73 AND 74.

NOTES:

[1] INSTALL INSULATOR (ITEM 79) WITH TRANSISTOR (ITEM 8 THRU 11). INSULATOR TO BE MOUNTED BETWEEN TRANSISTOR AND HEAT SINK AND COATED WITH GREASE (ITEM 70) BOTH SIDES.

[2] DELETED

REVISIONS REV	ECN	DATE	APPV
A	THOR SELECTED 1301722	11-21-72	
B	A REV NOT USED MIS-ENGINEERING ENGINEERING ORDER		
C	ECN 25424 ALL BOARDS	12-27-73	
D	PER ECN 3377 DC G 28-73		
E	PER ECN 3653 DC 8-7-73		
F	PER ECN 3377 DC 9-21-73		
RC 1	PER ECN 3377 DC 11-7-73		
G	PER ECN 3974 DC 11-19-73		
RC 2			
H	ECN 4303	7-1-74	
J	4476 JW	10/31/74	
K	4760 JW	9/31/74	
L	4866 JW	10/31/74	
M	4927 JW	10/31/74	
N	5003 JW	10/31/74	
RC 3	5124 JW	10/31/74	
P	5201 JC	10/31/74	
R	5580	3-10-75	

CÆLUS MEMORIES INC.
SAN JOSE CALIFORNIA

UNLESS OTHERWISE SPECIFIED TOLERANCES
ANGLES ± MACHINED SURFACES
MFG ENG. QA

DRAWN DESIGN PROJ. ENG. USED ON 302 NEXT ASSY

TITLE: ASSEMBLY POWER CONTROL MODULE

SCALE 2/1 SHT 1 OF 2 DO 301705 REV R

301705 R

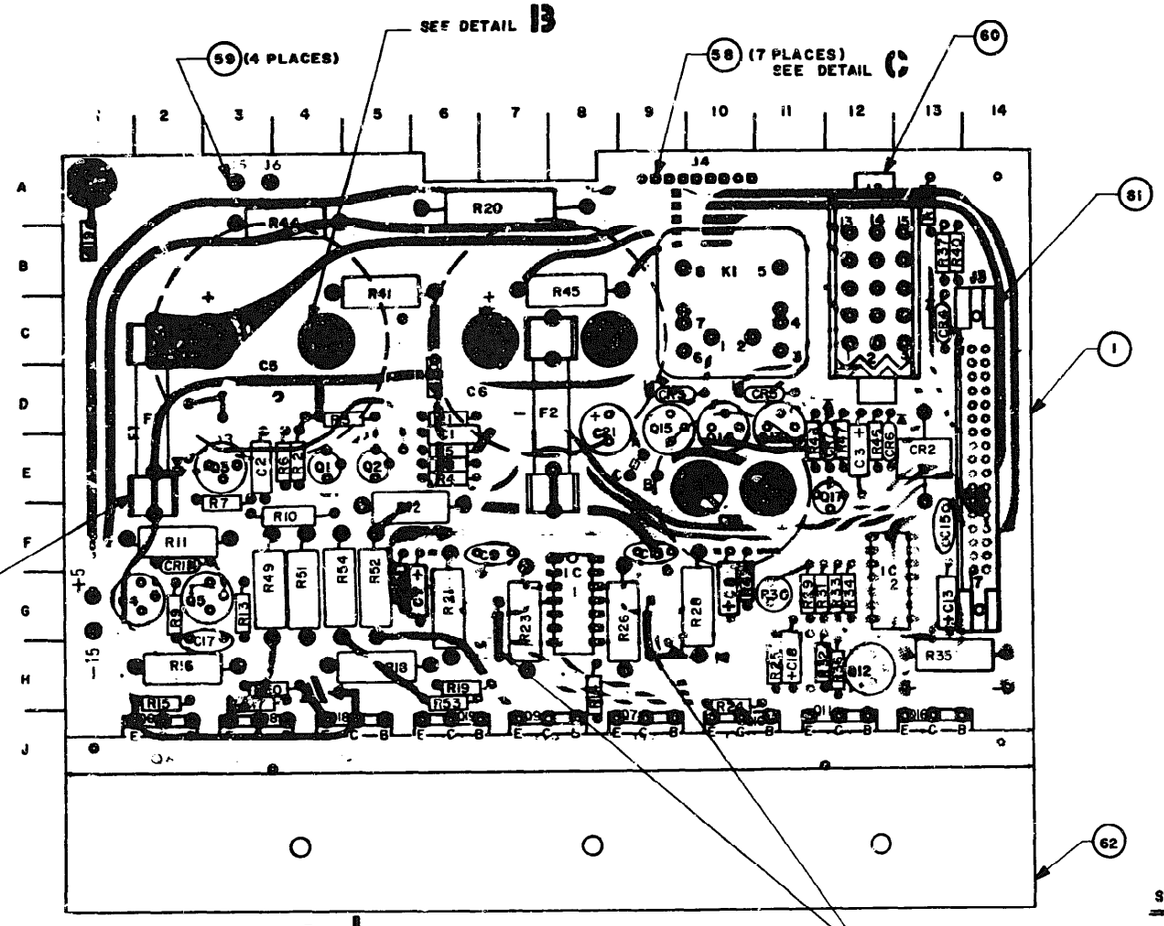
301705 D

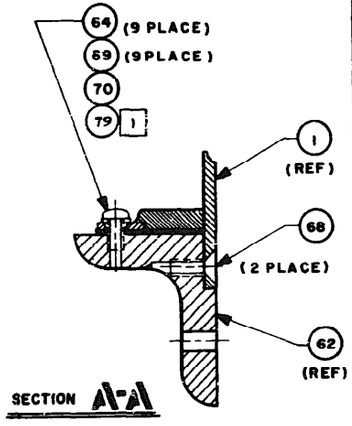
THIS DOCUMENT INCOMPLETE WITHOUT ECN'S

DETAIL B

DETAIL C
4/1 SCALE

MOUNT ON COMPONENT SIDE





				R32	11H														
				R31	11G														
				R30	11G														
				R29	11G														
				R28	10G														
				R26	9G														
				R25	11H														
				R24	10H														
				R23	7G														
Q19	6J							R54	4G										
Q18	5J			R21	6G			R53	6H			C21	8D						
Q17	12E			R20	7A			R52	5G			C20	6D			F2	7D		
Q16	13J			R19	6H			R51	4G			C19	1B			F1	1D		
Q15	9D			R18	5H			R50	3H			C18	11H						
Q14	10D			R17	3H			R49	3G			C17	3H						
Q13	11D			R16	2H			R48	11E			C16	10F						
Q12	12H			R15	2H			R47	12E			C15	13F						
Q11	12J			R14	8H			R46	12E			C14				K1	10B		
Q10	10J			R13	3G			R45	8B			C13	13G						
Q9	7J			R12	5F			R44	4B										
Q8	3J			R11	2F			R43	10G							CR7	12E		
Q7	9J			R10	4F			R42	5G			C10	9F			CR6	12E		
Q6	2J			R9	2G			R41	5B			C9	7F			CR5	11D		
Q5	3G			R8	6E			R40	13B			C8	10G			CR4	13C		
Q4	2G			R7	3E			R39				C7	6G			CR3	9D		
Q3	3E			R6	4E			R38	13A			C6	6C			CR2	13E		
Q2	5E			R5	6E			R37	13B			C5	3C			CR1	2F		
Q1	4E			R4	8E			R36	12H										
				R3	5D			R35	13H			C3	12E						
IC2	12G			R2	4E			R34	12G			C2	3E						
IC1	8G			R1	6D			R33	12G			C1	6E						
REF DESIG	LOCATION			REF DESIG	LOCATION			REF DESIG	LOCATION			REF DESIG	LOCATION			REF DESIG	LOCATION		

