M990 GCR CacheTape® Unit Technical Manual

cipher

Federal Communications Commission (FCC) Notice

Warning: This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

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1. Set Up and Installation

This manual supplies set up, installation, and maintenance information for repairing the M990 GCR tape unit, adjusting internal assemblies, and replacing field replaceable units.

1.1 Unpacking and Repacking Instructions

1.1.1 Packaging

The GCR CacheTape Unit (GCRCTU) is shipped in two, double-wall corrugated cartons. It is taped initially in a polyethylene bag and then placed between the top and the bottom polyethylene foam inserts. Each corner of the inner carton is additionally enforced with "V" boards (4). There is also a single, double-wall corrugated pad at the top and the bottom. Inside is a foam protector between the tachometer and the take-up hub.

The slide kit assembly is located in a "U" shaped, corrugated cardboard placed in the top polyethylene foam insert. The Operation and Maintenance manuals are taped to the top of the unit. All flaps are fastened. This carton is then placed into another carton with a single double-wall corrugated pad with foam corner pieces at the bottom and top. The carton is then taped closed and banded to a skid platform for extra protection. This method of packaging minimizes the possibility of damage during shipping.

1.1.2 Unpacking

1. Place the carton upright on the floor.
2. Cut the bands securing the carton to the skid.
3. Cut the tape securing top flaps.
4. Open top flaps.
5. Remove top pad.
6. Remove inner carton and set upright on a solid support (about desk height).
7. Cut the tape securing top flaps.
8. Open top flaps.
9. Remove top pad (1). See Figure 1.
10. Remove slide kit (2) from the top foam insert (3). See Figure 1.

11. Remove the top foam insert (3). See Figure 1.

12. Remove power cord and manuals (4). See Figure 1.

13. Remove tape (5) from the bag. See Figure 1.

14. Carefully lift the unit from the carton and put on the table. See Figure 2.

15. Remove slide and door tapes (5). If tie-wraps secure the slides to the chassis, remove the tie-wraps.

16. Remove door sticker (6).

17. Open the top cover (8) and secure it with the stay arm provided (9).

18. Carefully remove the Tachometer Roller Block by pulling the tachometer away from the block, then remove the block. Gently let the tachometer arm come back to rest against the take-up hub.

CAUTION

Do Not allow the tachometer to spring back against the take-up hub as this will damage the tachometer.

19. Loosen the two spring-loaded screws (2) on both sides of the base plate. See Figure 3.

20. Close the top cover.

21. Lift up on the two lower corners of the front panel to its maximum position. The latch mechanism locks in an upright position. Install the locking pin (4) provided.

WARNING

Insert the provided locking pin (4) into the hole (3) in the tape unit support arm. Never service the tape unit in the service position unless you install the locking pin. See Figure 3.

22. Remove the two foam blocks from between the printed wiring boards and the chassis sides.

23. Return front panel to its original position and tighten the two spring loaded screws (2) on the top base plate.

CAUTION

Do not attempt to operate GCRCTU until all foam sheets have been removed. Failure to do so will cause unit to overheat and could damage equipment.

The GCRCTU is ready for inspection. Check the contents of the shipping container against the packing slip and inspect for possible damage. **Notify the carrier if damage exists.**

NOTE

Save all packaging materials and the shipping carton. Should your drive ever need to be shipped again, these will provide it with the best possible protection.

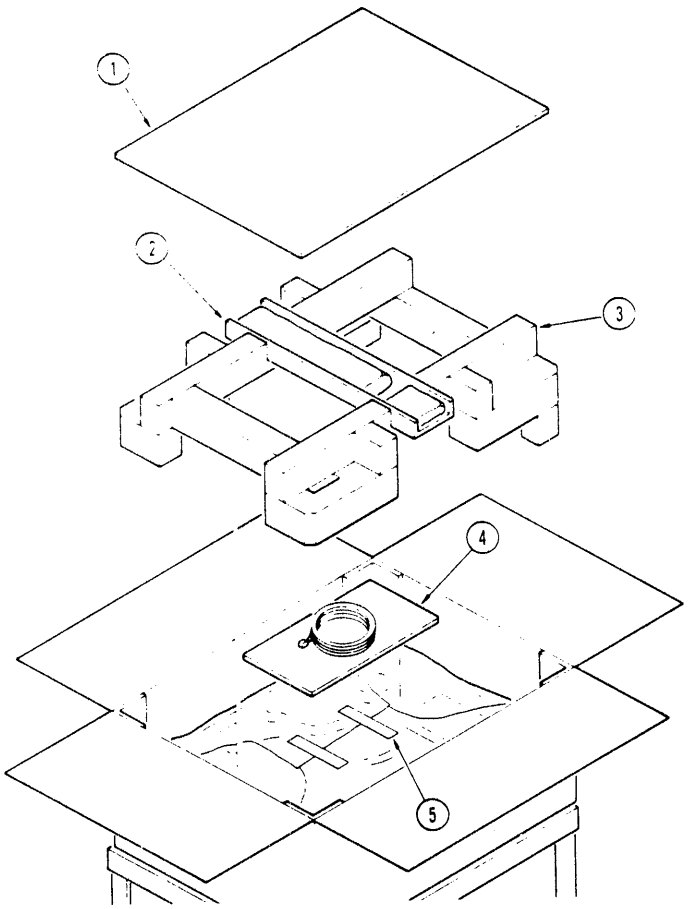


Figure 1.

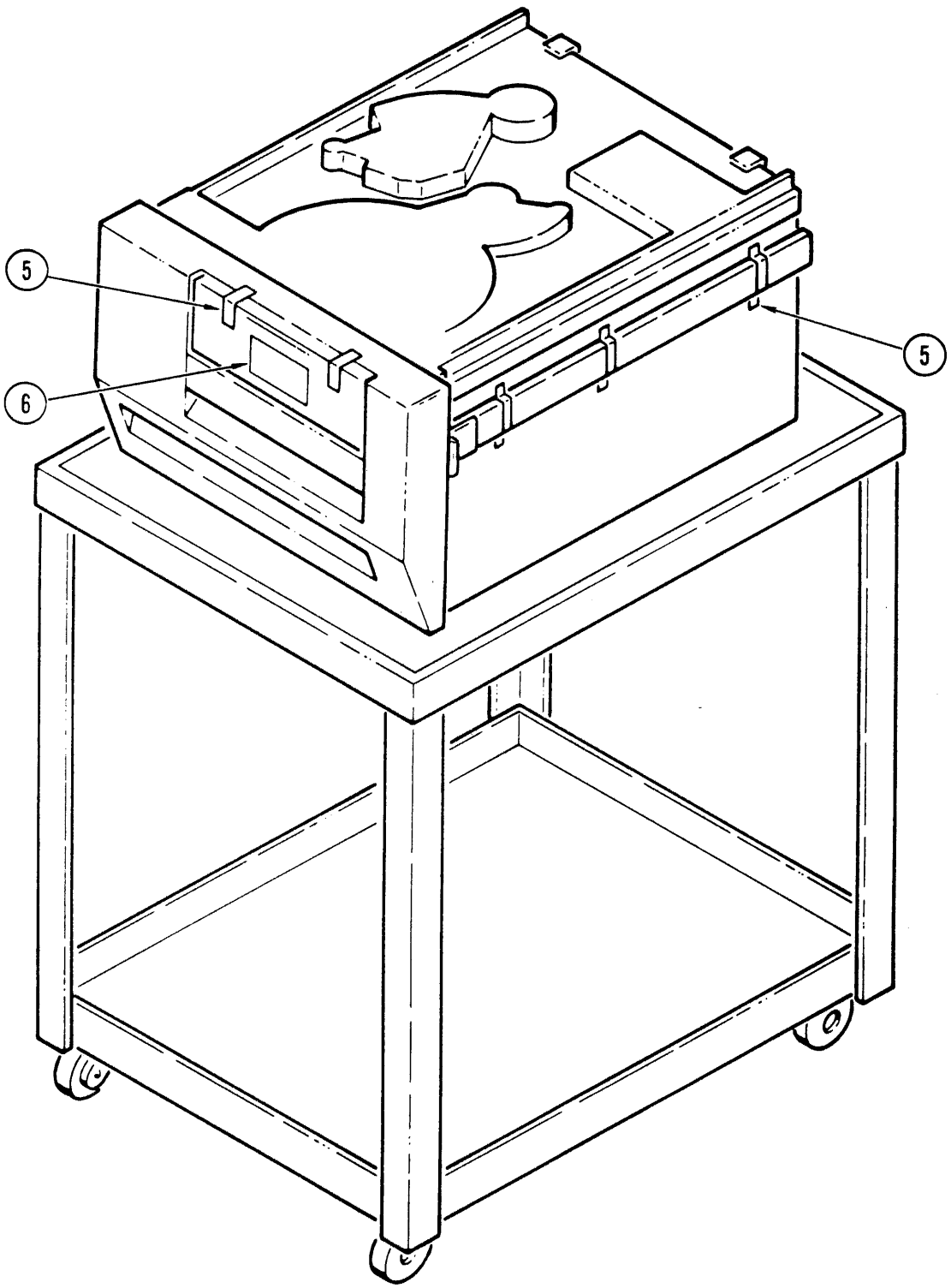


Figure 2.

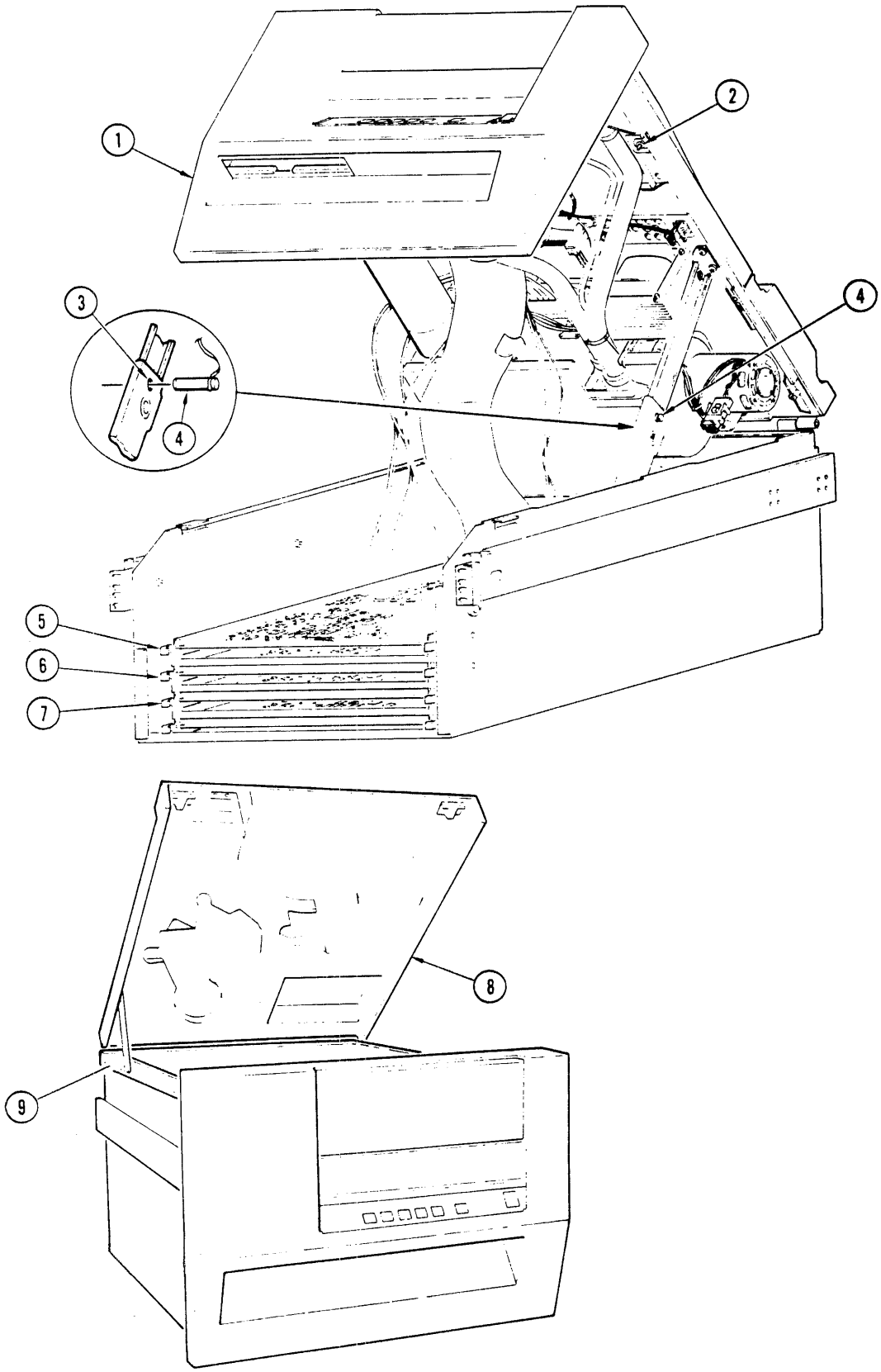


Figure 3.

1.1.3 Repacking GCRCTU

1. Using masking tape, tape the front panel door closed. Replace the front panel cover.

2. Open the top cover and install the Tach Roller Block on the take-up hub. See Figure 4. Loosen the chassis retaining screws and place the drive in the service access position. Use the support pin; see Figure 3. Insert the three thin foam pads in between the PWBs; insert the two foam blocks between the PWBs and the chassis, one on each side of the PWBs. Remove the safety pin, close the drive, and tighten the retaining screws.

3. Put the GCR into the plastic shipping bag that it originally came in. Tape bag closed.

4. Ensure that a deck pad (cardboard sheet) is in the bottom of the inner shipping carton.

5. Place the bottom frame into the bottom of the carton. Insert the V-boards into each corner of the carton. See Figure 5.

6. Carefully lift and lower GCRCTU into the shipping carton. (Be sure unit is in correct orientation with bottom frame).

7. Place power cord into a plastic bag and seal it up with tape. Set this bag on top of drive and tape in place with masking tape.

8. Place the top frame (correctly oriented) on top of the GCRCTU, and place the top deck-pad on top of the foam bars. See Figure 6.

9. Fold the short flaps into the box and the long flaps onto the short flaps. If a staple gun is available, install five staples equally spaced across the top of the box near the seam.

10. Seal the box by using reinforced tape. One piece centered across the long seam, and two pieces centered across the edge seams.

11. Insert one of the spacers that came with the outer shipping carton into this carton with the foam blocks up.

12. Place the inner shipping carton inside the outer shipping carton.

13. Fit the other spacer into the outer carton with the foam blocks down.

14. Fold the short flaps into the carton and the long flaps onto the short flaps. Install six staples equally spaced along the seam.

15. Seal the carton with reinforced tape, one piece centered along the seam, and two pieces centered along the two edge seams.

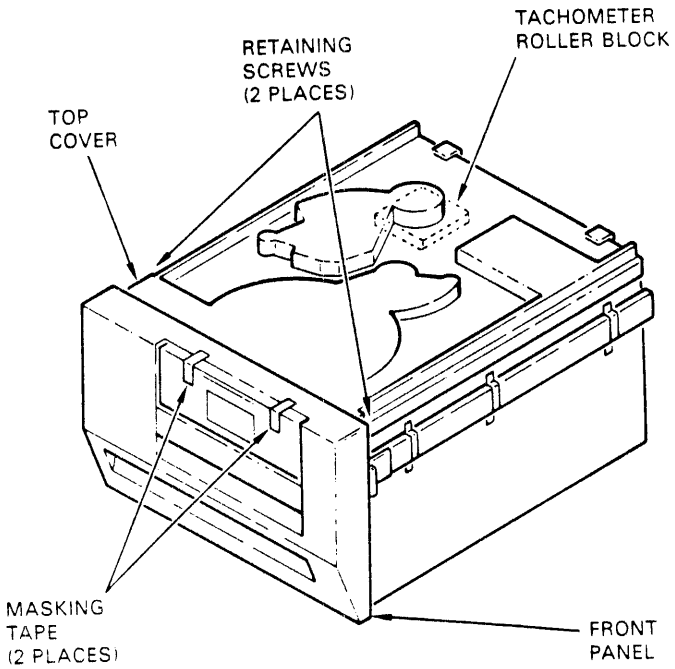


Figure 4.

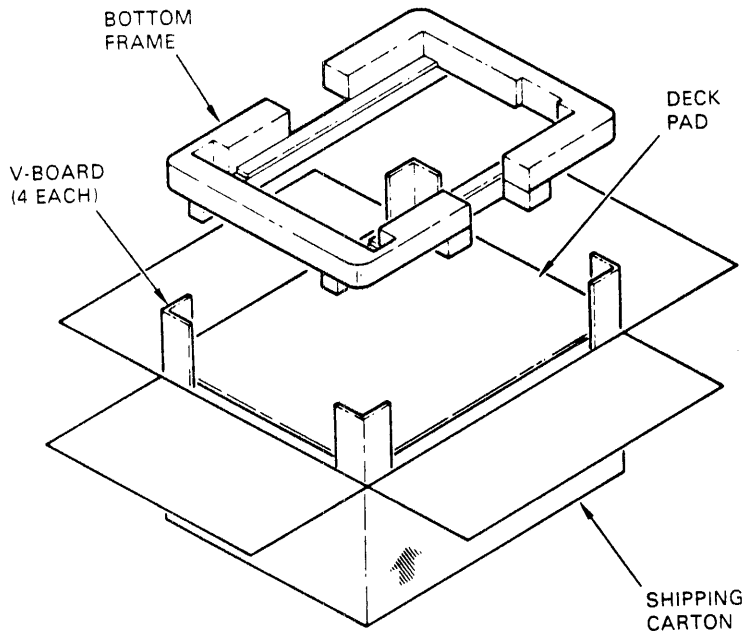


Figure 5.

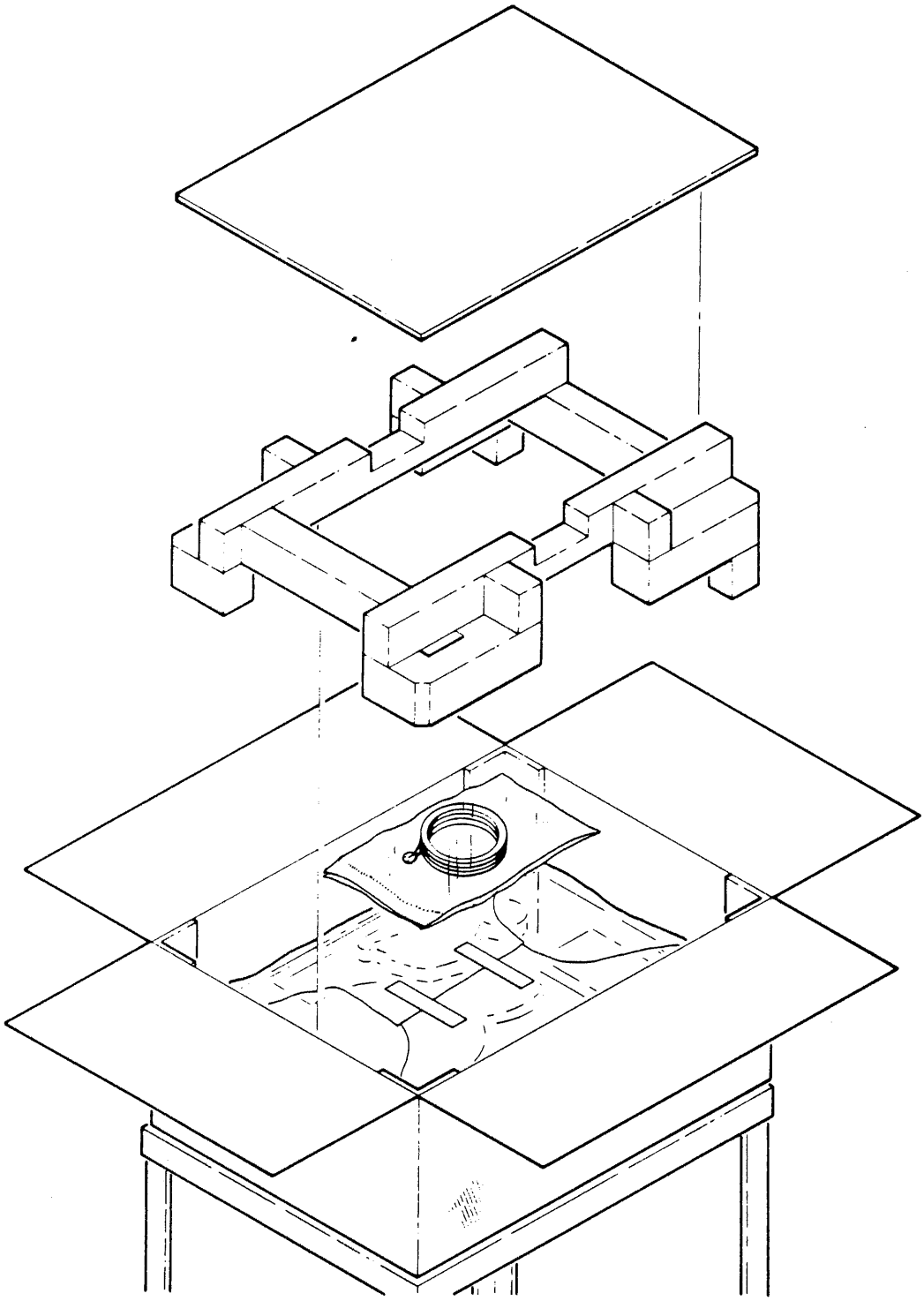


Figure 6.

1.2 Rack Mounting

The GCRCTU is designed to be mounted in a standard, 19-inch-wide, EIA equipment rack using the slides and mounting hardware provided with each unit. The tape drive must be mounted with no front panel obstructions. Refer to Figure 7 to mount the drive as follows:

1. Locate the front and rear holes to be used on the equipment rack (1, Figure 7). If they are threaded, drill them out to 0.281 inches.

2. Place the drive in service access position. Refer to paragraph 5.2.

3. Starting with either side, remove the stationary section of the slide (2) from the drive by pulling the stationary section to the rear of the drive and pushing down on the locking lever. Then pull the slide rearward another 1/2 inch, push inward on the spring lock, and remove the stationary section.

4. Determine, for the depth of the rack, the appropriate holes to use in the mounting bracket and secure it loosely to the stationary section using two screws (4) and a nut plate (5).

5. Mount the front flange of the stationary section (2) to front rail by placing flange behind rack rail holes.

6. Install two screws (6), first through front of rail, then through the stationary section flange, and secure them loosely with a nut plate (7).

7. Mount the mounting bracket to the rear by placing the flange in front of the rack rail holes.

8. Install two screws (8), first through back of rack, then through mounting bracket flange, and secure them loosely with a nut plate (9).

9. Check the alignment and correct as necessary. Tighten front, rear, and mounting bracket attachment screws.

10. Repeat steps 3 through 9 for the other slide.

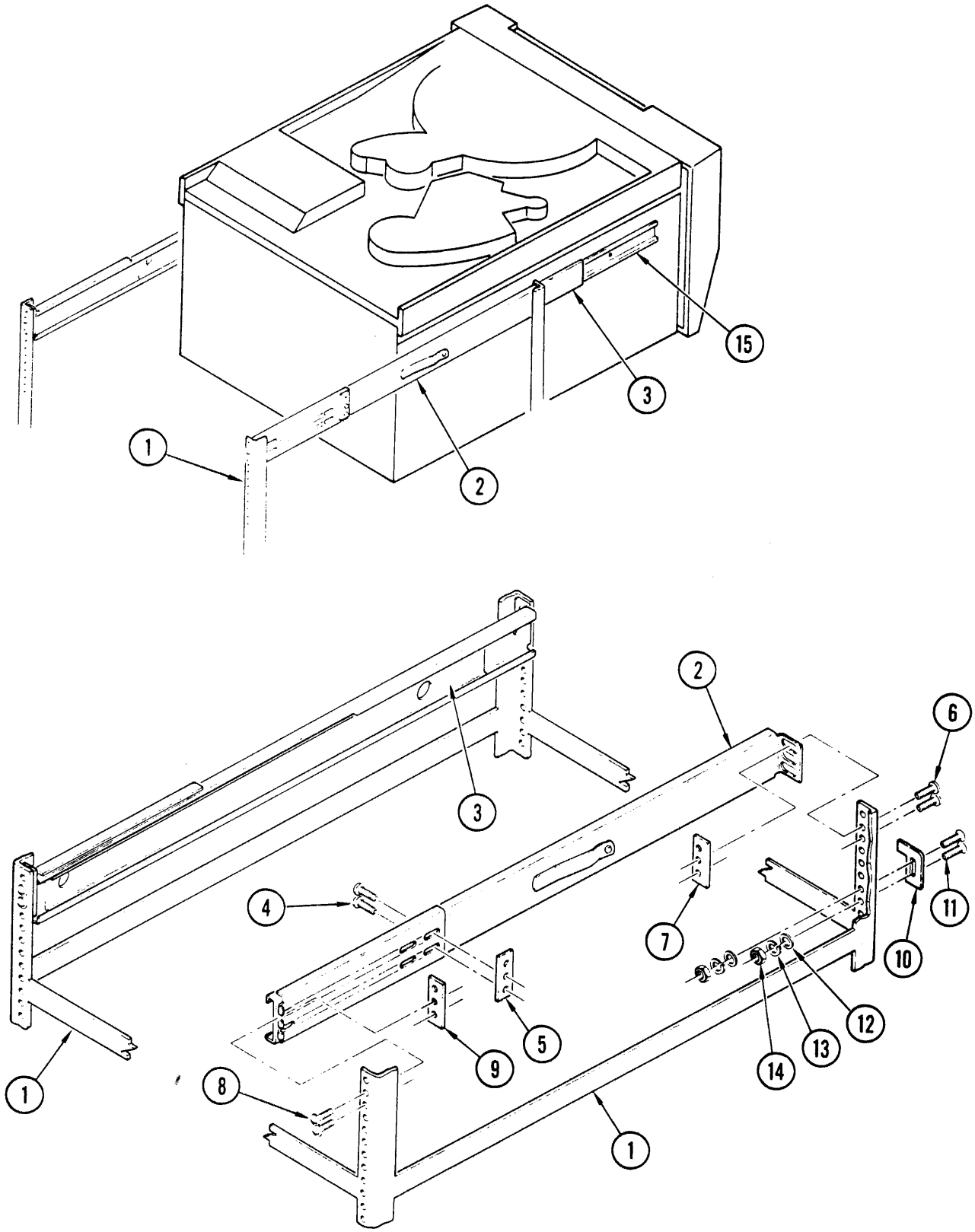


Figure 7. Rack Mounting

11. Install the bottom edge of the rack latch bracket (10) on the left rail 2.13 inches below the center-line of the slide using two screws (11), flat washers (12), split-lock washers (13), and nuts (14).

12. Carefully slide the drive into the rack-mounted slide sections while checking for binding or interference. Release the locks and, before closing fully, check that the rack latch will engage securely.

13. Adjust the rack latch bracket (10) or slides as required. To release, squeeze the rack latch plate inside the air duct opening at the lower left of the front panel.

1.2.1 Removing Slides

CAUTION
Use two people to remove the drive from the equipment rack.

1. Slide the drive outward fully from the equipment rack.

2. Push down on the locking lever of the slides, then pull the drive outward another 1/2 inch.

3. Push inward on the secondary spring lock (round button on side of slide near lever), then pull the drive out of the equipment rack and set it on a table.

4. There are two slide members still attached to the drive; both must be removed. Push inward on the leaf spring to allow the sliding member to be moved.

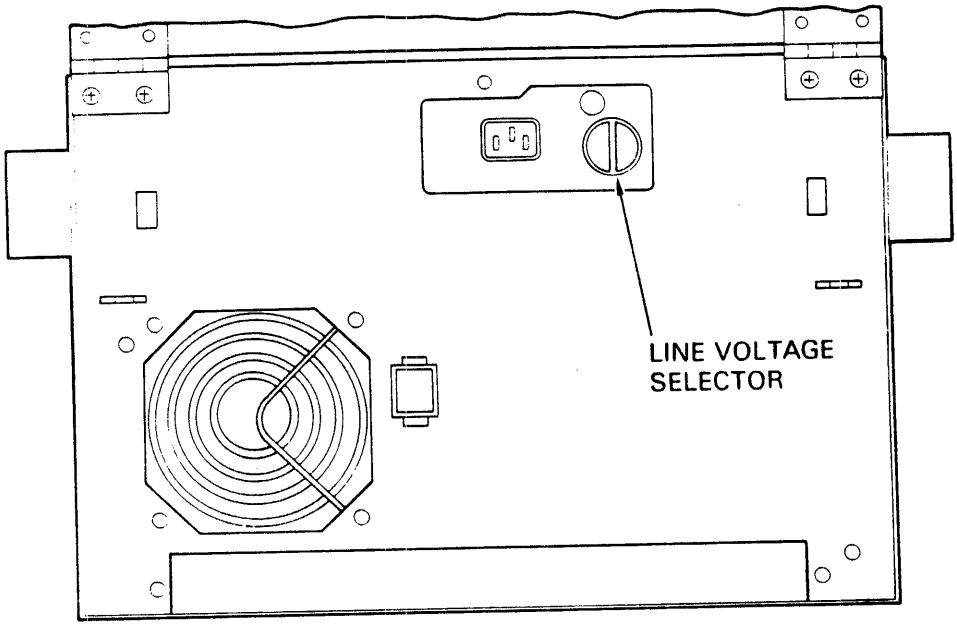
5. Align the access hole near the rear of the sliding member over the rear screw securing the stationary member. Remove the rear screw, then move the sliding member as necessary to remove the other two screws are secured by nuts accessible inside the chassis.

1.3 Power Connection

The a-c input voltage to the M990 is determined by a multi-position select switch located at the rear of the tape unit. The following voltages and frequencies may be selected:

NOMINAL VOLTAGE (Vac)	FREQUENCY (Hz)	AVAILABLE VOLTAGE (Vac)	OPERATING VOLTAGE LIMITS (Vac)	AC SWITCH SELECTION (Hz)
100	49-61	85-110	85-110	100,50/60
104	49-61	88-110	88-114	100,50/60
110	49-61	96.5-119	96.5-120	120,50/60
120	49-61	104-127	102-132	120,50/60
200	49-61	190-220	170-220	200,50/60
208	49-61	180-220	170-220	200,50/60
220	49-61	193-238	187-242	220,50/60
230	49-51	202-249	187-249	220,50/60
240	49-51	210-259	204-264	240,50/60
240	49-61	208-254	204-264	240,50/60

CAUTION:
To prevent damage to the M990 and ensure proper operation, be sure the outlet voltage is correct before applying power to the tape unit. Also, be sure the correct fuse is installed for the selected voltage. Section 5.12 explains how to change the fuse.



A power cord is supplied only for the voltage range indicated on the manufacturer's label.

1.3.1 Plug Connector - Power cord preparation - 3 conductor, 1-phase, 16 Amp max.

This unit may or may not have an electrically acceptable plug attached to the power cord. Select a plug from the chart on the following page that corresponds to the country in which the machine is being installed. If more than one plug is acceptable for use in your country, you must select a plug with an electrical rating equal to or greater than the machine rating.

This plug should comply with IEC Publication 83, and be marked with a safety agency mark acceptable to the country of installation.

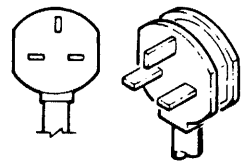
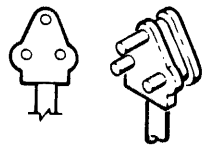
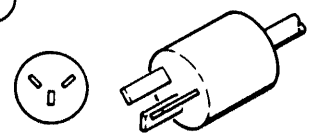
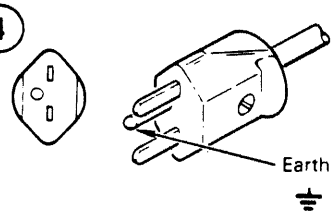
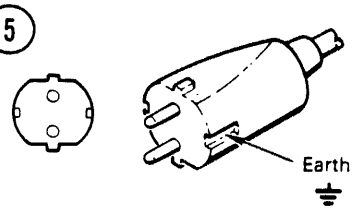
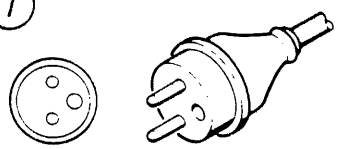
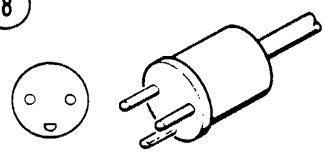
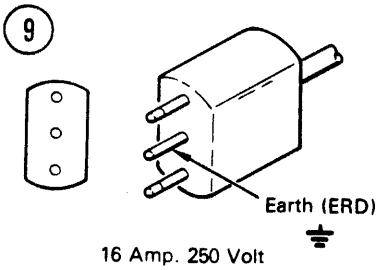
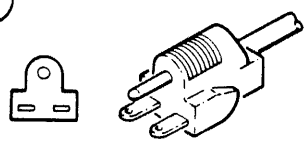
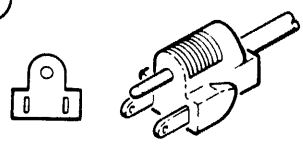
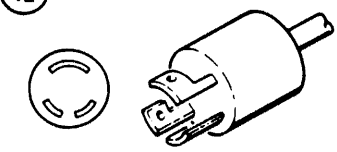
The Power Cord wires must be prepared by stripping the outside jacket and wire insulation to make with the respective plug. Strain relief clamps on the plug must secure the outside jacket of the power/cable when finished.

1.3.2 Power Cord Connections to Plug

1. Connect the blue wire to the Neutral terminal or the plug.
2. Connect the brown wire to the line (Hot) terminal on the plug.
3. Correct the green/yellow wire to the Earth terminal on the plug.

PLUG OUTLINE:
DELINEACIONES DE CLAVIJAS (EL):

STECKER SKIZZE:
BOUCHOM DECOURANT:

1  13 Amp. 250 Volt BS 1363	2  15 Amp. 250 Volt BSI 546	3  6/16 Amp. 250 Volt (Earth Pin may be round) S.I. 32
4  10 Amp. 250 Volt (Voltage Pins may be round) SNV 24509	5  16 Amp. 250 Volt CEE7	6  10 Amp. 250 Volt Approved as C112-1964
7  16 Amp. 250 Volt CEE7	8  6/10 Amp. 250 Volt Approved AFSNIT 107	9  16 Amp. 250 Volt
10  15 Amp. 250 Volt IEC 83 UL 498	11  15 Amp. 125 Volt IEC 83 UL 498	12  15 Amp. 125 Volt

(1) United Kingdom
Ireland
Malaysia
Singapore
Argentina

(2) South Africa

(3) Israel

(4) Switzerland

(5) Germany
Austria
Bulgaria
Finland
Iceland
Indonesia
Iran
Netherlands
Norway
Poland
Portugal
Romania
Spain
Sweden
Turkey
Bolivia

(6) Australia
New Zealand
Uruguay

(7) France
Belgium
Greece
Hungary
Yugoslavia

(8) Denmark

(9) Chile
Italy

(10) United States
Canada

(11) Bahamas
Barbados
Bermuda
Brazil
Canada
Colombia
Costa Rica
Dominican Rep.
Ecuador
Guatemala
Honduras
Jamaica

(11) Mexico
Antilles
Nicaragua
Panama
Paraguay
Peru
Phillippines
Taiwan
Trinidad
Venezuela
United States

(12) Japan

1.4 Interface Connection

Note: If the M990 is to be connected with the SCSI Interface, please refer to the SCSI Addendum, part number 799893-002, at this time.

Interconnection to the M990 and system equipment should be made with a twisted-pair shielded cable with approximately 110 ohms of characteristic impedance. To ensure reliable performance, the cables should have:

1. A maximum length of 30 feet to include service loop. The length of cable from the host to the first tape unit must not exceed 15 feet.

2. The cable length between units connected in the daisy chain harness should not exceed 10 feet.

3. 22 or 24 AWG conductors with a 0.01 inch minimum insulation thickness and not less than one twist-per-inch for twisted-pair cables.

It is important that the ground wires of twisted-pair be grounded at each end of the cable.

Note: This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions included in this manual, may cause interference to radio communications. Verification of compliance with Subpart J of Part15 of FCC Rules, which are designed to provide reasonable protection against such interference, is the responsibility of the installer. Interface connectors provided on the GCR are shown in Fig. 8. Tables 1 and 2 list the pin locations for interface inputs and outputs.

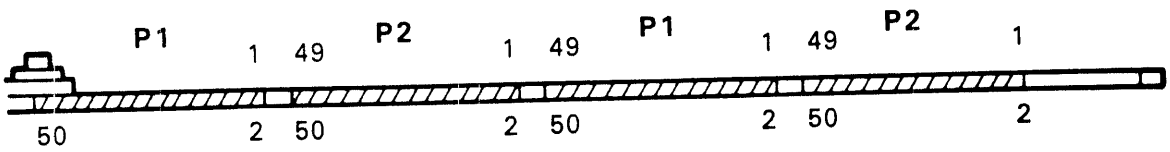


Figure 8. Interface Connectors

The M990 may be configured to allow of up to eight transports with a single controller. Use cables similar to those described above for interconnection of transports. Refer to Figures 9 and 10.

To configure the M990 to operate on a multiple transport system, proceed as follows:

1. Place M990 in service access position. (See Section 5.2.)

2. Remove terminator resistor pack U1B and U3C (Figure 10) from the CIF/Write PWB of each transport except the last one in the chain.

3. Install interconnection cables as shown in Figure 10.

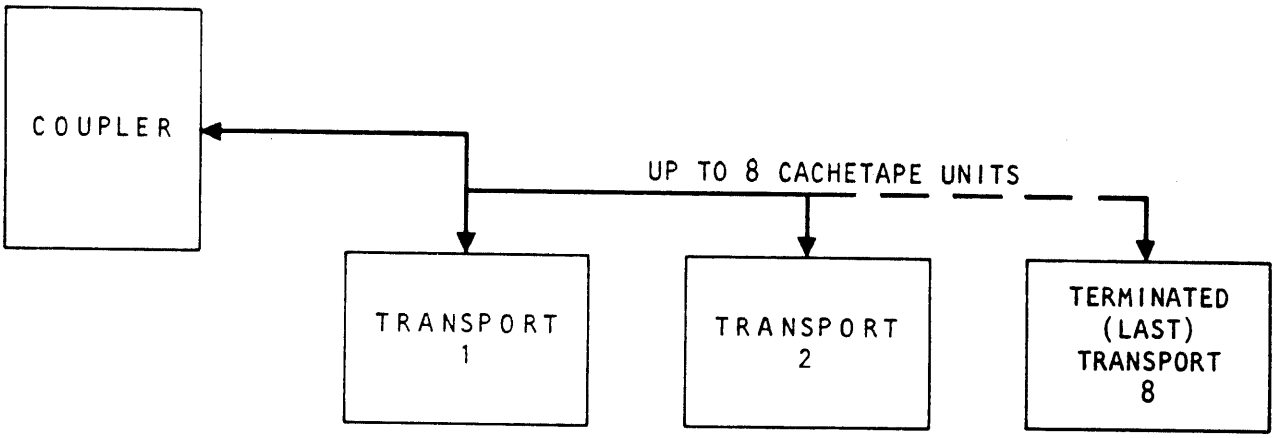


Figure 9. Daisy Chain Block Diagram

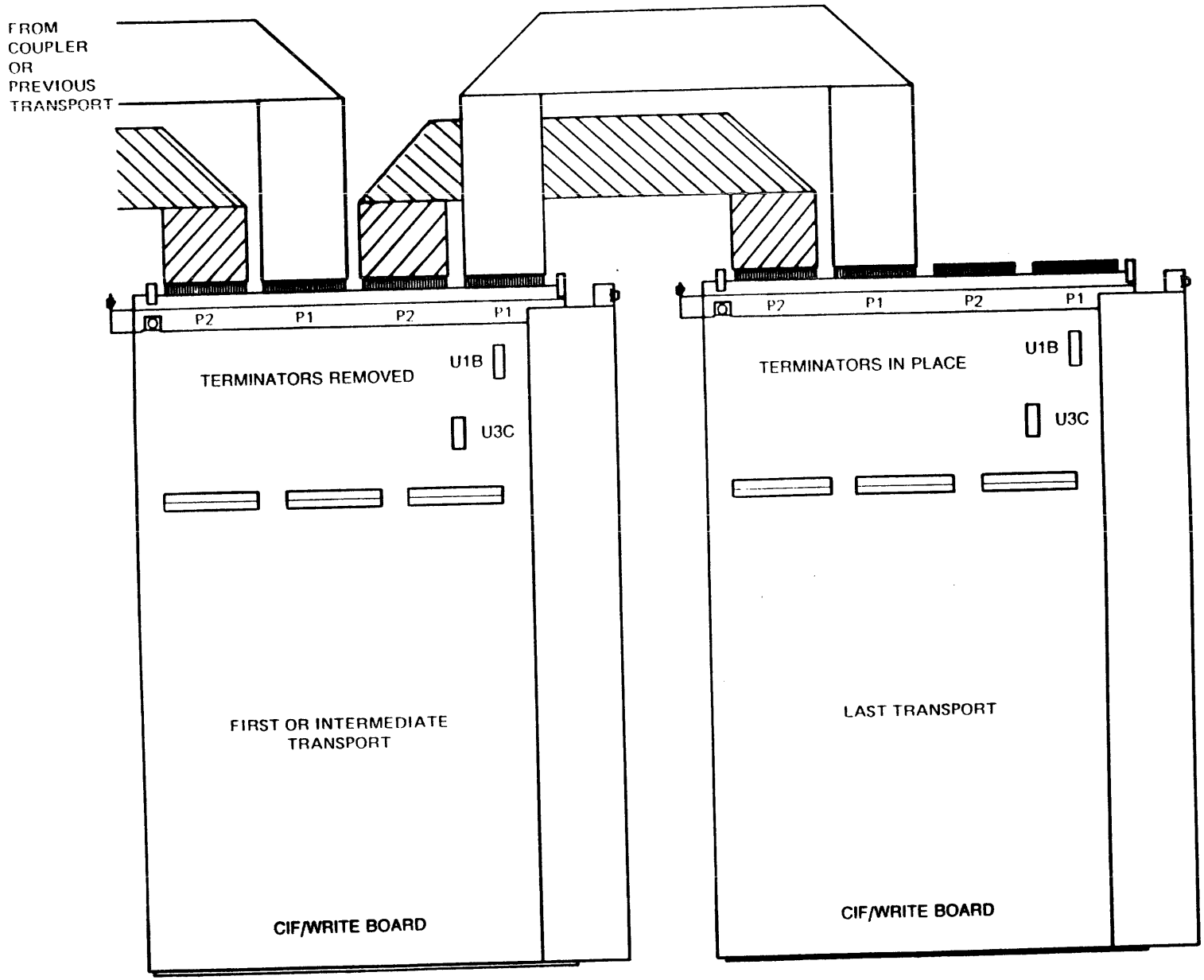


Figure 10. Daisy Chain Configuration

Plug No.	Live Pin	Ground Pin	Signal Description	Signal Name
P1	4	3	Last Word	ILWD
P1	6	5	Write Data 4	IW4
P1	8	7	Initiate Command	IGO
P1	10	9	Write Data 0	IWO
P1	12	11	Write Data 1	IWI
P1	16	15	Load On-line	ILOL
P1	18	17	Reverse	IREV
P1	20	19	Rewind	IREW
P1	22	21	Write Data Parity	IWP
P1	24	23	Write Data 7	IW7
P1	26	25	Write Data 3	IW3
P1	28	27	Write Data 6	IW6
P1	30	29	Write Data 2	IW2
P1	32	31	Write Data 5	IW5
P1	34	33	Write	IWRT
P1	36	35	Not Used*	---
P1	38	37	Edit	IEDIT
P1	40	39	Erase	IERASE
P1	42	41	Write File Mark	IWFM
P1	44	43	Not Used*	---
P1	46	45	Transport Address 0	ITADO
P2	18	17	Formatter Enable	IFEN
P2	24	23	Rewind/Unload	IRWU
P2	46	45	Transport Address 1	ITADI
P2	48	47	Formatter Address	IFAD
P2	50	49	Not Used*	---

* These are properly terminated for compatibility with other products.

Table 1. Interface Signals, Controller to Transport

Plug No.	Live Pin	Ground Pin	Signal Description	Signal Name
P1	2	1	Formatter Busy	IFBY
P1	48	47	Read Data 2	IR2
P1	50	49	Read Data 3	IR3
P2	1	--	Read Data Parity	IRP
P2	2	--	Read Data 0	IR0
P2	3	--	Read Data 1	IR1
P2	4	--	Load Point	ILDP
P2	6	5	Read Data 4	IR4
P2	8	7	Read Data 7	IR7
P2	10	9	Read Data 6	IR6
P2	12	11	Hard Error	IHER
P2	14	13	File Mark	IFMK
P2	16	15	Identification	IDENT
P2	20	19	Read Data 5	IR5
P2	22	21	End of Tape	IEOT
P2	28	27	Ready	IRDY
P2	30	29	Rewinding	IRWD
P2	32	31	File Protect	IFPT
P2	34	33	Read Strobe	IRSTR
P2	36	35	Write Strobe	IWSTR
P2	38	37	Data Busy	IDBY
P2	42	41	Corrected Error	ICER
P2	44	43	On-Line	IONL

Table 2. Interface Signals, Transport to Controller

TAPE DRIVE COMMAND LINES.

Decoding these five lines produces the commands listed below.

	IREV	IWRT	IWFM	IEDIT	IERASE
Read Forward	0	0	0	0	0
Read Reverse	1	0	0	0	0
Read Reverse Edit	1	0	0	1	0
Write Forward	0	1	0	0	0
Write Edit	0	1	0	1	0
Write File Mark	0	1	1	0	0
Erase Variable Length	0	1	0	0	1
Erase Fixed Length	0	1	1	0	1
Security Erase	0	1	1	1	1
Space Record Forward	0	0	0	0	1
Space Record Reverse	1	0	0	0	1
Space File Search Forward (Ignore Data)	0	0	1	0	1
Space File Search Reverse (Ignore Data)	1	0	1	0	1
Write Sync/Status Hold	0	0	0	1	1
Select 3200 CPI	1	0	1	1	1
Select 1600 CPI	0	0	1	1	1
Select 6250 CPI	1	1	0	0	0
Read Extended Status	0	0	0	1	0
Current Status	0	0	0	0	0
Configuration Status	1	0	0	0	0
Error History Status	0	0	0	1	0
Machine Status	1	0	0	1	0
Error History Status	1	0	0	1	1
Diagnostic Write	1	1	1	1	1
Write NovRam	0	1	0	1	0
Store NovRam	0	1	0	0	0
Diagnostic Write	1	1	1	1	1

1.5 Interface Description

Commands, status, and data are exchanged between the host controller and the M990 GCR tape unit via the interface section. The interface signals are all active low.

Interface Input Signals

The following signals are received by the M990 from the host controller.

IGO — Initiate Command. Used to latch the command specified on the command lines into the selected ready GCR tape unit.

IFEN — Formatter Enable. Enables the GCR tape unit. With GCR tape unit on-line and IDBY true, pulse will reset a command "runaway" condition.

IREW — Rewind. Interface input signal. With GCR tape unit ready, on-line, and not at BOT, causes tape to rewind in reverse direction.

IREWU — Rewind/Unload. With GCR tape unit on-line, cause selected unit to go off-line, rewind to BOT marker, and then unload the tape.

IREV — Reverse.

IWRT — Write.

IWFM — Write File Mark.

IEDIT — Edit.

IERASE — Erase.

ILWD — Last Word. Used during a write operation to indicate that the character to be strobed into the formatter is the last character of the record.

IW0-IW7 IWP — Write Data. Input lines that carry write data from the host controller to the GCR tape unit.

IFAD-(MSB) — Address lines used to select a daisy-chained GCR tape unit.

ITAD0, ITAD1-LSB

TAPE DRIVE ADDRESS			Logical Address
IFAD	ITAD0	ITAD1	
0	0	0	0
0	0	1	1
0	1	0	2
0	1	1	3
1	0	0	4
1	0	1	5
1	1	0	6
1	1	1	7

1.6 Integration Of The GCR To The System

To optimize performance of the GCR in the system, certain operating parameters for block size, ramp delay, simulated speed, parity, and various options need to be adjusted using diagnostic test 142. Refer to section 4.1.3.

This test is designed to be used by a knowledgeable service technician only when the GCR configuration needs to be redefined from the default values listed below.

1.	Option inactive -	
2.	Host Supplied Parity -	No
3.	Echo Read Strobes - On Write	Yes
4.	EOT Mode -	Normal
5.	Forward Hitch Enabled -	Yes
6.	Echo 3200 bpi ID Burst -	No
7.	Option inactive	
8.	Abort Active Writes on Overwrites	No
9.	Interface Transfer - Rate (kHz)	158.2
10.	Default Density on Power Up	6250 BPI
11.	Maximum Block - Size (k bytes)	9
12.	I/F Ramp Delay -	3 MS
13.	Write Sync Options -	ALL WRTS
14.	Read Error Retries -	3
15.	Write Error Retries -	15
16.	Read Error Correction on -	Yes
17.	Unit Address	0
18.	Lock Out 3200 bpi - Writes	No
19.	Remote Density - Select Enabled	Yes
20.	Report Corrected Errors - Enable	Yes
21.	Allow Single Track Write Errors -	No
22.	6250 Write Current - (read as XX.XX ma)	XXXX
23.	1600 Write Current -	XXXX
24.	3200 Write Current -	XXXX

25.	6250 RAW Threshold - (read as 0.XXX mv)	XXX
26.	1600 RAW Threshold -	XXX
27.	3200 RAW Threshold -	XXX
28.	3200/6250 BPI Select as 6250 BPI -	No
29.	Display "feet to EOT" -	No
30.	Write Error Override	No
31.	Remote Load/On-Line	No

Note: Items 22 thru 27 are not alterable by tests 142/242. If the operating parameters have not been previously established, the optimum operating configuration can be determined as follows:

1. Select a data transfer rate that you know to be compatible with the system, or try the default value of 158.2 kHz. Refer to the section 4.1.3 of this manual (test 142). The data transfer rate can be calculated using the following equation:

   Tape Speed (ips) * Density (bpi) = Data Transfer Rate (kHz)

2. Run an actual tape program or functional tape diagnostic to establish basic compatibility; e.g., measure time to backup 10 megabytes as a reference.

   Calculate the throughput using the following formulas:

   $$\frac{\text{Total Number of Bytes Written}}{\text{Total Time Required to Complete Write (seconds)}} = \text{bps}$$

   bps/1000 = kHz

   Note: Parametric diagnostics are designed for troubleshooting a particular tape transport and are not indicative of system performance. The best tests of GCR compatibility are live programs that use the tape sub-system. Functional diagnostics that measure tape system performance are another legitimate tool.

3. Select the next higher GCR burst transfer rate using test 142.

4. Repeat steps 2 and 3 until the data rate of the GCR exceeds the data rate capability of the system, as evidenced by data late flags in the host system or a substantial increase in repositioning activity in the GCR unit (caused by write retries due to incomplete data transfers).

5. Select the next lowest GCR burst transfer rate using test 142.

6. Refer to the section 4.1.3 of this manual (test 142) and modify the other variable parameters as required to complete the configuration.

1.6.1 Parameter Functions

A number of operating parameters are available to select standard and special options and make the drive performance compatible with the system. A brief description of each selectable operating parameter function follows:

Host Supplied Parity - compares the host supplied parity with the internally generated parity of the byte at the interface, and flags IHER if they do not match.

Echo Read Strobe on Writes - echoes a read strobe on write operations for systems that require an echo to know what data is being written. However, the read data lines do not transfer data during a write operation.

EOT Mode - causes the last record to be written at, or before, the EOT marker. This function supports systems that do not accept records written beyond the EOT marker. This option should be use only where necessary, because performance degradation near EOT will occur.

FWD Hitch Enabled - causes the drive to jog the tape forward, prior to any reverse operation in order to overcome static friction.

Echo 3200-BPI ID Burst - echoes, or does not echo, a 3200-BPI ID burst, depending on the requirements of the host. This function does not depend on a 3200-BPI ID burst being present on the tape.

Abort Active Writes on Overwrites - with this option enabled, a 'write-backspace-write' operation will physically execute both writes. This becomes significant, if the operation is an erase followed by a reverse operation and then a write (directory.) In this case, it is the intent of the software to have the tape erased prior to laying down the directory over that portion of tape. This option would need to be ON for this to happen. Normal operation has this option disabled, allowing command overwrite in cache memory.

Interface Transfer Rate - sets the burst rate at which data is transferred between GCR CacheTape and the host. Transfer rates from 70.3 to 632.8 kbs.

Default Density at Power Up - specifies the density to be displayed when the drive is powered up.

Maximum Block Size - sets the maximum acceptable size for a block of data. The acceptable sizes are 9K, 16K, 32K, and 64K. The actual available size of Cache depends on the specified block size, as available Cache is based on the full size of Cache, less the specified maximum block size, plus the actual size of one more block of data. (The actual size of the data blocks being sent are often less than the specified maximum size.) The selected maximum block size specifies the record size limit Cache will accept before pulsing IHER to initiate a host system retry, and expanding the specified block size to the next larger size.

Interface Ramp Delay - selects a 0 to 15 millisecond delay to be added to the standard time gap between the receipt of IGO and when IDBY is set. This delay is the command response time which, in a start/stop drive, would be the ramp time.

Auto Write Sync on Double File Marks - enables an automatic write sync, when two successive File Mark commands are received. When disabled, it prevents time outs and throughput degradation on systems sensitive to the length of time necessary to complete writing two consecutive file marks.

Read/Write Error Retries - sets the maximum number of read/write retries GCR CacheTape will perform on one record block.

Read Error Correction ON - enables, or disables, GCR software error correction.

Unit - specifies the unit number at power up.

Lock Out 3200-BPI Writes - prevents selection of the 3200-BPI density. However, the drive can still read a 3200-BPI tape, because of the normal "default to the density found" criteria in the read operation.

Remote Density Select Enabled - allows the integrator to disable the density selection sent through the interface. With this function, the operator can override a remote selection of a density that may not be available on GCR CacheTape.

Report Correct Errors Enabled - normal (yes) setting causes all read error corrections to be reported to the host at the time for data transmission by the ICER Line. Disabled (no) disables corrected error reporting.

Allow Single Track Write Errors - limits automatic write retries in the GCR mode to blocks having more than one channel in error. Use of this option should be limited to operations where error-free data is less important than sustained data throughput.

3200/6250 BPI Select as 6250 BPI - selects the 6250 BPI density through the interface, whether the drive command is for 6250 BPI or 3200 BPI. This option should be enabled when the system uses the same bit map to select the 6250 BPI density as the drive uses to select the 3200 BPI density. In this case, the 3200 BPI must be selected from the front panel.

Display Feet to EOT - displays the number of feet available before End-of-Tape when the drive is On Line. This information takes the place of the word "Active" on the alpha display.

Write Error Override - performs the number of Write Error Retries specified in Option 15 (0, 3, 7, 11, or 15). If the write retry count in Option 15 is exceeded, a hard error (IHER) occurs and the drive continues to the next block to be written. This feature is for real-time data operations that do not require retries, or where continous writing is

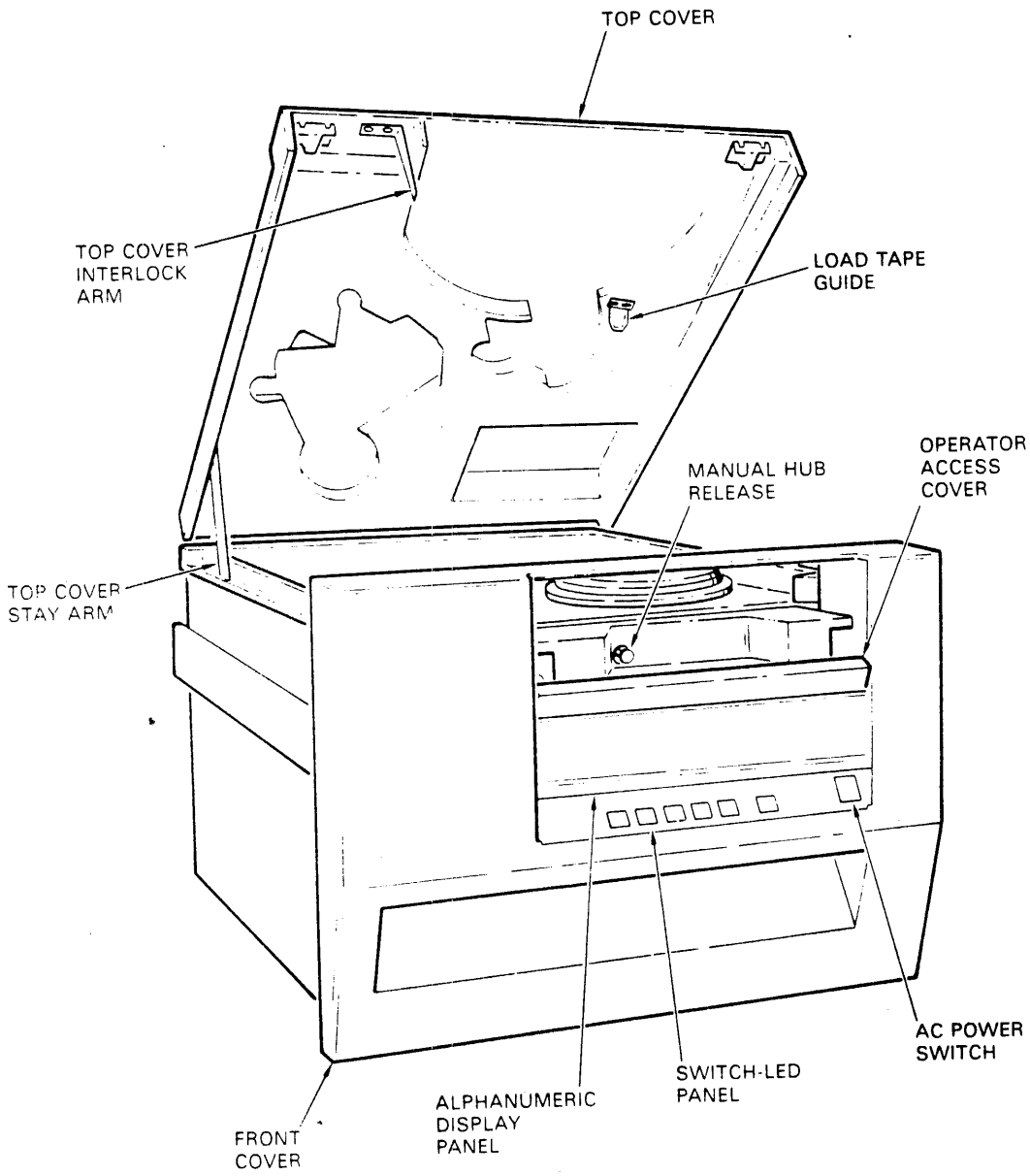
required after hard errors. "NO RETRY" is displayed instead of "ACTIVE".

Load/Online - allows a remote load and an On Line command after a tape drive in an unattended location experiences a power failure. When power is restored, the host can assert the ILOL signal (J1-16, for a minimum of one microsecond). The drive then retensions the tape, rewinds to BOT, and goes on-line.

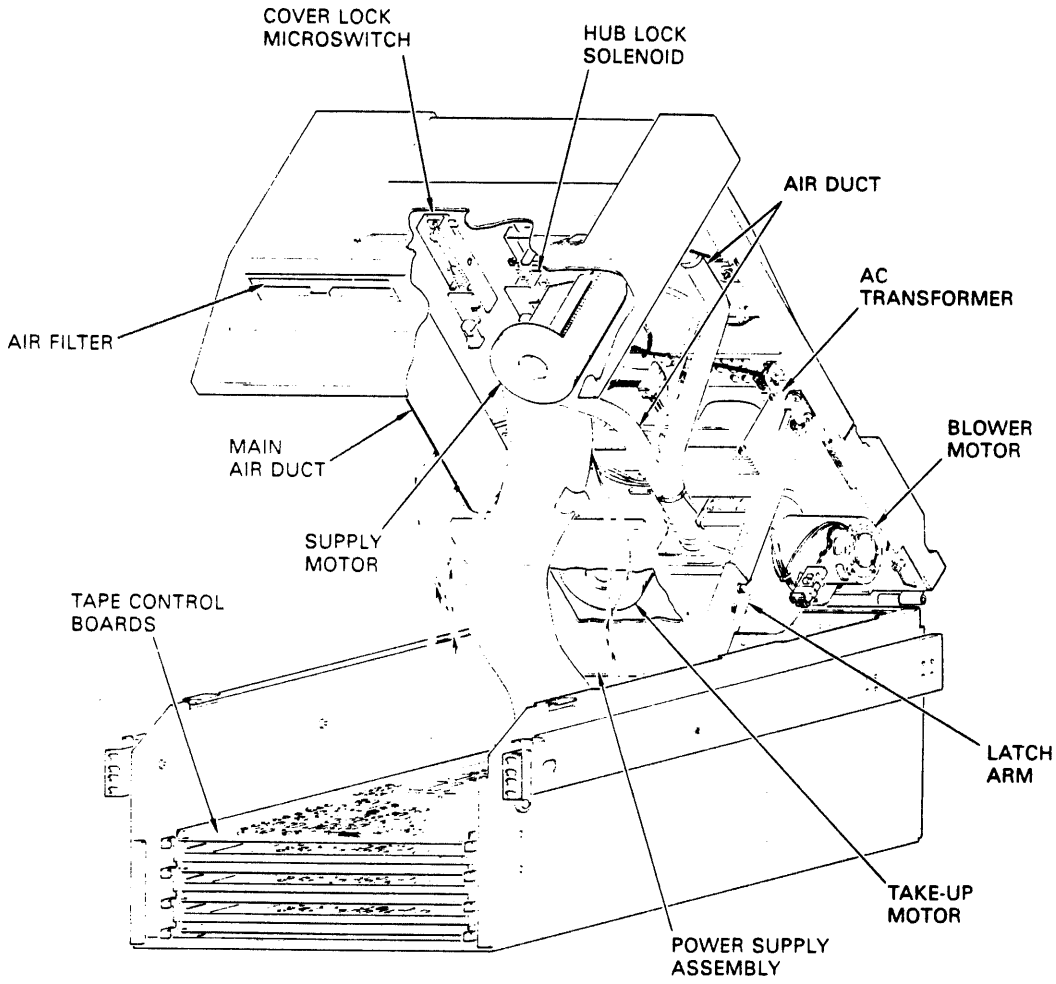
This option is implemented by jumpering from U6D pin 10 to U13F pin 21 on the CIF/WRITE PWB. The jumper connects the ILOL line to a CIO input command port.

Chapter 2. Parts and Location

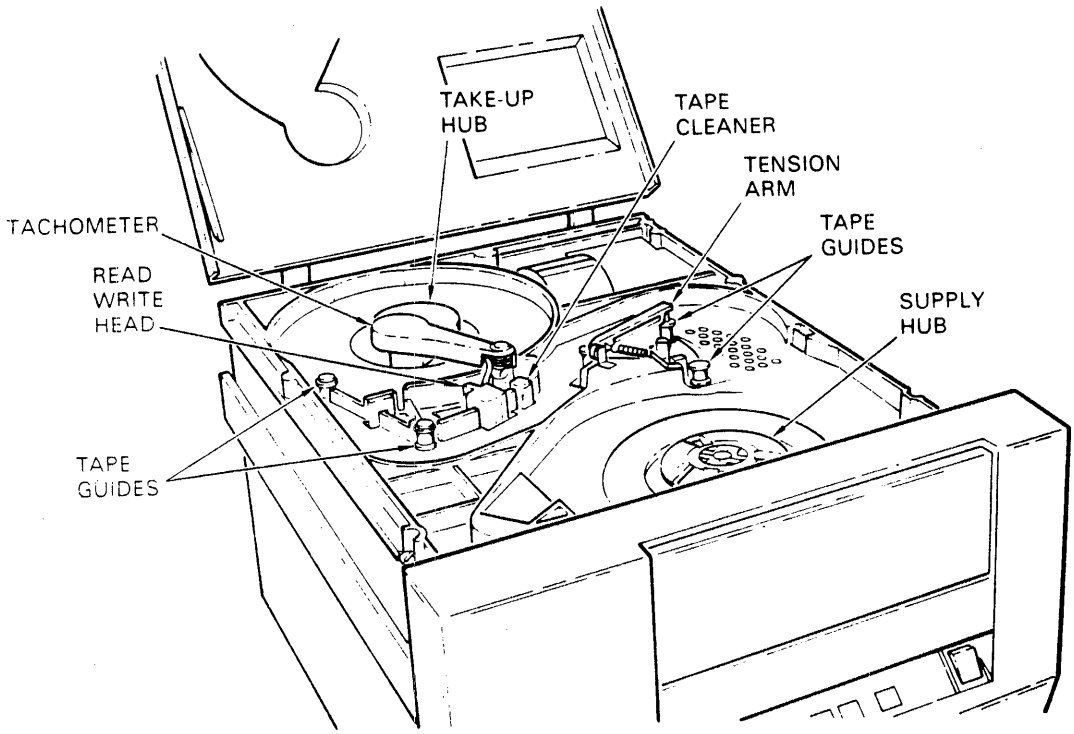
2.1 M990 GCR Tape Unit - Front view



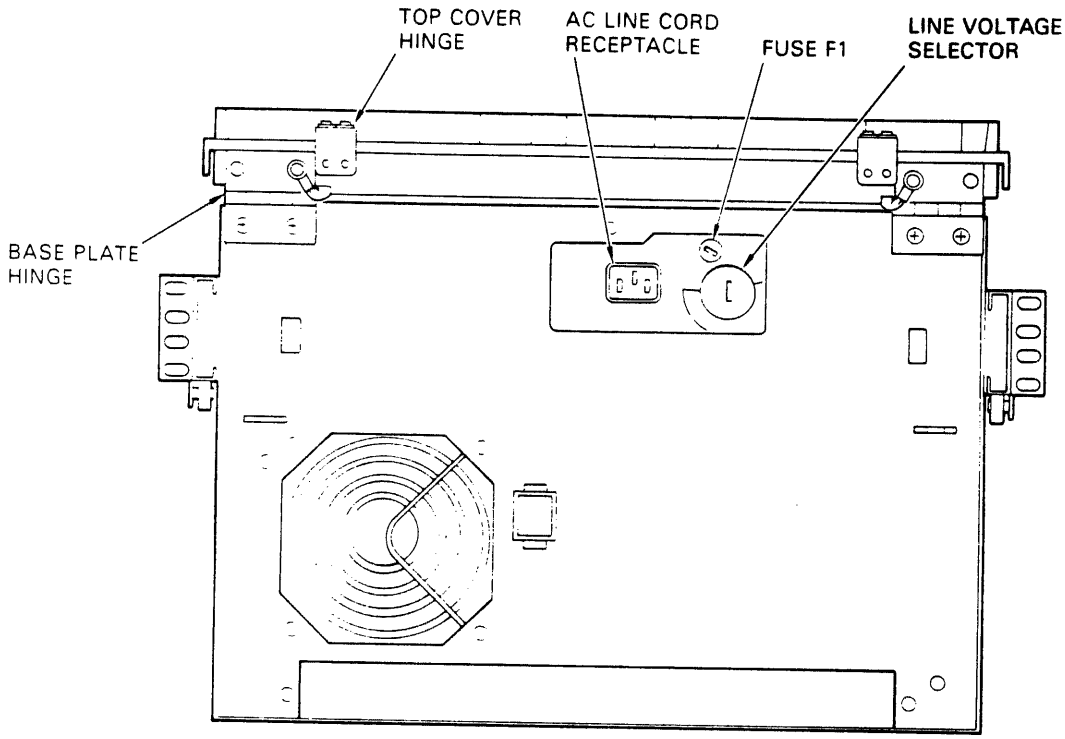
2.2 M990 GCR Tape Unit - Front View
(Unit in Service Position)



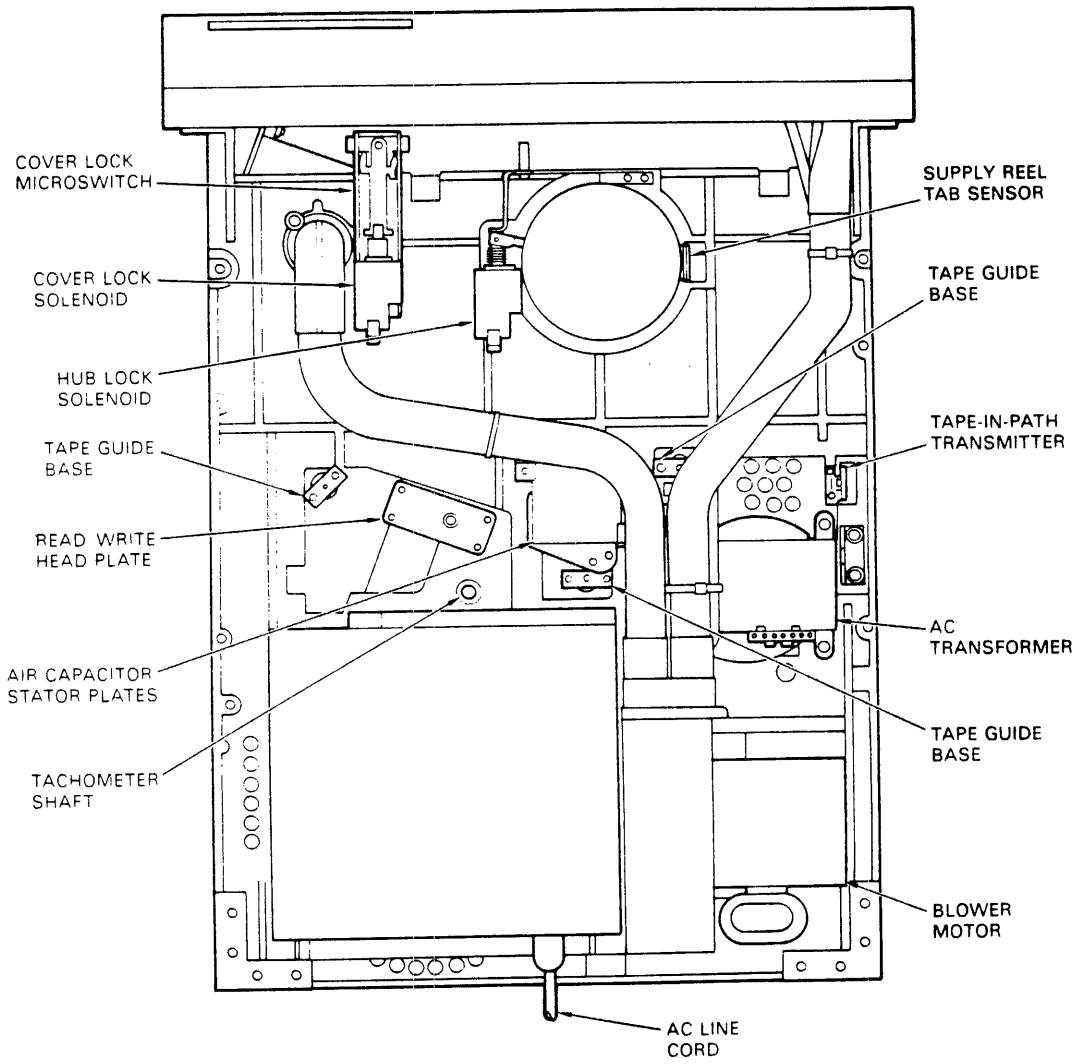
2.3 M990 GCR Tape Unit - Top View



2.4 M990 GCR Tape Unit - Rear View



2.5 M990 GCR Tape Unit - Bottom View



Chapter 3. Illustrated Parts Breakdown

The illustrated parts breakdown divides the Model M990 Magnetic Tape Streamer Unit into assemblies, subassemblies, and component parts.

Figure 3-1 is an overall view of the magnetic tape transport for use in identifying major assemblies. Figures 3-2 through 3-7 represent both an exploded view of these major assemblies and their relationships to the overall assembly.

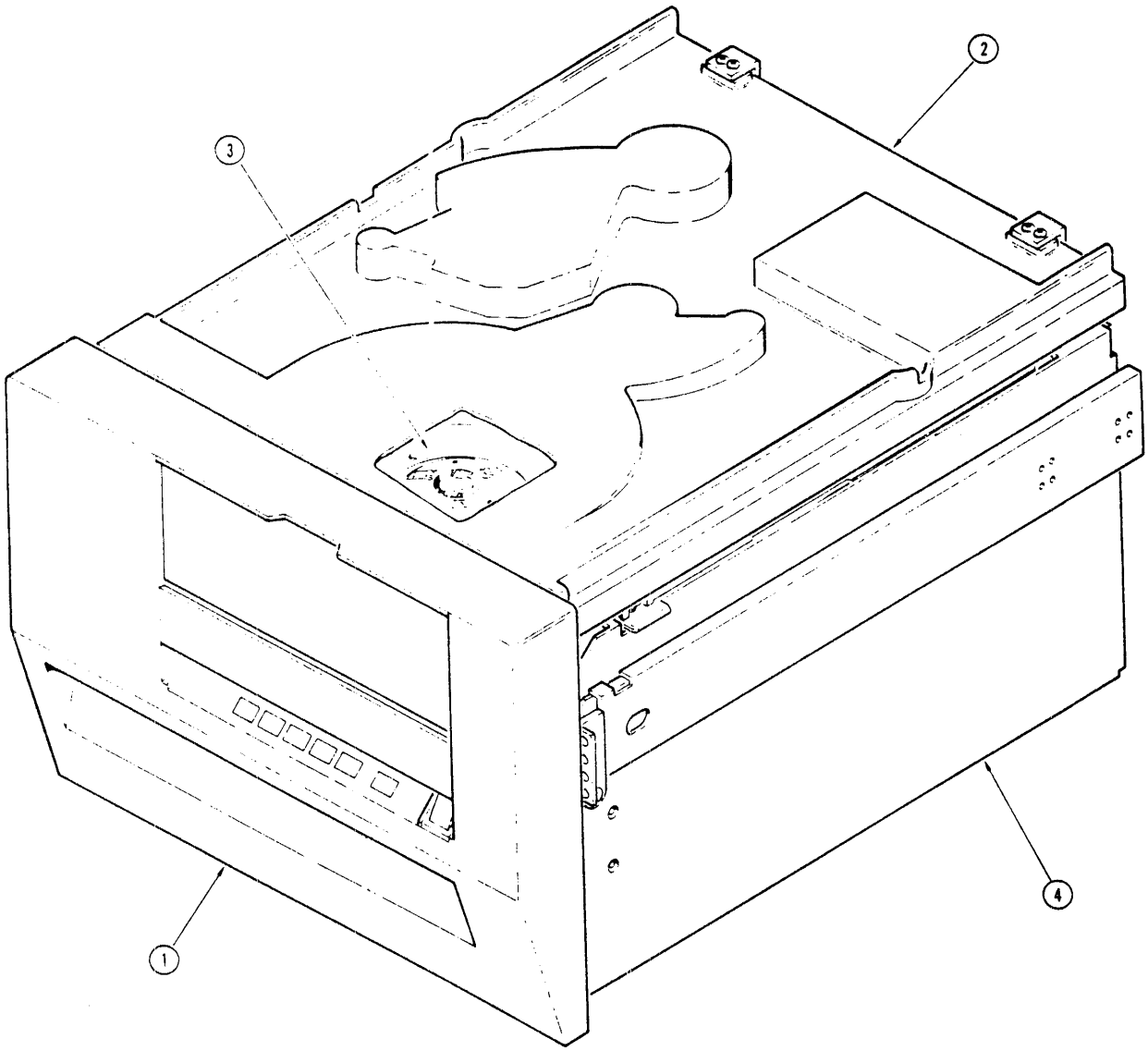


Figure 3-1. Model M990 Magnetic Tape Streamer
(Unit Assembled View)

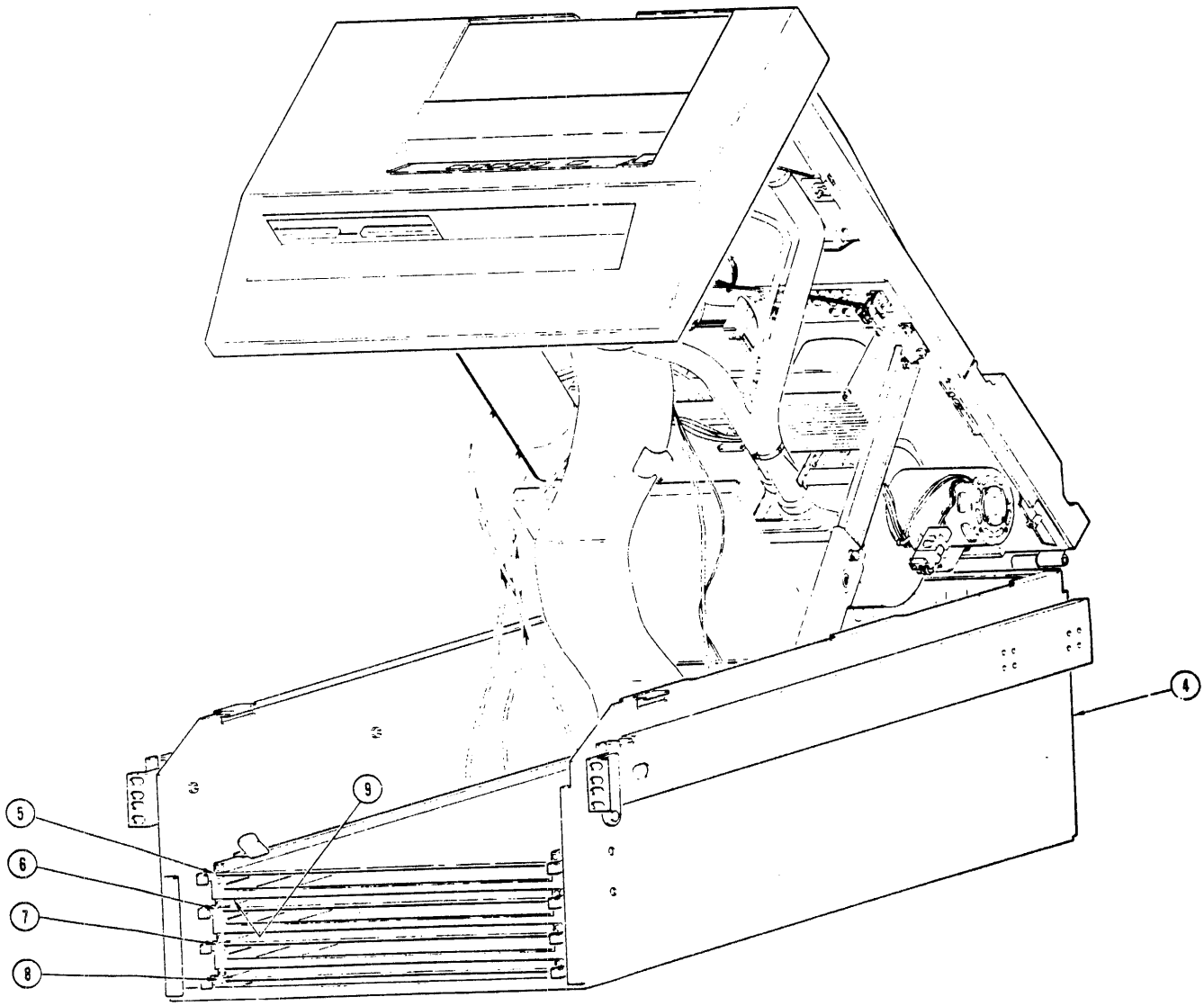


Figure 3-1. Model M990 Magnetic Tape Streamer Unit (Assembled View)

FIGURE & INDEX NO.	PART NUMBER	DESCRIPTION 1 2 3 4 5	UNITS PER ASSY	USABLE ON CODE
3-1	960954-007 963121-001	MAGNETIC TAPE STREAMER, Model M990 ..... Model M990 TUV (+37V)		
-1	964145-001	FRONT PANEL ASSEMBLY ..... (See Figure 3-3)	1	
-2	960057-001	TOP COVER ASSEMBLY	1	
-3	960942-004	BASIC DRIVE ASSEMBLY ..... (See Figure 3-4)	1	
-4	960948-001	CHASSIS ASSEMBLY ..... (See Figure 3-5)	1	
-5	963490-001	PRINTED WIRING BOARD ASSEMBLY, ... Sensor/Servo	1	
	963491-001	TUV (+37V) Sensor/Servo PWB		
-6	963394-001	PRINTED WIRING BOARD ASSEMBLY, ... CPU/MMU	1	
-7	963674-001	PRINTED WIRING BOARD ASSEMBLY, ... DATA	1	
-8	962357-001	PRINTED WIRING BOARD ASSEMBLY, ... CIF/Write	1	
-9	964692-001	SHIELD, PWB.....	1	

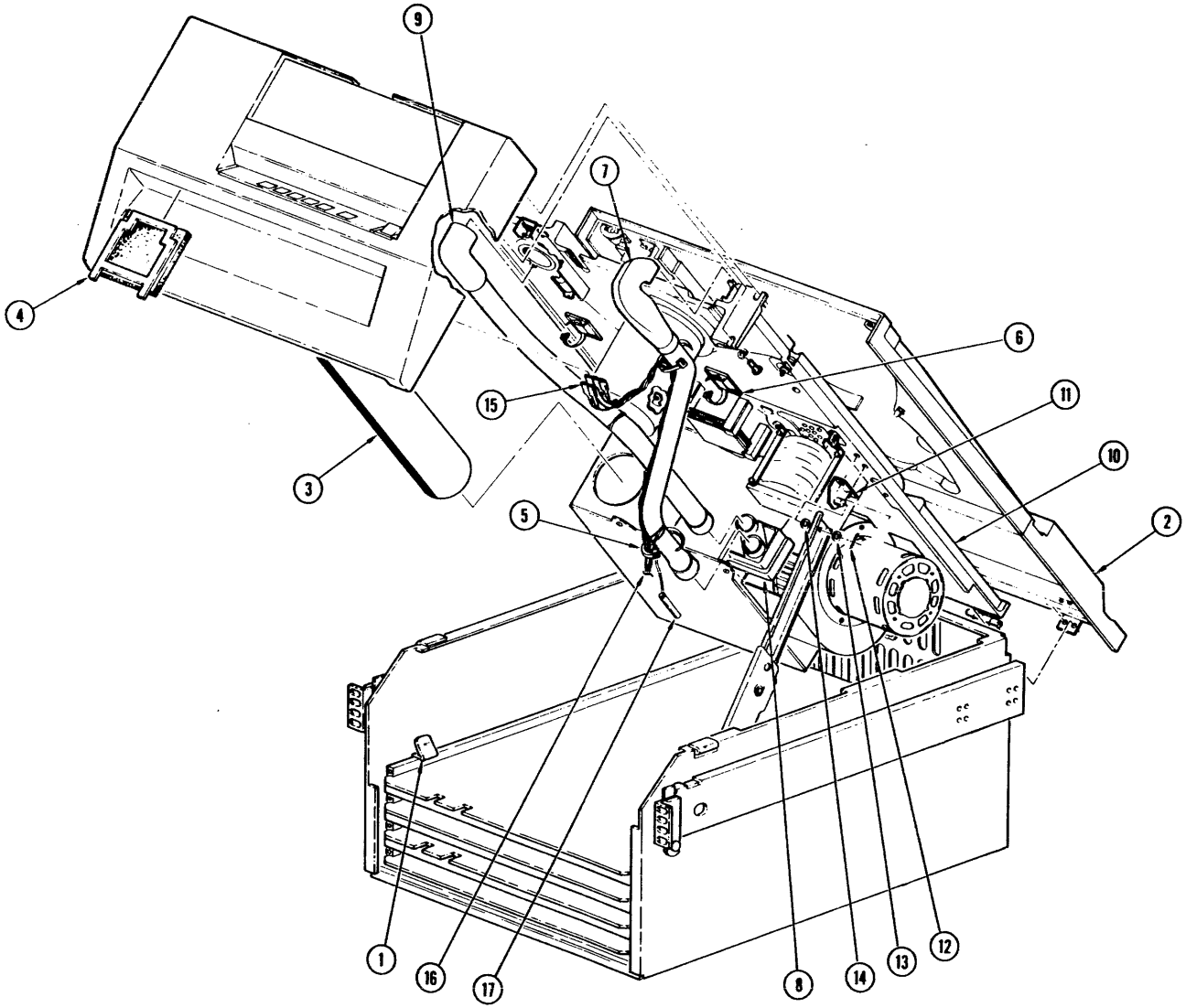


Figure 3-2. Model M990 Magnetic Tape Streamer Unit (Exploded View)

FIGURE & INDEX NO	PART NUMBER	DESCRIPTION 1 2 3 4 5	UNITS PER ASSY	USABLE ON CODE
3-2	960954-007	MAGNETIC TAPE TRANSPORT, ...	REF	
-1	963787-001	. HOLD DOWN, card cage	2	
-2	960057-001	. TOP COVER ASSEMBLY	1	
-3	760101-795	. AIR DUCT (Tube)	1	
-4	961514-001	. FILTER, Air	1	
-5	210229-516	. TY-RAP, 8 in	2	
-6	970457-001	. CABLE CLAMP, adhesive backed.....	3	
-7	160107-478	. DUCT, Air, front panel	1	
-8	760101-609	. NOZZLE, Blower	1	
-9	760106-554	. DUCT, Air, top plate	1	
-10	960942-004	. BASIC DRIVE ASSEMBLY ..... (See Figure 3-4 for breakdown)	1	
-11	160105-418	. BRACKET, Assembly, top plate support	1	
-12	205042-509	. PIN, Cotter, 1/16 x $\frac{1}{2}$ in. lg	1	
-13	207104-021	. WASHER, Flat, No. 10	1	
-14	961084-001	. SPACER	1	
-15	961881-001	. HARNESS ASSEMBLY, Power supply.....	1	
	961832-001	. HARNESS ASSEMBLY, Main.....	1	
-16	970134-001	. LANYARD, Elastic	1	
-17	760105-519	. PIN, Safety.....	1	

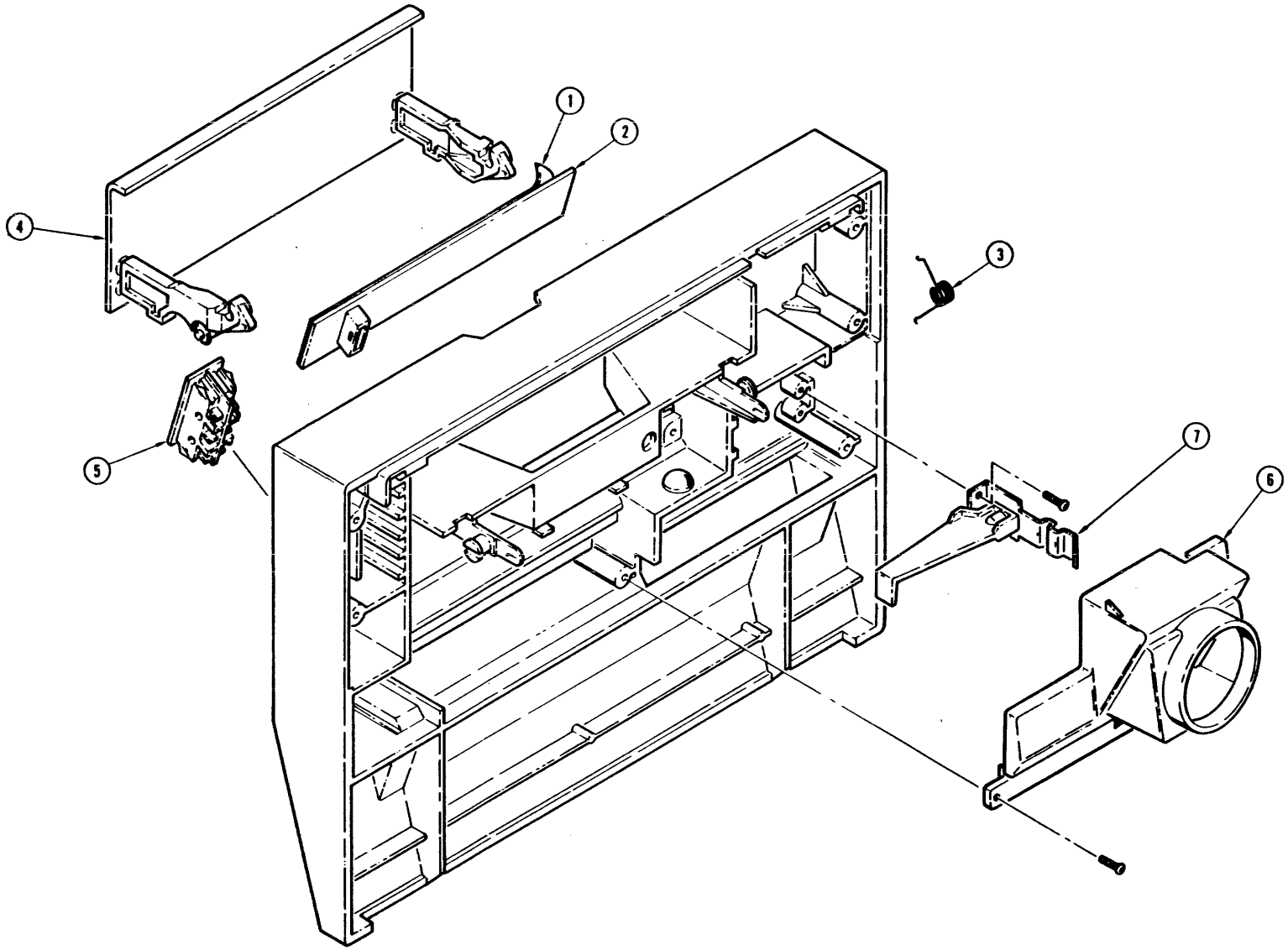


Figure 3-3. Front Panel Assembly (Exploded View)