DASH NO & QTY PER ASSY										ITEM	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION/MATERIAL	REMARKS
09	08	07	06	05	04	03	02	01	00				

PART NO	NEXT ASSY	USED ON
	APPLICATION	

UNLESS OTHERWISE SPECIFIED
TOLERANCES
.XX ± .XXX ±
ANGLES
DO NOT SCALE DRAWING
INTERPRET DIMENSIONS AND TOLERANCES PER USAS Y14.5
DIMENSIONS ARE IN INCHES AND APPLY AFTER HEAT TREAT AND FINISH
COUNTERSINK AND SPOTFACE FILLET RADII TO BE .020 MAXIMUM
REMOVE ALL BURRS AND BREAK SHARP EDGES EQUIVALENT TO .005
ROUGHNESS OF MACHINED SURFACES 125/ PER USAS B46.1
STANDARD HOLE TOLERANCE PER ANSI 14.5M

DRAWN Karabel Blum 11-7-72
CHECK
ENGR
PROD. ENGR
OTHER APPROVALS
THIRD ANGLE PROJECTION
INCH / mm

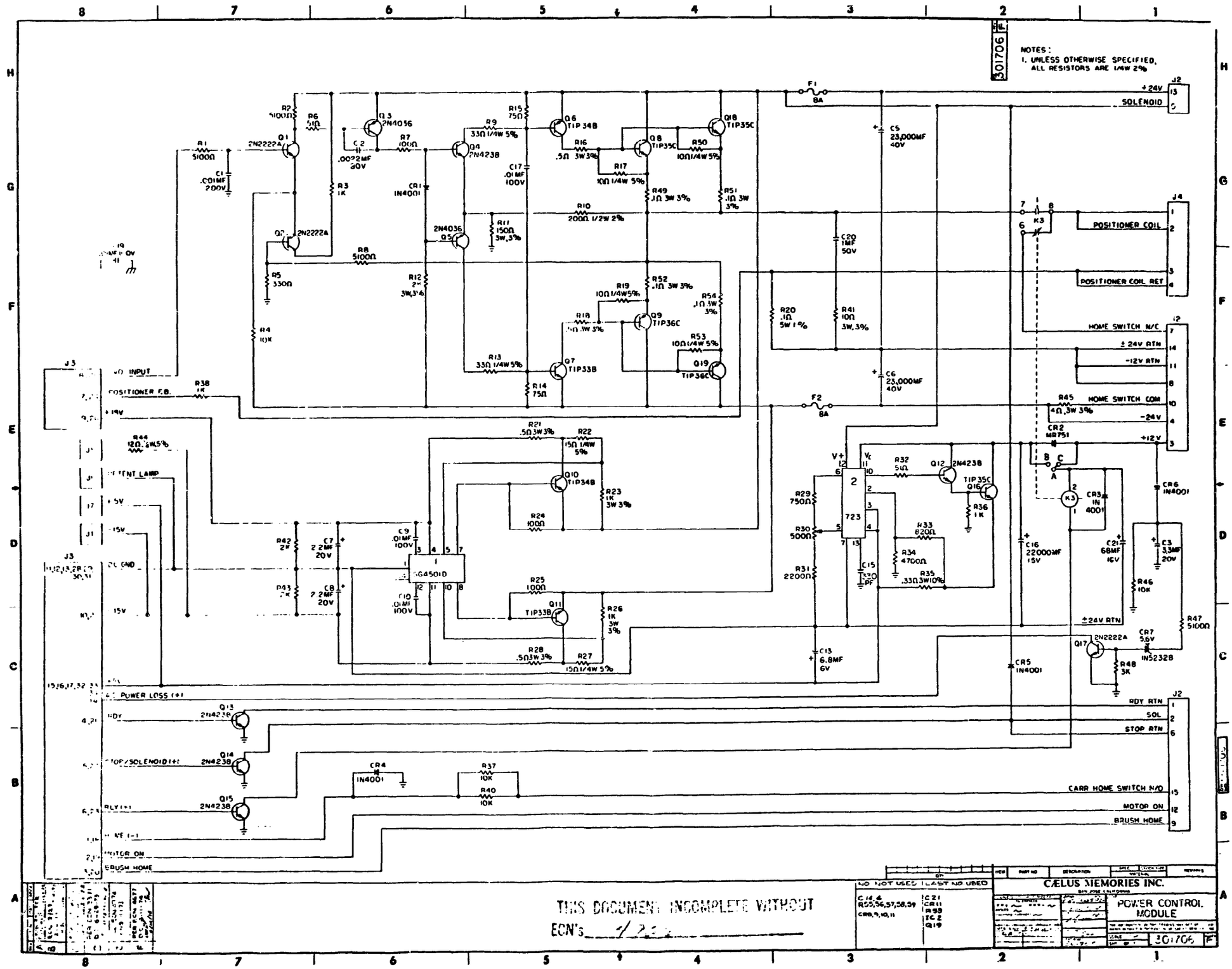
CÆLUS MEMORIES INC.
SAN JOSE, CALIFORNIA