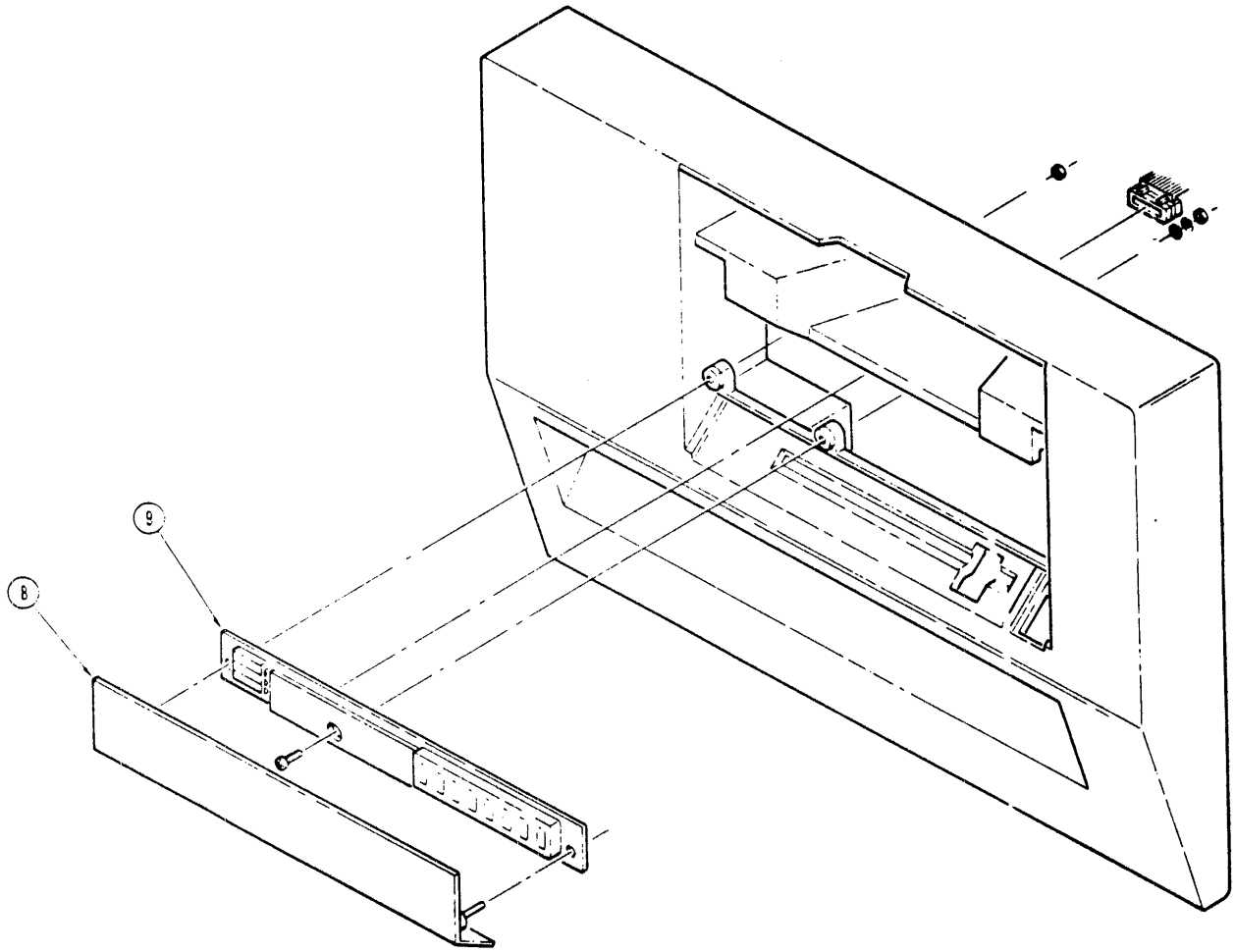


Figure 3-3. Front Panel Assembly (Exploded View)

FIGURE & INDEX NO.	PART NUMBER	DESCRIPTION 1 2 3 4 5	UNITS PER ASSY	USABLE ON CODE
3-3	964145-001	FRONT PANEL ASSEMBLY ..... (See Figure 3-1 for next higher assembly)	REF	
-1	961166-001	. FACIA, Touch Switch	1	
-2	961148-001	. TOUCH SWITCH, 6 position	1	
-3	961910-001	. SPRING, Filter side	1	
	961910-002	. SPRING, Switch side	1	
-4	964032-003	. DOOR ASSEMBLY	1	
-5	961348-001	. SWITCH, Power, DPDT, 16A, 250V	1	
-6	965052-001	. FILTER HOUSING	1	
-7	961266-002	. HANDLE, Rack latch	1	
-8	961140-001	. COVER, Display	1	
-9	961717-001	. PWB ASSEMBLY, Diagnostic display	1	

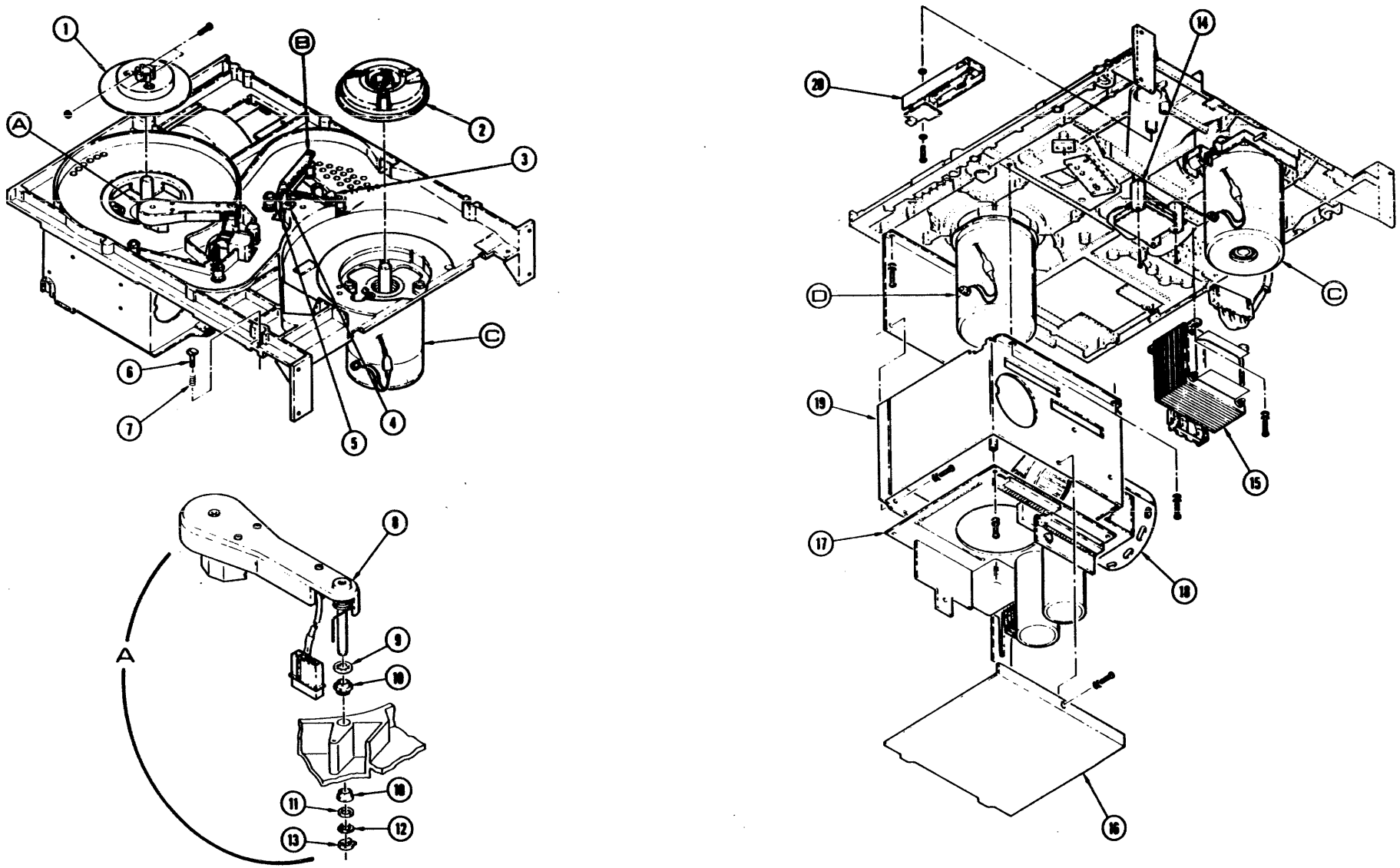


Figure 3-4. Basic Drive Assembly (Exploded View)

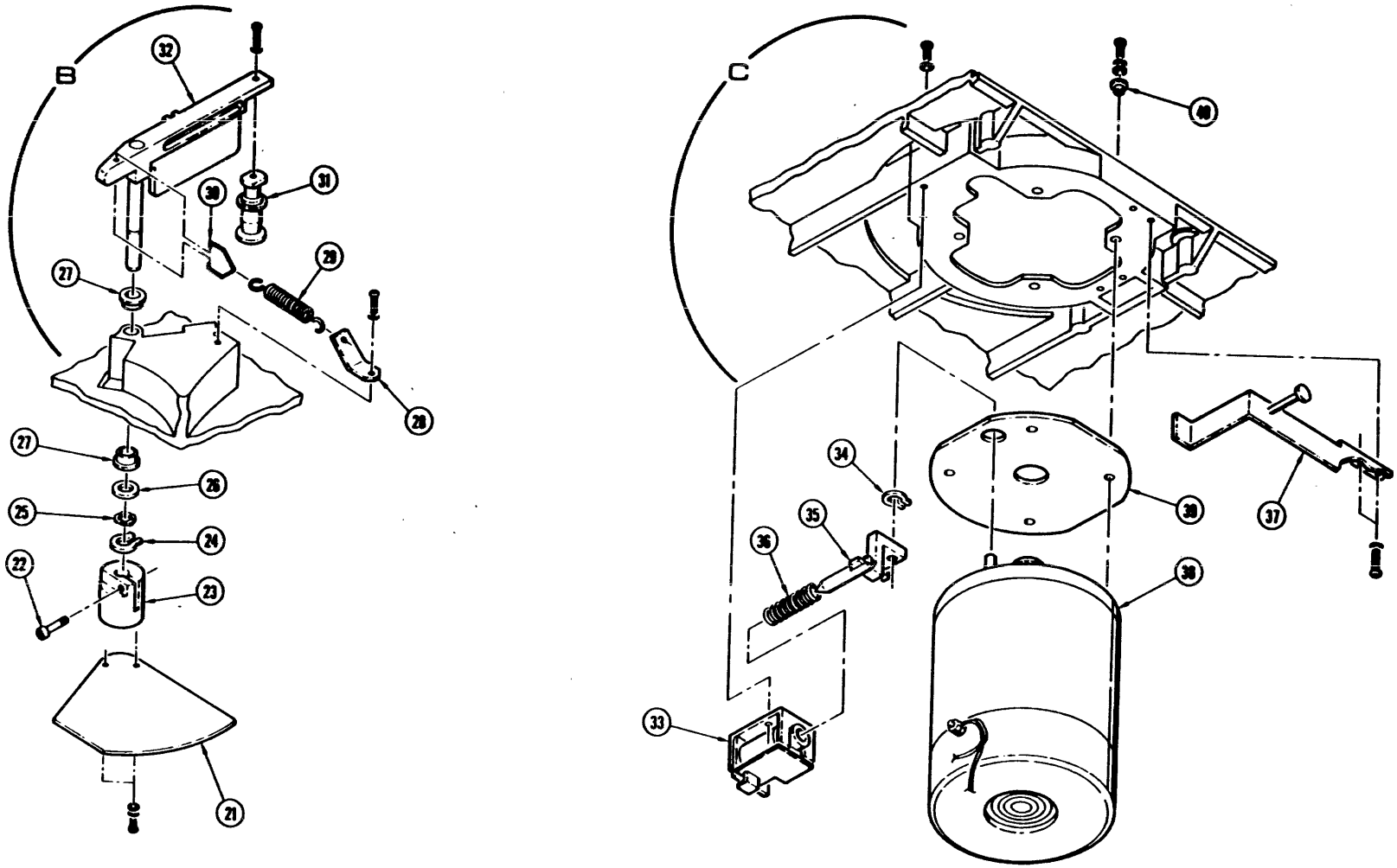


Figure 3-4. Basic Drive Assembly (Exploded View)

Figure 3-4
Sheet 2 of 3

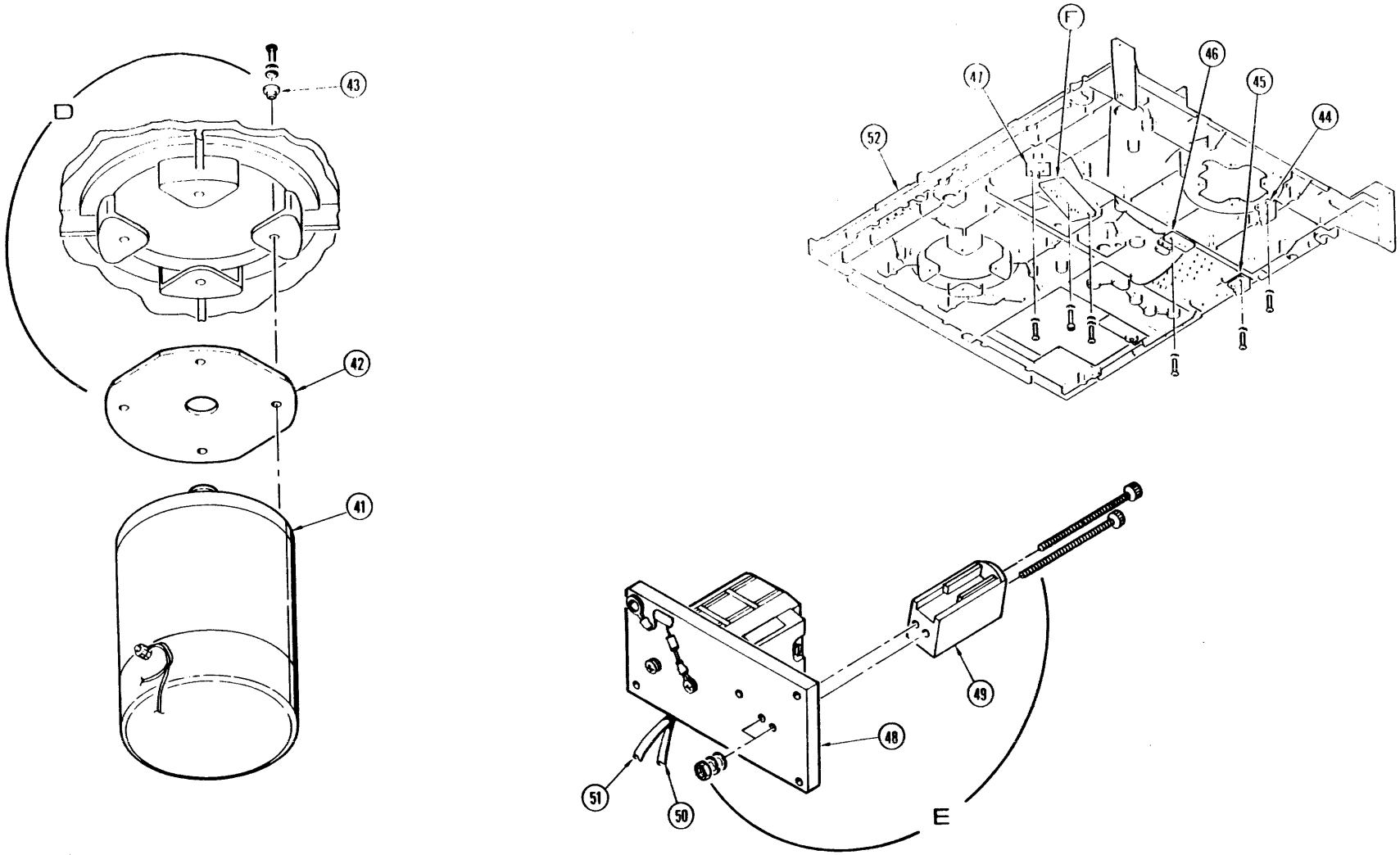


Figure 3-4. Basic Drive Assembly (Exploded View)

FIGURE & INDEX NO.	PART NUMBER	DESCRIPTION 1 2 3 4 5	UNITS PER ASSY	USABLE ON CODE
3-4	960942-004	BASIC DRIVE ASSEMBLY ..... (See Figure 3-1 for next higher assembly)	REF	
-1	760106-567	. HUB, Takeup	1	
-2	160101-406	. SUPPLY HUB ASSEMBLY	1	
-3	160103-433	. TAPE SENSOR ASSEMBLY, Molded.....	1	
-4	160106-479	. BUMPER ASSEMBLY	1	
	160106-478	. BUMPER ASSEMBLY	1	
-5	961699-001	. PRINTED WIRING BOARD ASSEMBLY..... Reflective sensor, EOT/BOT	1	
-6	962197-001	. SCREW, Captive, quick opening	2	
-7	962653-001	. SPRING, Compression, fastener	2	
-8	160105-433	. TACHOMETER ASSEMBLY.....	1	
-9	210200-032	. RING, Retaining, Push-On	1	
-10	210067-001	. BEARING, 1/4 x 3/8 in.	2	
-11	731911-102	. SHIM, .005 in. thick, 1/4 in. ID	AR	
-12	210008	. WASHER, Wave spring	1	
-13	205226-050	. RING, Grip, 1/4 in. ID	1	

FIGURE & INDEX NO.	PART NUMBER	DESCRIPTION 1 2 3 4 5	UNITS PER ASSY	USABLE ON CODE
3-4				
-14	160101-471	CAPACITOR PLATE ASSEMBLY.....	1	
-15	961874 001 961874-002	POWER TRANSFORMER, MGCR..... TUV	1	
-16	961087-001	COVER ASSEMBLY, Power supply housing.....	1	
-17	961181-002	PWB ASSEMBLY, Power Supply	1	
-18	961604-001 961604-004	AIR PUMP ASSEMBLY..... TUV	1	
-19	961087-001	POWER SUPPLY HOUSING.....	1	
-20	961507-001	DOOR LOCK ASSEMBLY	1	
-21	760102-575	SHUTTER, Capacitor, Molded.....	1	
	160103-499	COMPLIANCE ARM ASSEMBLY	1	
-22	970938-405	SCREW, Torx.....	3	
-23	963430-001	HUB, Capacitor shutter	1	
-24	210200-032	RING, Retaining, external, 1/4 in.....	1	
-25	210008	WASHER, Wave spring	1	
-26	731911-102	SHIM, 0.005 in. thick x 1/4 in. ID	1	
-27	210067-001	BEARING, 1/4 x 3/8 in.	2	

FIGURE & INDEX NO.	PART NUMBER	DESCRIPTION 1 2 3 4 5	UNITS PER ASSY	USABLE ON CODE
3-4				
-28	760101-565	. . BRACKET, Spring, compliance arm	1	
-29	210006-010	. . SPRING, Extension	1	
-30	760101-554	. . CLIP, Spring.....	1	
-31	760104-500	. . TAPE GUIDE, Crowned roller, short	1	
-32	160104-492	. . ARM AND SHAFT ASSEMBLY	1	
-33	961666-001	. HUB LOCK SOLENOID ASSEMBLY	1	
-34	210200-032	. RING, Retaining	1	
-35	960745-001	. BELLCRANK, Assembly	1	
-36	963188-001	. SPRING, Compression	1	
-37	960930-001	. . BRACKET, Hub, Unlock		
-38	962747-001	. MOTOR, Permanent magnet, 4 in. ..... diameter, supply	1	
	963494-001	. MOTOR, TUV (+37V), supply		
-39	760101-756	. INSULATOR, Motor	1	
-40	760101-768	. WASHER, Shoulder, insulating	4	
-41	961510-101	. MOTOR, Permanent magnet, ... 4 in. dia, takeup	1	
	962912-001	. MOTOR, TUV (+37V), take up		

FIGURE & INDEX NO.	PART NUMBER	DESCRIPTION 1 2 3 4 5	UNITS PER ASSY	USABL ON CODE
3-4				
-42	760101-756	. INSULATOR, Motor	1	
-43	760101-768	. WASHER, Shoulder, insulating	4	
-44	960771-001	. PRINTED WIRING BOARD ASSEMBLY, ... File protect	1	
-45	160101-010	. PRINTED WIRING BOARD ASSEMBLY, ... Reflective sensor, Tape-In-Path	1	
-46	160104-401	. ROLLER GUIDE ASSEMBLY.....	1	
-47	160104-400	. ROLLER GUIDE ASSEMBLY.....	3	
-48	961960-001	. HEAD ASSEMBLY.....	1	
-49	131047-001	. TAPE SCRAPER ASSEMBLY	1	
-50	963809-001	. HEAD CABLE, READ.....	1	
-51	963808-001	. HEAD CABLE, WRITE	1	
-52	760106-547	. TOP PLATE	1	

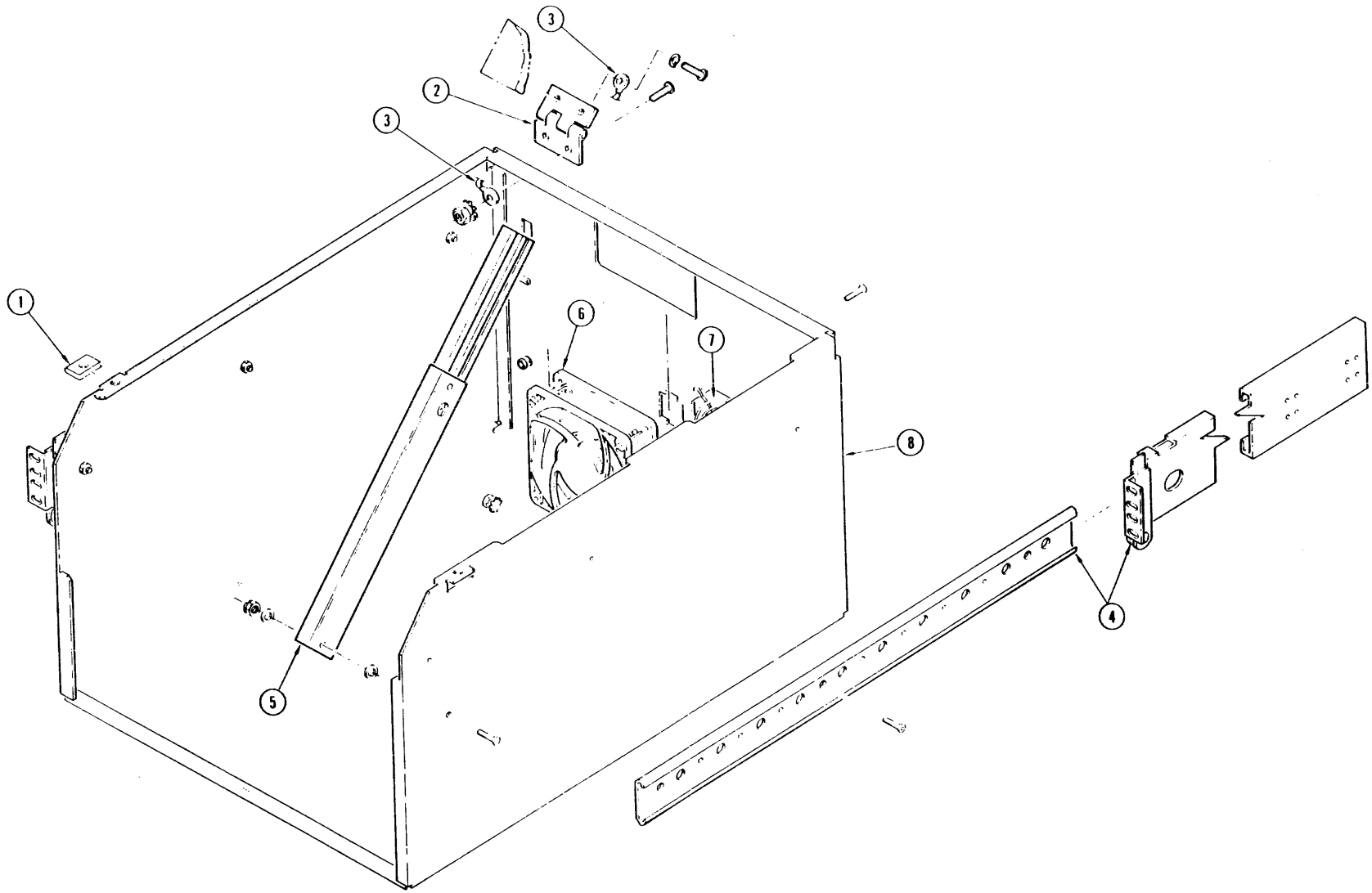


Figure 3-5. Chassis Assembly (Exploded View)

Figure 3-5
Sheet 1 of 1

FIGURE & INDEX NO.	PART NUMBER	DESCRIPTION 1 2 3 4 5	UNITS PER ASSY	USABLE ON CODE
3-5	960948-001	CHASSIS ASSEMBLY ..... (See Figure 3-1 for next higher assembly)	REF	
-1	210116-027	. FASTENER, Clip-on	2	
-2	960238-001	. HINGE, Top Plate	2	
-3	962788-001	. GROUND STRAP, Chassis	1	
-4	961544-002	. SLIDE-CHASSIS, GCR Left	1	
	961544-001	. SLIDE-CHASSIS, GCR Right	1	
-5	963442-001	. SUPPORT MEMBERS, Assembly.....	1	
-6	970027-001	. FAN, AC, Axial, 4.5 sq.	1	
-7	970372-001	. GUARD, Finger, Fan	1	
-8	961078-001	. CHASSIS, MGCR	1	

Chapter 4. Diagnostic Tests and Troubleshooting

CAUTION: This unit should be serviced by qualified maintenance personnel only.

ACHTUNG: Dieses Gerat darf nur von Fachpersonal gewartet werden.

CAUTION: If either the top cover or front tape loading door are forced open, moving mechanical parts may cause injury.

ACHTUNG: Wenn der Klappdeckel oder die vordere Bandladeture mit Gewalt geoffnet werden, besteht Gefahr der Verletzung durch die beweglichen Teile.

4.1 Diagnostic Test

The M990 tape unit has three separate types of built-in diagnostic tests.

1. Power-On Confidence Tests - Automatic power-on self diagnostic tests.
2. Series 100 Tests - Diagnostic tests **WITHOUT** a tape loaded.
3. Series 200 Tests - Diagnostic tests **WITH** a tape loaded.

The alphanumeric messages displayed during the diagnostic tests are shown below along with a brief description of each test.

4.1.1 Power-On Confidence Test

The power-on confidence test mode starts when the power is first switched on. During the power-on sequence, the number of the POC test that is being executed is displayed on the front panel.

The front panel indicators also illuminate with various patterns during the RAM test.

Note: Some tests run so fast that the test name i.e., POC Ø, will not appear in the alphanumeric display unless that test fails. Normal operation will show, TESTING RAM, POC 1, POC 2, 88888, ..., *****, and POC 5.

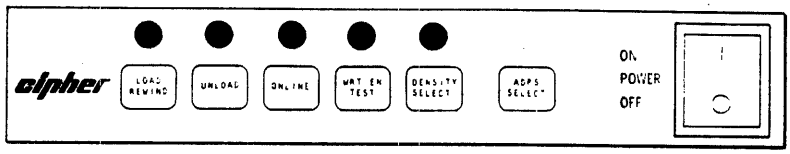
POC 0

This test checks both data and code RAM memory using a write/read and compare sequence of four patterns (FFFF, 5555, AAAA, 0000). The code RAM is checked first.

TESTING RAM

During the POC 0 test, the TESTING RAM message is displayed and the front panel indicators illuminate with various patterns.

RAM ERR



If the RAM ERR message is displayed and all of the front panel indicators remain lit, the unit failed to complete the RAM tests. Press any front panel switch to display a hex code (0000-FFFF) that indicates what area of RAM failed. The second activation of any front panel switch will display the reference designation of the faulty IC. Continue pressing the front panel switch until all faulty RAM IC reference designators are displayed. For example:

OOFF

Press any switch. Indicates that the lower bank of RAM failed.

IC U21N

Press any switch again. Indicates that U21N is one of the faulty IC's.

POC 1

This test calculates the check sum for the four PROM memories U20K, U22K, U23K, and U25K.

CSE UXXK

If the CSE UXXK message is displayed, POC 1 detected a check sum error on the indicated IC number. If more than PROM IC is faulty, its designator number will be displayed next.

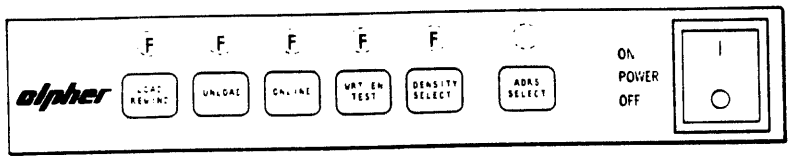
POC 2

This test copies the data and code contained in the ROM's into the RAM memory, also resets the boot line.

88888888

.....

****



This test checks the alphanumeric display with three patterns; 88888888, ..., and ********, that alternate every 1/2 second. The front panel indicators also cycle continuously during this test.

POC 3

This test checks the contents of the NOVRAM. It performs a recall cycle on the NOVRAM, copies the information into RAM and performs an ecc check. If the ecc check fails completely, the NOVRAM is uninitialized and the default values are copied into the NOVRAM and the zero servo routine is called.

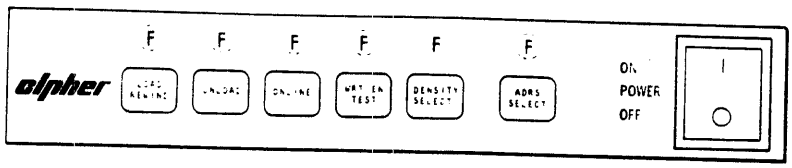
NVRM ERR

If the NVRM ERR message is displayed, the ecc routine corrected the erroneous bits. This message is displayed momentarily before the test continues.

POC 4

This test performs a fast check of the cache RAM by writing the patterns 1ff, 155, 099, and 000 in order into the first eight locations of each bank of cache RAM and then executing a read/compare operation.

CRAM ERR

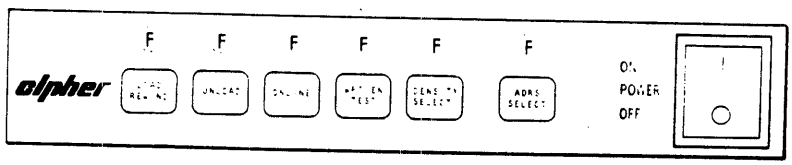


If the CRAM ERR message is displayed and all front panel indicators are flashing, the unit failed to complete the cache RAM test. Press the Load switch to display a hex code that indicates the section of cache RAM that failed. Press the Load switch again to display the reference designator of the faulty IC. Continue pressing the Load switch until all faulty IC reference designators are displayed. To exit the cache RAM test, press the Wrt En/Test switch.

POC 5

This test determines the phase quadrature of the tachometer and performs a pass/fail test by rotating the take-up hub in a clockwise direction for 200 milliseconds.

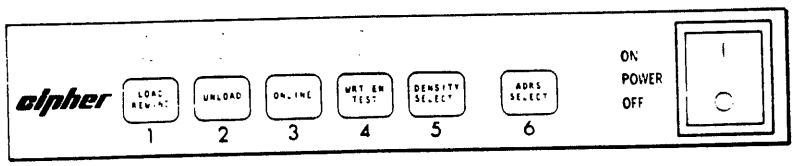
TACH ERR



If the TACH ERR message is displayed, the take-up hub moved less than .05 inch or 10 tachometer counts were not sensed.

4.1.2 Starting The Diagnostic Tests

Check to see that the On-Line indicator is off. If the indicator is on, press the On-Line switch to switch the unit to an off-line mode.



Note: Steps 2 through 5 must be accomplished within 3 seconds between keystrokes. If too much time is used, the GCR will automatically return to the normal operating mode.

1. Press the Wrt En/Test switch number 4.
2. Press the DENSITY SELECT switch number 5.
3. Press the switch numbers that represent the test to be run.
4. Press the DENSITY SELECT switch number 5 to **START** the diagnostic test.
5. Press the Wrt En/Test switch number 4 to **STOP** or cancel the diagnostic test.

   Note: Some diagnostic tests require you to stop the test from running before you cancel the diagnostic.

When a diagnostic test is first entered, specific front panel indicators are lit to indicate the options available at this point. The diagnostic tests can operate in either the test execution mode or the parameter selection mode. The parameter selection mode allows you to select the operational parameters that are used when the test is run in the execution mode.

During the test, the alphanumeric display will display information about the drive's status.

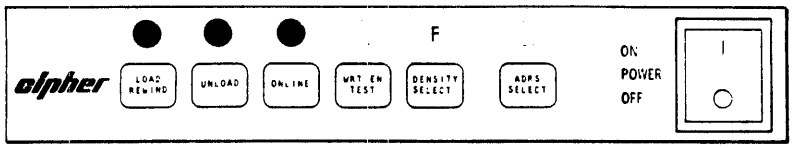
4.1.3 Diagnostic Tests WITHOUT Tape Loaded (Series 100)

CAUTION: Remove tape prior to running series 100 tests, failure to do so could cause damage to tape.

Test 111 (Oscillate Servos):

This test checks both the supply and take-up motors and their related servo circuits.

MODE ?



When entered, the test is in the parameter selection mode.

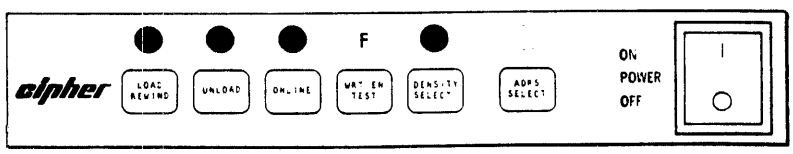
AUTO OSC — Press the Load switch to select the auto-oscillate option. The initial speed is about 25 ips.

MAN SPLY — Press the Unload switch to select the manual supply option with initial speed of 0 ips.

MAN TKUP — Press the On-Line switch to select the manual take-up option. The initial speed is 0 ips.

Press the DENSITY SELECT switch to access the execution mode.

Note: Press and hold the Load switch during MAN SPLY or MAN TKUP mode to steadily increase speed up to 115 ips. Press and hold the Unload switch to decrease the speed to 0 and reverse direction. A positive drive value corresponds to clockwise rotation of the hub and negative drive value corresponds to counterclockwise rotation. The sequence is identical but opposite indirection if the Unload switch is pressed first. Press the On-Line switch to reverse the direction of rotation in the MAN SPLY, MAN TKUP, or AUTO OSC mode.

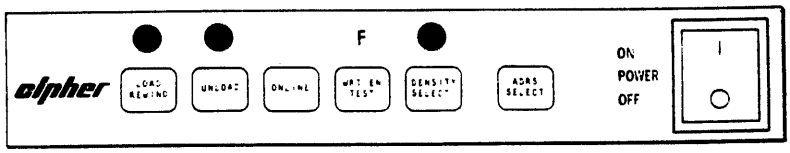


Test 124 (Voltage Display):

This test displays the analog voltage (± 20%) of the following signal:

ARM Compliance arm output voltage

ARM + X.XX



The compliance arm voltage is displayed when the test is executed.

Test 125 (PROM Revision):

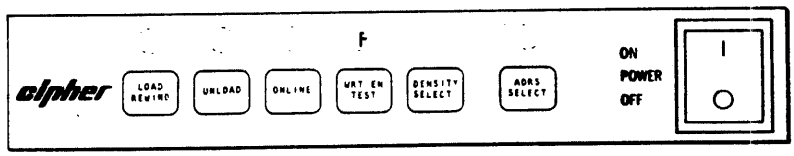
XXXXXX-XXX

This test displays the part number of the PROMs installed in the unit.

Test 131 (File Protect/Reel Seat, BOT, EOT, AND Tape-in-Path):

This test checks the status and operation of the file protect/reel seat, BOT, EOT, and Tape-in-Path sensor circuits.

The test begins by rotating the supply hub very slowly to allow the sensor to detect pulses reflected from the file protect and reel seat tabs. A reel of tape, with file protect ring inserted, must be placed on the supply hub (not loaded) and must be allowed to rotate freely. The display messages and corresponding actions are listed below:



This display occurs if there is no tape reel sensed on the supply hub. Exit the test and place the unit in the Operator Access Position (see para. 5.1). Place a tape reel on the supply hub and re-enter the test.

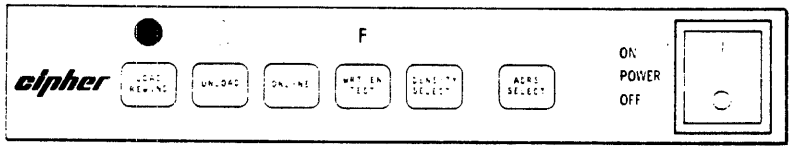
With a reel placed on the hub, as the reel seat tab passes the sensor the unload LED will flash twice. If the reel is write enabled, the LED will flash once as the write enabled tab passes the sensor, and twice for the reel seat sensor.

For BOT, EOT, and Tape-in-Path sensor, a strip of tape about three feet long with a BOT and EOT reflective strips placed on it. Remove the reel of tape from the supply hub and manually thread the piece of tape through the tape path.

B E T — Move the tape in front of the Tape-in-Path sensor, a "T" will be displayed on the alphanumeric display. As you move the BOT and EOT reflective strips past their respective sensors, a "B" or "E" will be displayed on the alphanumeric display.

Test 132 (Door and Hub Lock):

When entered, the test cycles both door lock and hub lock solenoids.



LOCKED — This display occurs when both front panel door and top cover are locked.

UNLOCKED — This display occurs if either the front panel door or top cover is open.

Press the Load switch to display the status of the door lock micro-switch.

SW OPEN — This message occurs when the solenoid is engaged.

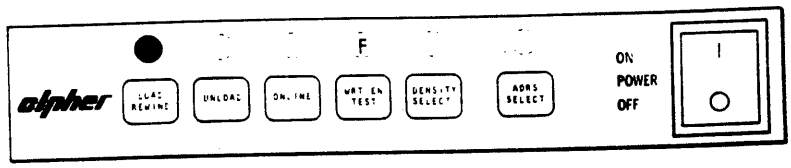
SW CLOSED — This display indicates that the switch is in its normally closed (solenoid disengaged) position.

Test 133 (Door Open):

DR OPEN — This test deactivates the front panel and top cover lock solenoid so that the covers may be opened during the next load attempt. The DOOR OPEN message is displayed for 20 seconds.

Test 134 (Blower Motor):

BLWR ON



When entered, this test activates the blower motor.

BLWR OFF — Press the Load switch to turn the blower motor off.

BLWR ON — Press the Load switch again to turn the blower motor on.

To exit the test, press the Wrt En/Test switch.

Test 142 (Edit NOVRAM):

This test allows you to select the NOVRAM values to configure the M990 for efficient operation in your system. When first entered, the test will display the current value of the serial port baud rate parameter. The values of the configuration parameters can be displayed in the same order as the following list:

1.	Option inactive	
2.	Host Supplied Parity -	Yes, No
3.	Echo Read Strobes - on Write	Yes, No
4.	EOT Mode -	Normal, T.I.
5.	Forward Hitch Enabled -	Yes, No
6.	Echo 3200 bpi ID Burst -	Yes, No
7.	Option inactive -	
8.	Abort Active Writes - on Overwrites	Yes, No
9.	Interface transfer Rate - (kHz)	70.3, 79.1, 90.4, 105.5, 126.6, 158.2 211.0, 316.5, 632.8
10.	Default Density - on Power-Up	1600, 6250, 3200

11.	Maximum Block - Size (k bytes)	9, 16, 32, 64
12.	Interface Ramp Delay -	0 through 15
13.	Write Sync Option -	DBLE FMK, SNGL FMK, NO W/S, ALL WRTS
14.	Read Error Retries -	0, 3, 7, 11, 15
15.	Write Error Retries -	0, 3, 7, 11, 15
16.	Read Error Correction on -	Yes, No
17.	Unit -	0 through 7
18.	Lock Out 3200 bpi - Writes	Yes, No
19.	Remote Density - Select Enabled	Yes, No
20.	Report Corrected - Errors	Yes, No
21.	Allow One Track Down - on Writes	Yes, No
22.	6250 Write Current - (read as XX.XX ma)	XXXX
23.	1600 Write Current -	XXXX
24.	3200 Write Current -	XXXX
25.	6250 RAW Threshold - (read as .XXX mv)	XXX
26.	1600 RAW Threshold -	XXX
27.	3200 RAW Threshold -	XXX
28.	3200/6250 BPI Select as 6250 BPI	Yes, No
29.	Display "feet to EOT"	Yes, No
30.	Write Error Override	Yes, No
31.	Remote Load/On-Line	Yes, No

Press the Load switch to display the next parameter. If you press and hold the Load switch, the display will increment through the parameter list.

Press the Unload switch to display the previous parameter. Press and hold the Unload switch to decrement through the parameter list.

Press the On-Line switch to redisplay the current parameter.

To exit the test without changing any of the parameters, press the Wrt En/Test switch.

If you want to change a parameter value, select the appropriate number, using the Load or Unload switch, and enter the edit mode by pressing the DENSITY SELECT switch.

Note: Items 22 thru 27 are not alterable by test 142.

Press the Load switch to get a yes/no parameter value to yes, or increment a value parameter to its next higher value.

Press the Unload switch to set a yes/no parameter value to no, or decrement a value parameter to its next lower value.

To scroll the parameter name through the display, press the On-Line switch. The parameter value will remain in the display.

Press the DENSITY SELECT switch to return to the test execution mode.

To save the new parameter values and exit the test, press the Wrt En/Test and DENSITY SELECT switches together. These new values will be stored in the NOVRAM when the unit is powered down.

4.1.4 Diagnostic Tests WITH Tape Loaded (Series 200)

When entered, the diagnostic tests that move tape will default to the density/speed combinations shown below if the tape is write enabled. If the tape is write protected, the test will determine the density/speed combination that is compatible with the data written on the tape. The density is displayed on the front panel LED's.

Model M990: 1600bpi/100ips

3200bpi/50ips

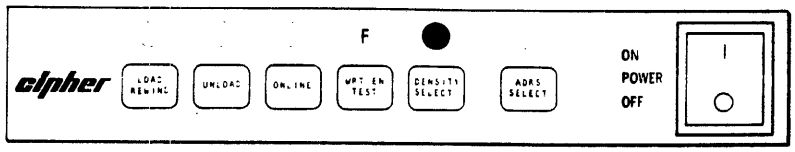
6250bpi/70ips

Test 212 (Read/Write Data):

This test writes 16 bytes of data per block incrementing from 01 to 0F on the tape, if write enabled, until EOT is detected, then reads reverse to BOT. No error correction attempts are made during this test. The data is written at the density indicated by the front panel LEDs.

If the tape is write protected, the drive will read forward to EOT, then read reverse to BOT until the test is terminated.

TEST 212



WRITING — This message is displayed if the tape is write enabled. Press the DENSITY SELECT switch to reverse direction if the tape is moving forward. Press the WRT EN/TEST switch to rewind to BOT and exit the test.

RUN FWD — The RUN FWD message is displayed if the tape is not write enabled. Press the Wrt EN/TEST switch to rewind to BOT and exit the test. Press the DENSITY SELECT switch once to stop tape movement, and a second time to cause a read reverse.

READ REV — The READ REV message is displayed if the tape is write enabled. Press the WRT EN/TEST to rewind to BOT and exit the test. Press the DENSITY SELECT switch once to stop tape movement, and a second time to cause a read forward.

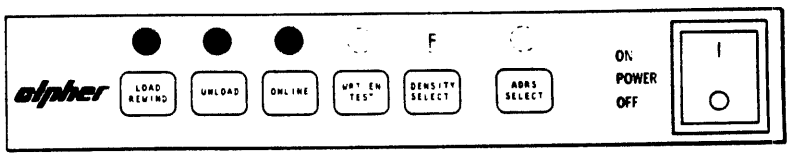
RUN REV — The RUN REV message is displayed if the tape is not write enabled. Press the Wrt EN/TEST to rewind to BOT and exit the test. Press the DENSITY SELECT switch once to stop tape movement, and a second time to cause a read forward.

Note: Tape must be moving to exit this test. If the tape is not moving, press the DENSITY SELECT switch to start tape movement, then press the Wrt EN/TEST switch to exit the test.

Test 222 (Tape Shuttle):

This test runs the tape forward and reverse for the amount of time selected in the parameter selection mode. There is no data transfer during this test.

SELECT FWD/REV
TIME IN SECONDS



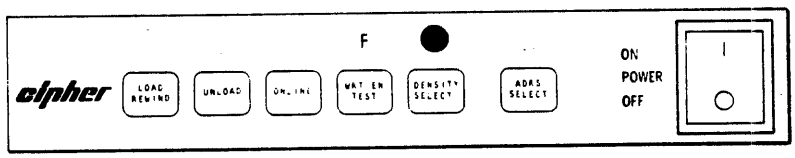
When entered, the test is in the parameter selection mode.

.5/.2 — Press the Load switch to run tape forward for .5 seconds and reverse for .2 seconds.

2/1 — Press the Unload switch to run tape forward for 2 seconds and reverse for 1 second.

10/5 — Press the On-Line switch to run tape forward for 10 seconds and reverse for 5 seconds.

Press the DENSITY SELECT switch to execute the test, if no time periods were selected, the tape will rewind to BOT and the test will terminate.



Test 223 (Read/Write Check):

This test cycles through the following sequence of operations until exited.

WRITING — The unit writes blocks of data forward to EOT. Write retries are performed and the number of write errors are recorded.

READ REV — The unit reads reverse to BOT and compares the read data with the write data of the previous operation. Read retries are performed as part of this test.

READ FWD

The unit next reads forward to EOT and performs a read/write data compare check with read retries.

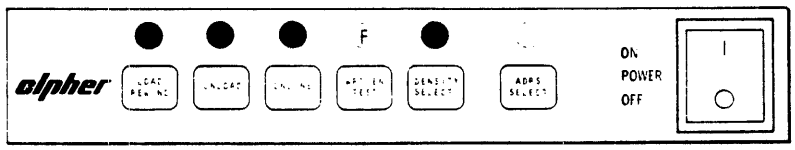
REWIND'G

The unit rewinds tape to BOT.

The unit increments the density to the next higher value, i.e., if the present density is 1600 bpi it increments to 3200 bpi.

The test increments the pass count by one and repeats the above loop.

TAPE MUST BE WRITE ENABLED



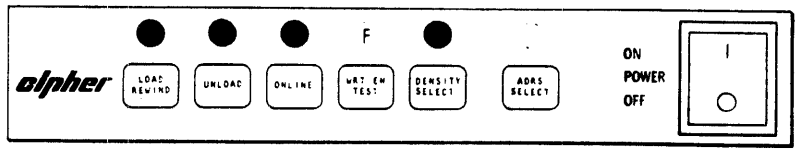
When entered, the tape loaded on the unit must be write enabled to allow test to continue.

Press the Load switch to increment to the next operation in the cycle, i.e., writing to Read Rev, Read Rev to Read Fwd, and Read Fwd to Rewind.

Press the Unload switch to abort the current operation, rewind and switch to the next density.

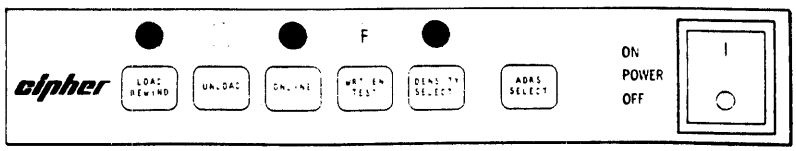
Press the On-line switch to lock or unlock the option to switch to the next density at the end of the read forward operation.

UNLOCKED



Default condition is Unlocked when entering the test. By pressing On-line once, 'LOCKED' will be displayed and you will continuously cycle in the current density until On-line is pressed again or the test is terminated.

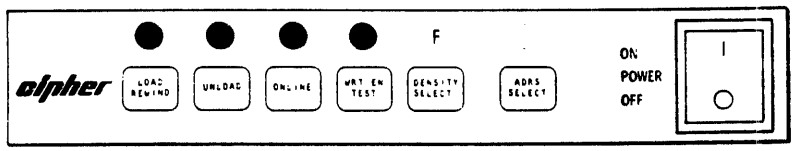
LOCKED



Press the Wrt En/Test switch to rewind the tape to BOT and enable the status mode.

Press the DENSITY SELECT switch to enable the status mode at any point on the tape.

STATUS



This display occurs when the test is in the status mode.

TOTAL — Press the Load switch to display the total errors that occurred during this test in all three densities.

1600 BPI — Press the Unload switch to display the errors that occurred in the 1600 bpi mode.

3200 BPI — Press the On-line switch to display the errors that occurred in the 3200 bpi mode.

6250 BPI — Press the Wrt En/Test switch to display the errors that occurred in the 6250 bpi mode.

The errors are displayed in the following sequence:

P A S S — This message represents the number of passes the test has completed.

H D E N — This message represents the number of hard errors.

C R E N — This message represents the number of corrected errors.

WT Tn — This display indicates the number of write retries.

RD Tn — This display indicates the number of read retries.

TRK ERRS

TRK tn

This message represents the error history of each track (t) 0 through 7, P.N. indicates the number of errors for each track. Only tracks with errors are displayed.

TOT 1600

TOT 3200

TOT 6250

These messages represent the sum of the previous errors that occurred with the unit operating at the indicated density. These will be displayed only if the total error display mode is selected.

Press the Wrt En/Test switch to rewind tape and enter the status mode. Press the DENSITY SELECT switch to exit the test.

Test 224 (Voltage Display): Same as test 124, but with tape loaded.

Test 233 (Door Open):

DR OPEN — This test disengages the top-cover/front-panel lock. The DR OPEN message is displayed for 20 seconds. The tape must be at BOT.

Test 242 (Edit Novram): Same as test 142 except that tape is loaded on unit during test.

Test 243 (No Write Retries):

WRT RETRIES OFF — This test disables the write retry circuit.

Note: To return the write retry circuit to normal operation, the ac power switch must be turned off then on.

Test 244 (Infinite Read/Write Retries):

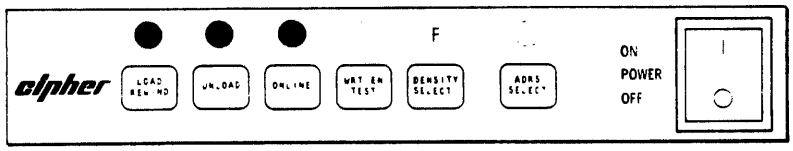
WRT/RD RTRYS = 64K

This test set both the write and read retries to 64K.
Note: To return the write retry circuit to normal operation, the ac power switch must be turned off then on.

Test 255 (Display Status):

This test displays the following error history information. The error history can be compiled during on-line operation or diagnostic tests that read and write data.

STATUS



HRD ERRS
COR ERRS

Press the Load switch to display the number of hard errors and corrected errors.

WRT TRYS
RD TRYS

Press the Unload switch to display the number of write retries, then the number of read retries.

TRACK ERROR
HISTORY

Press the On-line switch to display the error history of each track as TRK (t) (n) where (t) is the track number 0 through 7, and (n) is the number of errors. (Tracks without errors are not displayed.) If no errors have occurred, the message 0 ERRORS is displayed. Press 'Test' to display clear error history, followed by Yes/No. Press Load select for Yes or Unload select for No. Pressing density will execute your selection.
Press the DENSITY SELECT switch to exit the test.

4.2 Troubleshooting

The purpose of this section is to assist in repairing common faults through some simple tests designed to find the field replaceable subassembly that is causing the problem. The section is divided into three sub-sections: the Troubleshooting, Main Tests and Common Tests.

Troubleshooting

This section explains how to troubleshoot the M990 using this chapter and general information which is required to be known by the technician prior to troubleshooting.

Main Tests

This section contains all the tests used to find the source of the problem. It is divided into four areas: power up failures, load faults, operational faults, and data related errors.

Common Tests

Some subassemblies can cause more than one type of error, but the test is always the same. These tests are grouped together in this section. In the main tests section, a common test is shown by enclosing it inside parenthesis as "(common test)". Some of the common tests also refer to other common tests.

It is intended that this section be used by a technically skilled person who is familiar with the GCR tape unit and the diagnostics available on the machine. For more information on the GCR diagnostics, see section 4.1.

4.2.1 Using This Section -

1. Before doing anything, make a thorough visual inspection of the drive. Look for loose or damaged connectors and make sure that all the boards are seated properly. Also look for any damage to the backplane connectors or cables.

2. Find the type of problem the drive is having in the list below.

Problem type	Table
Power up failures	1
Load faults	2
Operational faults	3
Data related errors	4

3. Refer to the appropriate table (see pages 4-22 and 4-23) to further classify the problem.

4. Find the symptom or error message you are seeing in the table. Error messages are shown inside double quotes, e.g., "FRONT PANEL MESSAGE".

5. Go to the page listed in the "Page" column and follow the test procedure listed under "Test".

   Example -

   Suppose the drive won't load tape and the front panel display shows "LOAD FAILURE". In the table above we find "Load faults". The right hand column refers us to Table 2. In Table 2 we find "LOAD FAILURE" close to the bottom of the table. The right hand columns tells us to follow test B-9 to find the failing sub-assembly.

6. If you replace or repair anything, start the test over from the beginning unless told to do otherwise. (See the following section on changing boards.)

7. If after following the test procedure the problem continues, replace the backplane.

Recording NOVRAM values -

Record the values stored in the NOVRAM somewhere so you can check them and make sure someone has not changed them accidently.

4.2.2 Changing boards

To change any of the four main boards, use the following procedures. Anytime you change a board, check the connector on the backplane before pulling the board out. If you notice the backplane is damaged, try fixing it before swapping out the board.

4.2.2.1 Sense Servo Board

1. Zero the servo offsets using procedure 5.34.4.
2. Run Test 513 to set the Read/Write threshold.

4.2.2.2 CPU Board

1. Record the current NOVRAM values.
2. Run Test 542 to set drive to Internal Mode.
3. Enter Test 525 to set the default values in the NOVRAM. The display will read "INITIALIZE NOVRAM TO". Press the UNLOAD switch and "FIELD" will be displayed. Press the DENSITY SELECT switch to exit the test.
4. Run Test 542 to set the drive back to Field Mode.
5. Edit the NOVRAM using Test 142 and insert the values recorded in step 1.
6. Zero the servo offsets using procedure 5.34.4.
7. Run Test 513 to set Read/Write threshold.

4.2.2.3 Data board

1. Run Test 513 to set Read/Write threshold.

4.2.2.4 CIF Board

1. Run Test 513 to set Read/Write threshold.

4.2.3 Notes and Cautions

1. Using a digital voltmeter may give misleading readings when measuring voltages across the motors. Use Triplett model 630 NA, Fluke Model 77 or equivalent.
2. Be sure to turn the power off and wait for 10 seconds before removing or installing any boards.

Symptom or Message	Test
No alpha dsp, power light doesn't come on	A-1
No alpha dsp, power light on steady	A-2
All front panel LED'S on steady	A-3
"POC 0"	A-4
"TESTING RAM"	A-5
"POC 1"	A-6
"POC 2"	A-7
"POC 3"	A-8
"NVRM ERR"	A-9
"POC 4"	A-10
"POC 5"	A-11

Table 1. Power up failures.

Symptom or Message	Test
"ARM FAULT DURING LOAD"	B-1
"HUB SEAT"	B-2
"NOT ENOUGH TAPE ON TAKEUP" (Man. load)	B-3
"TAPE STUCK"	B-4
"NO DOOR LOCK"	B-5
"SERVO FAILURE"	B-6
"REEL UPSIDE DOWN"	B-7
"NO BOT"	B-8
"LOAD FAILURE"	B-9
During auto load, takeup doesn't turn	B-10
Pawls don't lock	B-11
Run away during auto load	B-12

Table 2. Load faults

Symptom or Message	Test
Interface timeout	C-1
Online but won't respond to commands	C-2
Blower won't come on	C-3
"ARM FAULT DURING RU"	C-4
"NO BOT" or Misses EOT or BOT	C-5
Doesn't sense write protected tape	C-6
Breaks tape	C-7
Destroys tape	C-8
"TAPE LENGTH 3700 FT"	C-9
"18 FT PAST EOT"	C-10
"ARM FAULT DURING LOAD"	C-11
"SPEED ERROR"	C-12
"CACHE RAM PARITY ERR"	C-13
Problems with impending EOT	C-14
Won't knock pawls down	C-15
Buttons don't work	C-16
Display doesn't work	C-17
Can't sense open door	C-18

Table 3. Operation faults

Symptom or Message	Test
Mispositions	D-1
Excessive repositioning	D-2
Excessive write retries	D-3
Excessive read retries	D-4
"BLOCK SIZE ERROR"	D-5
"VRC ERR"	D-6
Record length errors	D-7
Can't interchange tapes	D-8
"WRITE EDIT ERR"	D-9
Data errors	D-10
Continuous hard errors at host	D-11
Host detected misposition	D-12
Unit selects incorrect density for read	D-13

Table 4. Data related errors

4.3 Main Tests

Note - See section 4.4 for tests that are shown inside parenthesis, "( )".

As the GCR evolved, the Printed Wiring Boards were improved, resulting in several "sets" of boards being produced. The table below identifies which PWB Set a particular board belongs to based on the first six digits of its part number. Be sure to use the appropriate instructions for the board you are troubleshooting.

PWB	PWB Set A	PWB Set B	PWB Set C
S/S-37V		962810-XXX	963491-XXX
S/S-57V	961344-XXX	962832-XXX	963490-XXX
CPU	961730-XXX	962112-XXX	963394-XXX
Data	961420-XXX	962789-XXX	963674-XXX
CIF	961346-XXX	962357-XXX	962357-XXX

4.3.1 Tests for Power Up Failures

A-1. No alpha display, power light does not turn on.

a. Check (Power supply).

A-2. No alpha display, power light on steady. Same as A-3 below.

A-3. All front panel LED's on steady.

a. Check (Harness) to front panel and all Sense Servo connectors.

b. Cycle power while monitoring the reset line on TP-14, PWB Set A, or U11C Pin 7, PWB Set B, on Sensor/Servo board. Does reset change from high to low and remain low?

Yes - Continue at step c.

No - Continue at step f.

c. Check (Power supply). Is it ok?

Yes - Continue at step d.

d. On the CPU board, monitor CPU clock TP-11, PWB Sets A, B, and C, with an oscilloscope. Is the clock toggling up and down?

Yes - Continue at step e.

No - Replace CPU board.

e. On the CPU board, check U25B pins 1 through 5, 8, 9, and 32 through 40, PWB Sets A and B; check U25C, same pins, for PWB Set C. Are the data lines going up and down?

Yes - Continue at step g.

No - Replace CPU board.

f. Check (Power supply). Is it ok?

Yes - Replace Sensor/Servo board.

g. On the CPU board, check the vectored interrupts on U25B pin 11, PWB Sets A and B; U25C Pin 11, PWB Set C. Is there a negative pulse approximately every 1 millisecond?

Yes - Continue at step h.

No - Replace CPU board.

h. Turn off power. Pull out the Data and CIF boards. Power up the drive. Does the drive power up normally now?

Yes - Continue at step i.

No - Replace Sensor/Servo board.

i. Turn off the power, and reinstall Data board. Does the drive power up normally now?

Yes - Replace the CIF board.

No - Replace the Data board.

A-4. POC 0.

a. Replace CPU board.

A-5. TESTING RAM.

a. Replace CPU board.

A-6. POC 1.

a. Replace CPU board.

A-7. POC 2.

a. Replace CPU board.

A-8. POC 3.

a. Replace CPU board.

A-9. NVRM ERR.

a. Replace CPU board.

b. Recalibrate servo using Servo Offset adjustment procedure 5.34.4 of Maintenance Manual.

c. Enter the recorded values in the NOVRAM.

A-10. POC 4.

a. Replace CPU board.

A-11. POC 5.

a. Check (Tach assembly). Is it ok?

Yes - Continue at step b.

b. Check (Takeup motor).

4.3.2 **Tests for Load Faults**

B-1. Arm fault during autoload.

a. Check (Arm assembly).

b. Check (Supply motor).

c. Check (NOVRAM offset).

B-2. Hub Seat Failure.

a. Check (File protect / reel seat) sensor.

b. Check (NOVRAM offset).

B-3. Not Enough Tape on Takeup (Manual load only)

a. Check (Tach assembly).

b. Check (NOVRAM offset).

B-4. Tape Stuck.

a. Check (Tape in path) sensor.

b. Check (NOVRAM offset).

B-5. No Door Lock.

a. Check (Door lock).

B-6. Servo Failure.

a. Check (Supply motor).

b. Check (NOVRAM offset).

B-7. Reel is upside down.

a. Check (Tape in pat) sensor.

B-8. No BOT.

a. Check (EOT / BOT) sensor.

B-9. Autoload failure after 4 tries.

a. Check tape leader. Is it smooth and unwrinkled, and has the end been trimmed with the tape trimmer?

Yes - Continue at step b.

No - Repair tape leader.

b. Cycle power. Do you get a POC 5 error?

Yes - See A-11.

No - Continue at step c.

c. Check (Supply motor).

d. Check (Blower motor).

e. Check (NOVRAM offset).

B-10. During autoload, Takeup Motor does not turn.

a. Check (Takeup motor).

b. Check (NOVRAM offset).

B-11. Pawls do not lock.

a. Check (Supply motor).

b. Check (Hub lock).

c. Check (NOVRAM offsets).

B-12. Run away during autoload.

a. Check (Tach assembly). Is it ok?

Yes - Replace Sensor/Servo board.

4.3.3 Tests for Operational Faults

C-1. Interface timeout.

a. Replace CIF board.

C-2. Online but does not respond to commands.

a. Replace CIF board.

C-3. Blower does not come on.

a. Check (Blower motor).

C-4. Drops tape during rewind.

a. Cycle power. Do you get POC 5 error?

Yes - See A-11.

No - Continue at step b.

b. Check (Arm assembly).

Yes - Replace Sense/Servo board.

C-5. Misses EOT or BOT.

a. Check (EOT/BOT).

C-6. Does not sense write protected tape.

a. Check (File protect / reel seat) sensor.

C-7. Breaks tape.

a. Replace Sensor/Servo board.

C-8. Destroys Tape.

a. Check tape path (Hub height, roller guides, Tach Arm).

b. Clean Head and Rollers.

c. Check head for nicks or dings.

d. If problem is finning (uneven tape pack on the takeup reel), check tach roller or roller guide near the take-up reel for damage. If roller wear looks uneven, replace tach assembly.

C-9. Tape length greater than 3700 feet.

a. Check (Tach assembly).

C-10. 18 feet past EOT.

a. Check (EOT / BOT) sensor.

C-11. Arm fault during run.

a. Check (Arm assembly).

C-12. Speed error.

a. Check (Tach assembly).

b. Check (Takeup motor).

c. Run test 212 while monitoring on the Data board Pin 13 of U5B for PWB Set A; U12B Pin 13 for PWB Sets B and C. Is there a positive pulse approximately every 7 milliseconds?

No - Replace the Data board.

Yes - Replace Sensor/Servo board.

C-13. Cache RAM parity error.

a. Replace CPU board.

C-14. Problems with impending EOT.

a. Check (File protect / reel seat) sensor.

C-15. Does not retract pawls.

a. Check (Hub lock).

b. Check (Supply motor).

C-16 Front panel switches do not work.

a. Check (Harness). Is it ok?

Yes - Continue at step b.

b. Replace Sensor/Servo board. Problem fixed?

Yes - PASS.

No - Replace front panel switches.

C-17. Display does not work.

a. Check (Harness).

b. On the Sensor/Servo board, measure +5 volts for the display board at R163 for PWB Set A; U14F-10 for PWB Set B; and U11C-10 for PWB Set C. Is it between 4.85 to 5.15 volts?

Yes - Continue at step c.

No - Replace Sensor/Servo board.

c. Run test 143. On the Sensor/Servo board, PWB Set A, trigger the scope on the negative edge of the clock pulse on U16G pin 11. Check for data at U12G pins 3, 6, 8, 11 and U13G pins 3, 6, and 11. Are they toggling up and down? On the Sensor/Servo board, PWB Set B, trigger the scope on the negative edge of the clock pulse on U12F pin 8. Check for data at U14E Pins 3, 6, 8, and 11, and U14F pins 3, 8, and 11. Are they toggling? On the Sensor/Servo board, PWB Set C, trigger the scope on the negative edge of the clock pulse at U10F pin 8. Check for data at U11C pins 3, 6, 8, and 11, and U11D pins 3, 6, and 11. Are they toggling?

Yes - Replace display board.

No - Replace Sensor/Servo board.

C-18. Does not sense open door.

a. Check (Door lock).

4.3.4. **Tests for Data Related Errors**

D-1. Mispositions.

a. Check (Read threshold).

b. Replace Sensor/Servo board.

D-2. Excessive repositioning.

a. Check (File protect / reel seat) sensor.

b. Replace Sensor/Servo board. Does problem go away?

Yes - Pass.

No - Continue at step c.

c. Unless the transfer rate in the NOVRAM is at its maximum value, step it to the next higher rate (refer to section 4.1.3.) When you move data through the interface, do you get VRC, record length errors, or some other type of data error?

Yes - Lower the transfer rate one step.

No - Repeat step b above.

D-3. Excessive write retries.

a. Check (Common data problems).

b. Clean the tape scraper. Repeat test with a new reel of tape.

D-4. Excessive read retries.

a. Check (Common data problems).

D-5. Block size error.

a. Are you sure that the block size on tape is less than 64K?

Yes - Replace CPU board.

No - Continue at step b.

b. Check (Common data problems).

D-6. VRC error.

a. Check (Common data problems).

b. Replace the CIF board. Does problem go away?

Yes - PASS

No - Continue at step c.

c. Replace the CIF board with the one you took out, then replace the Data board. Does this fix the problem?

Yes - PASS.

No - Continue at step d.

d. Replace the Data board with the one you took out, then replace the CPU board.

D-7. Record length errors.

a. Check (Common data problems).

b. Replace the CPU board. Does problem go away?

Yes - PASS.

No - Continue at step c.

c. Replace the CPU board with the one you took out. Replace the CIF board. Does this fix the problem?

Yes - PASS.

No - Continue at step d.

d. Replace the CIF board with the one you took out. Replace the Data board.

D-8. Cannot interchange tapes. There are two types of failures for this problem. See (1) and (2) below for the one that applies.

(1) Does not read other drives tapes.

a. Check (Common data problems).

b. Replace Data board. Does this fix the problem?

Yes - PASS.

No - Continue at step c.

c. Replace the Data board with the one you took out. Replace the CIF board.

(2) Other drives cannot read the tapes written on this drive.

a. Check (Common data problems).

b. Replace CIF board.

D-9. Write edit error.

a. This problem is most often caused by the host command sequence not matching the GCR command sequence specifications. See the installation manual for more information.

b. Replace the CIF board.

D-10. Data errors.

a. Check (Common data problems).

b. Replace the Data board. Does problem go away?

Yes - PASS

No - Continue at step c.

c. Replace the Data board with the one you took out, then replace the CPU board. Does problem go away?

Yes - PASS

No - Continue at step d.

d. Replace the CPU board with the one you took out, then replace the CIF board.

D-11. Continuous hard errors at host.

a. Check (Common data problems).

b. Replace the CIF board.

D-12. Host detected misposition or wrong record ID.

a. Replace Sensor/Servo board. Does problem go away?

Yes - PASS.

No - Continue at step b.

b. Replace the Sensor/Servo board with the one you removed, then replace the Data board.

D-13. Unit selects incorrect density for read.

a. Check (Common data problems).

b. Replace the Data board. Does problem go away?

Yes - PASS

No - Continue at step c.

c. Replace the Data board with the one you took out, then replace the Sensor/Servo board.

4.4 Common Tests

The following table identifies the common tests listed in this section along with the page number of the test.

4.4.1 Arm assembly

Does the arm bind when you move it?

1. Yes - Perform visual inspection for anything interfering with arm movement.

   No - Continue at step 2.

2. Enter test 124. Pull the arm back to its stop while watching voltage on front panel display. Does the voltage change?

   Yes - Continue at step 3.

   No - Continue at step 4.

3. Record the voltage at rest, record the voltage at full arm travel. Is the difference between the two at least 2 VDC, but no more than 12.5 VDC?

   Yes - PASS.

   No - Replace Sensor/Servo board.

4. Check (Harness). Is it ok?

   Yes - Replace Sensor/Servo board.

4.4.2. Blower motor

1. Enter test 134. Can you hear the blower come on?

   Yes - PASS.

   No - Continue at step 2.

2. Check Sensor/Servo board for blower signal at R35 for PWB Set A; J1-5 for PWB Set B and Set C. The signal drops from +12V to +5V when the motor is activated with PWB Set A, and from +5V to 0 with PWB Set B or Set C.

   Yes - Continue at step 3.

   No - Replace Sensor/Servo board.

3. Turn off the power. Check voltage from power supply to blower by unplugging the P4 connector (a small, 3 position connector next to the blower motor). Place a AC voltmeter on pins 1 and 2 (female part of connector). Do you measure 110-140 Vac?

   Yes - Replace blower motor.

   No - Replace power supply.

4.4.3. Door lock

1. Open the front door and the top cover of the drive. Enter test 132. Looking through the opening between the front panel and the top plate on the left side of the drive, can you see the door lock solenoid pulling in then releasing, and does the display show "UNLOCKED"?

   Yes - Continue step 3.

   No - Continue at step 2.

2. Check (Harness). Is it ok?

   Yes - Replace Sensor/Servo board.

3. Press load button. Display should show "SW CLSD". Close both top cover and front door. Press load. Does drive show "LOCKED"?

   Yes - PASS.

   No - Replace door lock assembly.

4.4.4. EOT/BOT

1. Enter test 131. Place a tape marker in front of the BOT sensor in approximately the same place as the tape would hold it. Does the LOAD LED come on?

   Yes - Continue at step 2.

   No - Continue at step 3.

2. Place tape marker in front of the EOT sensor. Does the UNLOAD led come on?

   Yes - PASS.

   No - Continue at step 3.

3. Check (Harness). Is it ok?

   Yes - Continue at step 4.

4. On the Sensor/Servo board, check R122 on PWB Set A, R195 on PWB Set B, or R150 on PWB Set C for +5 Vdc to sensor. Is the voltage between 4.85 and 5.15 Vdc?

   Yes - Replace EOT/BOT sensor.

   No - Replace Sensor/Servo board.

4.4.5 File protect / reel seat

1. Place a write enabled reel of scratch tape in the drive. Enter test 131. Observe the "UNLOAD INDICATOR" comes on.

   Yes - PASS.

   No - Continue at step 2.

2. Is the (Harness) ok?

   Yes - Continue at step 3.

3. Measure power to sensor on Sensor/Servo board at R118 for PWB Set A, R270 for PWB Set B, or R149 for PWB Set C. Is it between 4.85 to 5.15 Vdc?

   Yes - Replace file protect / reel seat sensor.

   No - Replace Sensor/Servo board.

4.4.6. Harness

1. Check the harness where it connects with the sub-assembly under test. Is the connection ok?

   Yes - Continue at step 2.

   No - Repair or replace harness.

2. Check the harness where it connects with the Sensor/Servo board. Is the connection ok?

   Yes - PASS.

   No - Repair or replace harness.

4.4.7. Hub lock

1. Open top cover of drive. Face the drive and turn the supply reel so that the reel seat tab is in the 10 o'clock position. Look through the hole in the top plate next to the supply reel at about 8 o'clock. Enter test 132. Does the hub lock move?

   Yes - Continue at step 2.

   No - Continue at step 3.

2. While the door lock is pulled in (Display shows "UNLOCKED"), turn the supply hub slowly by hand counterclockwise. Does the hub stop with the reel seat tab at about the 9 o'clock position?

   Yes - PASS.

   No - Remove the supply hub and repair or replace the hub or bellcrank as necessary.

3. Check (Harness). Is the connection ok?

   Yes - Continue at step 4.

4. Check power to the hublock on Sensor/Servo board at CR39 cathode for PWB Set A, CR58 cathode for PWB Set B, or CR27 cathode for PWB Set C. Does the voltage toggle between -15 and +10 volts?

   Yes - Replace the hublock.

   No - Replace the Sensor/Servo board.

4.4.8. NOVRAM offset

1. From Unload state. Measure voltage across Supply and Takeup motors on the Sensor/Servo board at TP-7 and 8 for PWB Set A, TP 34 and 35 for PWB Set B, and TP-37 and 38 for PWB Set C for the supply; TP-6 and 9 for PWB Set A, TP 32 and 33 for PWB Set B, and TP-35 and 36 for PWB Set C for the takeup. Are both measurements less than 50 millivolts?

   Yes - PASS.

   No - Adjust offset using procedure 5.34.4.

4.4.9. Power supply

1. Is this a TUV machine?

   Yes - Continue at step 2.

   No - Continue at step 3.

2. On the Sensor/Servo board is the +37 volts measured at TP-5 on PWB Set A, the positive side of C4 on PWB Set B or the positive side of C6 on PWB Set C between +31.5 and +41 volts?

   Yes - Continue at step 4.

   No - Continue at step 9.

3. On the Sensor/Servo board is the +57 volts measured at TP-5 on PWB Set A, the positive side of C4 on PWB Set B, or the positive side of C6 on PWB Set C between +48.5 and +63 volts?

   Yes - Continue at step 4.

   No - Continue at step 9.

4. On the Sensor/Servo board at TP-42 for PWB Set A, the positive side of C258 for PWB Set B, or TP-13 for PWB Set C, is the +5 Vdc between +4.85 to +5.35 Vdc?

   Yes - Continue at step 5.

   No - Continue at step 13.

5. On the Sensor/Servo board at TP-37 for PWB set A, TP-2 for PWB Set B, or TP-4 for PWB Set C, is the +6 Vdc between +5.64 to +6.36 Vdc?

Yes - Continue at step 6.

No - Continue at step 13.

6. On the Sensor/Servo board at TP-38 for PWB Set A, TP-1 for PWB Set B, or TP-1 for PWB Set C, is the -6 Vdc between -6.36 to -5.64 Vdc?

   Yes - Continue at step 7.

   No - Continue at step 13.

7. On the Sensor/Servo board at TP-39 for PWB Set A, TP-4 for PWB Set B, or TP-3 for PWB Set C, is the +12 Vdc, between +11.28 to +12.72 Vdc?

   Yes - Continue at step 5.

   No - Continue at step 13.

8. On the Sensor/Servo board at TP-40 for PWB Set A, TP-3 for PWB Set B, or TP-2 for PWB Set C, is the -12 Vdc between -12.72 to -11.28 Vdc?

   Yes - PASS.

   No - Continue at step 13.

9. Check the (Harness) where it plugs into the power supply.

10. Is the power cord ok?

    Yes - Continue at step 11.

    No - Replace power cord

11. Is the fuse at the rear of the drive ok?

    Yes - Continue at step 12.

    No - Replace fuse

12. Is the power switch ok?

    Yes - Replace power supply

    No - Replace power switch

13. Replace the Sensor/Servo board. Is the voltage ok now?

    Yes - PASS.

    No - Turn off the power and reinstall the original Sensor/Servo board. Pull out the other boards one at a time until voltage is ok. Replace the board that was causing the problem.

4.4.10. **Supply motor**

1. With power off, turn supply motor by hand. Does motor turn in both directions smoothly?

Yes - Continue at step 2.

No - Replace supply motor.

2. Enter test 111. Before selecting a test mode, does the motor spin?

   Yes - Continue at step 6.

   No - continue at step 3.

3. Select the manual supply mode in test 111. Run the supply motor up to approximately 50 counts. Does the motor move?

   Yes - Continue at step 8.

   No - Continue at step 4.

4. Check the (Harness). Is it ok?

   Yes - Continue at step 5.

5. Is the drive on the Sensor/Servo board ok?

   Yes - Replace motor.

   No - Replace Sensor/Servo board.

6. Is the motor spinning fast or slow?

   Fast - Continue at step 10.

   Slow - Continue at step 7.

7. Check (NOVRAM) offsets. Are they ok?

   Yes - Replace Sensor/Servo board.

   No - Adjust the offset using procedure 5.34.4.

8. Is the speed of the motor fairly constant?

   Yes - Continue at step 9.

   No - Replace Sensor/Servo board.

9. Reverse direction of the motor. Is the speed about the same as in the opposite direction?

   Yes - PASS.

   No - Continue at step 7.

10. Replace Sensor/Servo board. Does motor still spin fast?

    Yes - Reinstall first servo board and continue at step 7.

    No - PASS.

4.4.11. Tach assembly

1. Enter 111 auto oscillate mode. Are both tach phases on the Sensor/Servo board ok? (Use O-scope and read at U11L pin 13 and pin 14 for PWB Set A, U16H pins 13 and 14 for PWB Set B, or U12J pins 2 and 13 for PWB Set C.)

   Yes - PASS.

   No - Continue at step 2.

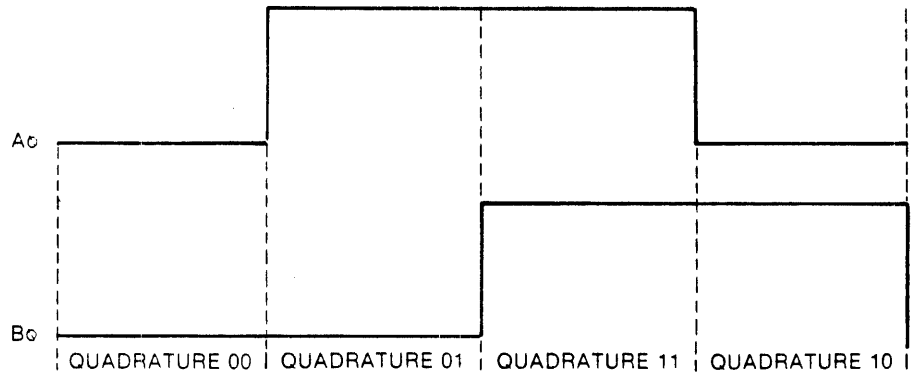
2. Check (Harness). Is it ok?

   Yes - Continue at step 3.

3. Is the power from the Sensor/Servo board to the tach ok?

   Yes - Replace the tach assembly.

   No - Replace the Sensor/Servo board.



Tachometer Phase Quadrature

4.4.12. Takeup motor

1. With power off, turn takeup motor by hand. Does motor turn in both directions smoothly?

   Yes - Continue at step 2.

   No - Replace takeup motor.

2. Enter test 111. Before selecting a test mode, does the motor spin?

   Yes - Continue at step 6.

   No - continue at step 3.

3. Select the "MAN TAKE-UP" mode in test 111. Run the takeup motor up to approximately 50 counts. Does the motor move?

   Yes - Continue at step 8.

   No - Continue at step 4.

4. Check the (Harness). Is it ok?

   Yes - Continue at step 5.

5. Is the drive on the Sensor/Servo board ok?

   Yes - Replace motor.

   No - Replace Sensor/Servo board.

6. Is the motor spinning fast or slow?

   Fast - Continue at step 10.

   Slow - Continue at step 7.

7. Check (NOVRAM) offsets. Are they ok?

   Yes - Replace Sensor/Servo board.

   No - Adjust the offset using procedure 5.34.4.

8. Is the speed of the motor fairly constant?

   Yes - Continue at step 9.

   No- Replace Sensor/Servo board.

9. Reverse direction of the motor. Is the speed about the same as in the opposite direction?

   Yes - PASS.

   No - Continue at step 7.

10. Replace Sensor/Servo board. Does motor still spin fast?

    Yes - Reinstall first servo board and continue at step 7.

    No - PASS.

4.4.13. Tape in path

1. Enter test 131. Place your hand between the tape in path transmitter and receiver. Does the "T" in the display come on?

   Yes - PASS.

   No - Continue at step 2.

2. Is the (Harness) ok?
   Yes - Continue at step 3.

3. On the Sensor/Servo board, check R118 for PWB Set A, R270 for PWB Set B, or R149 for PWB Set C for power to the tape-in-path transmitter and receiver. Is the voltage between 4.85 to 5.35 Vdc?

   Yes - Replace the transmitter, if that does not fix the problem, replace the receiver.

   No - Replace the Sensor/Servo board.

4.4.14. Common data problems

1. Check (Read threshold).

2. Check head cables.

3. Clean head, tape scraper, and roller guides.

4. Check the NOVRAM configuration with the values that were recorded before the drive started having problems. Pay special attention to the Parity, ramp delay, and transfer rate.

4.4.15. Read threshold

1. Enter test 212. Measure and record read after write envelope on the Data board at TP-60, TP-62, and TP-64 on PWB Set A; TP-93, TP-96, and TP-99 on PWB Sets B and C. Read the value from the zero point to the positive peak of the wave form. Average these three readings together for the other calculations. Measure and record Vcom at U15U pin 7 on PWB Set A and U26U pin 7 on PWB Sets B and C. This is Vcom1. Rewind and exit test. Measure and record Vcom once more. This is Vcom2. Is the average of the read after write envelope readings between the min and max values for Vcom1 in the read threshold table at the end of this test? (If the value you get isn't in the table, the average read after write envelope times 30% should be equal to Vcom1 plus or minus 5%.)

   Yes - Continue at step 2.

   No - Run (test 513) to set read threshold.

2. Is the average of the readings between the min and max values for Vcom2 in the read threshold table at the end of this test? (If the value you get isn't in the table, the average read after write envelope times 15% should be equal to Vcom1 plus or minus 3%.)

   Yes - PASS.

   No - Run (test 513) to set read threshold.

Read Threshold Table

Peak Average	VCOM1 min	VCOM1 max	VCOM2 min	VCOM2 max
0.500	0.133	0.147	0.049	0.052
0.600	0.160	0.176	0.058	0.062
0.700	0.186	0.206	0.068	0.072
0.800	0.213	0.235	0.078	0.082
0.900	0.239	0.265	0.087	0.093
1.000	0.266	0.294	0.097	0.103
1.100	0.293	0.323	0.107	0.113
1.200	0.319	0.353	0.116	0.124
1.300	0.346	0.382	0.126	0.134
1.400	0.372	0.412	0.136	0.144
1.500	0.399	0.441	0.146	0.155
1.600	0.426	0.470	0.155	0.165
1.700	0.452	0.500	0.165	0.175
1.800	0.479	0.529	0.175	0.185
1.900	0.505	0.559	0.184	0.196
2.000	0.532	0.588	0.194	0.206

4.4.16. Set Internal/Field Mode (Test 542)

CAUTION: Care must be taken when using 500 series tests. Follow instruction to the letter. Failure to do so could render the GCR unit inoperable.

(Internal Mode)

1. Enter test 542, does display scroll "SET FIELD MODE? YES NO".

   Yes - Press the UNLOAD switch, then the DENSITY SELECT switch to exit the test.

   No - Continue to step 2.

2. "PASSWORD ?" is displayed, enter 54524. Display now reads "MODE ?", press the LOAD switch and now "INTERNAL" is displayed, press DENSITY SELECT switch to exit the test.

   You are now in the internal mode and can run test 513.

(Field Mode)

1. Enter test 542, does display show "SET FIELD MODE? YES NO".

   Yes - Press LOAD switch and "YES" is now displayed. Press DENSITY SELECT to exit the test.

   No - "PASSWORD" is displayed. Press the WRT EN/TEST switch to cancel the test.

4.4.17.A Automatic Write Current Calibration (-006 and lower firmware)

1. This test requires that a write enabled tape be loaded before entering.

2. Enter test 513 per instructions in 4.4.16.

3. Test will now run automatically. When test is done the display will either read "PASS" or "FAIL". Did the test pass?

   Yes - PASS Go to step 4.

   No - FAIL, Check the last component that was installed prior to running this test. Check all contacts and connections and the backplane.

4. Return the tape drive back to Field Mode (test 542).

4.4.17.B Write Current Calibration (-007 and higher firmware)

1. Connect a jumper between U1H Pin 1 and ground on the Data PWB.

2. Power up the tape drive, enter test 142, and record for later use the values of options 22 through 27.

3. Exit test 142.

4. Enter test 542.

CAUTION: Care must be taken when using 500-series tests. Follow instructions exactly. Failure to do so could render the tape drive inoperable.

Is "SET FIELD MODE? YES NO" displayed?

Yes - Press the UNLOAD switch; "NO" is displayed. Press the DENSITY SELECT switch; the UNLOAD LED goes on. Go to Step 6.

NO - Go to Step 5.

5. "PASS WD?" is displayed. Enter 54524; "MODE?" is displayed. Press the LOAD switch; "INTERNAL" is displayed. Press the DENSITY SELECT switch; the UNLOAD LED goes on. Go to Step 6.

6. Load a good quality 10.5-inch reel of write-enabled tape, preferably a Standard Output Tape. Data will be written to the tape.

7. Enter test 513. "HEAD CAL" is displayed for several seconds, then "READY" or "-60 MV" is displayed. If "-60 MV" is displayed, go to step 8. If "READY" is displayed, go to step 9.

8. (The +5V supply is low or the -12V supply is high; the VCOM line may have a negative offset that cannot be adjusted automatically by the tape drive.) The LOAD, UNLOAD, and ONLINE LEDs are on; the WRT EN/TEST LED is flashing.

Connect a digital volt meter to the VCOM line at pin 7 of any read amplifier chip. Set the offset to -60 ± 1.2 millivolts using the front panel switches as follows:

LOAD — Adds 2.2 millivolts of positive offset with each actuation. No more than +60 millivolts can be added. If the maximum offset is added without reaching -60 ± 1.2 millivolts, exit test 513 (press UNLOAD) and start troubleshooting with the Sense/Servo PWB.

UNLOAD — Aborts test 513 and unloads tape. NOVRAM data is not changed.

ONLINE — Same as LOAD except that a negative 2.2 millivolts is added per actuation.

WRT EN TEST — Exits this adjustment and continues at Step 9.

NOTE: If a digital volt meter is not available, press the LOAD switch twice to partially compensate for the negative offset. Press the WRT EN/TEST switch to continue to Step 9.

9. The UNLOAD and WRT EN/TEST LEDs are flashing. At this point you have the option of exiting test 513. Press the UNLOAD switch to exit the test and unload tape. Press the WRT EN/TEST switch to continue.

10. Values for the three operating densities will be entered during this step. They are found in one of two places: 1) At the top of the read/write head a tag has the values for 6250 and 3200 bpi; the lower value is the 6250 bpi current, the higher value is the 3200 bpi current. The 1600 bpi current is 4100. 2) If the tag is not there, use the NOVRAM values recorded in Step 2, options 22 (6250 bpi), and 24 (3200 bpi).

    The LOAD, UNLOAD, and DENSITY SELECT LEDs are on. The density display reads "6250 BPI" and the alphanumeric display shows tens of microamperes (e.g., 1567 equals 15.67 milliamps). Enter the appropriate values for each density using the front panel switches as follows:

    LOAD — The first actuation starts tape motion, and an all ones pattern is written to tape at the displayed density. Successive actuations increase the current value in increments of 25 on the display (equals 0.25 milliamps). Pressing the ADRS SELECT switch while actuating the LOAD switch reduces the increments to 1 on the display (0.01 milliamps). In 6250 bpi density, the drive writes to all nine tracks; in 1600 and 3200 bpi, it writes to the six file mark tracks.

    UNLOAD — Same as LOAD, except that current value is decreased. The ADRS SELECT switch reduces decreases to 1 on the display.

    ONLINE — Stops tape motion.

WRT EN TEST — Exits this step and continues at Step 11. This switch does not function until all densities have been set and tape motion stopped; the WRT EN/TEST LED then flashes.

DENSITY SELECT — Selects each density for editing or reviewing. Tape motion must be stopped.

11. This step runs automatically. The tape drive determines the correct read threshold for each density based on the values entered during Step 10 and writes to tape in each density. When this step is completed, "THR DONE" is displayed, the LOAD, ONLINE, and DENSITY SELECT LEDs are on, and WRT EN/TEST is flashing.

12. The average peak-read amplitude (EOUT) and read-after-write (RAW) voltages can now be examined or this step may be skipped by pressing the WRT EN/TEST switch. The front panel switches function as follows:

    LOAD — The first actuation causes "EOUT AVG" then the value of the selected density in millivolts to be displayed. The second actuation causes "THRESHLD" then the value of the new RAW voltage to be displayed. Used in conjuction with the DENSITY SELECT switch.

    ONLINE — Aborts the display sequence started by pressing the LOAD switch. (The LOAD switch may be pressed again.)

    WRT EN TEST — Exits this step and continues at Step 13.

    DENSITY SELECT — Changes the density of the EOUT and RAW voltages being displayed. Used in conjunction with the LOAD switch.

13. "SAVE NEW" is displayed and the LOAD and UNLOAD LEDs are flashing. This step allows the new values to be written to NOVRAM or the existing values to be retained. The front panel switches function as follows:

    LOAD — A 'yes' response. New values are written to NOVRAM.

    UNLOAD — A 'no' response. New values are discarded and the existing values remain in NOVRAM.

    After a yes or no response is entered, "NEW DATA" or "OLD DATA", respectively, is displayed for several seconds.

    NOTE: If you use tests 142 or 242 to verify values just entered, the values may differ slightly because of binary to decimal translation. Readings that vary by up to 20 counts are acceptable.

14. Enter test 542. "SET FIELD MODE? YES NO?" is displayed. Press the LOAD switch, then the DENSITY SELECT switch.

15. Unload the tape. Switch the drive power off.

16. Remove the jumper from the Data PWB.

17. Remove the safety pin from the support arm. Lower the drive to the operating position. Secure the chassis retaining screws.

Chapter 5. Preventive Maintenance and Replacement Procedures

5.1 Preventive Maintenance Schedule

Instructions for performing the maintenance listed in the table below are in section 6.3.

Part	Frequency (hours)
Tachometer Roller	40*
Hub pads	40*
Take Up Hub	40*
Roller Guides	40*
Sensors	40*
Head	20*
Tape Cleaner	40*
Filter	Quarterly

* The schedule should be performed weekly if enough hours are not accumulated in a typical week.