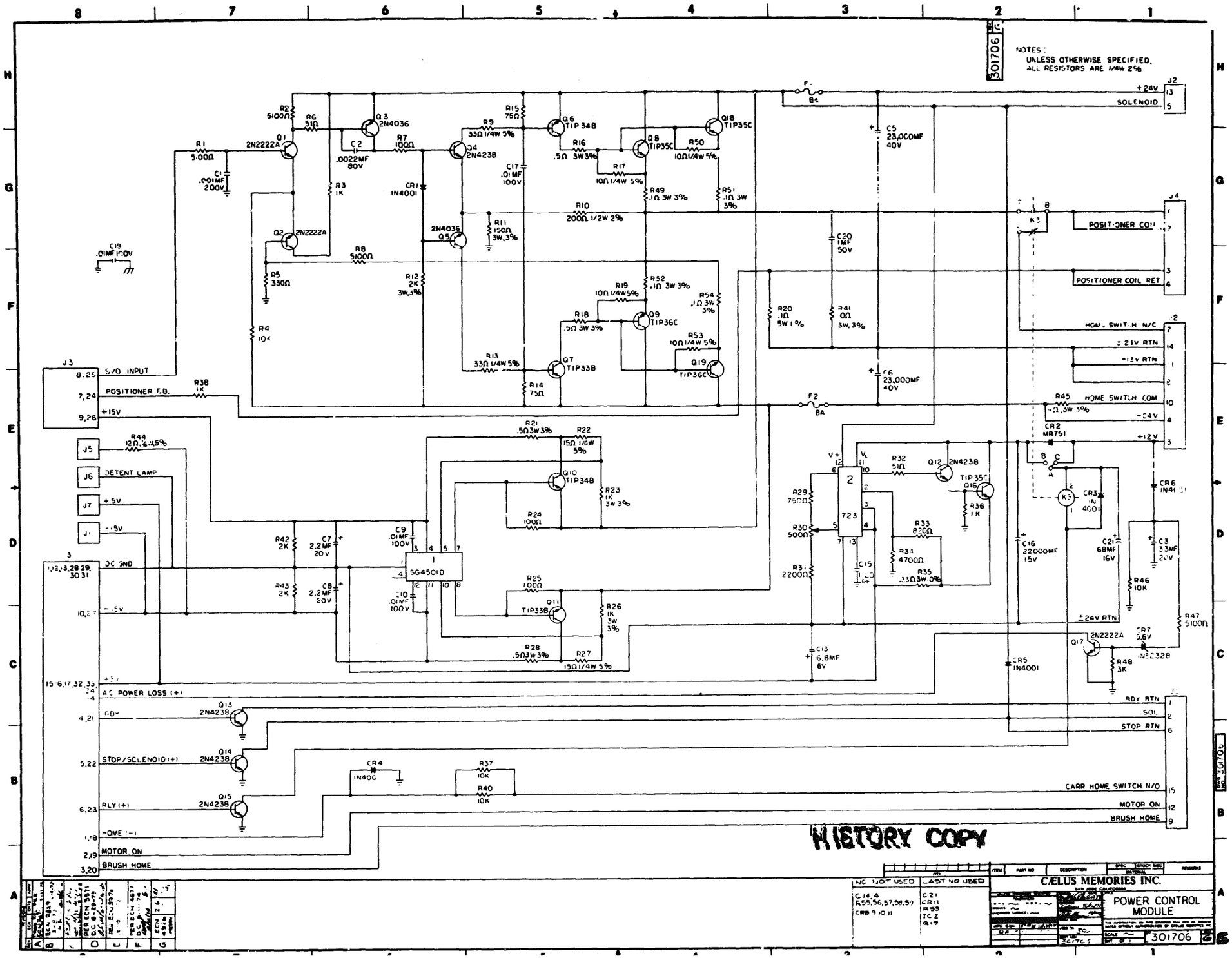
TITLE: ASSEMBLY POWER CONTROL MODULE

SIZE D | SCALE 2/1 | SHT 2 OF 2 | THE INFORMATION ON THIS DRAWING MAY NOT BE DISSEMINATED WITHOUT AUTHORIZATION OF CAELUS MEMORIES INC.

PD 301705 REV R

301705 R


301706
NOTES:
1. UNLESS OTHERWISE SPECIFIED, ALL RESISTORS ARE 1/4W 2%
+24V SOLENOID
POSITIONER COIL
POSITIONER COIL RET
HOME SWITCH N/C
+24V RTN
-12V RTN
HOME SWITCH COM
-24V
+12V
I/O INPUT
POSITIONER F.B.
+5V
-15V
I/O GND
+24V RTN
RDY RTN
SOL
STOP RTN
CARR HOME SWITCH N/O
MOTOR ON
BRUSH HOME
THIS DOCUMENT INCOMPLETE WITHOUT ECN's
CÆLUS MEMORIES INC.
POWER CONTROL MODULE
301706


NOTES:
UNLESS OTHERWISE SPECIFIED,
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301706
+24V SOLENOID
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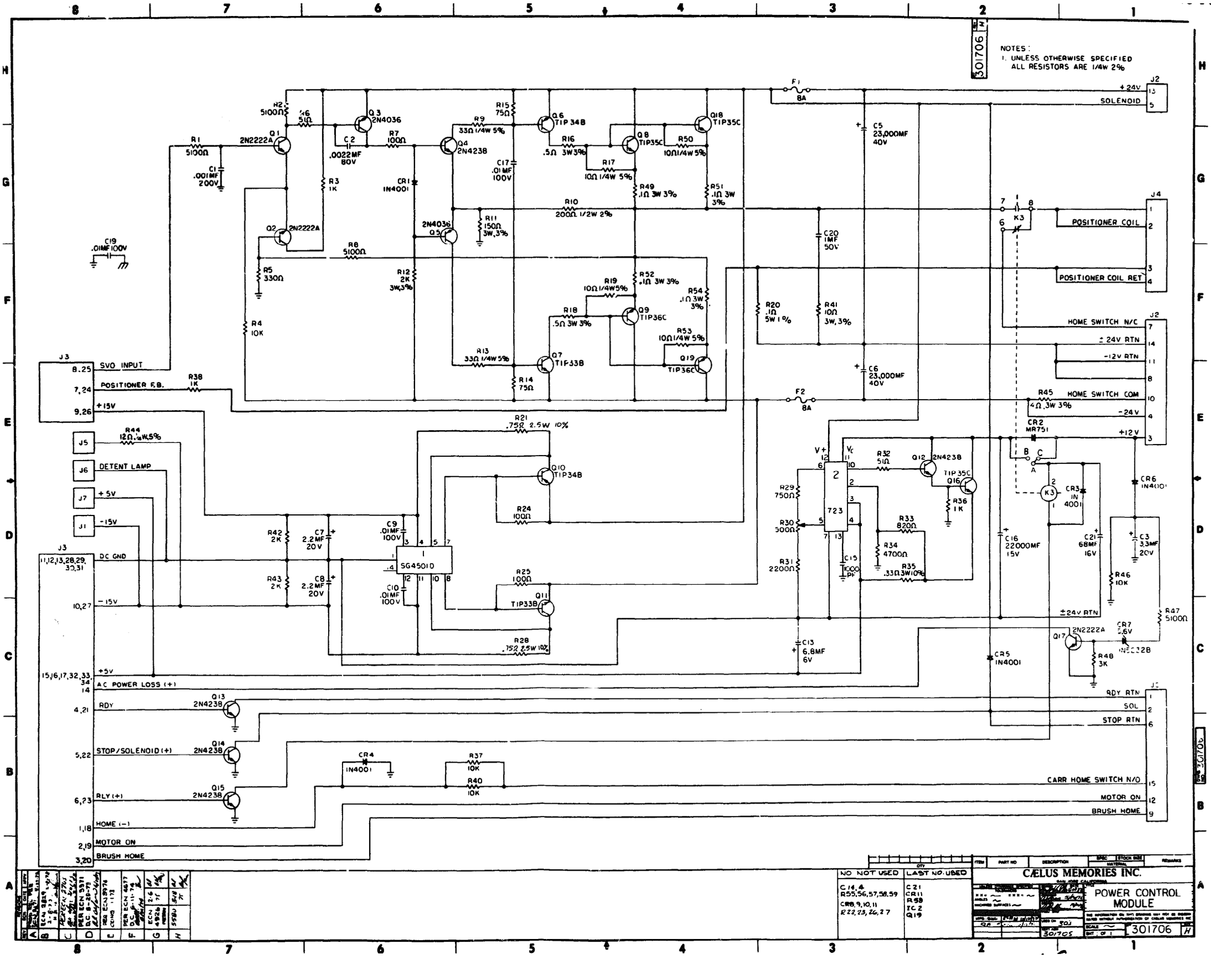
HOME SWITCH N/C
+24V RTN
+12V RTN
HOME SWITCH COM
-24V
+12V
S.V.O. INPUT
POSITIONER F.B.
+15V
DETENT LAMP
+5V
-15V
DC GND
AC POWER LOSS (+)
RDY
STOP/SOL ENOID (+)
RLY (+)
HOME (-)
MOTOR ON
BRUSH HOME
SG4501D
MR751
CARR HOME SWITCH N/O
RDY RTN
SOL
STOP RTN
HISTORY COPY
CÆLUS MEMORIES INC.
POWER CONTROL MODULE
301706