5.2 Placing Unit In Operator Access Position

1. Switch off ac power.

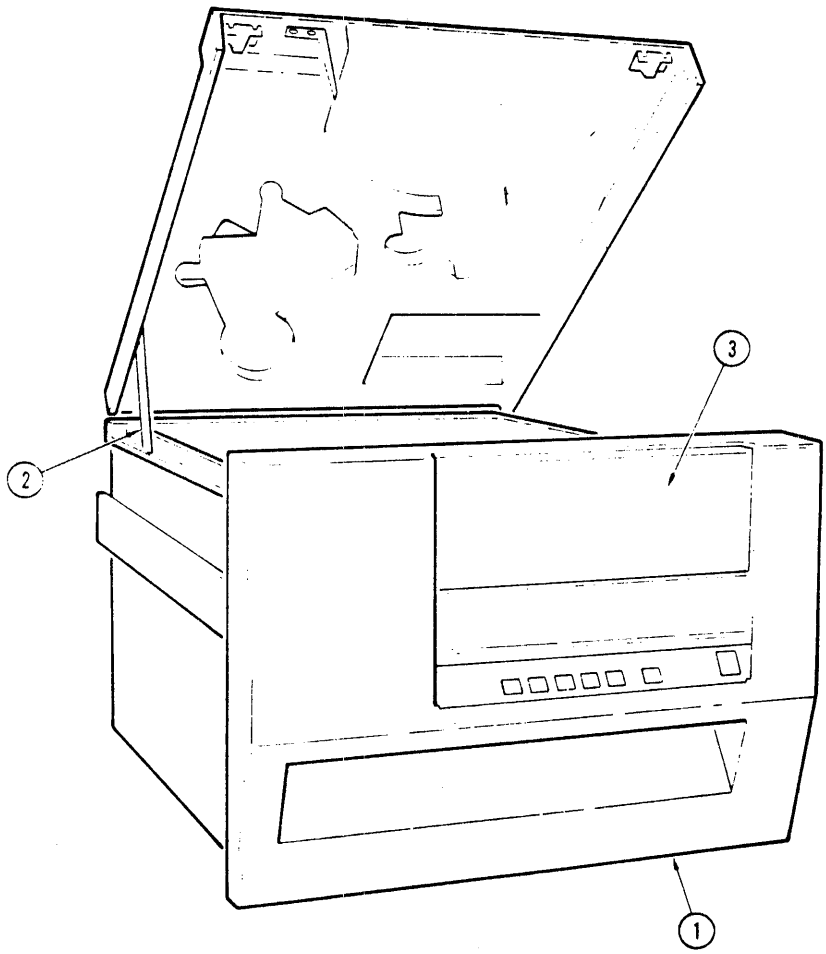
   CAUTION: If the tape unit is to be extended on its slides from the equipment rack for maintenance, ensure that the rack is stabilized. Weight of the transport in the extended position could upset an inadequately mounted equipment rack.

2. Pull the tape unit out of the rack by using the front panel at position (1).

3. Withdraw the drive on its slides. Make sure the tape unit is clear of the unit above before you open the top cover.

4. Open the top cover and support it with the stay arm (2).

5. Open the operator access cover (3).



5.3 Placing Unit In Service Position

6. Switch off ac power.

   CAUTION: Before extending the drive on its slides from the equipment rack for maintenance, ensure that the rack is stabilized. Weight of the transport in the extended position could upset an inadequately mounted equipment rack.

7. Pull the tape unit out of the rack by using the front panel at position (1).

8. While holding the front panel firmly, withdraw the drive on its slides until the slide locks engage. Make sure the tape unit is clear of the unit above before opening the top cover.

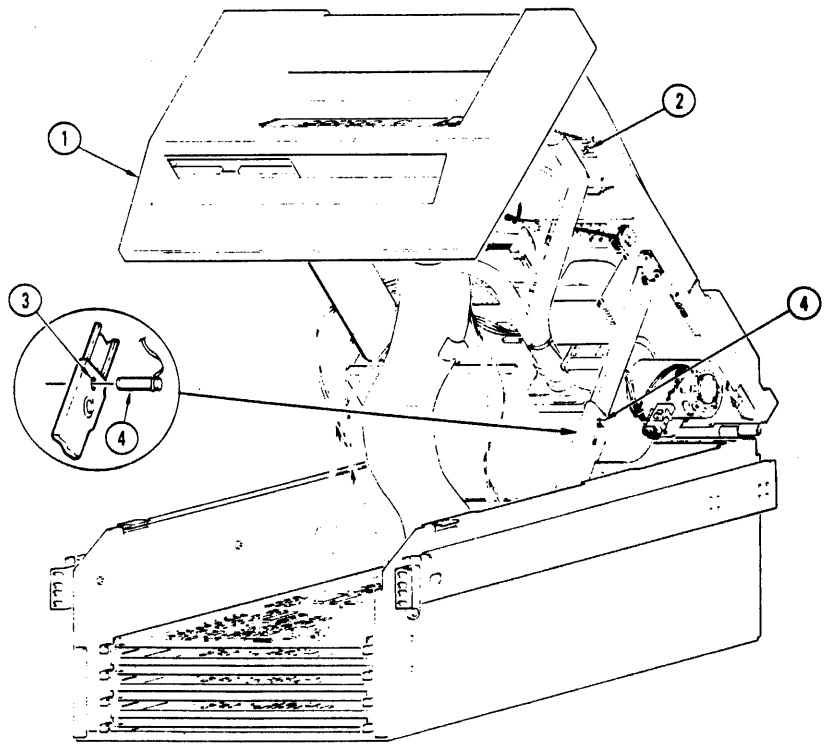
9. Open the top cover and secure it with the stay arm provided.

10. Loosen the two spring-loaded screws (2) on both sides of the base plate.

11. Close the top cover.

12. Lift up on the two lower corners of the front panel to its maximum position. The latch mechanism locks in an upright position. Install the locking pin (4) provided.

    WARNING
    Insert the provided locking pin (4) into the hole (3) in the tape unit support arm. Never service the tape unit in the service position unless you install the locking pin. See Illustration.



5.4 Restoring Unit To Operating Position

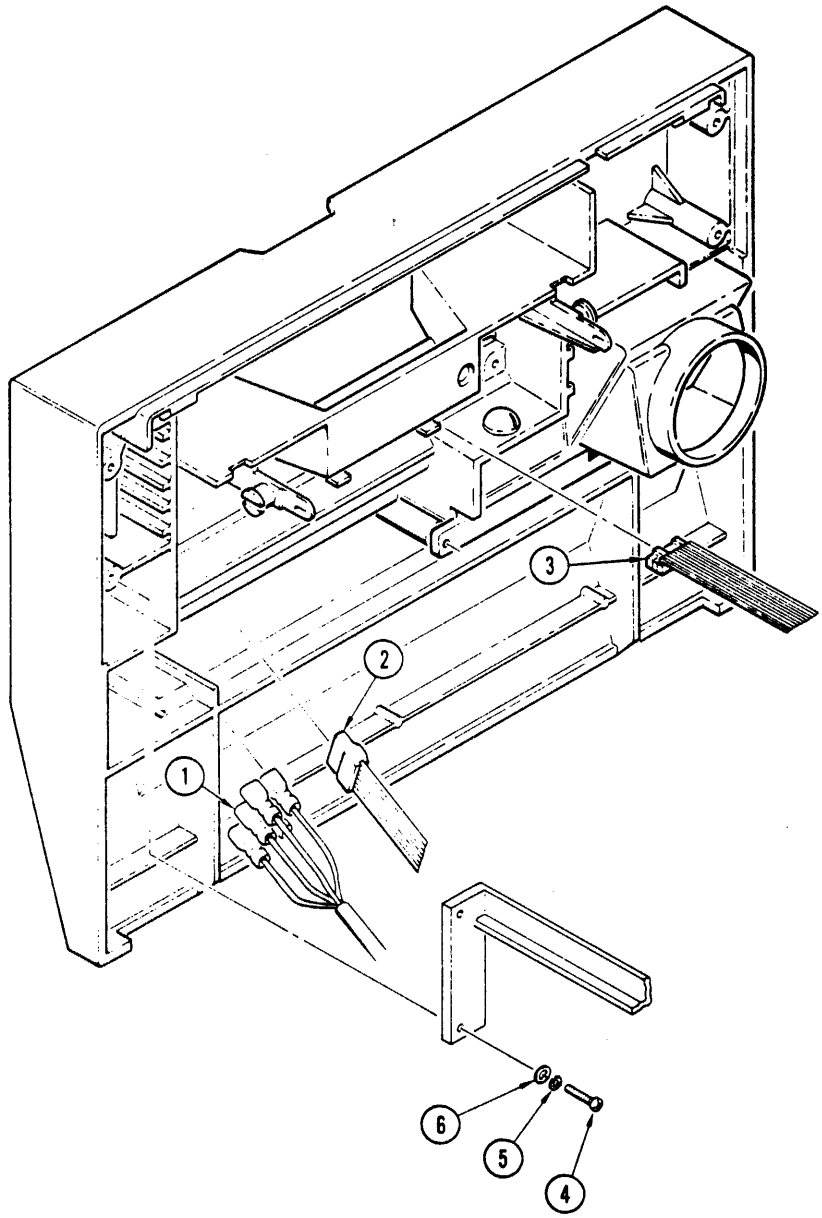
1. Switch off ac power.
2. Remove the lock pin (4), and pull up on the tape unit to release the latch mechanism.
3. While lowering the drive, make sure that the cables are secure and are not pinched.
4. Open the top cover and secure it with the stay arm provided.
5. Secure the spring-loaded screws (2) to lock the base unit to the frame.
6. Close the top cover.
7. Press in on the locking tabs in the slides and push the tape unit into the rack until secure.

5.5 Front Panel

5.5.1 Removal

1. Switch off ac power.
2. Disconnect the ac power cord.
3. Place the unit in the service position.
4. Note the wire positions and disconnect the ac power switch cable (1) from the ac power switch.
5. Disconnect the cable connector (2) from the switch-LED front panel.
6. Disconnect the cable connector (3) from the alphanumeric display.
7. Remove the four screws (4), flat washers (5), and lockwashers (6).

8. Lift the front panel from the unit. Note the position of the air ducts for replacement.



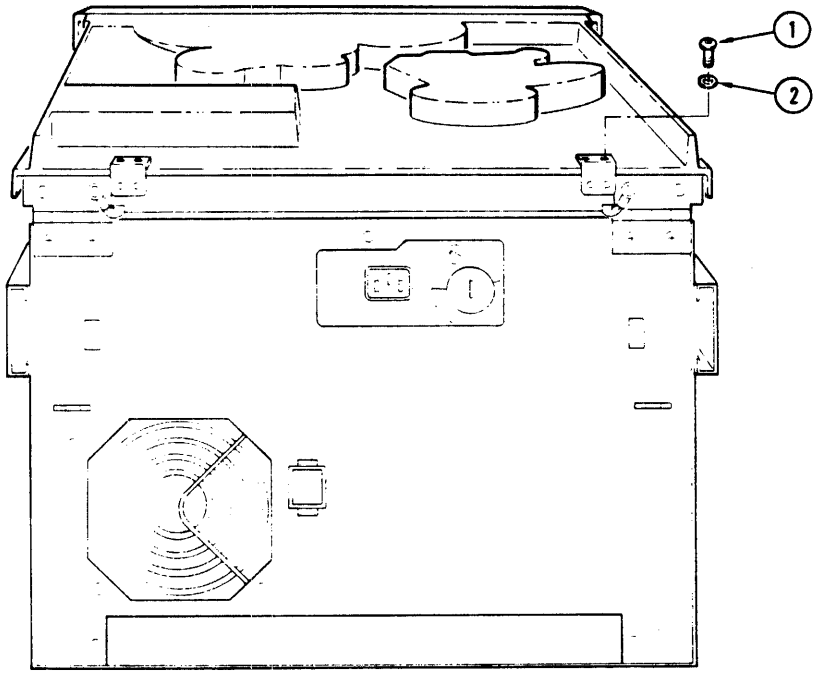
5.5.2 Replacement

To replace the front cover, reverse the removal procedure steps. Also, be sure to replace all air ducts.

5.6 Top Cover

5.6.1 Removal

1. Switch off ac power.
2. Place the unit in the operator access position. (See section 5.1.)
3. Remove the four screws (1), and four washers (2) to remove the cover.



5.6.2 Replacement

To replace the top cover, reverse the removal procedure steps. Proceed to the adjustment procedure.

5.6.3 Adjustment

1. Adjust the rear hinges so that the top cover opens and closes without binding on the front cover.
2. Adjust the ball latches on the top cover to ensure that the top cover is fully closed.

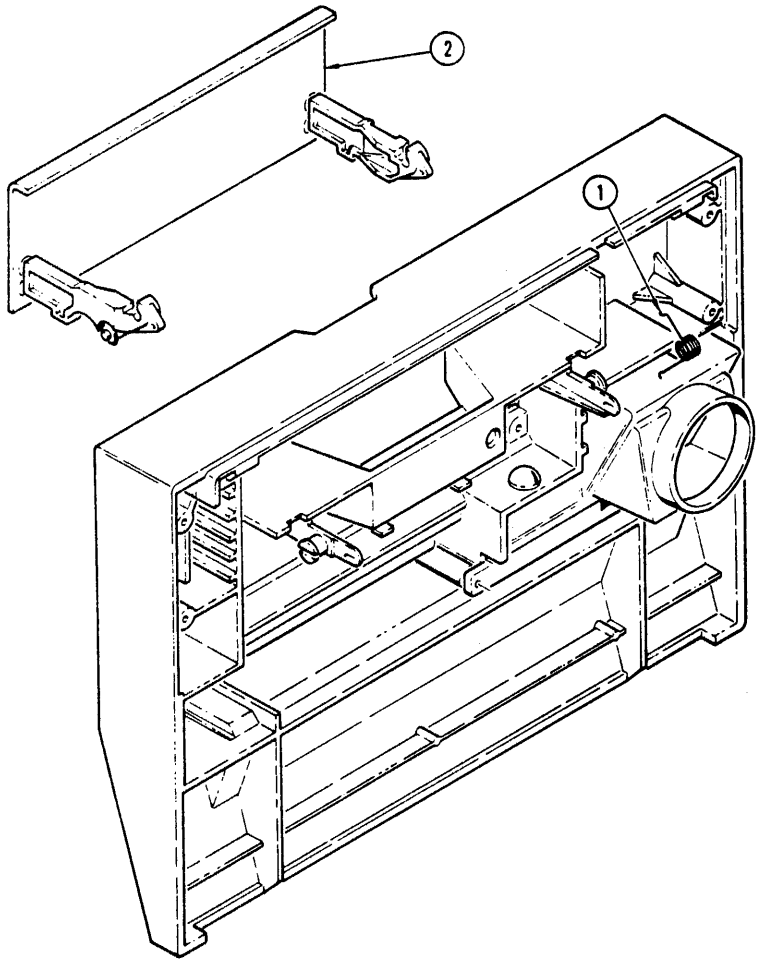
5.7 Operator Access Cover

5.7.1 Removal

1. Switch off ac power.
2. Place the unit in the service position. (See section 5.2.)
3. Remove the front panel. (See section 5.5.)
4. Remove the two springs (1).

   Note: The springs are under compression. Take care when removing them.

5. Push out the operator access cover (2) from the rear of the front cover.



5.7.2 Replacement

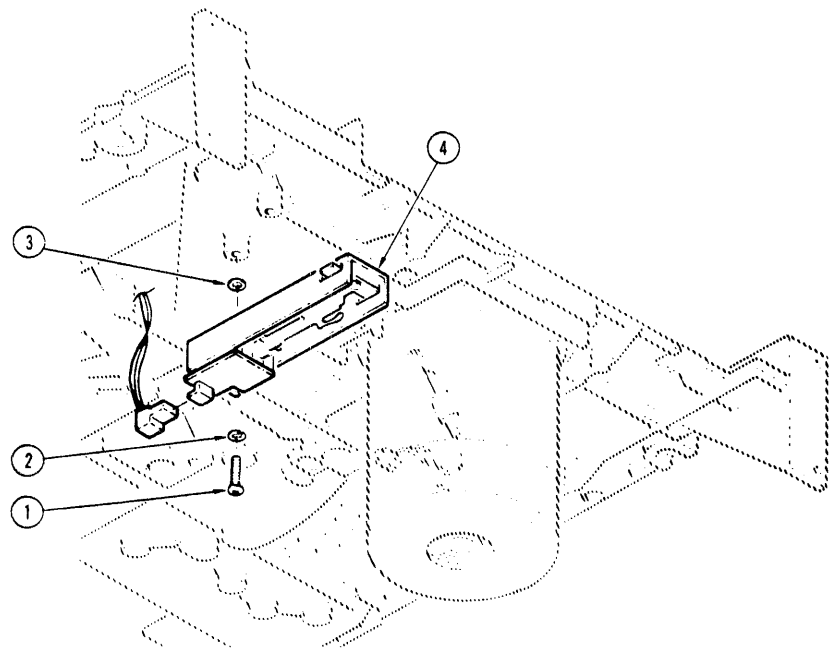
To install the operator access cover, reverse the removal procedures. Ensure that the bearing surface of each arm has a small amount of Lubriplate on it.

1. Open and close the operator access cover.
2. Make sure that the access cover returns to the fully closed position.
3. If the access cover does not close properly, adjust the two springs (2) and repeat until the cover closes properly.

5.8 Cover Lock Assembly

5.8.1 Removal

1. Switch off ac power.
2. Place the unit in the service position. (See section 5.3.)
3. Remove the front panel.
4. Remove the main air duct. (See section 2.2.)
5. Locate the cover lock assembly (4) next to the air duct.
6. Remove the two screws (1), two lock washers (2), and two washers (3) from the cover lock assembly.
7. Remove the connector from the lock assembly.



5.8.2 Replacement

1. Install the assembly and reverse the removal procedure.
2. Perform the adjustment procedure, 5.8.4.

5.8.3 Service Check

1. Enable test 132 with both of the covers closed. (See section 4.1.3 for diagnostic tests.)
2. When both of the covers and the cover lock assembly are properly adjusted, the On-line LED should be off. If not, perform the adjustment procedure 5.8.4.

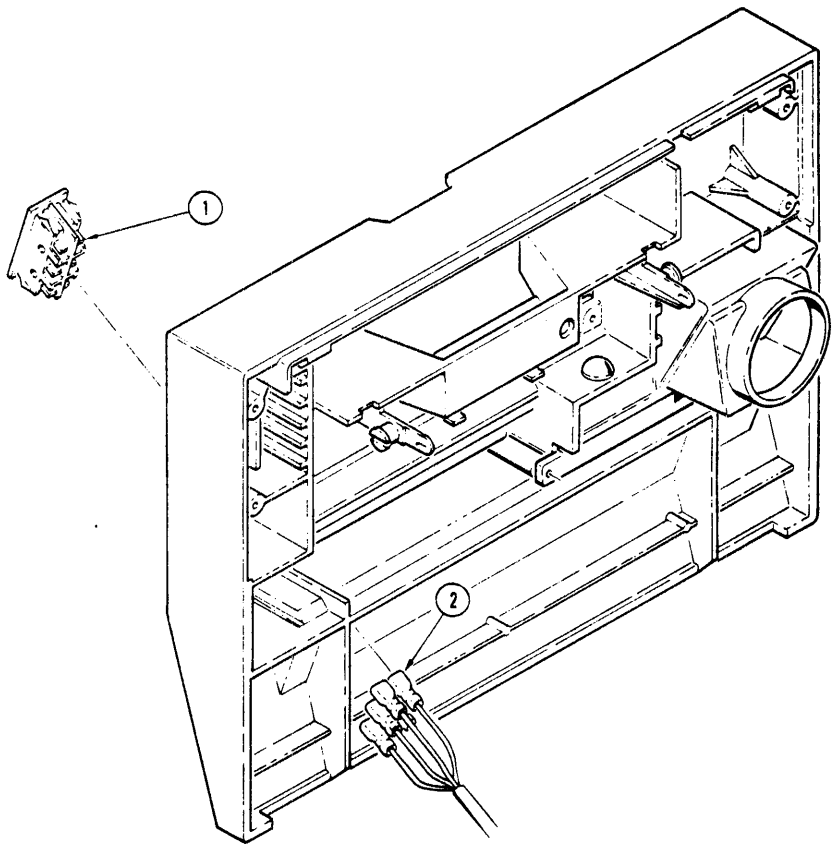
5.8.4 Adjustment

1. Close the top cover of the tape unit.
2. Attempt to close the operator access cover with light pressure. If the access cover does not close completely, loosen the screws, and push the cover lock assembly toward the front of the unit until the access cover closes.
3. Switch on ac power and press the Load switch. If the LOADING message is displayed, cover lock assembly is properly positioned. If the NO DOOR LOCK message is displayed, loosen the screws, and push the cover lock assembly slightly forward toward the front of the tape unit.
4. Repeat step 3 until the Loading LED is flashing.
5. Restore the unit to an operating position. (See section 5.2.)

5.9 AC Power Switch

5.9.1 Removal

1. Switch off ac power.
2. Disconnect the ac power cord.
3. Place the unit in the service position. (See section 5.2.)
4. Disconnect the ac power switch cable (2) from the switch. Note the position of the wires for replacement.
5. Bend the tabs (1) that hold the switch to the panel, and push the switch out from the back.



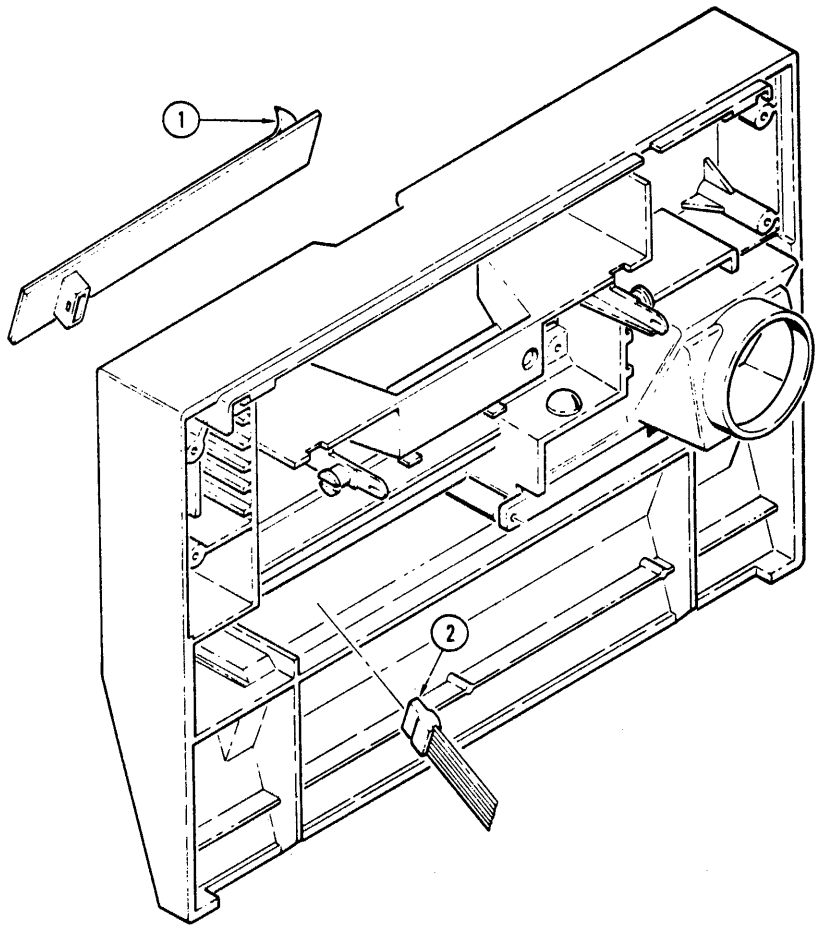
5.9.2 Replacement

1. Install the switch.
2. Bend the tabs in back of the switch as necessary for a proper fit.
3. Reinstall ac cable (2) to the switch terminals.

5.10 Switch-LED Front Panel

5.10.1 Removal

1. Switch off ac power.
2. Place the unit in the service position. (See section 5.2.)
3. Remove the connector (3) from the switch panel back.
4. Remove the front cover. (See section 5.5.)
5. Remove the switch-LED panel (1) from the front cover by peeling off from the front.



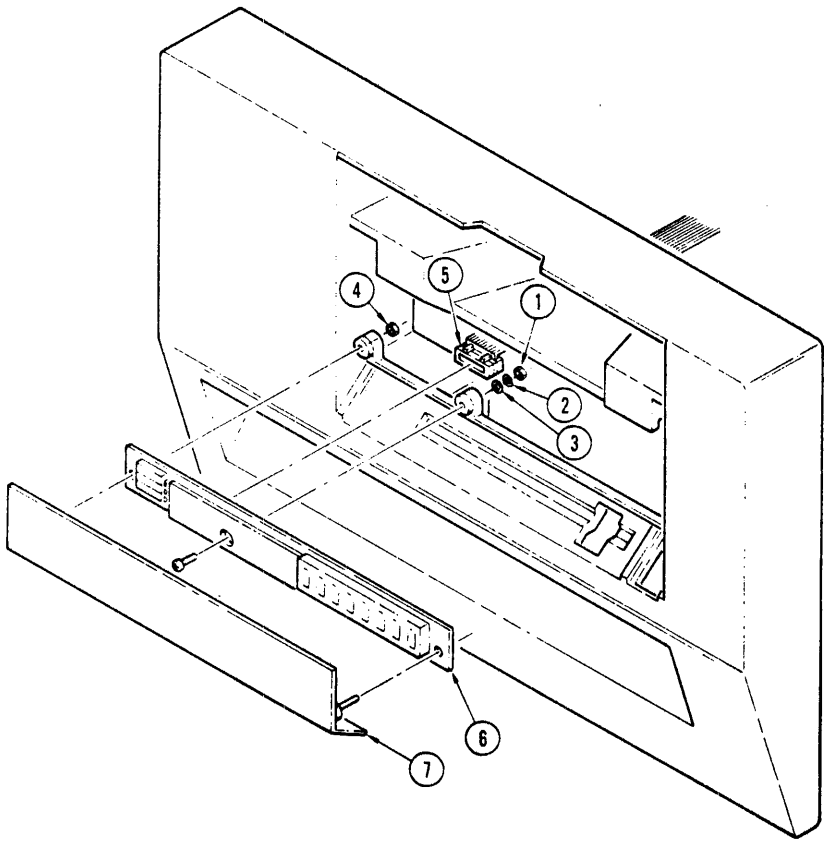
5.10.2 Replacement

Install the panel, and reverse the removal procedure.

5.11 Alphanumeric Display

5.11.1 Removal

1. Switch off ac power.
2. Place the unit in the service position. (See section 5.2.)
3. Remove connector (5) from back of display PWB.
4. Remove nut (1), lockwasher (2), and flatwasher (3).
5. Remove push-on retaining rings (4).
6. Remove cover (7) and diagnostic PWB (6) from front panel.



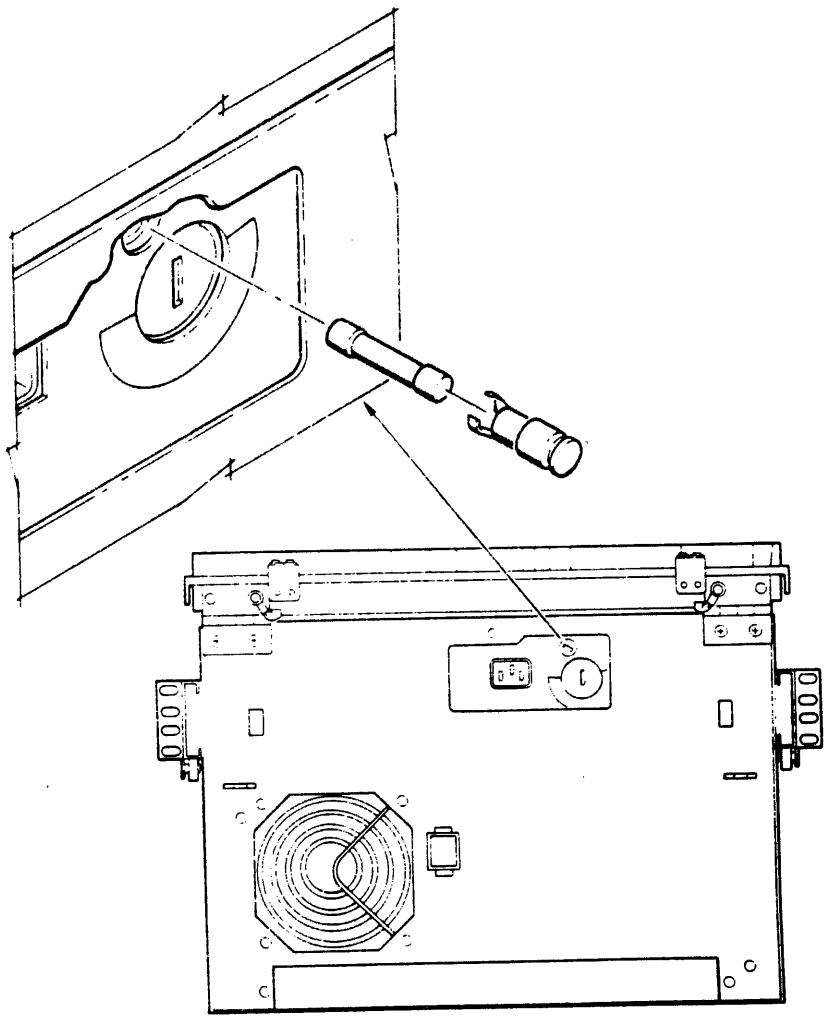
5.11.2 Replacement

Install the diagnostic PWB, and reverse the removal procedure.

5.12 Fuse

5.12.1 Removal

1. Switch off ac power.
2. Disconnect the ac power cord.
3. Locate the fuse F1 on the power supply enclosure through the rear of the chassis and remove it.
4. For 100-120V range, use a 6.25A slow-blow fuse for drives with 57V Servo PWBs or a 4A slow-blow for 37V PWBs.
5. For 200-240V range, use a 3A slow-blow fuse for drives with 57V Servo PWBs or a 2A slow-blow fuse for 37V PWBs.



5.12.2 Replacement

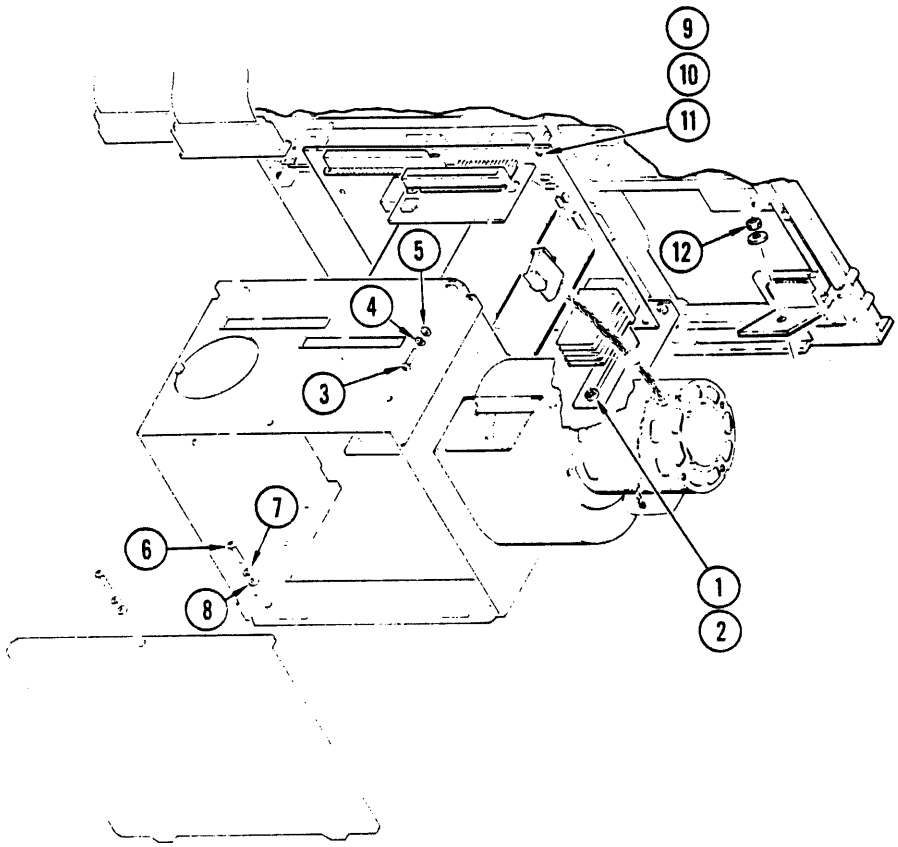
To replace the fuse, reverse the removal procedure steps.

5.13 Power Supply Enclosure and PWB

5.13.1 Removal

Switch off ac power and disconnect the ac power cord.

1. Switch off ac power and disconnect the ac power cord.
2. Place the unit in the service position. (See section 5.2.)
3. Remove the four tape unit boards from the PWB rack. (See sections 5.34 through 5.37.)
4. Remove the front panel. (See section 5.5.) Remove the main and smaller air duct
5. Cut the cable ties holding the cables to the left side and front of the enclosure. Disconnect the connectors to the front of the enclosures.
6. Remove the screw attaching the ground wire to the side of the air pump assembly. Cut the cable tie around the air pump connector and disconnect the air pump from the wiring harness.
7. Remove nut (12) which secures Blower Motor to top plate.
8. Remove the power supply cover.
9. Remove the nut (1) and flatwasher (2) holding AC line filter bracket to the enclosure.
10. Remove the two socket head screws (3), two lockwashers (4), and two flatwashers (5) from the rear of the enclosure.
11. Remove the two screws (6), two lockwashers (7), and two flatwashers (8) from the front of the enclosure.
12. Disconnect the connector from the take-up motor to the power supply PWB.
13. Remove the four screws (9), lockwashers (10), and flatwashers (11) securing the power supply PWB.
14. Carefully lower the power supply enclosure and PWB from the top plate.
15. Remove the power supply PWB from the enclosure.



5.13.2 **Replacement**

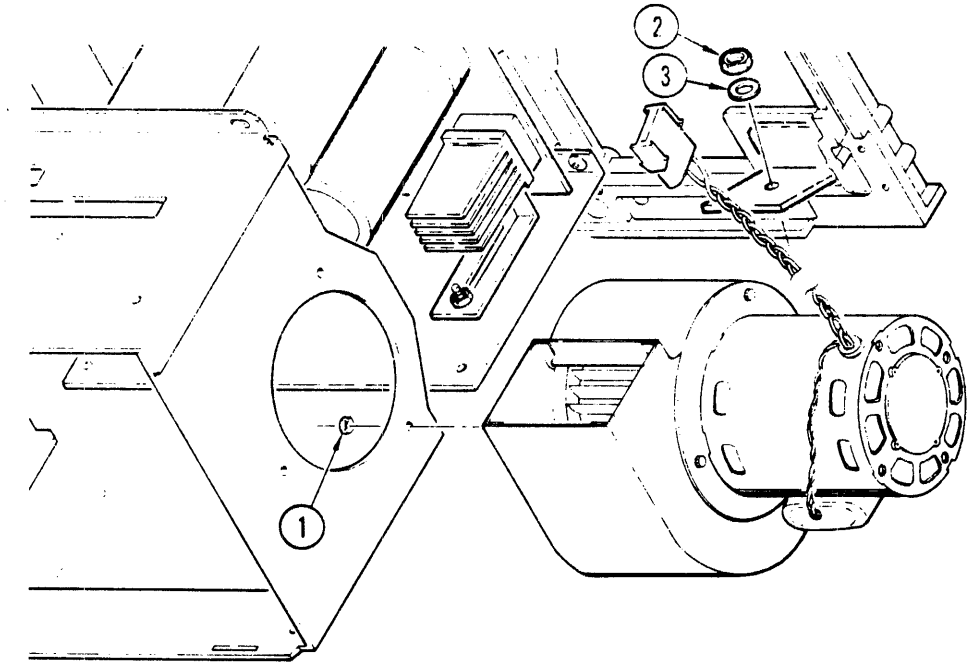
1. To replace the power supply enclosure, reverse the removal procedure steps. Make sure not to pinch any cables when replacing the enclosure.

2. Use replacement cable ties to replace the cables.

5.14 Blower Motor

5.14.1 Removal

1. Switch off ac power.
2. Disconnect the ac power cord.
3. Place the unit in the service position. (See section 5.2.)
4. Note that a ground wire is attached to the power supply cover and remove the power supply cover.
5. Remove the cable ties on the power supply enclosure and remove the power supply enclosure. (See section 5.13.)
6. Remove the three nuts (1) that attach the blower motor to the power supply enclosure.
7. Remove the nut (2) and washer (3) securing the blower motor to its bracket.



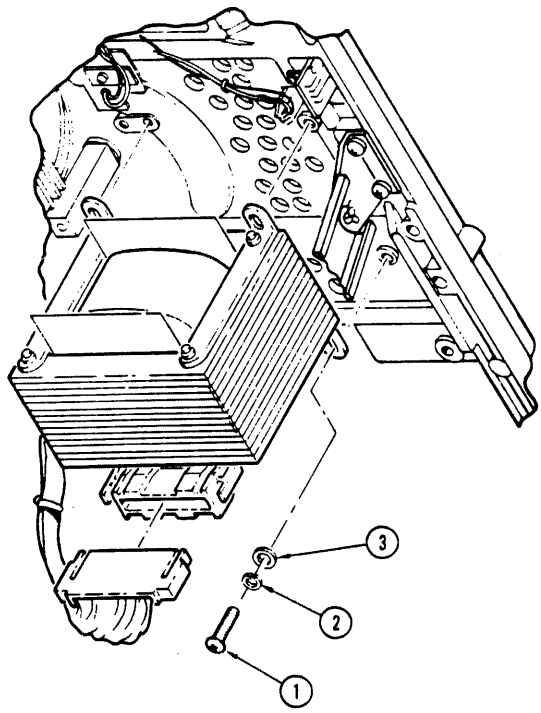
5.14.2 Replacement

Replace the blower motor by reversing the removal procedure.

5.15 AC Transformer

5.15.1 Removal

1. Switch off ac power.
2. Disconnect the ac power cord.
3. Place the unit in the service position. (See section 5.2.)
4. Remove the front cover. (See section 5.5.)
5. Remove the air duct that is in front of the transformer.
6. Remove plug from the transformer.
7. Remove the four screws (1), four lockwashers (2), and four washers (3) from the base of the transformer. Note the position of the cable ties and remove them.



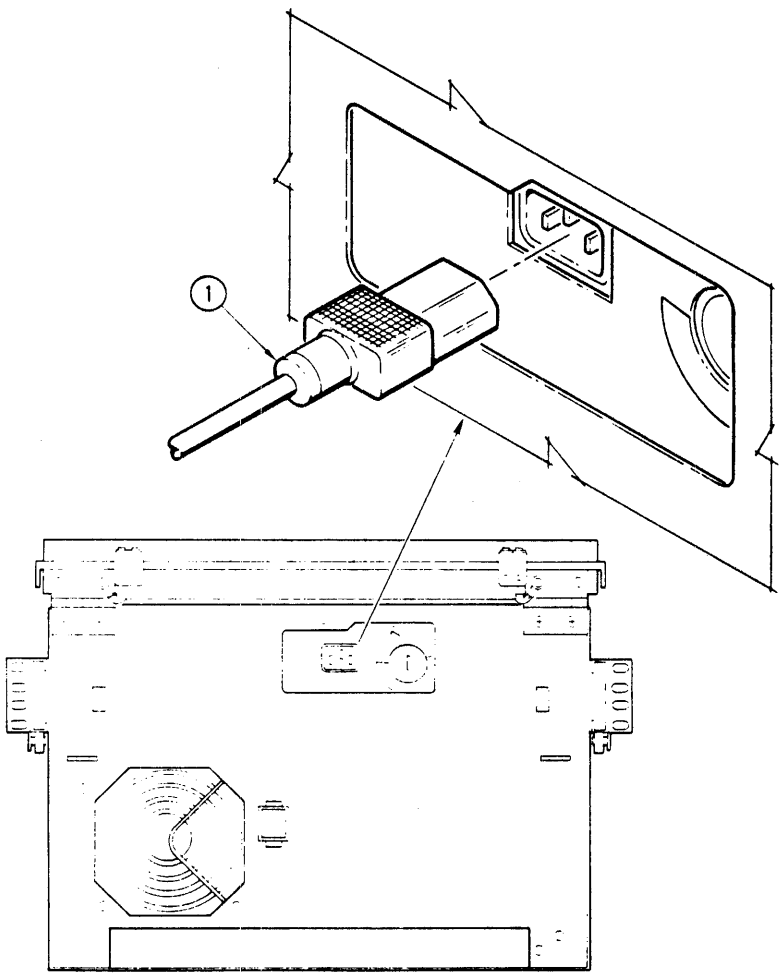
5.15.2 Replacement

Install transformer with the screws removed earlier. Reverse the removal steps for replacement.

5.16 AC Line Cord

5.16.1 Removal

1. Switch off ac power.
2. Disconnect the power cord from the ac socket.
3. Disconnect the ac power cord (1) from the back of the unit.



5.16.2 Replacement

Reverse the removal procedure to replace ac line cord. Replace with the same type of cord and plug.

5.17 Supply Reel Hub

5.17.1 Removal

1. Switch off ac power.
2. Place the unit in the operator access position. (See section 5.1.)

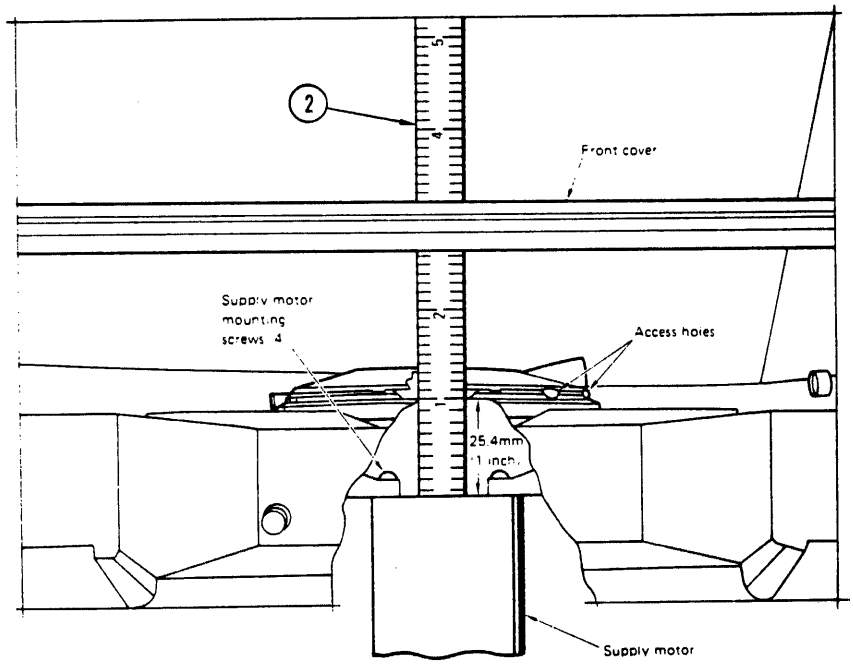
3. Open the top cover and operator access cover.

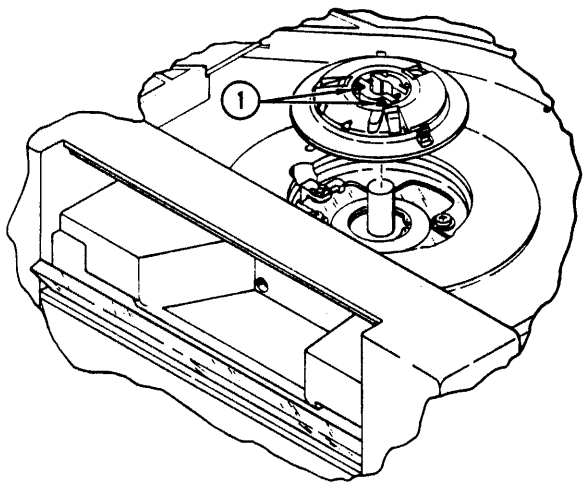
4. Measure the hub height and record the value.

5. Rotate the supply hub until the clamp screws (1) are aligned with the front cover.

6. Locate the access holes in the hub and insert the wrench from the front of the machine to loosen the two screws (1).

7. Lift the hub off the motor shaft.





5.17.2 **Replacement**

Place the hub on the shaft. Do not tighten the screws. Proceed to the adjustment procedure.

5.17.3 Adjustment

1. With the reel hub pads down, insert the ruler scale (2) between the reel hub pad and the hub. Make sure the hub is in the position shown.

2. If only the supply hub was removed for repair or replacement, then use the hub height value recorded in the preceding removal steps and continue with step 4. If not, proceed to step 3.

3. Adjust the hub on the shaft until you obtain a gap of 25 mm (1 inch) between the motor case and edge of the hub. Tighten the screws (1).

4. Check the gap. If it is correct, proceed to step 5; if not, do step 3 until a proper gap is obtained.

5. Enable diagnostic test 131 to check the supply reel tab sensor. (See section 4.1 for diagnostic tests.) If the test is not correct, adjust the hub up or down for the proper LED results.

6. Load a tape and manually lock and unlock by running test 132, and check to see that the hub locks and unlocks properly.

7. Enable diagnostic test 212. At 100 ips, run the tape out to the EOT marker and start the test in the reverse direction. Observe the tape while it is rewinding onto the supply reel. If the tape is not centered on the hub, adjust the hub height as necessary.

8. Restore the unit to the operating position. (See section 5.3.)

5.18 Read/Write Head

5.18.1 Removal

1. Switch off ac power.

2. Place the unit in the service position. (See section 5.2.)

3. Remove the read and write cables from the head assembly.

4. Remove Azimuth adjusting screw (4).

5. While supporting the read/write head with your hand, remove four screws (2), four lockwashers (3), four washers (4) and remove the head from the tape unit.

   CAUTION: Use extreme care when removing and replacing the read/write head; do not allow ANYTHING to come in contact with the FACE of the HEAD.

2. Hold the head in place and tighten the four mounting screws within equal amount of torque. Verify wrap angle adjustment after tightening screws.
3. Section 5.19.3 and perform the Tape Scraper Adjustment.
4. Load a skew tape, Cipher Part No. 799019-401, **WITHOUT** a write enable ring.
5. Disable the front panel door and top cover interlock using test 133. Refer to section 4.1.3.
6. Press the Load/Rewind switch to load the tape.
7. Connect the oscilloscope to J1-19 on the Data Board.
8. Remove the center adjustment screws, and clean dried Vibratight.
9. Apply fresh Vibratight, Cipher Part No. 209990-075, to threads of adjustment screw and reinstall loosely into baseplate.
10. Use test 212 (section 4.1.4) in 1600 bpi mode to move tape forward at 100 ips.
11. Adjust azimuth screw so that outputs of all tracks fall within 12% or less of the byte-to-byte period. See Figure 5.18.3 Skew Adjustment Waveform.
12. Alternate tape direction between forward and reverse and optimize skew adjustment by minimizing the skew pulse width. Make final adjustment by optimizing forward skew (smallest skew pulse). Run forward to EOT and run reverse to BOT without stopping.
13. Apply torque seal, Cipher Part No. 209994-025 to head of adjustment screw. Run Test 513.
14. Unload the skew tape and refer to section 5.38 to check tape path alignment.
15. Perform Test 542 (section 4.4.16) and Test 513 (section 4.4.17).

5.19 Tape Scraper

5.19.1 Removal

1. Remove two socket-head screws (3), nuts (1), lockwashers (5), and flat washer (2).

5.19.2 Replacement

1. Install replacement scraper in reverse order of removal.

5.19.3 Adjustment

1. Insert and load a tape.
2. Loosen socket-head screws (3) and move tape scraper away from tape.

5. Disable the front panel door and top cover interlock using test 133. Refer to section 4.1.3.
6. Press the Load/Rewind switch to load the tape.
7. Connect the oscilloscope to J1-19 on the Data Board.
8. Remove the center adjustment screws, and clean dried Vibratight.
9. Apply fresh Vibratight, Cipher Part No. 209990-075, to threads of adjustment screw and reinstall loosely into baseplate.
10. Use test 212 (section 4.1.4) in 1600 bpi mode to move tape forward at 100 ips.
11. Adjust azimuth screw so that outputs of all tracks fall within 12% or less of the byte-to-byte period. See Figure 5.18.3 Skew Adjustment Waveform.
12. Alternate tape direction between forward and reverse and optimize skew adjustment by minimizing the skew pulse width. Make final adjustment by optimizing forward skew (smallest skew pulse). Run forward to EOT and run reverse to BOT without stopping.
13. Apply torque seal, Cipher Part No. 209994-025 to head of adjustment screw. Run Test 513.
14. Unload the skew tape and refer to section 5.38 to check tape path alignment.
15. Perform Test 542 (section 4.4.16) and Test 513 (section 4.4.17).

5.19 Tape Scraper

5.19.1 Removal

1. Remove two socket-head screws (3), nuts (1), lockwashers (5), and flat washer (2).

5.19.2 Replacement

1. Install replacement scraper in reverse order of removal.

5.19.3 Adjustment

1. Insert and load a tape.
2. Loosen socket-head screws (3) and move tape scraper away from tape.
3. Slowly move the tape scraper toward the tape until it just barely makes contact with the tape.
4. Rotate tape scraper until both scraper blades are touching the tape, producing two vertical creases in the tape at the points of contact.

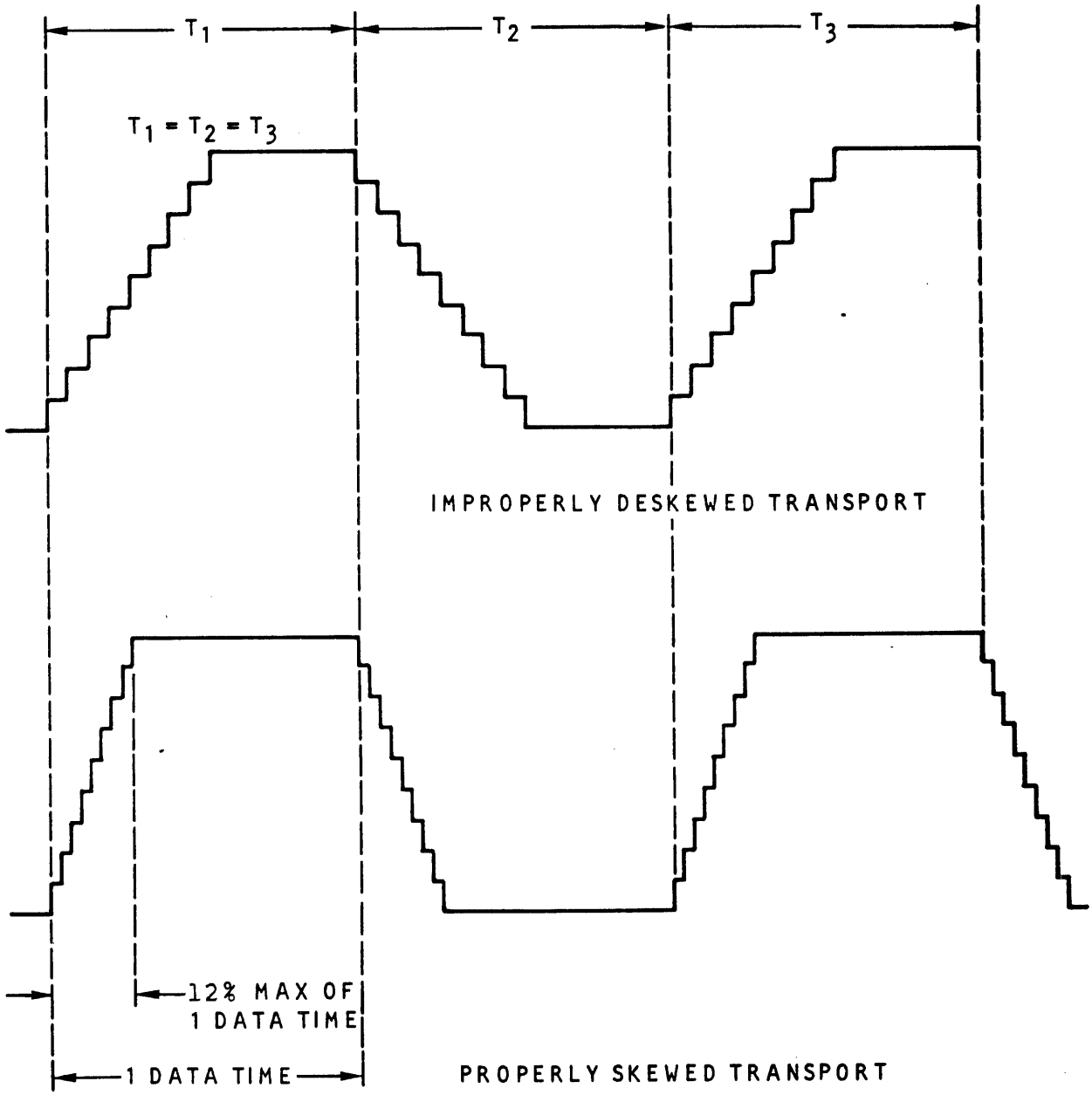
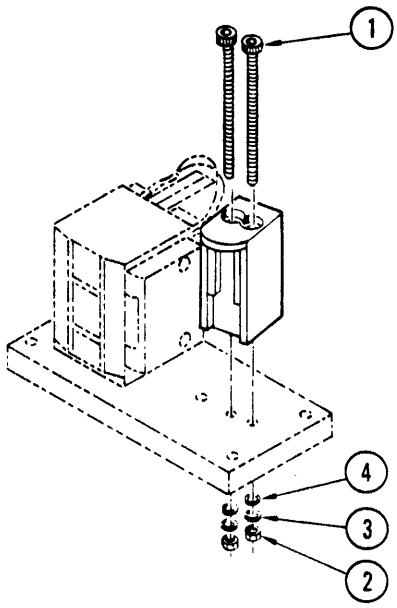


Figure 5.18.3 Skew Adjustment Waveform

5. Verify that tape is touching erase bar. Check for vertical crease in tape at the point of contact.

6. Tighten socket-head screws (3) and reverify that tape is in contact with both blades of tape scraper and the erase bar.



5.20 Take-Up Hub

5.20.1 Removal

1. Switch off ac power.

2. Place the tape unit in the operator access position. (See section 5.1.)

3. Open the top cover.

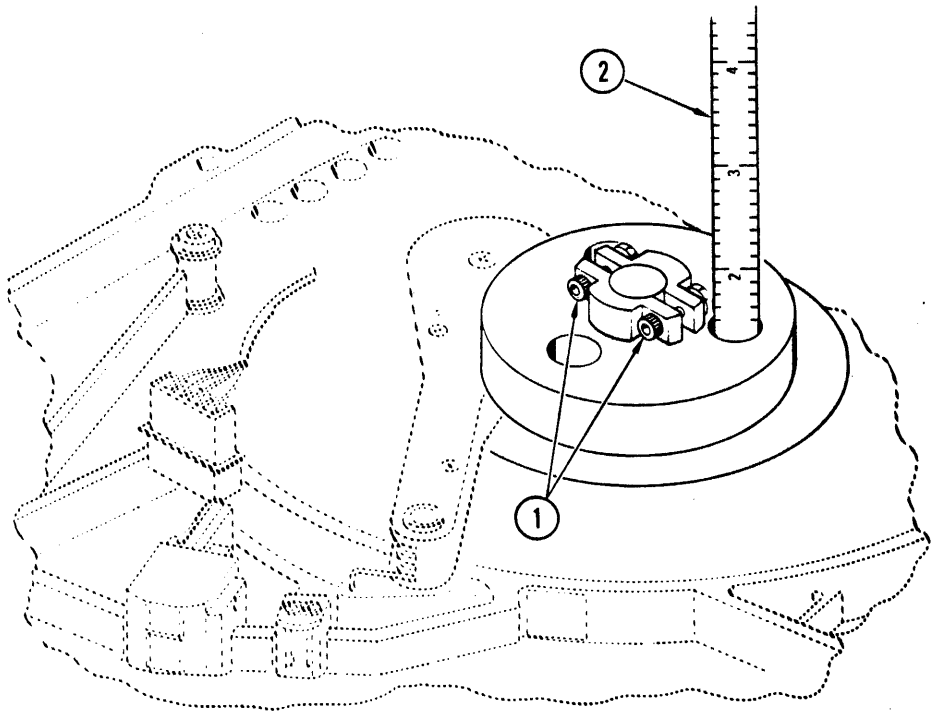
4. Measure the hub height and record the value.

5. Loosen the two screws (1) on the hub.

   CAUTION: Take care when moving the tachometer toward the take-up hub. Do not let the tachometer strike against the take-up hub.

6. Gently move the tachometer away from the hub and lift the hub from the motor shaft.

7. Gently rest the tachometer on the motor shaft after you remove the hub.



5.20.2 Replacement

CAUTION: Do not force the top cover closed with the hub removed. Damage to the tachometer will occur.

Replace the take-up hub onto the motor shaft and perform the adjustment procedure.

5.20.3 Adjustment

1. With the hub in place, insert the ruler scale (2) into the hole in the top of the hub.

2. Position the hub so that the ruler scale rests on the motor case and not on the mounting screws. If only the take-up hub was removed for repair or replacement, then use the value recorded in the previous removal steps and continue with step 4; if not, then proceed with step 3.

3. Adjust the hub for a clearance of 38 mm (1.5 inches) from the motor case to the top of the hub. Tighten the screws.

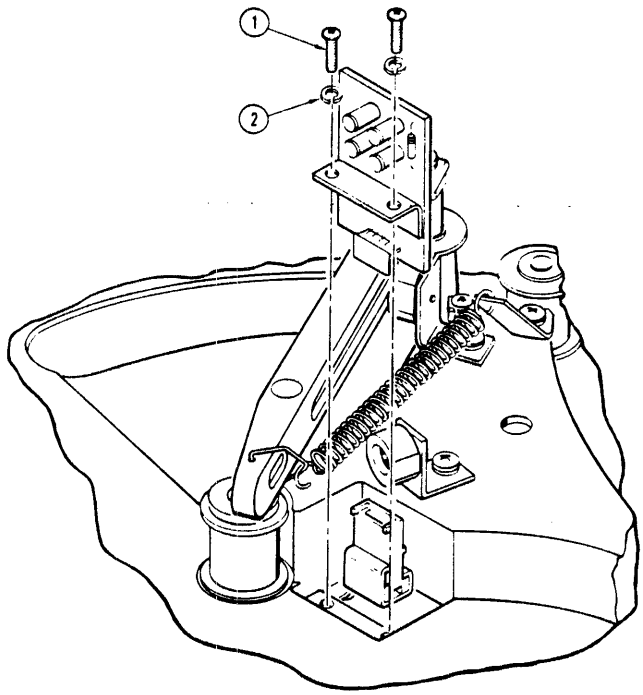
4. Check the hub height. If it is correct, load a tape and check to see if the tape is on the center of the hub. If it is not correct, loosen the screws and repeat steps 2 through 4 until it is correct.

5. Restore the unit to an operating position. (See section 5.3.)

5.21 BOT/EOT Sensor

5.21.1 Removal

1. Switch off ac power.
2. Place the tape unit in the operator access position. (See section 5.3.)
3. Remove the two screws (1) and the two lockwashers (2) attaching the sensor to the top plate.
4. Remove the EOT/BOT sensor and unplug the cable from the sensor.



5.21.2 Replacement

1. To replace the sensor, reverse the removal procedure. Make sure that the base of the sensor is parallel to the edge of the base casting.
2. Proceed to the Service Check.

5.21.3 Service Check

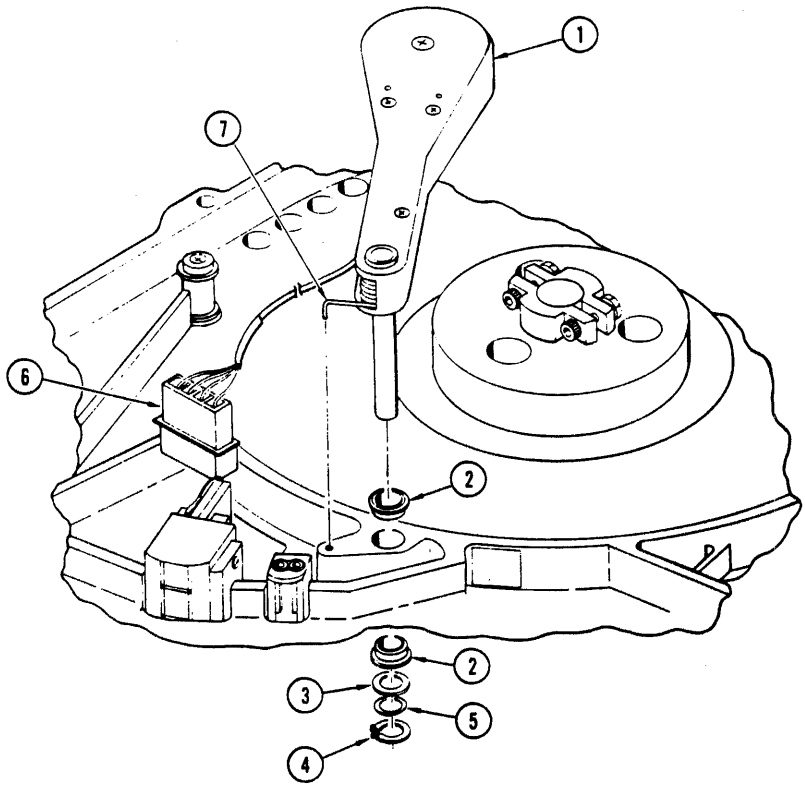
1. Switch off ac power.
2. Use diagnostic test 131 to check the operation of the EOT/BOT sensor.
3. Restore the unit to an operating position. (See section 5.3.)

5.22 Tachometer

5.22.1 Removal

1. Switch off ac power.
2. Place the unit in the service position. (See section 5.2.)
3. Disconnect the tachometer signal cable (6).
4. With a retaining ring tool, remove the retaining ring (4) from the shaft. Be careful not to drop the shim(s) (3), retaining ring 4, or wave washer (5).

   CAUTION: Do not let the tachometer strike sharply against the hub.
5. Remove the tachometer (1) and the spring (7) from the top of the tape unit.
6. If the upper and lower bearings (2) are replaced, use Loctite 601 or equivalent to set in place. Be careful when you remove or replace the bearings.



5.22.2 Replacement

1. Carefully insert the tachometer and its spring into the tape base plate.

2. Gently rest the tachometer onto the take-up hub and reverse the removal procedures.

5.22.3 Adjustment

1. After the shim(s), wave washer, and retaining ring are in place, install the retaining ring onto the shaft. The wave washer should be compressed to about half its original height with the retaining clip.

2. Restore the unit to an operating position. (See section 5.3.)

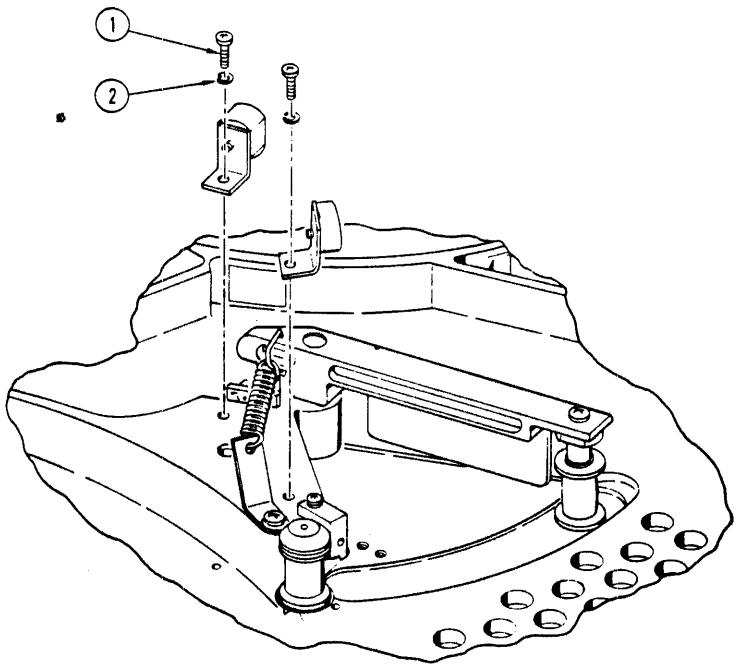
5.23 Tension Arm Bumper

5.23.1 Removal

1. Switch off ac power.

2. Place the tape unit in the operator access position. (See section 5.1.)

3. Open the top cover and remove the screw (1) and lockwasher (2) from the defective bumper.



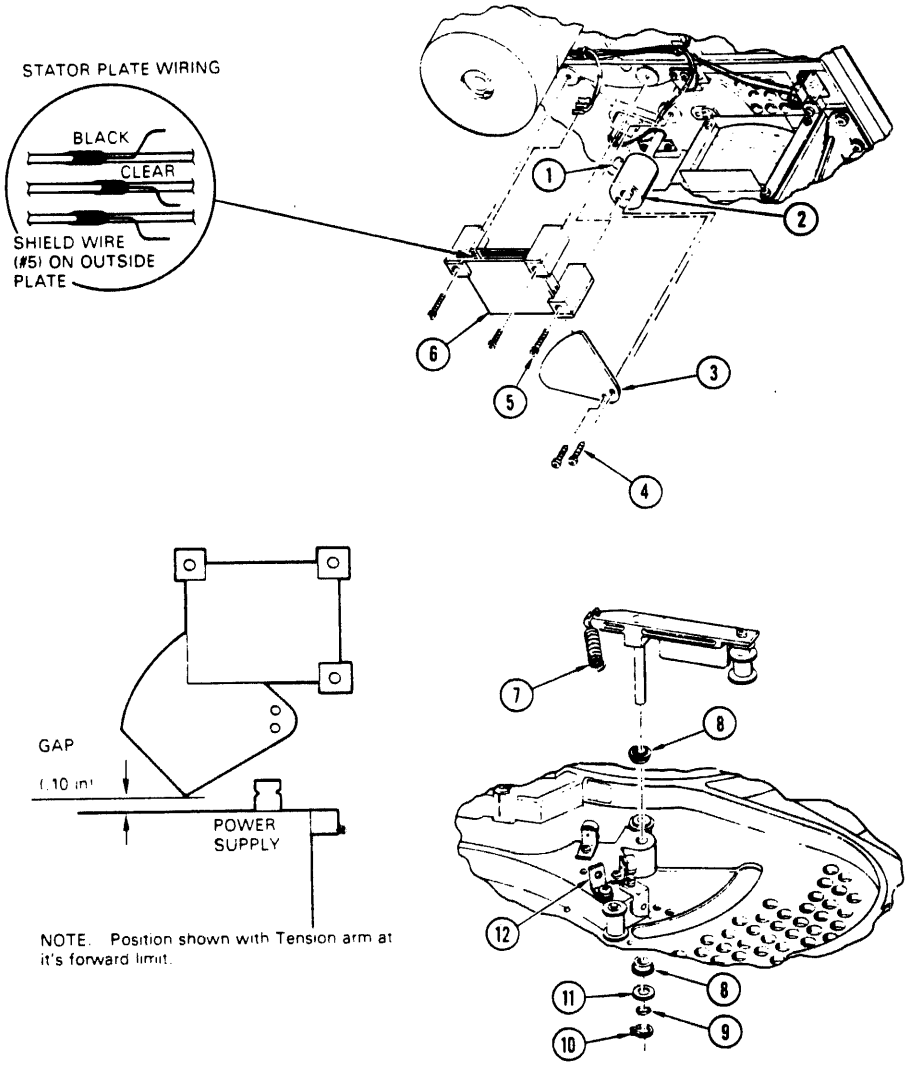
5.23.2 Replacement

1. Replace the bumper onto the unit base.

2. Position the bumpers so that each one contacts the tension arm squarely. Tighten the screws.

3. Place the unit in an operating position. (See section 5.3.)

5.24 Tension Arm/Air Capacitor Assembly



NOTE. Position shown with Tension arm at it's forward limit.

5.24.1 Removal

1. Switch off ac power.
2. Place the unit in the service position. (See section 5.2.)
3. Remove the front panel. (See section 5.5.) Remove the main air duct.
4. Remove the screw that attaches the smaller air duct to the unit. Remove the air duct.
5. Remove the two screws (4), that attach the shutter blade (3) to the hub (2). Remove the shutter blade (3).

6. Record the position of and remove the clip wires on the stator plates. See illustration.

7. Remove the three screws (5). Remove the stator plate (6).

8. Loosen the screw (1), and remove the shutter hub (2) from the tension arm shaft.

9. From the top side of the unit, remove the spring (7) from the bracket (12).

10. From the bottom side of the unit, remove the retaining ring (10), wave washer (9), and shim(s) (11) from the shaft. Be careful not to drop any springs or washers.

11. Remove the tension arm from the unit. If the upper and lower bearings (8) are to be replaced, remove them from the unit and set in place with Loctite 601.

5.24.2 Replacement

Reinstall the tension arm/air capacitor assembly by reversing the removal procedures. When you install the shim(s), washer, and wave washer, check to see if the wave washer is compressed to about half its original height with the retaining ring installed. If it is not, add or remove any shim(s) to compress the wave washer to about half its original height.

Note: Replace shutter blade between the two plates closest to the casting.

5.24.3 Adjustment

1. Loosen the clampscrew (1), and remove the spring (7) on the air capacitor arm. Secure the tension arm to the front bumper.

2. Rotate the shutter blade (3) to within 2.5 mm (.10 inch) from the power supply enclosure.

3. Check the clearance on the shutter blade. Make sure that it does not rub on the stator plates. Tighten the screw (1).

4. Swing the tension arm to both limits of travel and check for free operation. If it binds, repeat the adjustment until the arm swings free to both limits of travel.

5. Replace the clip wires on the stator plates, the air ducts and the front cover.

6. Replace the spring (7) onto the arm. Load a tape to check for proper operation and restore the unit to an operating position. (See section 5.3.)

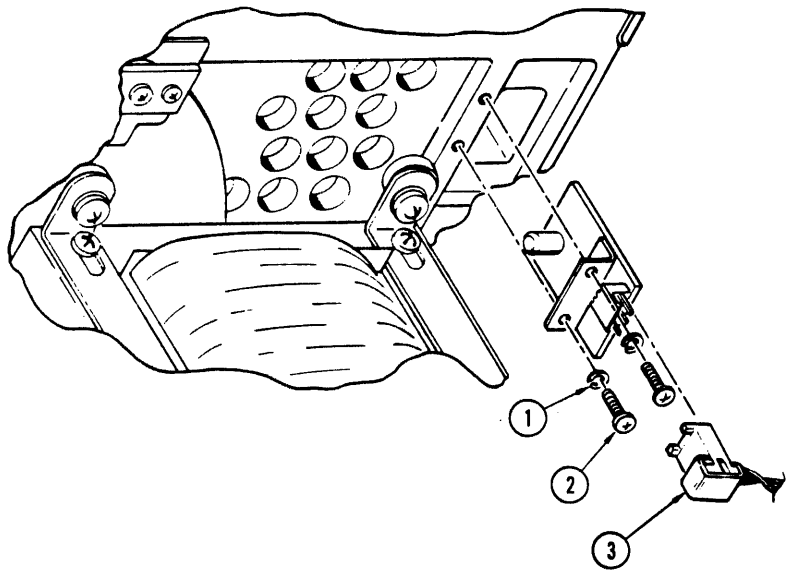
5.24.4 Service Check

Activate test 124 to display the compliance arm voltage on the alphanumeric display. Check the voltage with the arm in the rest position, the voltage displayed should be less the +14.2 volts. Move the arm forward until it contacts front bumper, the voltage should be greater than -14.2 volts. If the voltages are not correct, perform the adjustment procedure (5.24.3).

5.25 Tape-In-Path Transmitter

5.25.1 Removal

1. Switch off ac power.
2. Place the unit in the service position. (See section 5.2.)
3. Remove the wire connector (3) from the tape-in-path transmitter.
4. Remove the two screws (2) and the two lockwashers (1) from the tape-in-path LED.



5.25.2 Replacement

For replacement, reverse the above removal procedures.

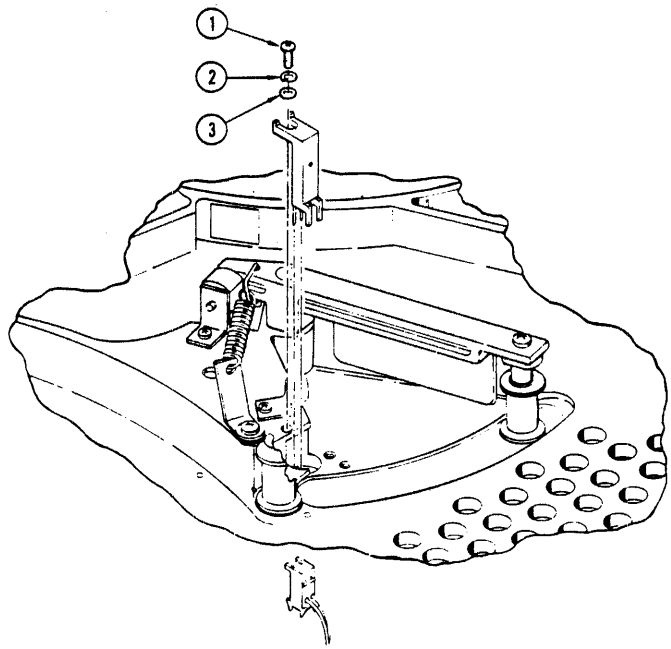
5.26 Tape-In-Path Sensor

5.26.1 Removal

1. Switch off ac power.
2. Place the unit in the operator access position. (See section 5.1.)

3. Open the top cover and remove one screw (1), one lockwasher (2), and one washer (3) from the sensor.

4. Note the position of and remove the wire cable connected to the sensor.



5.26.2 Replacement

1. Reverse the following procedures for the tape-in-path sensor.

2. Proceed to the adjustment procedure.

5.26.3 Adjustment

1. Place the unit in the service position. (See section 5.2.)

2. Switch on ac power.

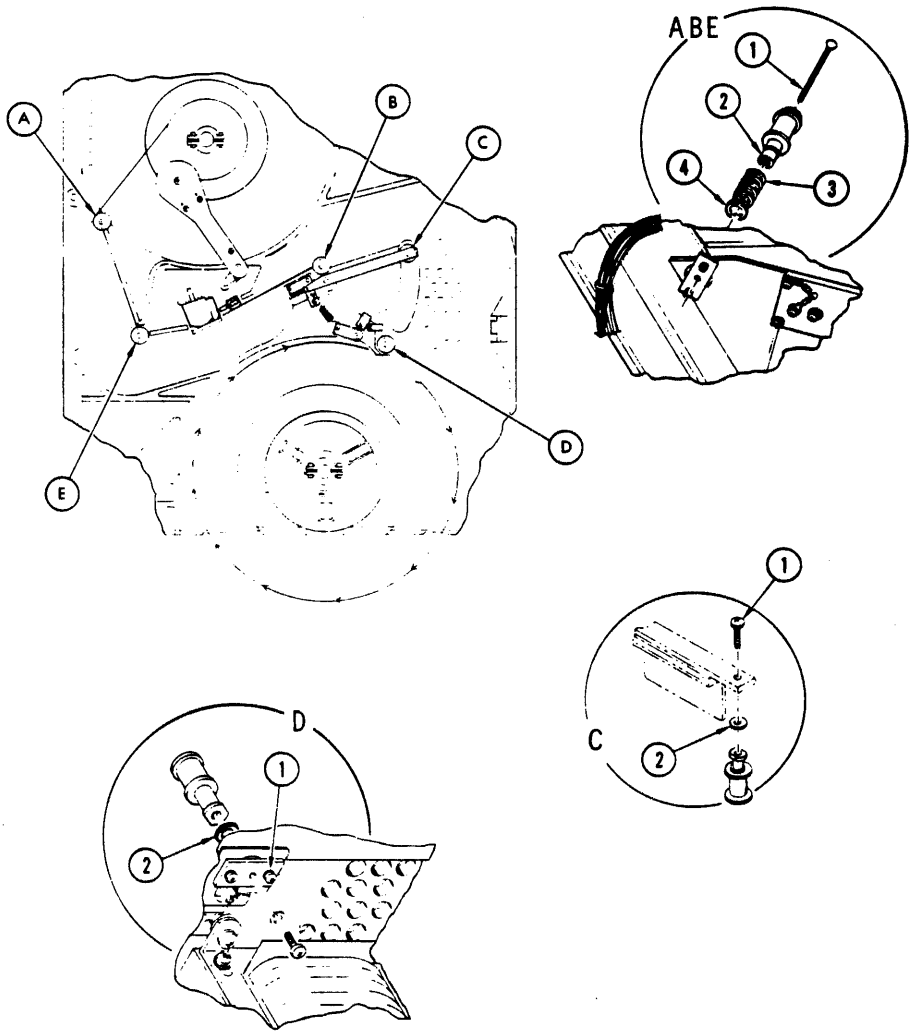
3. Connect a volt meter to connector J9 on the Sense/Servo PWB. For PWB Sets A and B, connect the leads to pins 13 (signal) and 17 (ground). For PWB Set C, connect the leads to pins 15 (signal) and 1 (ground). You should get the following results:

CONDITION	RESULT
With tape loaded	< 0.1 Vdc
Without tape loaded	> 0.4 Vdc

4. Without any tape in front of the sensor, loosen the screw and adjust the sensor for maximum voltage. Tighten the screw.

5. Place the unit in an operating position. (See section 5.3.)

5.27 Tape Guides



5.27.1 Removal

1. Switch off ac power.
2. Place the unit in the service position. (See section 5.2.)
3. Locate the guide to be removed and follow the procedures.

Tape Guide A,B & E

1. Remove attaching screw (1), leaving shims (4) and spring (3) in place.
2. Remove roller guide assembly through top of top plate.

Tape Guide C

1. Remove attaching screw (1) while holding on to tape guide.
2. Carefully remove tape guide and washer (2) from beneath tension arm.

Tape Guide D

1. Remove attaching screw (1) and lockwasher.
2. Leave shims in place.
3. Remove tape guide assembly from top of top plate.

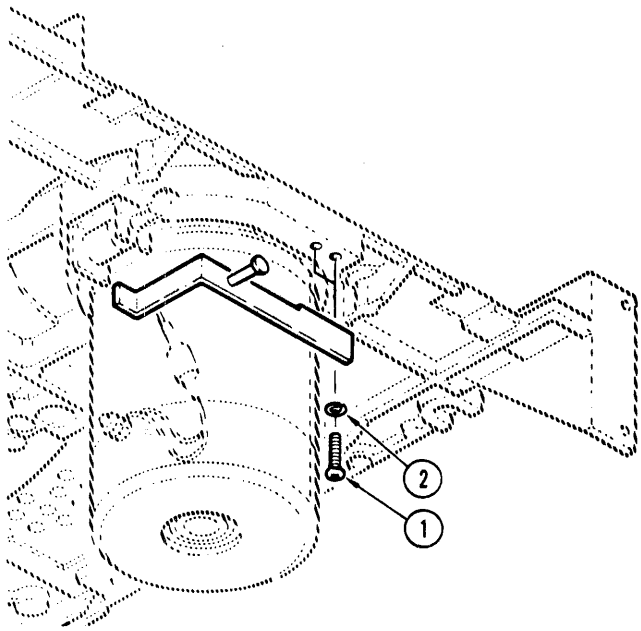
5.27.2 **Replacement**

1. Replace the tape guide with the original shim(s) by reversing the removal procedure steps.
2. Perform the Tape Tracking Procedure. (See section 5.38.)

5.28 **Manual Hub Release Assembly**

5.28.1 **Removal**

1. Switch off ac power.
2. Disconnect the ac line cord.
3. Place the unit in the service position. (See section 5.2.)
4. Remove the front panel. (See section 5.5.)
5. Remove the two screws (1) and two lockwashers (2) from the assembly.



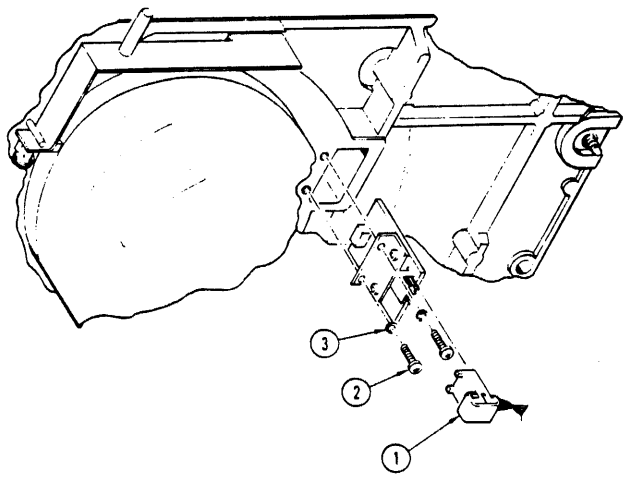
5.28.2 **Replacement**

Reverse the removal procedure for the hub release assembly.

5.29 Supply Reel Tab Sensor

5.29.1 Removal

1. Switch off ac power.
2. Place the unit in the service position. (See section 5.2.)
3. Remove the cable (1) from the sensor.
4. Remove the two screws (2) and two lockwashers (3) from the tab sensor. Carefully remove the tab sensor from the unit.



5.29.2 Replacement

1. Reverse the above removal procedures for replacement.
2. Proceed to the service check.

5.29.3 Service Check

1. Connect a volt meter to connector J9 on the Sense/Servo PWB. For PWB Sets A and B, connect the leads to pins 14 (signal) and 17 (ground). For PWB Set C, connect the leads to pins 14 (signal) and 1 (ground). You should get the following results:

CONDITIONS	RESULTS
Reflector	> 0.5 Vdc
No reflector	< 0.1 Vdc

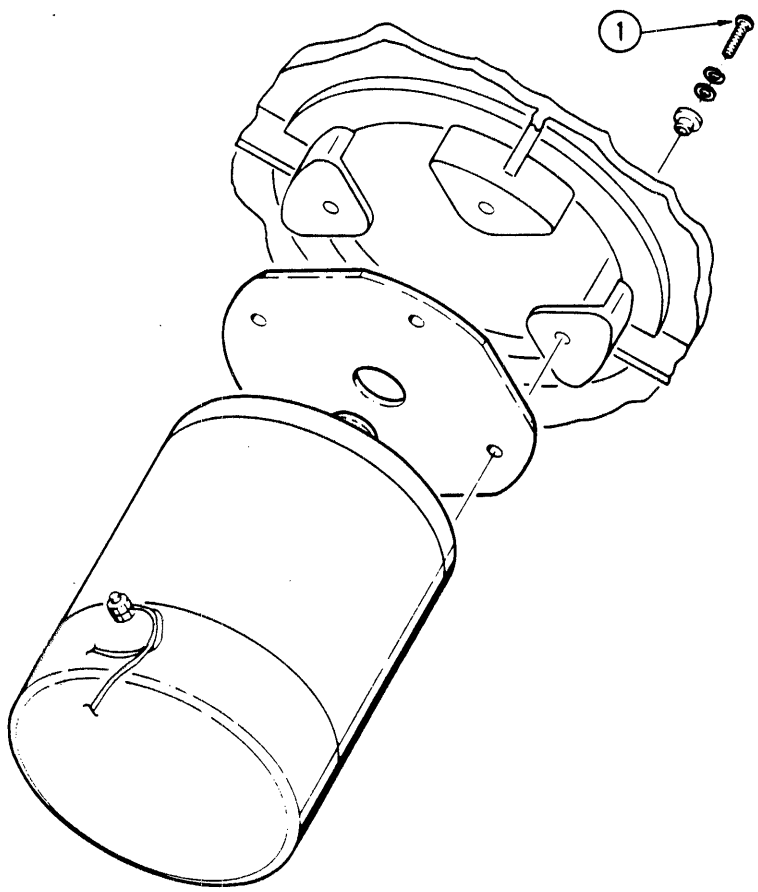
2. Activate test 131 with no tape on the supply hub. (See section 4.1.3 for diagnostic test).

5.30 Take-Up Motor

5.30.1 Removal

1. Switch off ac power.
2. Remove the ac power cord.
3. Place the tape unit in the service position.
4. Remove the tape unit boards. (See sections 5.34 through 5.37.)
5. Remove the take-up hub. (See section 5.20.) Loosen, but do not remove, all of the screws (1) from the motor.
6. Remove the power supply cover. Label and disconnect the take-up motor wires.
7. Using one hand as a support, remove the four screws and washers; with the other hand, remove the motor. Save the motor insulator and screws for replacement.

   CAUTION: Do not force the cover with the take-up hub removed.



5.30.2 Replacement

1. Reverse the removal procedure for replacement with the motor insulator removed earlier.
2. Perform the take-up hub adjustment procedure. (See section 5.20.3.)
3. Perform Servo Offset adjustment procedure. (See section 5.34.4.)

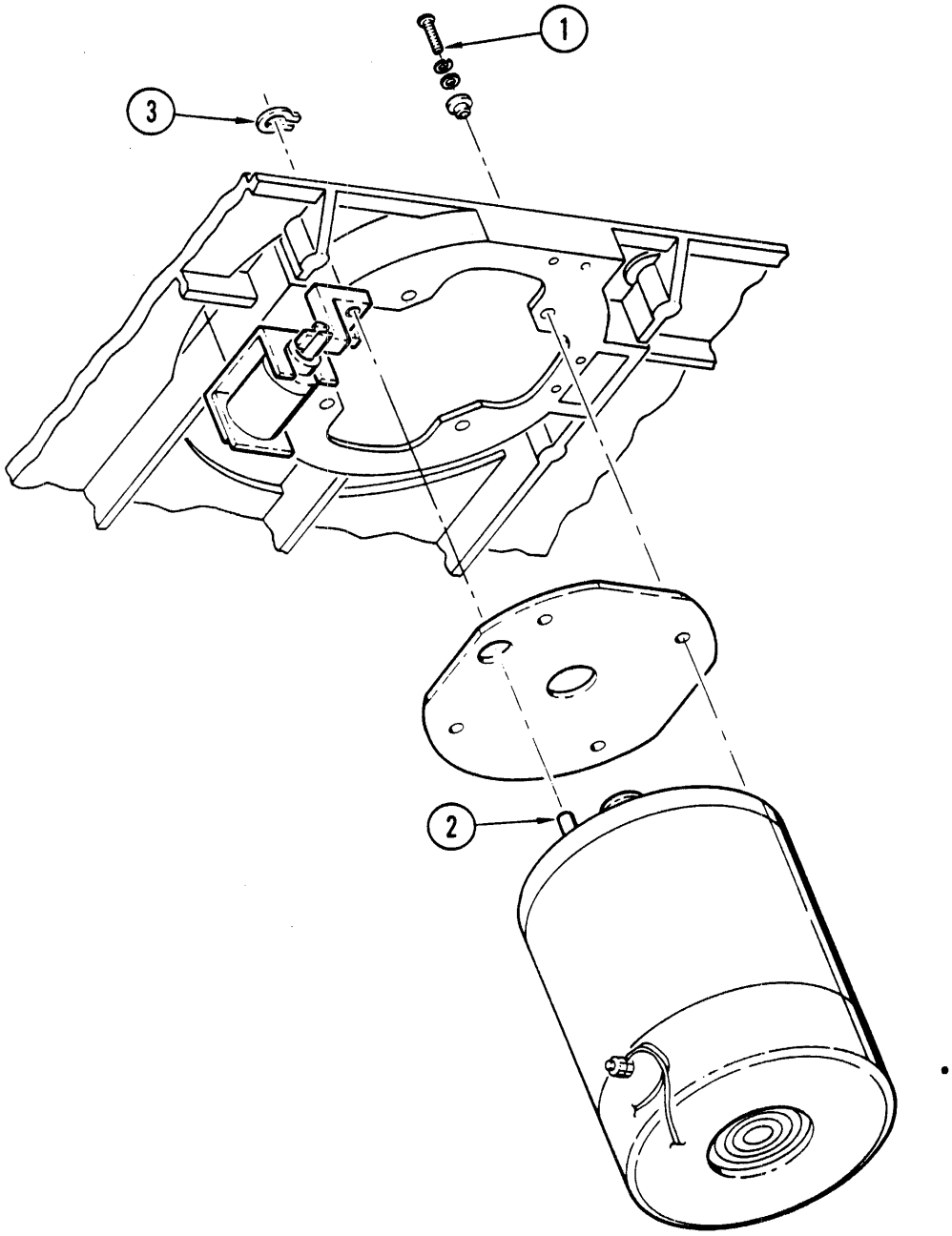
5.31 Supply Motor

5.31.1 Removal

1. Switch off ac power.
2. Place the unit in the service position. (See section 5.2.)
3. Loosen the two screws on the supply hub and lift the hub off of the shaft. (See section 5.17.)
4. Remove the clip (3) on the hub lock pawl shaft.
5. Disconnect the supply motor wire cable.

   CAUTION: Do not drop the motor onto tape control board.

6. Loosen, but do not remove, the four screws (1) from the motor. With one hand as a support, remove the four screws and washers with the other hand. Lower the supply motor while simultaneously slipping the pawl off its shaft.
7. Save the motor insulator and screws for replacement. If the replacement motor does not have the hub lock pawl shaft 2, remove it from the old motor and place it on the new motor.



5.31.2 **Replacement**

1. Install the motor and the insulator with the screws removed earlier.

2. Tighten the screws until snug. Place the supply hub on the shaft and check to see if the motor is centered. Adjust the motor as necessary to center it.