THIS DOCUMENT INCOMPLETE WITHOUT ECN's

ENGINEERING CHANGE NOTICE 4760

CHANGE EFFECTS	Y	N	PART/MATL DISPOSITION: USE AS IS	REWORK	SCRAP
INTERCHANGEABILITY		X			
TOOLING		X			
FIXTURES		X			
TEST EQUIPMENT		X			
PARTS IN STOCK		X			
PARTS IN PROCESS		X			
PARTS ON ORDER		X			
PARTS @ CUST DEPOTS		X			

F. Gonzalez 5/1/74
DEPT. SUPERVISOR

TEST EQUIPMENT

MANUFACTURING 5/1/74

CONF. CONT. BOARD

PRODUCT ENG. Bailey

CUSTOMER

PRODUCTION CONTROL J Stuart 5/15/74

ITEM EFFECTIVITY: 5/16/74

301705 H

DOCUMENT TITLE: Assembly Power Control Module 203/303

CHANGE TYPE
CLASS 1 ☐
CLASS 2 ☒
RECORD ☐

ACCEPTED ☒
REJECTED ☐

REASON FOR CHANGE:
PAR 1550

REASON FOR REJECTION:

DESCRIPTION OF CHANGE

ADD TO BILL OF MATERIALS:

QTY	ITEM	PART NUMBER	DESCRIPTION	REMARKS
8	75	25-000065-008	Flat Washer	Note [4]

ADD TO NOTES:

[4] To be used as spacers for C5 and C6 when required

ISSUED
MAY 17 1974

TACD	203/303
NEXT ASSY. DWG. NO.(S)	PROGRAM (S)

SHEET 1 OF 1

ENGINEERING CHANGE NOTICE 4860

TO 31S5-4-519-1

CHANGE EFFECTS	Y	N	PART/MATL DISPOSITION: USE AS IS	REWORK	SCRAP
INTERCHANGEABILITY		X			
TOOLING		X			
FIXTURES		X			
TEST EQUIPMENT		X			
PARTS IN STOCK		X			
PARTS IN PROCESS		X			
PARTS ON ORDER		X			
PARTS @ CUST DEPOTS		X			

REQUESTOR DATE: F. Gonzalez 5/28/74

QUALITY ASSURANCE: F16

DEPT. SUPERVISOR: [signature] DP

TEST EQUIPMENT:

MANUFACTURING: [signature]

CONF. CONT. BOARD:

PRODUCT ENG.: [signature]

CUSTOMER:

PRODUCTION CONTROL: [signature] 6-12

END ITEM EFFECTIVITY: 6-12-74

REASON FOR REJECTION:

DOCUMENT NO: 301705

REV: C

DOCUMENT TITLE: Assembly, Power Control Module

CHANGE TYPE

CLASS 1 ☐
CLASS 2 ☒
RECORD ☐

ACCEPTED ☒
REJECTED ☐

REASON FOR CHANGE:

PAR #1636

DESCRIPTION OF CHANGE:

THIS ECN WILL MAKE THIS DRAWING REV L

Change Bill of Materials FROM:

1	63	36-000619-001	Relay K1	Guardian 1355PC-2C-12D
009	ITEM	PART NUMBER	DESCRIPTION	Remarks

TO:

1	63	36-000619-001	Relay K1	Note 5
009	ITEM	PART NUMBER	DESCRIPTION	REMARKS

ADD NOTE 5: For substitute parts use 36-000619-002

ISSUED
JUN 13 1974

TACD	203/303
NEXT ASSY [illegible]	[illegible]

1 1

ENGINEERING CHANGE REQUEST / NOTICE

NO 4927

CHANGE EFFECTS	Y	N	PART/MATL DISPOSITION ✓ USE AS IS	REWORK	SCRAP
INTERCHANGEABILITY		X			
TOOLING		X			
FIXTURES		X			
TEST EQUIPMENT		X			
PARTS IN STOCK	X				
PARTS IN PROCESS	X				
PARTS ON ORDER	X				
PARTS @ CUST DEPOTS		X			

REQUESTOR/DATE	QUALITY ASSURANCE	DOCUMENT NO	REV
H.W. Robinson 7/16/74		301705	
DEPT' SUPERVISOR	TEST EQUIPMENT	DOCUMENT TITLE	
MANUFACTURING	CONF. CONT. BOARD	Assembly Power Control Board	
PRODUCT ENG.	CUSTOMER	CHANGE TYPE	
PRODUCTION CONTROL		CLASS 1 ☐ CLASS 2 ☐ RECORD ☐	
ITEM EFFECTIVITY:		ACCEPTED ☐ REJECTED ☐	

REASON FOR CHANGE:

PAR #1516 5V Regulator Oscillation

REASON FOR REJECTION:

DESCRIPTION OF CHANGE:

		QTY	ITEM	PART NUMBER	DESCRIPTION	REF. DES.
CHANGE ITEM 50	FROM:	1	50	13-000043-043	Cap 330pf 500v	C15
	TO:	1	50	13-000043-056	Cap 1000pf 100v	C15

ISSUED

JUL 26 1974

NEXT ASSY. DWG. NO.(S)	PROGRAM (S)	SHEET 1 OF 1
	303/203	

ENG 023

TO 31S5-4-519-1

5002

CHANGE EFFECTS	Y	N	PART MATERIAL DISPOSITION: USE AS IS	REWORK	SCRAP
INTERCHANGEABILITY		X			
TOOLING		X			
FIXTURES		X			
TEST EQUIPMENT		X			
PARTS IN STOCK		X			
PARTS IN PROCESS	X				
PARTS ON ORDER	X				
PARTS @ CUST DEPOTS		X			

REASON FOR CHANGE:
PAR 1649

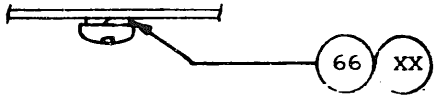
REQUESTOR/DATE: Bob Talbot 7/12/74
DEPT SUPERVISOR:
MANUFACTURING:
PRODUCT ENG.: Bobzb
PRODUCTION CONTROL:
ITEM EFFECTIVITY: 5/29/74
CONFIGURATION CONTROL BOARD: 7/16 - 7/24
TEST EQUIPMENT:
CUSTOMER:
REASON FOR REJECTION:

DOCUMENT NO: 301705 L
DOCUMENT TITLE: Assembly Power Control Module
CHANGE TYPE: CLASS 1 ☐ CLASS 2 ☒ RECORD ☐
ACCEPTED ☒ REJECTED ☐
DRAWING REV. N

DESCRIPTION OF CHANGE:

ADD ITEM "XX" 25-000085-063 Screw Pan Head 10-32 X .50 lg

ADD TO PAGE 2, ZONE D-8 DETAIL B "XX" Callout



(6 places)