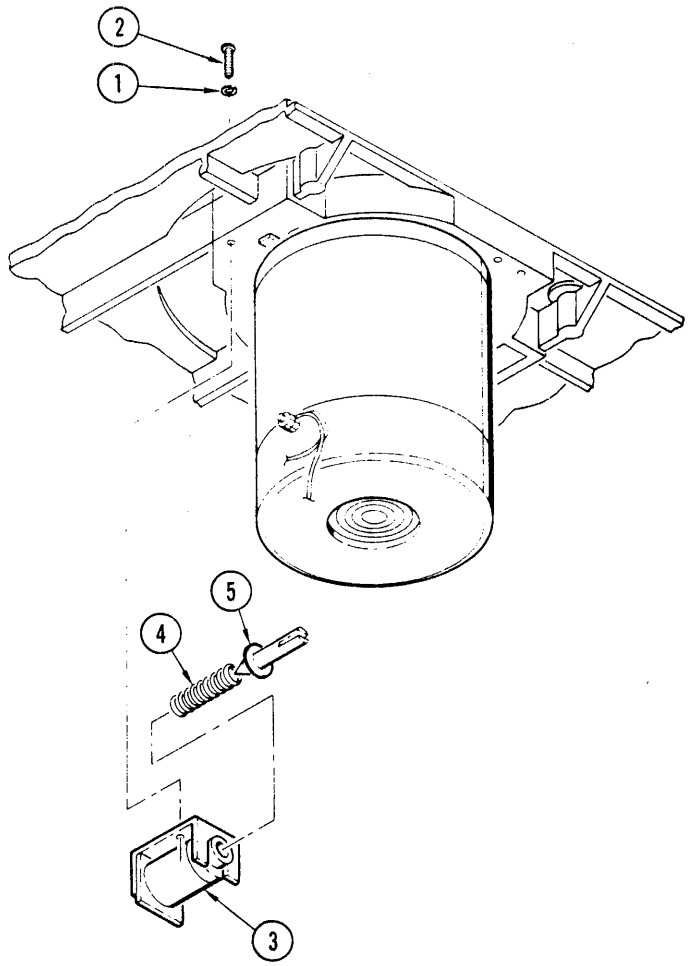
3. Remove the hub and tighten the screws (1). Perform the supply hub adjustment. (See section 5.17.3.)

4. Perform Servo Offset adjustment procedure. (See section 5.34.4.)

5.32 Hub Lock Solenoid

5.32.1 Removal

1. Switch off ac power.
2. Place the unit in the service position. (See section 5.2.)
3. Locate and disconnect the solenoid wires. Note the position of the wires for replacement.
4. Remove the two screws (2) and the two lockwashers (1) from the top of the tape unit.
5. Remove the solenoid (3) and the plunger spring (4).



5.32.2 Replacement

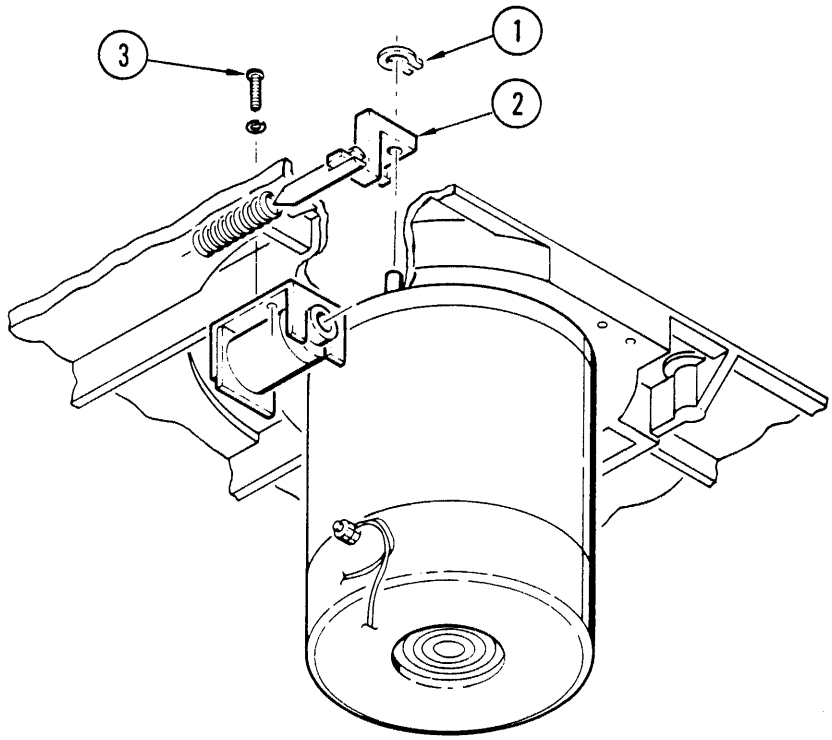
Reverse the removal steps for the hub lock solenoid.

Note: Make sure that the pawl pivots freely. If not, loosen screws (2) and adjust the solenoid so that the pawl pivots freely.

5.33 Hub Lock Pawl

5.33.1 Removal

1. Switch off ac power.
2. Place the unit in the service position. (See section 5.2.)
3. Remove the supply hub. (See section 5.17.)
4. Remove the clip 1 from the pawl shaft.
5. Remove the hub lock solenoid. (See section 5.32.)
6. Lift the pawl assy. (2) up and out of the tape unit housing.



5.33.2 Replacement

1. Reverse the removal procedures for the hub lock pawl.

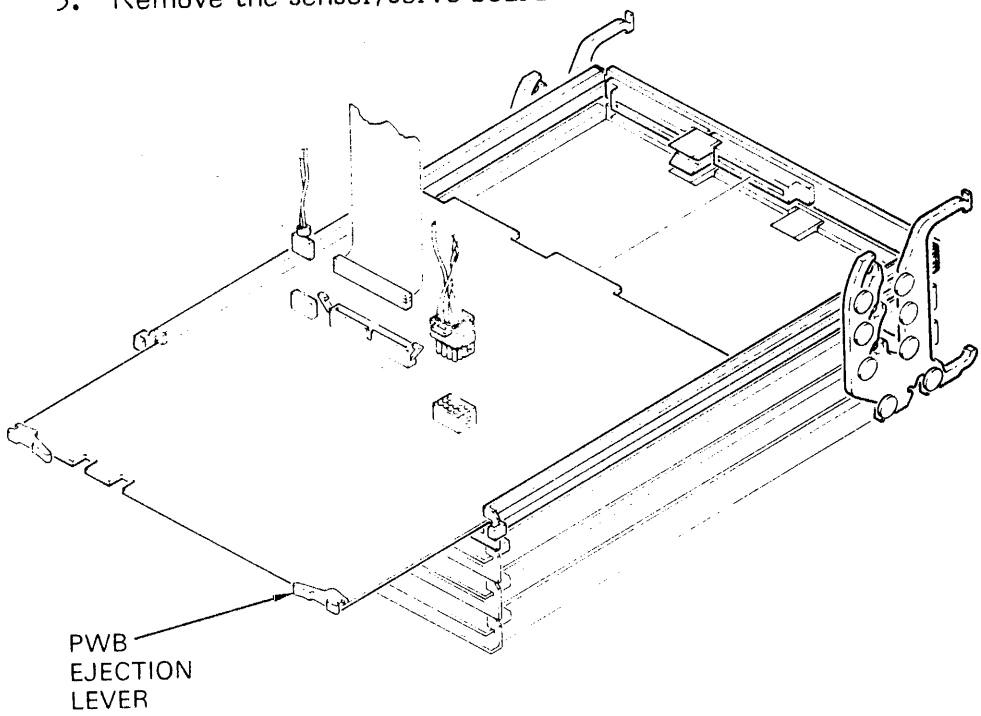
   Note: Make sure the pawl pivots freely. If not, loosen the two screws (3) and adjust the solenoid so that the pawl pivots freely.

2. Perform the supply hub adjustment. (See section 5.17.3.)

5.34 Sensor/Servo Board

5.34.1 Removal

1. Switch off ac power.
2. Place the unit in the service position. (See section 5.2.)
3. Remove all cables from the sensor/servo board.
4. Grasp the PWB ejection levers at the front corner of the board and pull outward to release the board from the edge connections at the rear of the PWB rack.
5. Remove the sensor/servo board from the PWB rack.



5.34.2 Replacement

Reverse the removal procedure of the sensor/servo board.

Note: Make sure that all connectors are properly replaced before turning on ac power.

5.34.3 +5Vdc Adjustment (961334-003 board only)

1. Switch on ac power.
2. Remove tape and place the unit in the service position. (See section 5.2.)
3. Connect a DVM to test point 42 (+5Vdc reference) and test point 44 (ground). Adjust R85 on the sensor/servo board for +5.1Vdc.

5.34.4 Servo Offset Adjustment

1. Switch ac power on.

2. Remove tape from unit if installed.

   CAUTION: Use a battery operated or ac ground isolated DVM when checking the servo offset voltage. Damage to the servo circuits will result if a DVM with common ac ground is used.

   NOTE: Steps 3 and 4 cannot be done if -009 or higher firmware is installed.

3. On the Sensor/Servo Board, connect the DVM leads to J-1 pins 7 and 10 for PWB Set A, the right-hand side of C194 and C197 for PWB Set B, or TP-37 and TP-38 for PWB Set C to check the supply motor offset voltage. The voltage should be 0.0 ± 0.035 volts. Use 2-volt scale.

4. Connect the DVM leads to J-1 pin 8 and pin 11 for PWB Set A, the right-hand side of C195 and C196 for PWB Set B, or TP-35 and TP-36 for PWB Set C to check the take-up motor offset voltage. The voltage should be 0.0, ± 0.035V.

5. If adjustment of either voltage is required, proceed as follows:

   CAUTION: Follow these instructions to the letter. Failure to do so could result in your GCR being inoperable.

   Note: Do not enter test 515 to check offset values without completing the entire adjustment procedure since all previously stored values are cleared upon entry.

a. Enter diagnostic test code 455155 using the front panel switch/indicators.

b. Enter password 54524 using the front panel switch/indicators.

c. The O supply message will be momentarily displayed, then the SDAC +000 (supply motor DAC offset value) message will appear.

d. Connect the DVM leads to J-1 pin 7 and pin 10 for PWB Set A, the right-hand side of C194 and C197 for PWB Set B, or TP-37 and TP-38 for PWB Set C.

e. Press the Load switch to increase, or the Unload switch to decrease the voltage until it is as close to zero as possible. The voltage must be within the ±0.035V range.

f. Press the Write Enable/Test switch to enable take up servo offset adjustment. The messages DONE ... 0 TAKE UP ... TDAC +000 should be displayed.

g. Connect the DVM leads to J-1 pin 8 and pin 11 for PWB Set A, the right-hand side of C195 and C196 for PWB Set B, or TP-35 and TP-36 for PWB Set C.

h. Repeat step e.

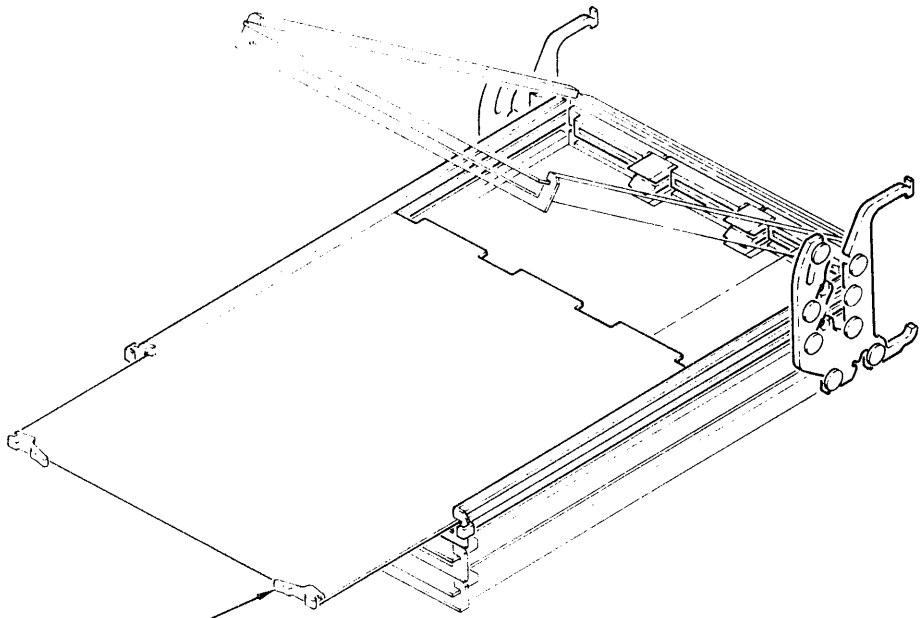
i. Press the Write Enable/Test switch again to return the unit to normal operating status and return unit to field mode by performing Test 542.

j. Switch ac power off to store the new offset values in NOVRAM. The new adjustment can be checked by repeating steps 3 and 4 of this procedure.

5.35 CPU/MMU Board

5.35.1 REMOVAL

1. Switch off ac power.
2. Place the unit in the service position.
3. Lift sensor/servo PWB and frame assembly and push toward rear of chassis to lock in the raised position.
4. Grasp the PWB ejection levers at the front corners of the CPU/MMU board and pull outward to release the board from the edge connectors at the rear of the PWB rack.
5. Remove the CPU/MMU board from the PWB rack.



CAUTION: Caution should be used when removing the NOVRAM because it is a static sensitive device. Use proper handling procedures.

Note: By removing the NOVRAM chip (U25J) and reinstalling it into the new CPU/MMU board, the Servo Offset adjustment and NOVRAM settings do not need to be performed.

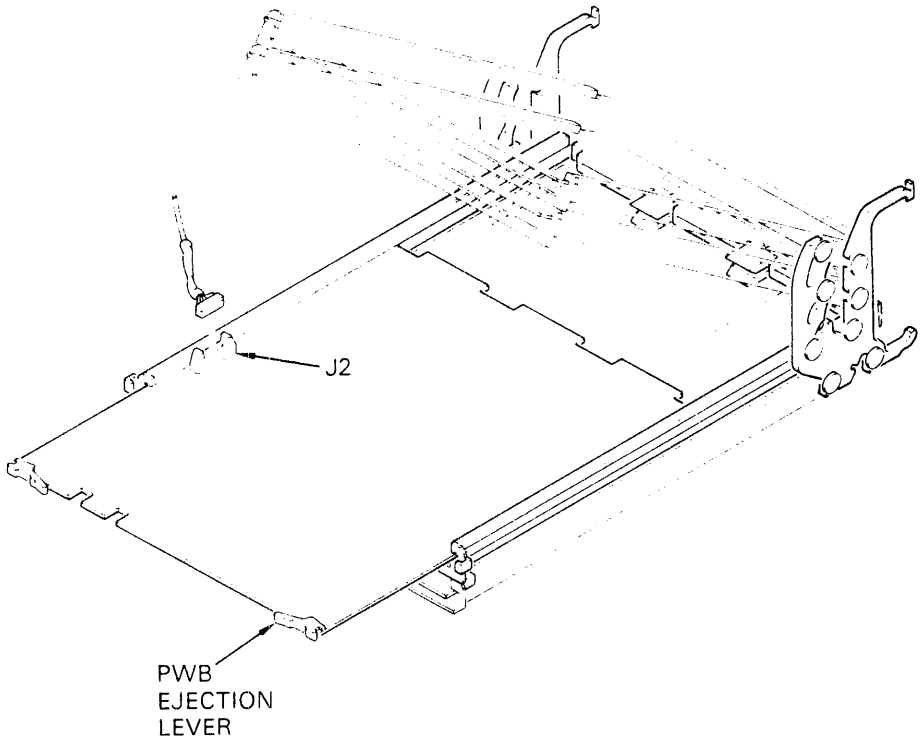
5.35.2 Replacement

1. Reverse the removal procedure for the CPU/MMU board.
2. Perform Servo Offset adjustment procedure (see section 5.34.4.), unless you keep NOVRAM from removed CPU PWB.

5.36 Data Board

5.36.1 Removal

1. Switch off ac power.
2. Place unit in the service position. (See section 5.2.)
3. Lift the sensor/servo PWB and frame assembly and push toward rear of chassis to lock in the raised position.
4. Repeat the previous step with the CPU/MMU board.
5. Remove the read head assembly cable from J2 on the data board.
6. Grasp the PWB ejection levers at the front corners of the data board and pull outward to release the board from the edge connectors at the rear of the PWB rack.
7. Remove the data board from the PWB rack.



5.36.2 Replacement

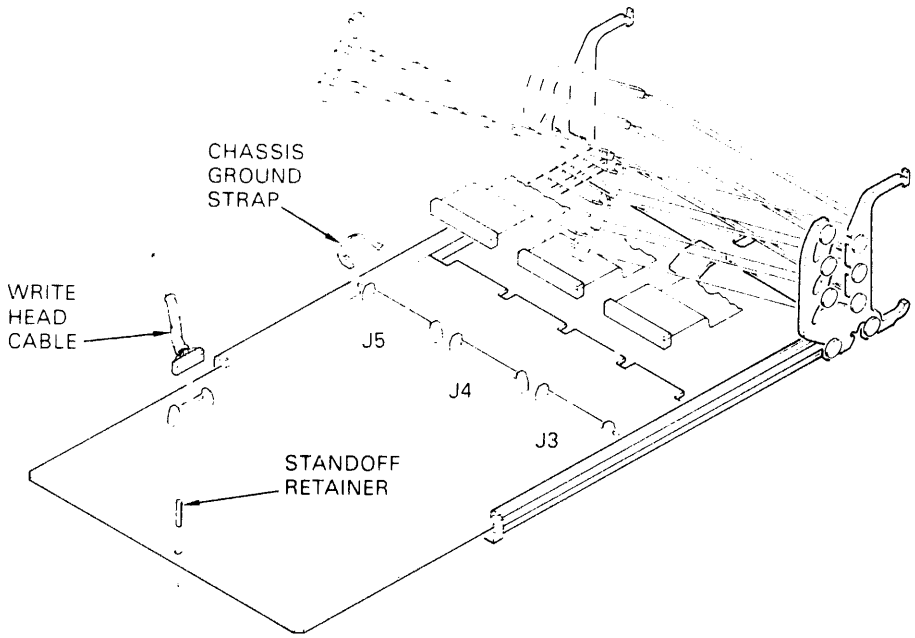
Reverse the removal procedure for the data board.

1. Run Test 513 (see section 4.4.17.)

5.37 CIF Write

5.37.1 Removal

1. Switch off ac power.
2. Place unit in the service position. (See section 5.2.)
3. Lift the sensor/servo PWB and frame assembly and push toward rear of chassis to lock in the raised position.
4. Repeat the previous step with the CPU/MMU and data boards.
5. Remove the connectors from J3, J4, and J5 at the rear of the CIF/write board.
6. Remove the chassis ground straps from the back of the CIF/write board.
7. Remove the write head cable from the CIF/write board.
8. Unscrew the standoff retainer at the center front edge of the board and slide the CIF/write board out of the PWB rack.

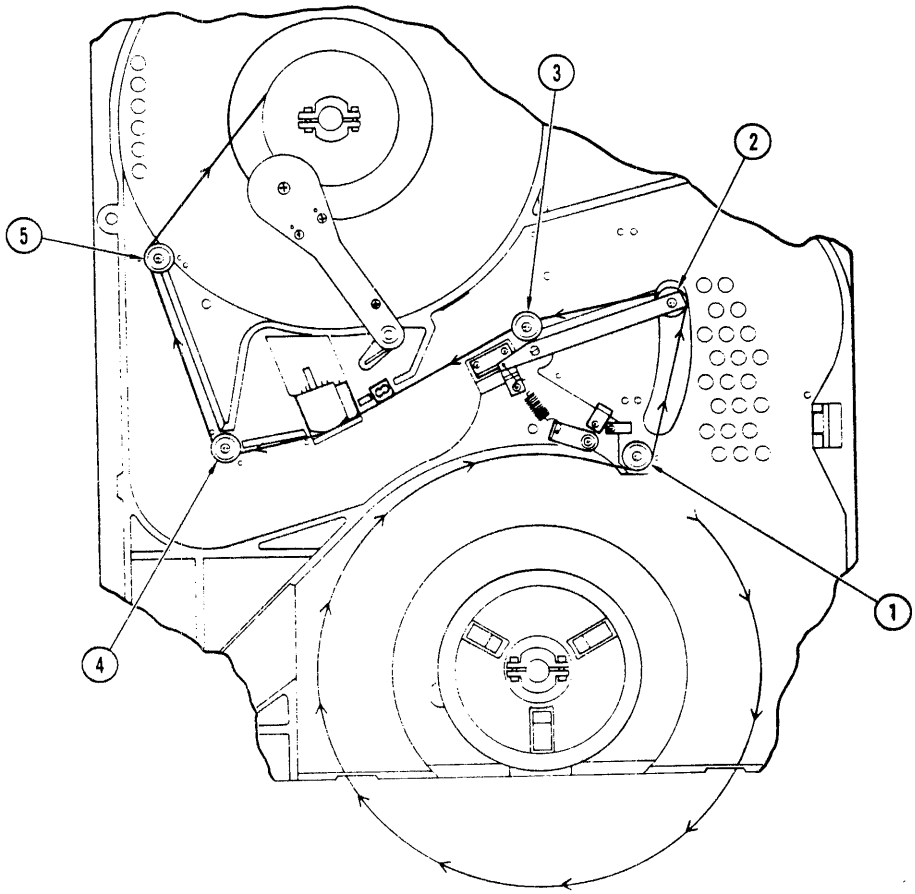


5.37.2 Replacement

Reverse the removal procedure for the CIF/write board.

1. Run Test 513 (see section 4.4.17.)

5.38 Tape Tracking Procedure



1. Switch on ac power.

2. Insert and load a new tape. Ensure that the supply reel is properly seated on the supply hub.

   Note: A used tape may have damaged or weak edges which could adversely affect its tape-path tracking characteristics.

3. Activate test 233 to disable door and top cover lock. (See section 4.4)

4. Open the top cover and front panel door.

5. Press the Density Select switch to select the 1600 bpi mode.

6. Activate test 212 to write data in the forward direction. (See section 4.1.4.)

7. Observe the tape as it unwinds from the supply tape reel. If necessary, adjust the supply hub height (5.17.3) to eliminate any interference between the tape and supply reel flanges.

8. If tape is not centered on guide, turn power switch to OFF, and remove guide (2) from compliance arm. (See section 5.27.1.)

9. Add or reduce thickness of shims as required to compensate for off-center position and reinstall guide on compliance arm. Repeat as necessary to obtain correct centering of tape on guide (2).

10. Run tape forward and check for edge curl on guide (3). If curl is present on lower washer, turn power switch to OFF and increase shims under roller guide (1). If curl is present on upper washer of guides (3), decrease shim thickness under roller guide (1). Resume forward tape motion and recheck tape position. Repeat this step until tape tracks smoothly around guide (3).

11. Depress lower washer on guide (3) and check for optimum movement of tape away from top washer of 0.005 inch. If necessary, reshim guide (2) to maintain proper tape centering.

12. Run tape in forward direction and check for edge curl on guide (4). If curl is present, turn transport power to OFF and add or remove shims on guide (5). Normally, improper alignment of guides (1) and (2) will show up as tracking problem on guide (3).

    Note: Curl on guide (4) can be caused by improper alignment on any other guide in the tape path. If tracking has been verified on guide (3), tape curl on guide (4) is probably caused by misalignment of guides (1) and (2) will show up as tracking problems on guide (3).

13. Run tape in reverse direction (test 212) and check for tape curl on all edges.

14. Depress lower washer on guides (3), (4), and (5) and check for optimum tape movement, away from top washer, of 0.005 inch.

15. Add or delete shims on guides (1), (2) and (5) as required to eliminate edge curl on all rollers and reverify forward tape path alignment by checking for maximum tape shift on guide (2) of ±0.015 inch.

16. Check head azimuth and read skew. (See section 5.18.3.)

    Select switch to select the 1600 bpi mode.

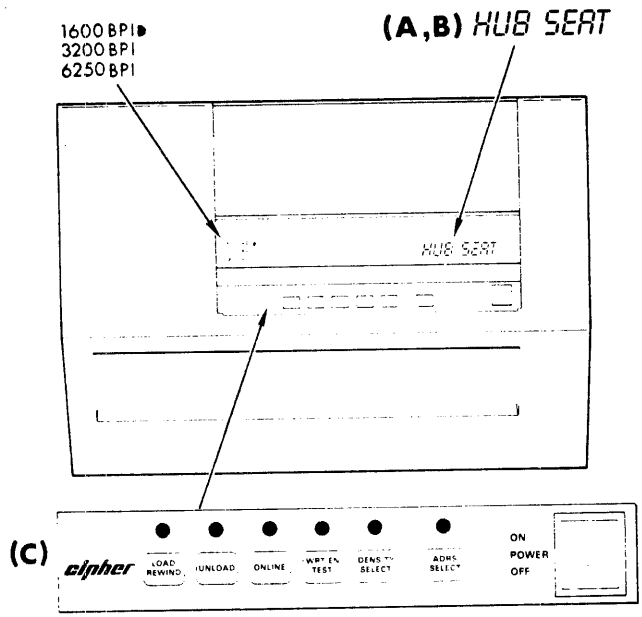
17. Activate test 212 to write data in the forward direction. (See section 4.1.4.)

18. Observe the tape as it unwinds from the supply tape reel. If necessary, adjust the supply hub height (5.17.3) to eliminate any interference between the tape and supply reel flanges.

Chapter 6. Operation

6.1 Operator Display Panel

The operator display panel contains an eight-character alphanumeric display (A) that provides information to the operator during normal operation and diagnostic testing. Error messages (B) give more specific information about problems. Indicators (C) alert the operator to any problems in the loading or unloading operation.



6.1.1 Switches/Indicators

Load-Rewind Switch/Indicator

Press the Load/Rewind switch to load or rewind the tape. The indicator flashes as the tape loads and remains lit when loading is complete.

Unload Switch/Indicator

Press the Unload switch to remove tape from the tape path. The indicator flashes as the tape rewinds and remains lit when the tape path is clear.

On-line Switch/Indicator

Press the On-line switch to place the tape drive under host system control. The On-line indicator then lights. Press the On-line switch a second time to remove the tape drive from system control. The On-

line indicator then shuts off. While on-line, the tape drive does not respond to other front panel switches.

Write Enable-Test Switch/Indicator

When this indicator is lit, a write-enable ring is installed on the tape reel and information can be written to or erased from the tape.

If the unit is in the off-line mode and the Test switch is pressed, the indicator flashes to signal the operator that the unit is in the diagnostic mode. Refer to section 4.1 for a description of the available tests. When the Test switch is pressed again, the unit exits the diagnostic mode.

Address Select Switch

Press the Address Select switch to determine the tape drive address for each M990 when more than one is connected to the same system. To change the address, continue to press the Address Select switch and press the On-line switch to reset the address to 0. Press the On-line switch again to increment the address until the desired number is reached. The address selected is displayed on the alphanumeric display as UNIT X, where X is 0 through 7. Each tape drive connected to the same system must have a unique address.

Density Select Switch/Indicator

Press the Density Select switch to select the operating density. The available densities are PE 1600 bpi, PE 3200 bpi, and GCR 6250 bpi. The selected density is indicated by the density LEDs. This switch can only be used when the tape is at load point.

Density LED Lights

1600 bpi
3200 bpi
6250 bpi

Found Density

This denotes the density that is currently recorded on the tape. Upon completion of the load sequence, the alpha display will reflect the found density with the message "ID XXXX." "NO ID" will be displayed if a blank tape or invalid format is detected. This found density message continuously displays until execution of an interface command or a front panel diagnostic. The message can be restored by cycling the On-Line Switch to the on-line state when the tape unit is idle.

Commanded Density

This denotes the density that has been selected for recording. The density LED lights on the left side of the display panel denote the last commanded density (1600 bpi, 3200 bpi, or 6250 bpi). Density is commanded by one of four means.

1. Power-up default: Selected by the internal processor when power is applied to the tape drive. The desired power-up density is stored as NOVRAM option 10.

2. Front Panel: Selected by the operator using the density select switch when the drive is unloaded or with tape loaded, offline, and positioned at the beginning of tape.

3. Interface: Selected remotely by the host system using the five command lines (IREV, IWRT, IWFM, IEDIT, IERASE). This method is system dependent and also requires NOVRAM option 19 enabled.

4. Internal: The tape drive internally commands the recording density under one condition. A read operation from beginning of tape, followed immediately by a write operation, switches to commanded density (if necessary) to match the density that was read. If a rewind precedes the first write operation, the commanded density is not switched. This feature ensures that an operator or system error does not create a mixed density tape.

Operating Density

This denotes the density that is read from or written to the tape. During a read operation from beginning of tape, if the commanded density does not agree with the found density, the density LED lights will automatically switch to reflect the found density. Using this approach, the LED lights always indicate the current operating density of the tape drive when active. This allows the operator to identify procedural problems that could result in tape generation in an unspecified density.

6.1.2 Alphanumeric Display Panel

When the drive fails to operate properly, the indicators on the front panel flash patterns to alert the operator of an error condition. Error messages are also displayed by the alphanumeric display and describe the condition that must be corrected to allow normal operation. To reset the error,

press the Load/Rewind or Unload switch. Press the Load/Rewind switch again to restart the load sequence.

6.1.3 Error Conditions

Three types of error conditions can be displayed.

1. Soft errors
2. Medium errors
3. Hard errors

Soft errors are usually caused by operator error or a slightly damaged tape that prevents completion of the autoload sequence.

Medium and hard error messages are described in Section 6.4. The following alphanumeric display messages indicate soft error conditions that can usually be corrected by the operator.

HUB SEAT

If this message is displayed, check that the tape reel is positioned properly on the supply hub. After correcting the reel alignment, press the Load/Rewind or Unload switches to reset the error.

LOAD FAILURE

If this message is displayed, the unit failed to load tape. Inspect the tape leader for damage. Refer to section 6.2.1.

Once the tape leader has been paired, press the Load/Rewind or Unload switches to reset the error. If the unit still does not load tape properly, refer to section 6.2.4.

TAPE STUCK

If this message is displayed, the unit failed to unwind tape from the supply reel into the tape path. Check the tape leader to make sure that it is properly crimped. Refer to section 6.2.1. Press the Load/Rewind, Unload, or Test switches to reset the error.

NO DOOR LOCK

If this message is displayed, you tried to load the tape reel while leaving the tape access door or the top cover open. After closing the tape access door and top cover, press the Load/Rewind or Unload switches to reset the error.

REEL UPSIDE DOWN

If this message is displayed, the tape reel was inserted upside down. Insert the tape with the write-enable ring down. Press the Load/Rewind or Unload switches to reset the error.

NO BOT

If this message is displayed, the unit could not locate the load-point marker within the first 35 feet of tape. Make sure that the marker is at least 16 feet from the leading end of the tape. Press the Load/Rewind or Unload switches to reset the error.

NOT ENOUGH TAPE ON TAKE-UP

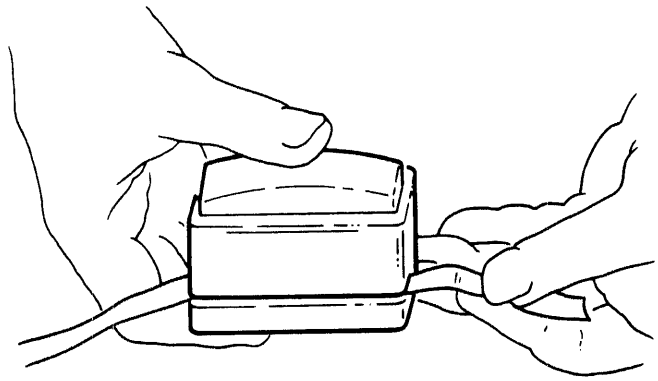
If this message is displayed, the unit does not have any tape in path while attempting to do a manual load.

6.2 Operation

6.2.1 Preparing Magnetic Tape

Prepare the leading end of the magnetic tape using the tape leader tool (Part No. 209990-500) shown below. This tool shapes the tape so that the drive can load tape automatically.

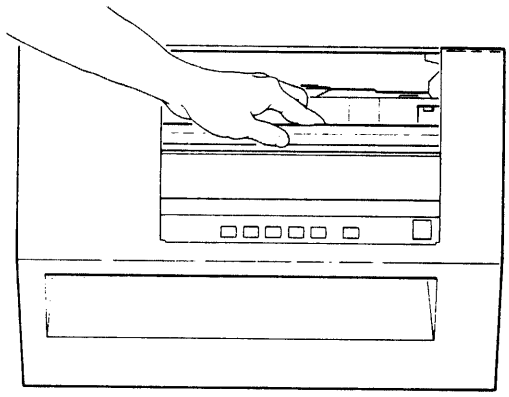
Place the tape in the slot and squeeze the tool as shown.



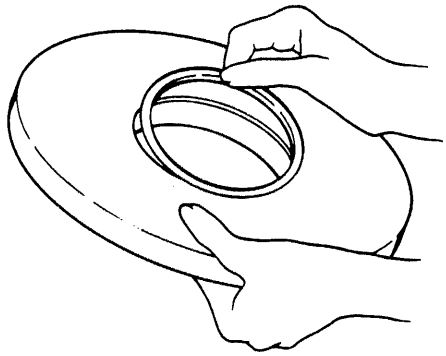
6.2.2 Loading Tape

1. If the power is off, switch it on.

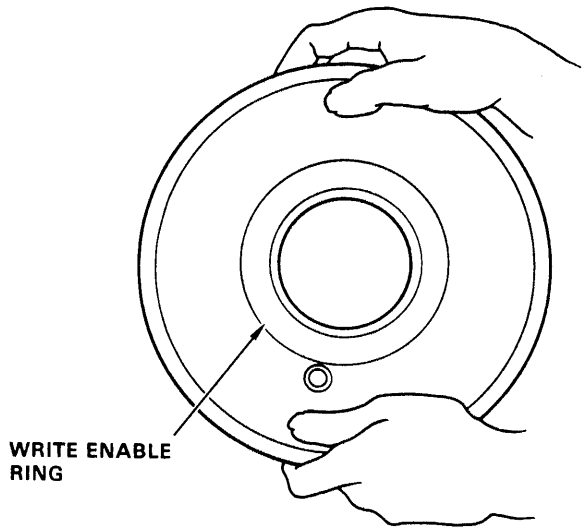
2. Open the tape access door by gently pressing down on the top (center) of the door.



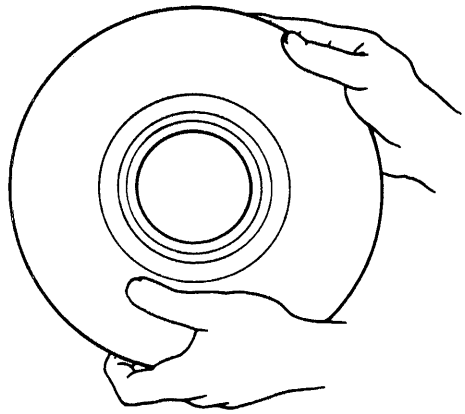
3. If you intend to write data on the tape, place a write-enable ring in the slot on the back of the tape reel.



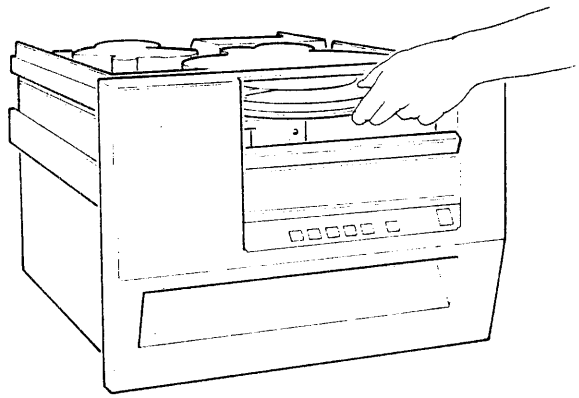
4. Make sure that the tape is wound completely onto the reel.



5. Hold the tape reel so that the write-enable ring is down.



6. Insert the tape reel so that it lies flat inside the front opening. The reel should lie evenly on the hub.



7. Close the tape access door. The drive does not load the tape if this door is open.

8. Press the Load/Rewind switch. The load indicator flashes while the tape loads and remains lit when loading is complete. During the auto-load sequence, the alphanumeric display will present the word LOADING. When the sequence is complete, the Density is displayed for 15 seconds.

   CAUTION: The top cover and front panel door are locked while the tape is loading and during operation.

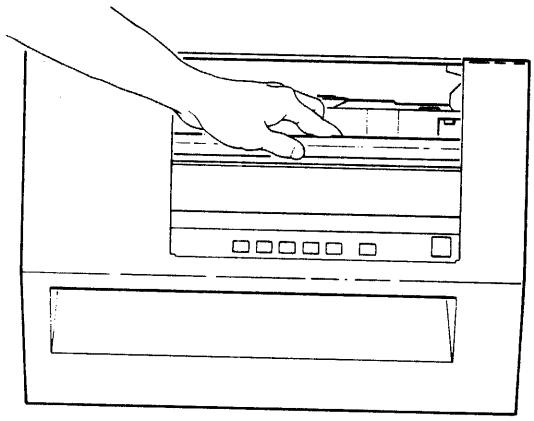
6.2.3 Unloading Tape

1. Make sure that the tape access door and the top cover are closed.

2. Press the Unload switch.

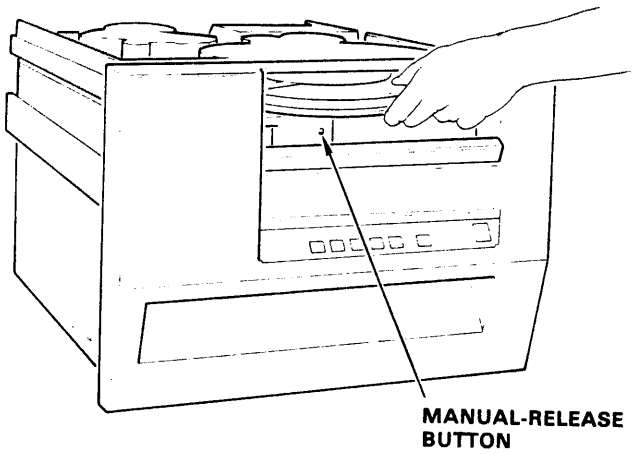
CAUTION: The top cover and tape access door are locked while the tape is unloading.

3. Open the tape access door when the Unload indicator remains lit continuously.



Note: If an indicator other than the Unload indicator flashes at this time, refer to section 6.1.2.

4. Remove the tape reel.



If the reel is locked to the hub, press and hold the manual release button, located behind the front panel door on bottom left-hand side of tape reel opening, while rotating the tape reel counterclockwise.

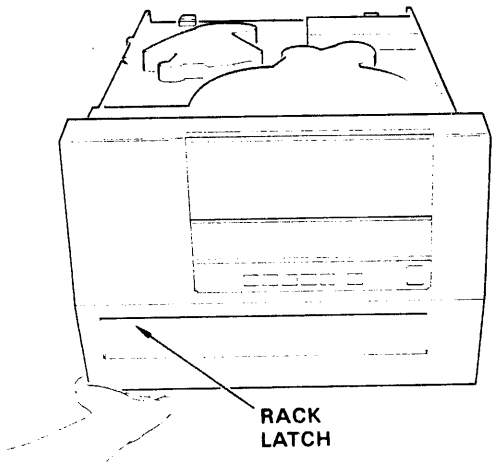
5. Close the tape access door.

6.2.4 Loading Tape Manually

Note: Do not load tape manually if any of the indicators are flashing. Refer to section 6.1.2 of the manual if any of the indicators are flashing.

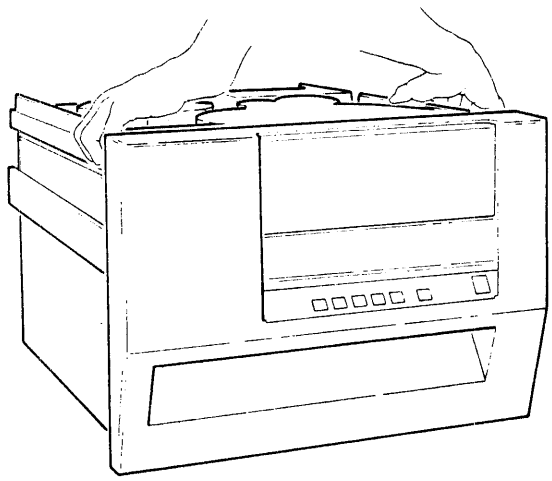
1. If the power is on, press the power switch to remove power from the drive.

2. Release the rack latch just inside the lower left side at the front panel. Pull from behind the lower left-hand side of the front panel and slide the tape drive out of the rack.

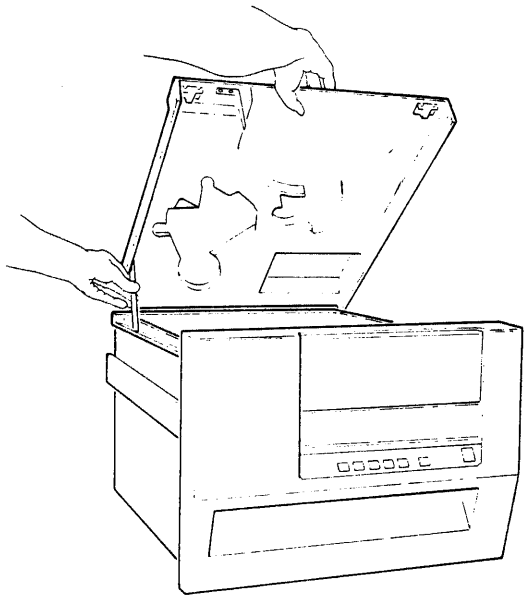


3. Slide the tape drive forward until it is fully extended from the rack.

4. Grasp the lower edges of the top cover and lift.



5. While holding the top cover in the raised position, place retainer bar in its slot next to the tape path.



6. If you intend to write data on the tape, place a write-enable ring on the tape reel.

7. Hold the tape reel so that the write-enable ring is down.

8. Open the tape access door and insert the tape reel so that it lies flat inside the front opening.

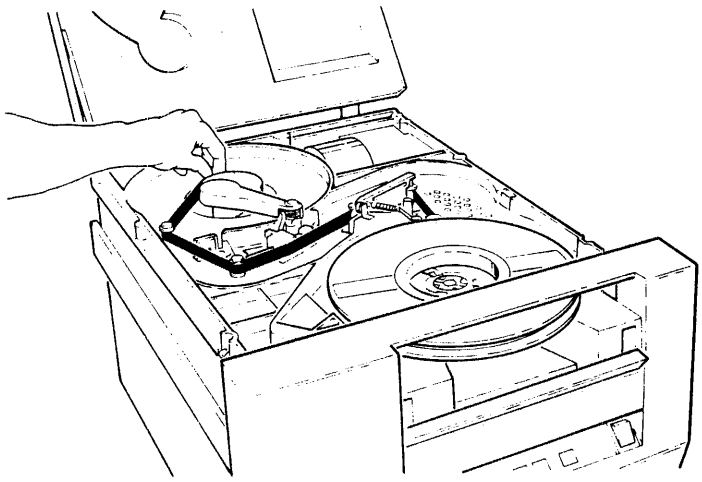
9. Depress and hold the manual unlock button, located behind the front-panel door on the bottom left side of the tape reel opening, and simultaneously rotate the supply hub clockwise until the supply hub is locked in place.

10. Press the power switch to apply power to the drive.

11. Pull the tape around the first two roller guides.

12. Pull the tape around the third roller guide and across the read/write head.

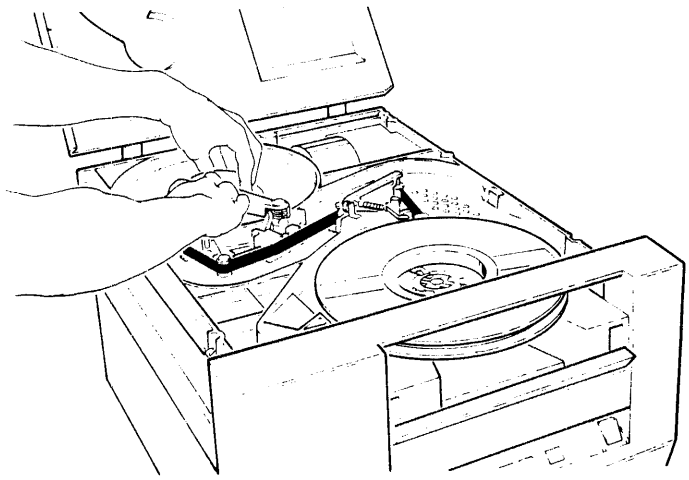
13. Pull the tape around the next two roller guides.



14. Pull the tachometer away from the take-up hub.

    CAUTION: Do not release the tachometer while holding it away from the take-up hub. It could be damaged if it strikes sharply against the hub.

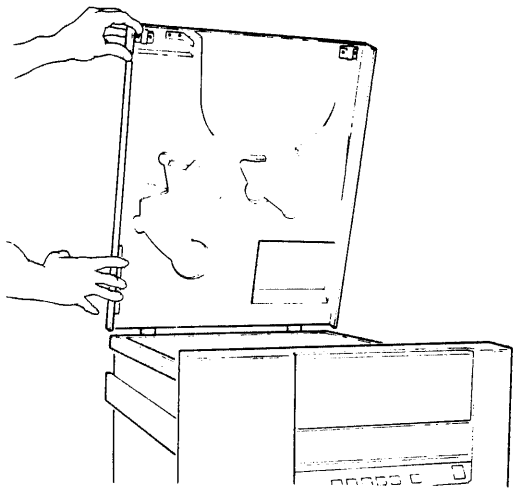
15. While holding the tachometer away from the hub, press the end of the tape against the hub and turn the hub clockwise until the end of the tape is held by the next layer of tape. Turn the hub six revolutions clockwise.