203/303

NEXT ASSY. DWG. NO.(S) | PROGRAM (S)

SHEET 1 OF 1

ENGINEERING CHANGE REQUEST / NOTICE

NO 5024

CHANGE EFFECTS	Y	N	PART/MATL DISPOSITION: USE AS IS	REWORK	SCRAP
INTERCHANGEABILITY		X			
TOOLING		X			
FIXTURES		X			
TEST EQUIPMENT		X			
PARTS IN STOCK		X			
PARTS IN PROCESS		X			
PARTS ON ORDER		X			
PARTS @ CUST DEPOTS		X			

REQUESTOR/DATE: JoAnn Brengard 8/5/74	QUALITY ASSURANCE	DOCUMENT NO: 301705	REV
DEPT' SUPERVISOR	TEST EQUIPMENT	DOCUMENT TITLE: P.C. Board Assembly PCM	
MANUFACTURING	CONF. CONT. BOARD 9/4/74		
PRODUCT ENG.	CUSTOMER	CHANGE TYPE: CLASS 1 ☐ CLASS 2 ☐ RECORD ☒	
PRODUCTION CONTROL			
END ITEM EFFECTIVITY:		ACCEPTED ☒ REJECTED ☐	

REASON FOR CHANGE:
PAR #1797

REASON FOR REJECTION: THIS ECN WILL MAKE THIS DRAWING REV. RC 3

DESCRIPTION OF CHANGE:

ADD NOTE TO DRAWING: NOTE — Both ends of jumpers to be wire wrapped using 28 Awg K[redacted]r wire. (Item # *)

ADD TO BILL OF MATERIALS: (All dash numbers) — 04-000429-001 Wire, Wire Wrap UL Style 1422 QTY A/R

(*Note fill-in item number for wire 04-000429-001)

ISSUED SEP 5 1974

NEXT ASSY. DWG. NO.(S)	PROGRAM (S)	SHEET 1 OF 1
	203/303	

ENG 023

ENGINEERING CHANGE REQUEST / NOTICE

NO. 5201

CHANGE EFFECTS	Y	N	PART/MATL DISPOSITION: USE AS IS	REWORK	SCRAP
INTERCHANGEABILITY		X			
TOOLING		X			
FIXTURES		X			
TEST EQUIPMENT		X			
PARTS IN STOCK					
PARTS IN PROCESS					
PARTS ON ORDER					
PARTS @ CUST DEPOTS		X			

REQUESTOR/DATE	QUALITY ASSURANCE	DOCUMENT NO	REV
JoAnn Brengard 10/28/74		301705	H
DEPT' SUPERVISOR	TEST EQUIPMENT	DOCUMENT TITLE: POWER CONTROL MODULE 203/303	
MANUFACTURING	CONF CONT BOARD		
PRODUCT ENG.	CUSTOMER	CHANGE TYPE: CLASS 1 ☐ CLASS 2 ☒ RECORD ☐	
PRODUCTION CONTROL			
END ITEM EFFECTIVITY:		ACCEPTED ☒ REJECTED ☐	

REASON FOR CHANGE: PAR #2159 & 1840

REASON FOR REJECTION: P

DESCRIPTION OF CHANGE: Manufacturing is conforming to requirements of this ECN.

1. ADD NEW ITEM TO BILL OF MATERIALS:

9 009	* ITEM	45-000911-001 PART NUMBER	Transistor Insulator DESCRIPTION

2. CHANGE ITEM 69 FROM:

9	69	25-000435-002	Washer, Shldr

TO:

9 009	69 ITEM	45-001112-006 PART NUMBER	Insulator, Screw (Shldr Washer) DESCRIPTION

3. CHANGE NOTE 1 FROM: Install insulator supplied with transistor (Item 8 thru 11). Insulator to be mounted between transistors and heat sink and coated with grease (Item 70) both sides.

TO: Install insulator (Item *) with transistor (Item 8 thru 11). Insulator to be mounted between transistor and heat sink and coated with grease (Item 70) both sides.

RELEASED 11/19/74

TACD	203/303
NEXT ASSY. DWG. NO.(S)	PROGRAM (S)

SHEET 1 OF 2

ENG 023

ENGINEERING CHANGE REQUEST / NOTICE

NO 5201

4. SHEET 2, VIEW A-A: CHANGE FROM:

64 (9 place)
69 (9 place)
70

|1

TO:

64 (9 place)
69 (9 place)
70

* |1

5. CHANGE BILL OF MATERIALS:

FROM:	6	76	25-000085-063	SCREW PAN HEAD	10-32 x .50 lg
TO:	6	76	25-000086-063	SCREW PAN HEAD	10-32 x .50 lg

ENG 023-1

ENGINEERING CHANGE REQUEST / NOTICE

NO. 5580

CHANGE EFFECTS	Y	N	PART/MATL DISPOSITION: USE AS IS	REWORK	SCRAP
INTERCHANGEABILITY					
TOOLING					
FIXTURES					
TEST EQUIPMENT					
PARTS IN STOCK	✓				
PARTS IN PROCESS					
PARTS ON ORDER	✓				
PARTS @ CUST DEPOTS		✓			

REQUESTOR/DATE	QUALITY ASSURANCE	DOCUMENT NO	REV
Mike Ranger 3/7/75		Noted	
DEPT' SUPERVISOR	TEST EQUIPMENT	DOCUMENT TITLE	
MANUFACTURING	CONF. CONT. BOARD	Noted	
PRODUCT ENG. 3-7-75	CUSTOMER	CHANGE TYPE	
PRODUCTION CONTROL		CLASS 1 ☐ CLASS 2 ☐ RECORD ☐	
END ITEM EFFECTIVITY:		ACCEPTED ☒ REJECTED ☐	

REASON FOR CHANGE: 1. PCM Regulator problem
PAR 2760 & PAR 2713 2. Shoulder washer too long

REASON FOR REJECTION:

DESCRIPTION OF CHANGE:

Documents Affected:

1. 302126 Rev J - Power Control Module Assembly
2. 302127 Rev E " " " Schematic
3. 301705 Rev P " " " Assembly
4. 301706 Rev G Power Control Module Schematic

* 302126 K
302127 F
301705 R
301706 H

301000	301500	Doc 3 & 4	303/2 & 303/1
301600	301750	Doc 1 & 2	203/2 & 203/1
302065	302645	Doc 1 & 2	203FA/2
302525	302819	Doc 3 & 4	303FA/2 303FA/1

ISSUED
MAR 12 1975

NEXT ASSY. DWG. NO.(S) | PROGRAM (S)

SHEET 1 OF 2

ENG 023

ENGINEERING CHANGE REQUEST / NOTICE

NO 5580

1. 302126 & 301705: In part list:

   a. Delete item 27 was 2 reqd, 17-000052-019 Res, 15Ω, R22 & R27
   b. Delete item 33 was 2 reqd, 16-000307-077 Res, 1K, R23 & R26
   c. Item 29: from 4 reqd, 16-000307-004, Res, .5Ω, R16,18,21,28
      to 2 reqd, 16-000307-004, Res, .5Ω, R16,18
   d. Add item: 2 reqd, 16-000307-005 Res, .75Ω; 2.5w, 10% R21, 28
   e. Add item: A/R, 04-000349-005, Wire, Bus Bar, 22 Awg
   f. Add item: A/R, 08-000489-001, Tubing, PVC
   g. Item 69: from: 45-001112-006, Insulator, Screw
      to: 45-001112-005, Insulator, Screw

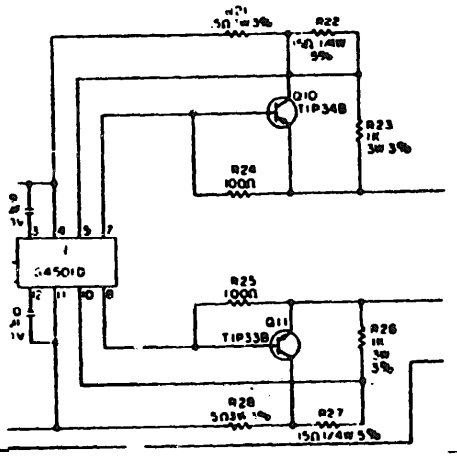
2. 302126 & 301705:

   a. Remove R22 & R27 from picture, sheet 2, & show jumpers in their place
   b. Remove R22 & R27 from component list, sheet 2
   c. Add note & code to jumpers: "Install jumper across R22 & R27 using items (1e & 1f) above.

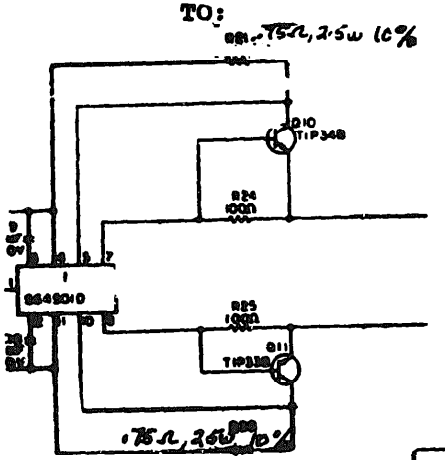
3. 302127 & 301706:

   a. Add R22 & R27 to "component not used", Zone A3
   b. In Zone C, D & E5:

FROM:



TO:



ENG 023-1

ENGINEERING CHANGE REQUEST / NOTICE

NO 4926

CHANGE EFFECTS	Y	N	PART/MATL DISPOSITION: USE AS IS	REWORK	SCRAP
INTERCHANGEABILITY		X			
TOOLING		X			
FIXTURES		X			
TEST EQUIPMENT		X			
PARTS IN STOCK	X				
PARTS IN PROCESS	X				
PARTS ON ORDER	X				
PARTS @ CUST DEPOTS		X			

REQUESTOR/DATE: H.W. Robinson

QUALITY ASSURANCE:

DEPT' SUPERVISOR:

TEST EQUIPMENT:

MANUFACTURING:

CONF. CONT. BOARD:

PRODUCT ENG.:

CUSTOMER:

PRODUCTION CONTROL:

ITEM EFFECTIVITY: 7-24-74

DOCUMENT NO: 301706

REV: F

DOCUMENT TITLE: Schematic Power Control Module

CHANGE TYPE:
- CLASS 1 ☐
- CLASS 2 ☒
- RECORD ☐

- ACCEPTED ☒
- REJECTED ☐

REASON FOR CHANGE:
PAR #1516 5V Regulator Oscillation

REASON FOR REJECTION:

DESCRIPTION OF CHANGE:

ZONE D3 CHANGE C15 FROM: 330pf

TO: 1000pf

ISSUED JUL 26 1974

301705	203/303
NEXT ASSY. DWG. NO.(S)	PROGRAM (S)

SHEET 1 OF 1

ENG 023

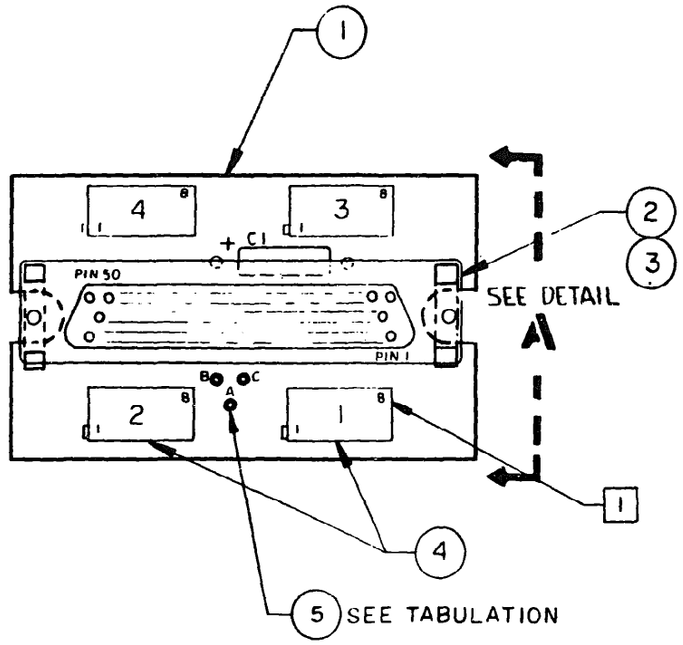
ENGINEERING DRAWING CONFIGURATION

Assembly: Termination Board

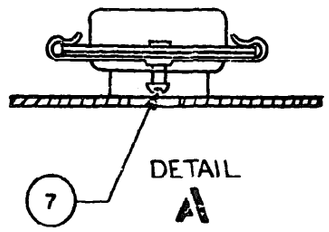
PC Board Assembly P/N 301308	Applicable Schematic Dwg. No. 301309
Rev	Rev
D	B

☆U.S. GOVERNMENT PRINTING OFFICE: 1979 O—603-128/1393 REGION 3-1

NOTE:
1. NOTE DELETED.



	VOLTAGE SELECTION TABULATION
-009	DRIVE +5 JUMPER A TO B
-019	CONTROLLER +5 JUMPER A TO C



QTY 019	QTY 009	ITEM	PART NO	DESCRIPTION	SPEC / MATERIAL	STOCK SIZE	REMARKS
1	1	7	25-000672 -001	SCREW LOCK			MALE
1	1	6	13-000037 -033	CAP 2.2UF 20V	C1		
A/R	A/R	5	04-000349 -001	WIRE BUSS BARE 22 GA			
4	4	4	52-000893 -020	DIGITAL SIGNAL TERMINATOR			
50	50	3	35-000309 -001	CONTACT - MALE P.C.			CONNON-NO. 031-1989-000
J	1	2	41-000308 -001	HOUSING CONNECTION			CANNON-NO. DDC-50P
1	1	1	301307 -001	TERMINATION BOARD			

REVISIONS REV	ECN	DATE	APPR
B	3156	4/19/73	
C	3271	5/17/73	
D	4853	11/14/74	

THIS DOCUMENT NOT APPLICABLE WITHOUT ECN's

CÆLUS MEMORIES INC.
SAN JOSE CALIFORNIA

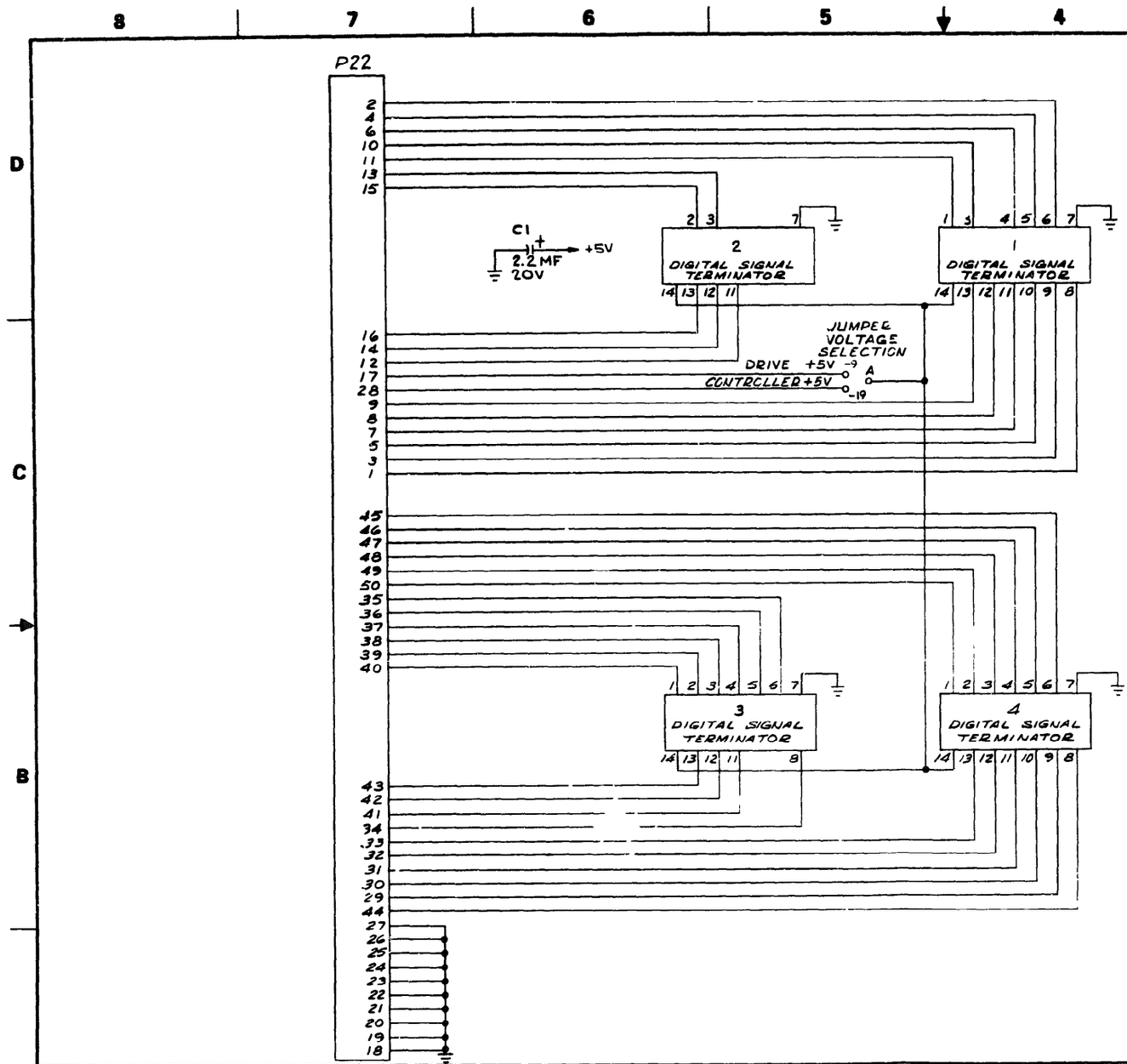
UNLESS OTHERWISE SPECIFIED
TOLERANCES
.XX ± .XXX ±
ANGLES
MACHINED SURFACES
APPLICABLE SPECIFICATIONS (REF)

DRAWN DATE 10 21
CHECKED
DES GN
PROJ ENG
USED ON CD300
NEXT ASM 301000

TITLE
TERMINATION BOARD ASSEMBLY

SCALE 2/1
SHT 1 OF 1
DO 301308
REV D

301308 REV D



REVISIONS REV	DESCRIPTION	DATE	APPV
A	PROD REL 11682	12/3 71	
B	2874		
C	ECN 5900 Revision	9.20.74	

ITEM	PART NO	DESCRIPTION	QTY	SPEC / MATERIAL	STOCK SIZE	REMARKS

CÆLUS MEMORIES INC.
SAN JOSE CALIFORNIA

UNLESS OTHERWISE SPECIFIED TOLERANCES
ANGLES
MACHINED SURFACES
APPLICABLE SPECIFICATIONS (REF)

Drawn 12/11/71
Checked
Design
Appd Engr
Issued On D306
Next Assy

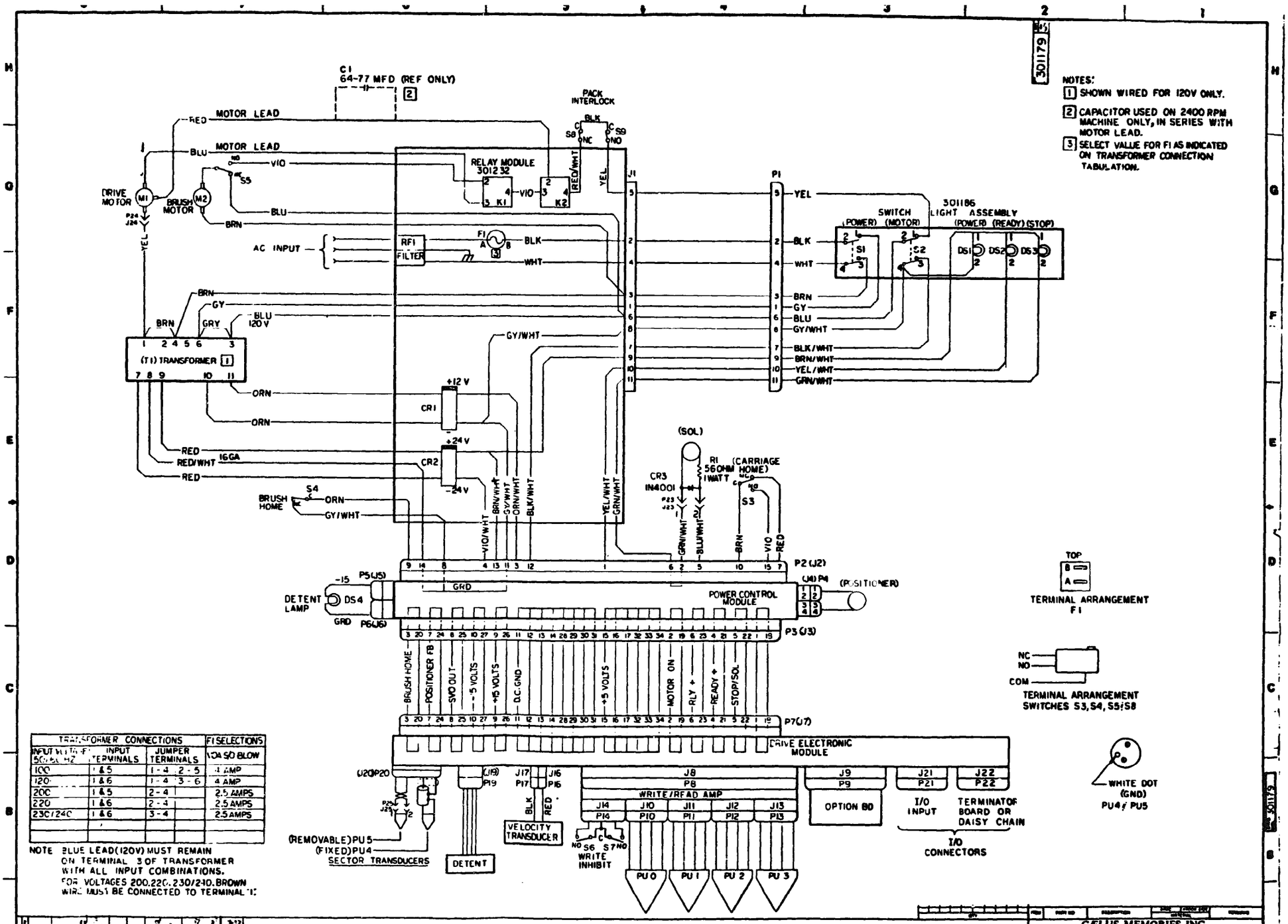
TITLE: SCHEMATIC TERMINATION BOARD

THE INFORMATION ON THIS DRAWING MAY NOT BE DISSEMINATED WITHOUT AUTHORIZATION OF CÆLUS MEMORIES INC

SCALE NONE
SHT 1 OF 1
SIZE D
301309
REV

301309 3

D 301309



NOTES:
1. SHOWN WIRED FOR 120V ONLY.
2. CAPACITOR USED ON 2400 RPM MACHINE ONLY, IN SERIES WITH MOTOR LEAD.
3. SELECT VALUE FOR F1 AS INDICATED ON TRANSFORMER CONNECTION TABULATION.

TRANSFORMER CONNECTIONS			F1 SELECTIONS
INPUT WITH F 50/60 HZ	INPUT TERMINALS	JUMPER TERMINALS	1/4 SO BLOW
100	1 & 5	1 - 4, 2 - 5	4 AMP
120	1 & 6	1 - 4, 3 - 6	4 AMP
200	1 & 5	2 - 4	2.5 AMPS
220	1 & 6	2 - 4	2.5 AMPS
230/240	1 & 6	3 - 4	2.5 AMPS

NOTE BLUE LEAD (120V) MUST REMAIN ON TERMINAL 3 OF TRANSFORMER WITH ALL INPUT COMBINATIONS. FOR VOLTAGES 200, 220, 230/240, BROWN WIRE MUST BE CONNECTED TO TERMINAL 1.

THIS DOCUMENT INCOMPLETE WITHOUT
ECN's NONE

CÆLUS MEMORIES INC.
INTERCONNECTION DIAGRAM 303
301179

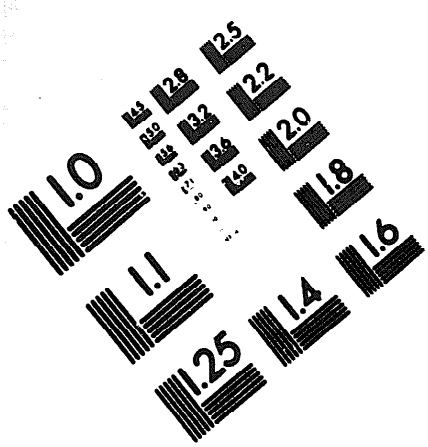
END

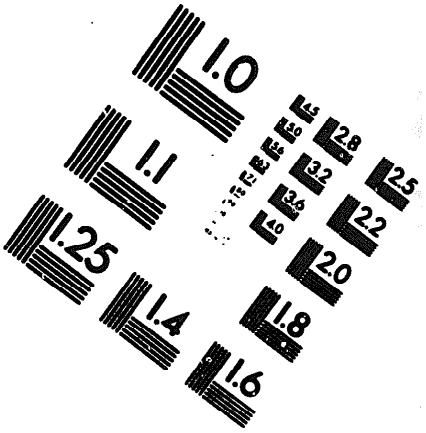
03-20-83

DATE

DEPARTMENT OF THE ARMY

MICROFORM
TEST TARGET





150 MM

1.0 mm (e= .81 mm)

ABCDEFGHIJKLMNOPQRSTUVWXYZ1234567890
abcdefghijklmnopqrstuvwxyz$¢£/%#½¼¾—=+×&@*

1.5 mm (e= 1.09 mm)

ABCDEFGHIJKLMNOPQRSTUVWXYZ1234567890
abcdefghijklmnopqrstuvwxyz$¢£/%#½¼¾—=+×&@*

2.0 mm (e= 1.37 mm)

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890$¢£/%#½¼¾—=+×&@*

2.5 mm (e= 1.77 mm)

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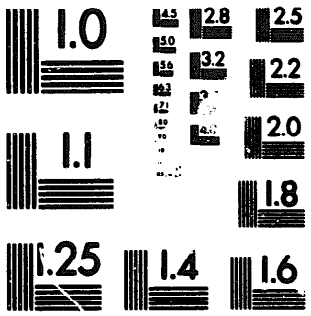
abcdefghijklmnopqrstuvwxyz
1234567890$¢£/%#½¼¾—=+×&@*



1.0 mm (e= .81 mm)

ABCDEFGHIJKLMNOPQRSTUVWXYZ1234567890
abcdefghijklmnopqrstuvwxyz$¢£/%#½¼¾—=+×&@*

1.5 mm (e= 1.09 mm)

ABCDEFGHIJKLMNOPQRSTUVWXYZ1234567890
abcdefghijklmnopqrstuvwxyz$¢£/%#½¼¾—=+×&@*

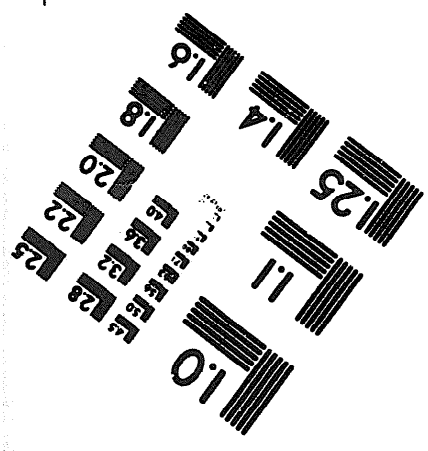
2.0 mm (e= 1.37 mm)

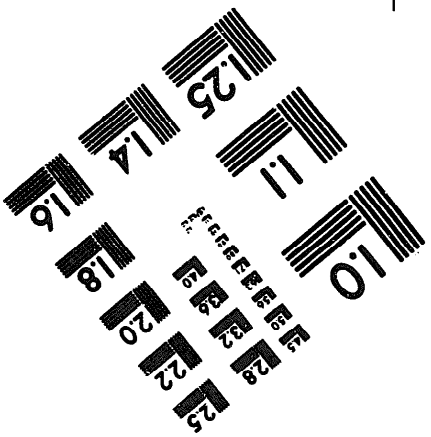
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890$¢£/%#½¼¾—=+×&@*

2.5 mm (e= 1.77 mm)

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890$¢£/%#½¼¾—=+×&@*

200 MM





250 MM