16. Gently place the tachometer against the hub.

17. Lift the top cover until the retainer bar is clear of its slot.

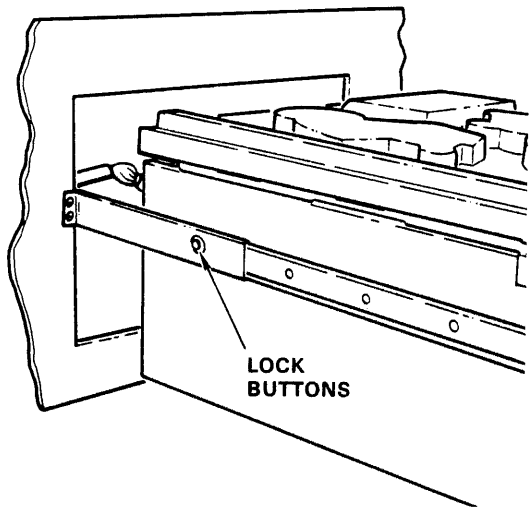
18. While holding the top cover in the raised position, push the retainer bar back and up so that it is flat against the underside of the top cover.



19. Close the top cover.

20. Close the tape access door.

21. Press and hold the lock buttons on both slides and slide the tape drive carefully into the rack.



22. While pressing the Density Select switch, press the Load/Rewind switch.

    The Load indicator flashes while the tape loads and remains lit when loading is complete.

    If the ARM FAULT DURING LOAD message is displayed, you did not wrap enough tape onto the take-up hub.

After threading the tape securely onto the take-up hub, press the Load/Rewind, Unload, or Test switches to reset the error.

WARNING: If either the top cover or front tape loading door are forced open, moving mechanical parts may cause injury.

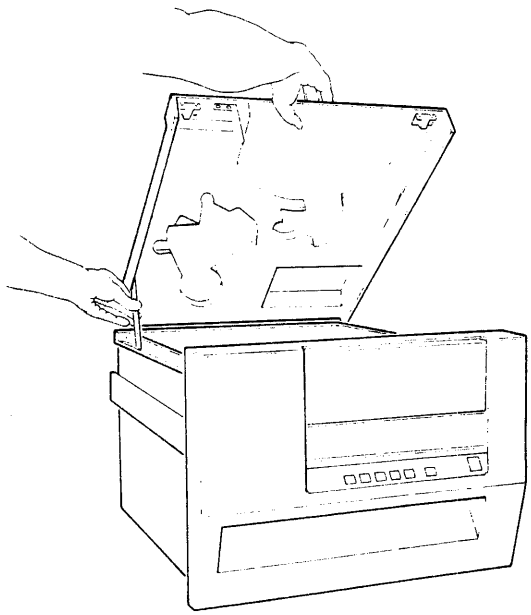
ACHTUNG: Wenn der Klappdeckel oder die vordere Bandladeture mit Gewalt geoffnet werden, besteht Gefahr der Verletzung durch die beweglichen Teile.

6.3 Operator Maintenance

6.3.1 Cleaning the Tape Drive

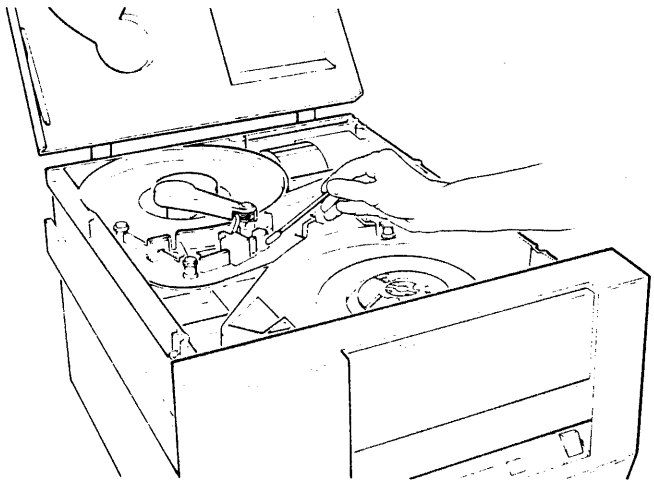
Use the following procedure after every eight hours of operation.

1. If the power is on, press the power switch to remove power from the tape drive.
2. Pull from behind the lower left-hand side of the front panel and slide the drive out of the rack.
3. Slide the drive forward until it is fully extended from the rack.
4. Grasp the lower edges of the top cover and lift.
5. While holding the top cover in the raised position, place the retainer bar in its slot next to the tape path.



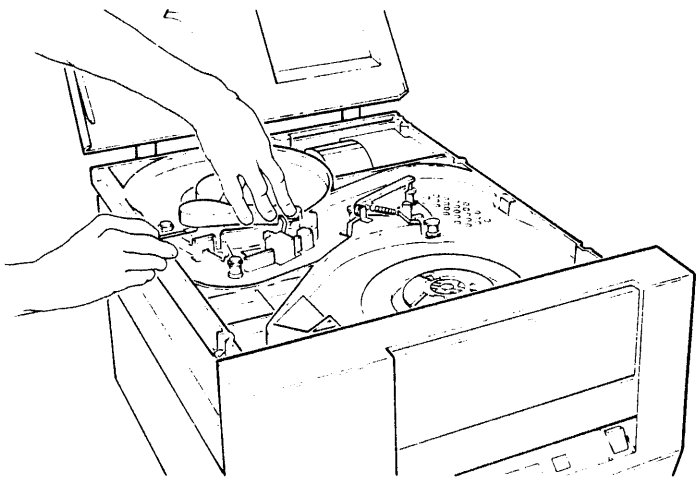
6. To clean the tape path, use the Cipher cleaning kit (Part 960855-001). Moisten a swab applicator with cleaner and carefully swab the surface of the read/write head and tape cleaner.

CAUTION: Rough or abrasive materials can scratch sensitive surfaces of the head resulting in permanent damage. Other cleaners, such as alcohol based types, can cause read/write errors or load failures. USE ONLY FREON TF (Trichlorotrifluoroethane).

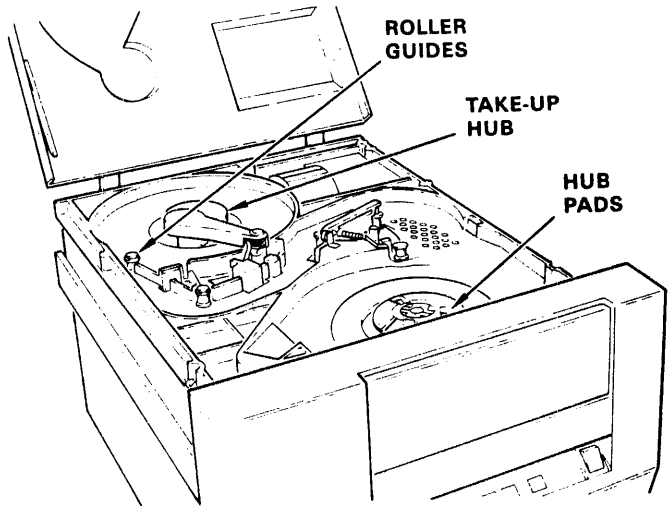


7. Clean the tachometer roller using the method described in step 6.

CAUTION: If the cleaning solvent seeps into the tachometer housing, it could damage the tachometer. Do not release the tachometer while holding it away from the take-up hub. It can be damaged if it strikes sharply against the hub.



8. Use the felt pads provided in the tape cleaning kit to clean the hub pads, takeup hub, and roller guides.



9. Lift the top cover until the retainer bar is clear of its slot.

10. While holding the top cover in the raised position, push the retainer bar back and up so that it is flat against the underside of the top cover.

11. Close the top cover.

12. Press and hold the lock buttons on both slides and slide the tape drive back into the rack.

6.3.2 Cleaning the Sensors

The EOT, BOT, and Tape in Path sensors should be cleaned every 40 hours using a dry, clean, cotton swab. Gently wipe any dust off the face of each LED lense, both the transmitter and receiver.

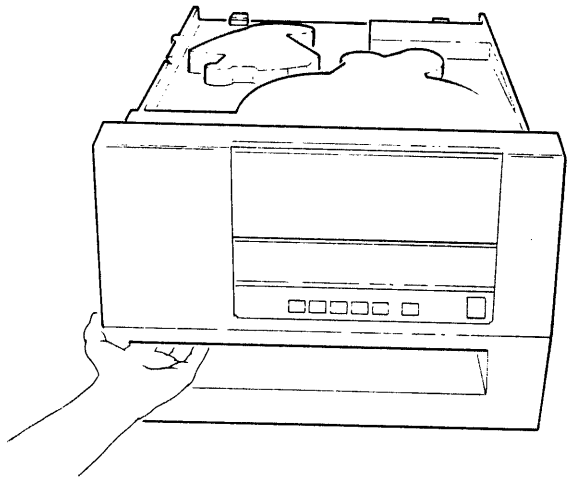
CAUTION: Wipe as gently as possible; the alignment of the LEDs is critical. Do not use any solvents to clean the LEDs; use only a dry swab.

6.3.3 Cleaning the Air Filter

Use the following procedure every three months of operation.

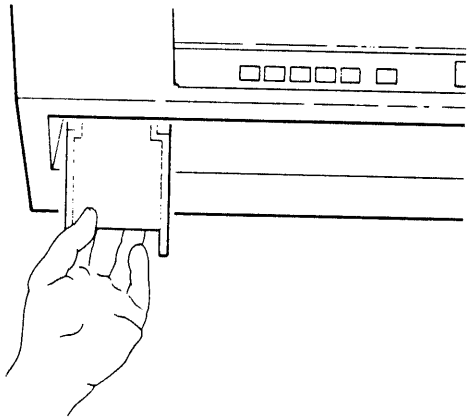
1. If the power is on, press the power switch to remove power from the tape drive.

2. The filter is located just behind the rack latch at the lower left-side of the front panel. Feel for the filter tab and gently remove the filter.



3. Shake the filter clean.

4. Replace the filter.



CAUTION: This unit should be serviced by qualified maintenance personnel only.

ACHTUNG: Dieses Gerat darf nur von Fachpersonal gewartet werden.

6.4 Error Conditions

When the drive fails to operate properly, the indicators on the front panel of the unit flash patterns to alert the operator of an error condition. Error messages are also displayed by the alphanumeric display and describe the condition that must be corrected to allow normal operation. To reset soft or medium errors, press the flashing indicator switches on the front panel.

Three types of error conditions can be displayed:

1. Soft errors
2. Medium errors
3. Hard errors

Soft error messages are described in Section 6.1.3.

6.4.1 **Medium Errors**

Medium errors are usually caused by interface command or format violations. Medium errors are reported to the host system via the interface and usually require a restart command from the host. An error message is displayed on the alphanumeric display to aid in identifying the problem. The indicated problem must be corrected in order to continue operation. To reset the medium error, press the Load/Rewind and Unload indicator/switches on the front panel. Press the Load/Rewind switch again to restart the load sequence.

READ ONLY TAPE

If the READ ONLY TAPE message is displayed, the unit received a write command with a write protected reel of tape loaded on the transport. Install the write protect ring or load the proper tape on the unit and press the Load/Rewind or Unload switches to reset the error.

ILLEGAL COMMAND

If the ILLEGAL COMMAND message is displayed on the alphanumeric display, an illegal or undefined command was received by the unit. Press the Load/Rewind or Unload switches to reset the error. Receipt of a valid command will also reset the error.

WRITE RETRY EXCEEDED

If the WRITE RETRY EXCEEDED message is displayed, the unit exceeded the allowable number of write retries. Press the Load/Rewind or Unload switches to reset the error.

PAST EOT

If the PAST EOT message is displayed, tape travel beyond the EOT marker exceeded 18 feet. Once the controller error has been corrected, press the Load/Rewind or Unload switches to reset the error.

BLOCK SIZE ERROR

If the BLOCK SIZE ERROR message is displayed, the data block size exceeded the NOVRAM 64K value. Press the Load/Rewind or Unload switches to reset the error.

6.4.2 Hard Errors

Hard errors are caused by severely damaged tape, or a serious deviation from the normal operating routine of the M990. Since these malfunctions could cause damage to the tape, the transport drive servos are disabled and tape tension is removed in a controlled manner. Hard errors are reported to the host via the interface and an error message is displayed on the alphanumeric display. To reset the hard error, switch the unit power off and on, reload the tape, and issue a restart from the host system. The hard error messages are described below.

ARM FAULT DURING LOAD

If the ARM FAULT DURING LOAD message is displayed, the tension arm swing exceeded the range of normal operation during the auto-load sequence. After correcting the problem, switch the unit power off then on and issue a restart from the host system.

ARM FAULT DURING RUN

If the ARM FAULT DURING RUN message is displayed, the tension arm exceeded its free travel limits during any operation except those functions of the load and unload sequence when tape tension is not under arm control. After correcting the problem, switch the unit power off then on and issue a restart from the host system.

SPEED ERROR

If the SPEED ERROR message is displayed, tape speed variations in excess of the ANSI maximum of ± 10% deviation from normal operating speed occurred.

TACH READ ERROR

If the TACH READ ERROR is displayed, a stable tachometer count could not be made. Since a record may have been erased while repositioning during a write operation, the tape should be rewound to BOT and the write operation repeated. A tape path that needs cleaning can cause this error.

6.5 Read Extended Status

Extended drive status is available to the host as four independently accessible records containing up to 16 bytes each. Extended status can only be read when the drive is ON-LINE. To access one of the 16-byte records, the host must first issue the Read Extended Status command, which is "00010" (EDIT). The command is accompanied by the usual IGO pulse. This command places the drive in the Extended Status Mode whereby the drive will wait for a second "ACCESS" command, accompanied by IGO. This second command, or Block Access Code, selects the appropriate 16-byte block to be transferred to the host as a normal read operation on the IR0-IR7 data lines, with read strobes. Should more than one record be desired, the Read Extended Status command/IGO pulse may be reissued and the appropriate block access code asserted on the five command lines, accompanied by the IGO pulse. The new status block is then strobed to the interface.

The Error History Block may be reset to zero if the block access code is "10011." A 16-byte block is still transferred, but the bytes have no meaning. A description of the information provided by the Read Extended Status command is given in Table 6-1.

Byte No.	Bit*	Contents
0		**Tape Status Byte #1**
	0	IIDENT
	1	IHER
	2	ICER
	3	IFMK
	4	IRDY
	5	IONL
	6	IRWD
	7	IFPT
1		**Tape Status Byte #2**
	0	ILDP
	1	IEOT
	2	Read Retries Exceeded
	3	Write Parity Error At Interface
	4	Write Hard Error
	5	Illegal Command
	6	
	7	
2		**Error Classification**
	0 1 2	Cache Auto-Expanded Block Size: 000 = 9K, 001 = 16K, 010 = 32K, 011 = 64K, 100 = Reserved
	3	Read From Tape To Cache Overrun
	4	Write From Host To Cache Overrun
	5	25 feet of blank tape detected
	6	
	7	
3		**Track In Error**
	0	Track 7 In Error
	1	Track 6 In Error
	2	Track 5 In Error
	3	Track 4 In Error
	4	Track 3 In Error
	5	Track 2 In Error
	6	Track 1 In Error
	7	Track 0 In Error

* Bit 0 = LSB; Bit 7 = MSB, unless otherwise specified. (1 = True/Yes, 2 = False/No)

Current Status Block (Access Code = 00000)

Table 6-1. Read Extended Status

Byte No.	Bit*	Contents
4	0	**Track P In Error**
	1 Thru 7	LSB Read/Write Retry Count On Current Host Record MSB
5	0 Thru 4	**LSB** Front Panel Error Code MSB
6		**Density Code**
	0	Density Found/Operating Density (bpi):
	1	000 = Reserved 001 = 1600
	2	010 = 3200 011 = 6250
	3	Density Requested:
	4	000 = Reserved 001 = 1600
	5	010 = 3200 011 = 6250
	6	Read Density Conflict
	7	Write Density Conflict
7		**Unfixed Block Count** (includes file marks)
	0 Thru 7	Block Detectable Structures Remaining In Cache
		Fixed Block Count From BOT (includes file marks)
8		**Low Order Byte**
9		**Mid Order Byte**
10		**High Order Byte**
		Sequence Number Of Record In Hard Error
11		**Low Order Byte**
12		**Mid Order Byte**
13		**High Order Byte**

Current Status Block (Access Code = 00000)

Table 6-1. Read Extended Status (Continued)

Byte No.	Bit*	Contents
0		**Capability**
	0	Reserved
	1	1600 bpi — 0 = Does not have capability
	2	3200 bpi — 1 = Does have capability
	3	6250 bpi
	4	Other
1		**Vendor Code**
2		**Model Code**
	0	000 = Other; 011 = Reserved; 110 = M990
	1	001 = Reserved; 100 = Reserved; 111 = Reserved
	2	010 = Reserved; 101 = Reserved
	Thru 7	
3		**Configuration State**
	0	EOT Location-- 1 = EOT Search, 0 = STD.
	1	Parity-- 1 = External, 0 = Internal
	2	Max. Block 00 = 9K; 10 = 32K
	3	Size 01 = 16K; 11 = 64K
	4	Ramp-- 1 = Disabled, 0 = Enabled
	5	Simulated Speed Setting (LSB)
	6	Simulated Speed Setting
	7	Simulated Speed Setting (MSB)
4		**Software Configuration**
	0	
	1	
	2	
	3	EOT and Double Filemark Streaming Option
	4	3200 BPI IIDENT Status Option
	5	
	6	
	7	

Configuration Status Block (Access Code = 10000)

Table 6-1. Read Extended Status (Continued)

Byte No.	Bit*	Contents
0		**Read Retry Count - Since Unload (255 max)**
1		**Write Retry Count - Since Unload (255 max)**
		Track History - Error Counts Per Track (255 max)
2		**Track 0**
3		**Track 1**
4		**Track 2**
5		**Track 3**
6		**Track 4**
7		**Track 5**
8		**Track 6**
9		**Track 7**
10		**Track P**

Error History Block (Access Code = 00010)

Byte No.	Bit*	Contents	
		Head Position/Tach Count In Multiples Of 1.28 Inches	
0		**Low Order Byte Of Tach Count**	
1		**High Order Byte Of Tach Count**	
		Logical Command History	
2		**Previous Host Command**	
3		**2nd Previous Host Command**	
4		**3rd Previous Host Command**	
5		**4th Previous Host Command**	
6		**5th Previous Host Command**	
7		**Operating Status**	
	0	Reel Size (LSB)	00 = Unknown, 01 = 7 Inch, 10 = 8-1/2 Inch, 11 = 10-1/2 Inch
	1	Reel Size (MSB)	
	2	Door Lock Status:	0 = Unlocked, 1 = Locked
8	(LSB)	Tachometer reading indicating BOT location	
9	(MSB)		
10	(LSB)	Tachometer position at impending EOT	
11	(MSB)		

Machine Status Block (Access Code = 10010)

Table 6-1. Read Extended Status (Continued)

GLOSSARY

CHAPTER 7

SIGNAL PWB	DESCRIPTION
f+ SERVO	Switching frequency + to pulse-width modulator 20 Khz sawtooth.
f- SERVO	Switching frequency - to pulse-width modulator 20 Khz sawtooth.
+12V SERVO	Used for IC operation.
+15V SERVO	Used for IC operation.
+57V SERVO	Input from power supply for operation.
+5V SERVO	Used for TTL logic circuits.
+6V SERVO	Used for IC operation.
-12V SERVO	Used for IC operation.
-15UR SERVO	Used for IC operation.
-6V SERVO	Used for IC operation.
10.85MHZ CLK CPU	Crystal frequency.
159 CLK CIF	Character clock pulse - one for each character received.
158 TC CIF	Terminal count equals 158 characters.

1600 PE CPU	Write mode, 1600 BPI.
2.71MHZ CLK CPU	Boot frequency.
5.43MHZ CLK CPU	CIO frequency.
6250 SERVO	GCR mode selected.
6250 WRT SERVO	6250 write mode selected. Changes head current.
A SERVO	Multiplexer code select A/D.
A0-A11 CPU	Channel clock (DMA).
A0-A7 CPU	DRAM address bus.
A0-A11 CIF	Write state machine input.
A0A-A7A CPU	Low order cache memory address bus.
A0B-A7B CPU	High order cache memory address bus.
ABUF CPU	DMA 'A' buffer clock.
AD0-AD15 CPU	Address/data bus.
ADC IN SERVO	Analog to digital IC select.
ADRSEL SERVO	Address switch from OCP.
ADV/H* CIF	Advance/hold DMA address logical drive.
ADV/HEN* CIF	Enable ADV/H* logic.
AFBY CIF	Formatter busy output gate enable.

AL12-AL15 SERVO	Latched address line, decoded for servo PWB control.
AMUX CPU	Dynamic RAM address multiplexer switch.
ARMCLK SERVO	20Khz compliance arm clock.
ARMDIV CIF	Compliance arm rate of change.
ARMPOS SERVO	Compliance arm position.
ARMSNS SERVO	Air capacitor output.
AS CPU	Address strobe. Rising edge indicates address on bus valid.
A to D CLK SERVO	333Khz for A/D converter.
B SERVO	Multiplexer input code BIT A/D converter.
B CLK CPU	Channel clock.
B/W CPU	Byte/word - 8 or 16 bits on Z8000 address/data bus.
B0-B1 DATA	Control inputs to master state machine.
BAD0-BAD15 CPU	Buffered address/data.
BAD0-BAD5 SERVO	Alpha display bits, front panel.
BBUF CPU	DMA 'B' buffer clock.
BDS SERVO	Alpha display strobe.
BLOCKDET DATA	Distinguishes between erased tape and recorded tape.
BLWR SERVO	Turn on blower motor.

BLWR* SERVO	Blower control from Z8000.
BLWRR SERVO	Blower relay return.
BOOT CPU	Set on Power-up Reset to allow 1/2 speed clock.
BOOTRD CPU	Enable EPROMS for boot readout.
BOT SERVO	Beginning of tape sense.
BR/W* CPU	Buffered R/W Z8000 line.
BRD0-BRDF CIF	Buffered cache read data.
BRDATA0-BRDATAP DATA	Input to data bus.
BRWLB CIF	Buffered R/W last byte.
BUF DWN DATA	Disables master state machine during power-up.
C SERVO	Multiplexer input code to A/D converter.
C CLK CPU	Channel clock.
C REFRESH CPU	Refresh cache address.
C0-C2 CIF	Write state machine outputs to data encoder.
CA0-CA2 CIF	Data character count, syncs DMA cache with formatter.
CACRC CIF	Clear auxiliary CRC.
CADD CPU	Select cache address.
CAS0-CAS4 CPU	Memory address strobes for cache.

CASH CPU	Memory address strobe for high DRAM.
CASL CIF	Memory address strobe for low DRAM.
CBUF CPU	DMA 'C' buffer clock.
CC1-CC5 CIF	Data rate control bits.
CCR CIF	CPU data clock.
CCRC CIF	CRC clock.
CDATA CPU	Select cache data.
CER CIF	Corrected data error.
CH0-CH P CIF	Write data to head.
CHCLEAR DATA	Clear channel state machine.
CHERR0-CHERR P DATA	Channel drop detected.
CHRDY0-CHRDY P DATA	Deskew circuit has data in it.
CK/I CIF	Check or input parity.
CLK CIF	Clock to write data encoders.
CLK271 DATA	2.7Mhz clock.
CLK2X CIF	2 times 1600 bpi clock rate.
CLK542 DATA	5.4Mhz clock.
CLKX CIF	1600 bpi clock rate.

CN CPU	Carry-in bit to MMU.
CNT14 CIF	Reduced rate counter output.
CNT15 CIF	Reduced rate counter output.
COMV/SHIFT* CIF	GCR control signal.
CPU ADV CPU	Gate Z8000 data to cache bus.
CPU C READ CPU	Output CPU cache address.
CPU DOWN CPU	Decrement CPU cache address.
CPU LOAD CPU	Load CPU cache address.
CPU+4 CPU	Carry-out bit from MMU.
CPUCLK CPU	CPU DMA cycle.
CRSTR CIF	CIF read strobe.
CZDS CPU	Data strobe to cache.
DAC SERVO	Digital to analog IC select.
DATA+STACK CPU	Select data portion of DRAM.
DATA/CONT* CIF	Control term from write state machine.
DBY CIF	Data busy.
DDIS CIF	Data DMA strobe.
DIS CIF	Data interface strobe.

DMA0-DMA17 CPU	Input address to MMU.
DMP D0-DP CPU	Input to cache memory.
DPPE CIF	CIF logic data path parity error.
DR SERVO	Door sense.
DRAM R/W* CPU	Read/write control to DRAM.
DRDY DATA	Data in FIFO registers.
DRLK SERVO	Door lock solenoid driver.
DS CPU	Data strobe.
DS1-DS5 SERVO	Front panel (OCP) LEDS.
DSPSL SERVO	Display select.
DT CIF	Data transmission, start the state machine.
EDIT CIF	Edit command bit.
EH1 SERVO	Erase head.
EH1EN SERVO	Erase head 1 enable.
EH1R SERVO	Erase head return.
EH2EN SERVO	Erase head 2 enable.
EH2R SERVO	Erase head return.
EMK0-EMKP DATA	End of GCR data detected.

EMK1PE0 DATA	End mark or PE all zeros detected.
EN2 SERVO	Erase head.
ENA CPU	Enable CPU bus and DMA 0-15.
ENAX CPU	Enable DMA bus.
ENDATA DATA	Enable clock to gate data to bus.
ENFIFO DATA	Enable FIFO clock.
ENMASTER DATA	Enable master state machine
EOT SERVO	End of tape sensed.
ER1 CIF	Erase head.
FAD1-FAD3 CIF	Formatter address.
FB1-FB4 CIF	State machine control feedback.
FBOE1 CIF	State machine feedback enable/clear.
FEN CIF	Formatter enabled.
FGCR CIF	CDC status line indicating GCR mode.
FHMPE CPU	Force high memory parity error.
FIFO CLK DATA	Clock to FIFO register.
FLGAP CIF	Long gap instruction (N.U.).
FLMPE CPU	Force low memory parity error.

FLOL CIF	Not used.
FMK CIF	File mark detected.
FP/RSS SERVO	File protect/reel seat sensor.
FPT SERVO	File protect sensed.
FRC1-FRC4 CIF	PE carrier control.
FSEL CIF	Formatter selected.
FWD SERVO	Control to reel motor drivers.
FWD/REV DATA	Indicates direction of tape.
G0 CIF	Command strobe.
G1 CIF	Gate timing.
G2 CIF	Gate timing.
G4 CIF	Gate timing.
GCR/PE* DATA	Recording mode selection.
GN CIF	Enable pad and CRC gate.
GPAD CIF	Gate pad character to data bus.
GRESID CIF	Gate residual counter to data bus.
HBANK SERVO	MSB DRAM address.
HBLK SERVO	Hub lock solenoid driver.

HER CIF	Uncorrectable error.
HI I* SERVO	HI current detected one shot. Used mostly during start-up.
HIDEN SERVO	High density push button/LED.
HISP CIF	High speed command bit.
I/CK* CIF	Input or check parity.
I/O CPU	Input or output operation to CPU bus.
I2/4 CPU	MMU instruction bit.
I3 CPU	MMU instruction bit.
IACRC CIF	Increment ACRC.
IBLE CIF	Interface logic board enable.
ICER CIF	Indicates a correctable error has occurred during write or read operation.
ICR CIF	Cache interface clock.
ICRC CIF	Increment CRC.
IDBY CIF	Data busy, true during commands initiated by IGO.
IDENT CIF	PE ID burst detected.
IECC CIF	Increment ECC.
IEDIT CIF	Host command line.
IEI CPU	Interrupt enable in, sets interrupt priority.

IEO CPU	Interrupt enable out, sets interrupt priority.
IEOT CIF	Tape is located past the end of tape marker.
IERASE CIF	Host command line.
IES CIF	Interface early strobe.
IESUB CPU	Interface early strobe buffer.
IFAD CIF	Formatter address bit.
IFBY CIF	Formatter busy, tape motion.
IFCREAD CPU	Output logical tape address.
IFDOWM CPU	Decrement logical tape address.
IFEN CIF	Formatter enable.
IFLOAD CPU	Load logical tape address.
IFMK CIF	Pulsed to indicate a file mark has been detected.
IFPT CIF	File protect, reel does not have a write-protect ring.
IFO CIF	Latches command from host to tape drive. Minimum 1us pulse.
IHER CIF	Record being written or read contains an uncorrectable error (Hard).
IHISP CIF	High speed mode line from the controller.
IIDENT CIF	PE identification burst detected at load point.
ILDP CIF	Tape is located at load point (BOT).

ILW CIF	Write last word.
ILWD CIF	Last word terminates a write or variable length erase operation.
INFACE EARLY ST CPU	Interface early strobe.
INTO-INT5 CPU	Interrupt priority selection.
INTA CPU	Acknowledge interrupt from CIO.
INTACK CPU	Acknowledge interrupt.
INTERFACE ADV CIF	Advance cache memory address.
INTERFACE CLK CPU	Logical tape drive DMA cycle.
IO CPU	IO operation.
IONL CIF	Tape drive is on-line to host.
IORD CPU	IO read data strobe.
IOW1 CIF	Latch interface output word 1.
IOW2 CIF	Latch interface output word 2.
IOW3 CIF	Latch interface output word 3.
IOWR CPU	IO write data strobe.
IR0-IR P CIF	Read data to host.
IRDY CIF	Ready, tape tensioned, not rewinding, loading, or unloading.
IREV CIF	Initiates a rewind command minimum 1us pulse.

IREWU CIF	Rewind to load point and unload tape.
IRST CIF	Interface reset or stopped.
IRSTR CIF	Read data strobe, pulsed with each character - drive to host.
IRWD CIF	Tape drive is busy rewinding.
ISPEED CIF	Speed status.
ISU SERVO	Supply motor drive current.
ITAD0-ITAD1 CIF	Used for tape drive address.
ITC CIF	Read last word.
ITHR SERVO	Read threshold voltage.
ITU SERVO	Take-up motor drive current.
IW0-IW P CIF	Host write data.
IWFM CIF	Host write file mark command.
IWRT CIF	Host write command.
IWSTR CIF	Write strobe, pulsed with each character sent from host.
LA0-LA15 CPU	Latched address bits.
LDP CIF	Load point.
LEDSL SERVO	LED select.
LLWD CIF	Read or write last word.

LOAD SERVO	Load push button/LED.
M321-M325 CIF	Module 32 counter.
MA0-MA2 CPU	Byte sync between cache and data bus.
MAD AB SERVO	Analog to digital multiplexer select.
MDAC SERVO	Digital to analog multiplexer select.
MK2/PE1 DATA	Mark 2 or PE all ones detected.
MK2/PEPO-MK2/PE DATA	Mark 2 or postamble detected.
MRD0-MRD P CPU	Cache read data bus.
MREQ CPU	Memory request, address/data bus holds an address.
MWD0-MUD P CPU	Cache write data bus.
N CIF	Control decision to pad or not to pad CRC.
NMI CPU	Non-maskable interrupt.
OACRC CIF	Output of Aux CRC character to data bus.
OCRC CIF	Output CRC character to data bus.
OECC CIF	Out put ECC character to data bus.
ONL CIF	On-line status.
ON-LINE SERVO	On-line push button/LED.
OVERFLOW DATA	Deskew buffer full.

P/G* SERVO	Recording mode PE or GCR.
PADCNT DATA	Pads eighth character during PE read into cache.
PC CIF	Positive cycle of the CPU clock.
PCHECK CPU	Cache memory parity error.
PCHECK CLK CPU	Check cache parity.
PE/GCR DATA	Recording mode selection.
PEPAD DATA	PE preamble detected.
PFB1-PFB4 CIF	State machine control feedback.
PI CIF	Positive cycle of interface clock.
PLL RESET DATA	Reset phase lock loop.
POSTAM DATA	Postamble detected.
PROCINT DATA	Processor interrupt.
PRW CIF	Positive cycle of read/write clock.
PWR RES SERVO	Power reset (10ms).
Q0-Q P CPU	Cache memory data output.
QMP CPU	Cache memory parity bit.
R BOOT CPU	Reset boot latch.
R/W CPU	Read or write.

R/W BC CPU	Read/write byte clock.
R/W C READ CPU	Output physical tape cache address.
R/W DOWN CPU	Decrement physical tape cache address.
R/W L BUB CPU	Read or write last byte.
R/W LOAD CPU	Load physical tape to a physical address.
R/W* CIF	Transport read/write mode.
RAM DS CPU	RAM data strobe.
RAS CPU	RAM address row select.
RAS0-RAS3 CPU	Address strobe cache row address.
RCRCS CIF	Reset CRC and ACRC.
RD C DATA CPU	Gate cache data to Z8000 bus.
RD0-RD P CIF	Read data bus.
RDATA0-RDATAP DATA	Skew check data output.
RDC BIT0-BIT P DATA	Read data clock.
RDPLS0-RDPLS P DATA	Pulse for each transition from tape.
RDROP0-RDPLS P DATA	Loss of read data in channel.
RDT CIF	Reset data transmission latch (DT).
RDY CIF	Ready, not rewinding or loading.

READ ADV DATA	Advance MMU address.
READ CAS CPU	Enable column address to read from cache.
RECALL NR CPU	Recall NOVRAM.
RECC CIF	Reset ECC.
RECEIVE SERVO	Serial port receive signal.
REFRESH CPU	Selects low byte of DRAM.
RESET CPU	
RESET CIF	
RESET SERVO	
RESET DATA	
REV CIF	Motion direction command bit.
REVEN CIF	Read data parity even.
REVERSE BANKS CPU	Reverse control and data portion of DRAM.
RFBYP CIF	Reset formatter busy.
RLGP CIF	Reset long gap.
RLY EN SERVO	Enable motor shorting relay K1.
RPH CPU	RAM parity high byte.
RPL CPU	RAM parity low byte.

RSTP CIF	Reset interface logic.
RSTREN CIF	CIF read strobe enable.
RTEST CIF	Test mode, Z8000 directs output to read data latches.
RWCR CIF	Cache physical drive clock.
RWD CIF	Rewind latched.
RWLB DATA	Read or write last byte.
RWSEN CIF	Enable read strobe during WRT.
SCIO CPU	Select CIO.
SCLK SERVO	20Khz clock to serial port controller.
SD BIT0-BIT P DATA	Separated data.
SDTP CIF	Start data transmission.
SEL 2P CIF	Latch on-line status to Cipher interface.
SEL 3P CIF	Latch rewind status to Cipher interface.
SEL 8F CIF	Reset on-line status to Cipher interface.
SEL 9P CIF	Reset rewind status to Cipher interface.
SERVCLK SERVO	40Khz servo clock for motors.
SERVEN1 SERVO	Servo enable SU.
SERVEN2 SERVO	Servo enable TU.

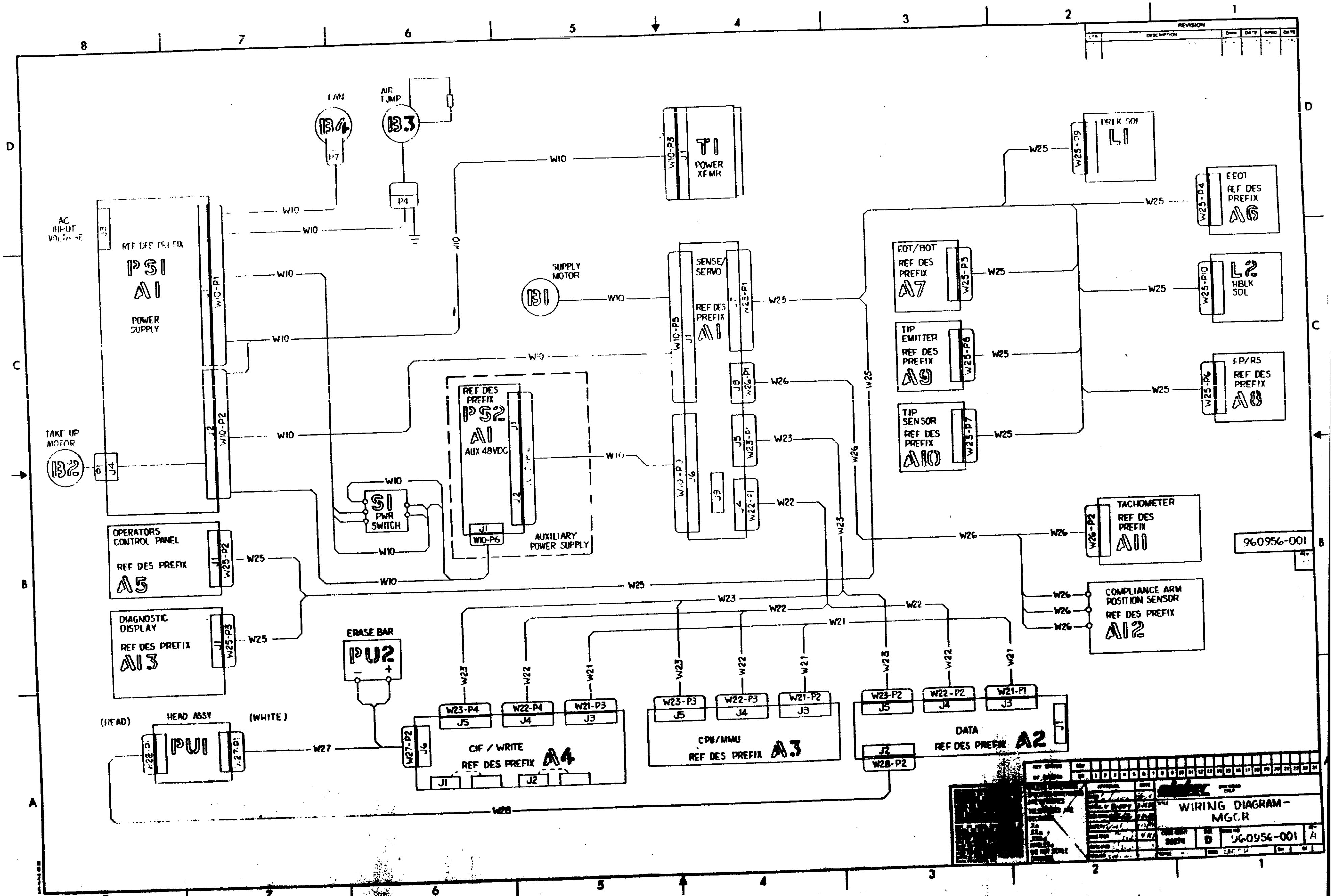
SMCLK CIF	State machine clock determines data interface transfer rates.
SMI SERVO	Supply motor current.
SMOE2 CIF	State machine enable.
SMRST CIF	State machine reset.
SMV SERVO	Supply motor voltage.
SPECIAL IO CPU	Memory addressing mode.
SRDATAO-SRDATAP DATA	Serial read data.
STACK CPU	Memory addressing mode.
B,C STCKL A DATA	Master state machine clocks.
STEPEN 0 CIF	Write driver current step enable.
STEPEN 1 CIF	Write driver current step enable.
STORE NR CPU	Store NOVRAM.
SUD SERVO	Supply motor drive.
SUDR SERVO	Supply motor drive return.
SUPPLY FWD SERVO	Forward command to H bridge.
SUPPLY REV SERVO	Reverse command to H bridge.
SYSCLK CPU	5.4Mhz clock.
TAKE-UP FWD SERVO	Forward motion to H bridge.

TAKE-UP REV SERVO	Reverse command to H bridge.
TDREQ CIF	Test mode request.
TERMCNT/TEST DATA	Read termination count or test.
TIP SERVO	Tape in path sensed.
TMI SERVO	Take up motor current.
TMV SERVO	Take up motor voltage.
TP0 SERVO	Tachometer phase 2.
TP1 SERVO	Tachometer phase 1.
TRANSMIT SERVO	Serial port transmit signal
TRAP CIF	CIF state machine error.
TUD SERVO	Take up motor drive.
TUDR SERVO	Take up motor drive return.
UNLOAD SERVO	Unload push button/LED.
VCERR DATA	Vertical parity error.
VCOM DATA	Read threshold voltage.
VI CPU	Vectored interrupt.
VREF SERVO	Reference voltage (+5V).
VREF ADJ SERVO	Monitor point for adjustment of VREF.

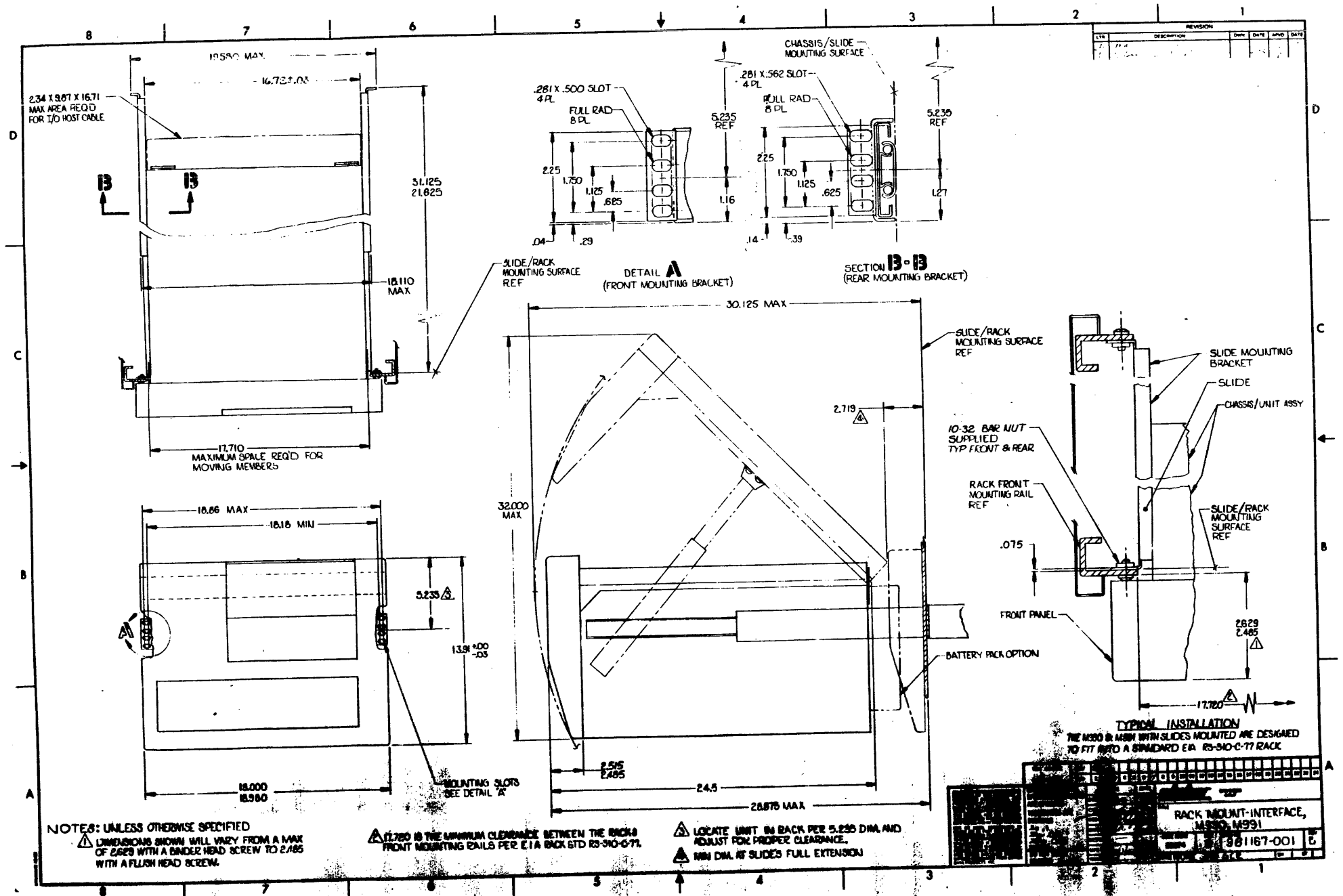
WAIT CPU	Memory of IO device is not ready for data transfer.
WATCHDOG ENABLE CPU	Enable watchdog circuit.
WCL0 CIF	Write clock to write driver.
WCL1 CIF	Write clock to write driver.
WCL2 CIF	Write clock to write driver.
WCLR CIF	Clear write drivers.
WCTV SERVO	Write voltage center tap.
WDATA0-WDATA P CIF	Write data to head drivers.
WDOGEBA UB CPU	Resets watchdog if a DRAM parity error is detected.
WE0-WE3 CPU	Write control to cache memory.
WEN SERVO	Write mode selected.
WEVEN CIF	Write parity is even.
WFB3 CIF	PE/GCR* phase encode/not GCR mode.
WFB0-WFB2 CIF	Write formatter state machine control bits.
WFLC CIF	Write formatter state machine load command.
WFM CIF	Write file mark command bit.
WFWA CIF	Write formatter write advance.
WIP CIF	Write data latch output enable.

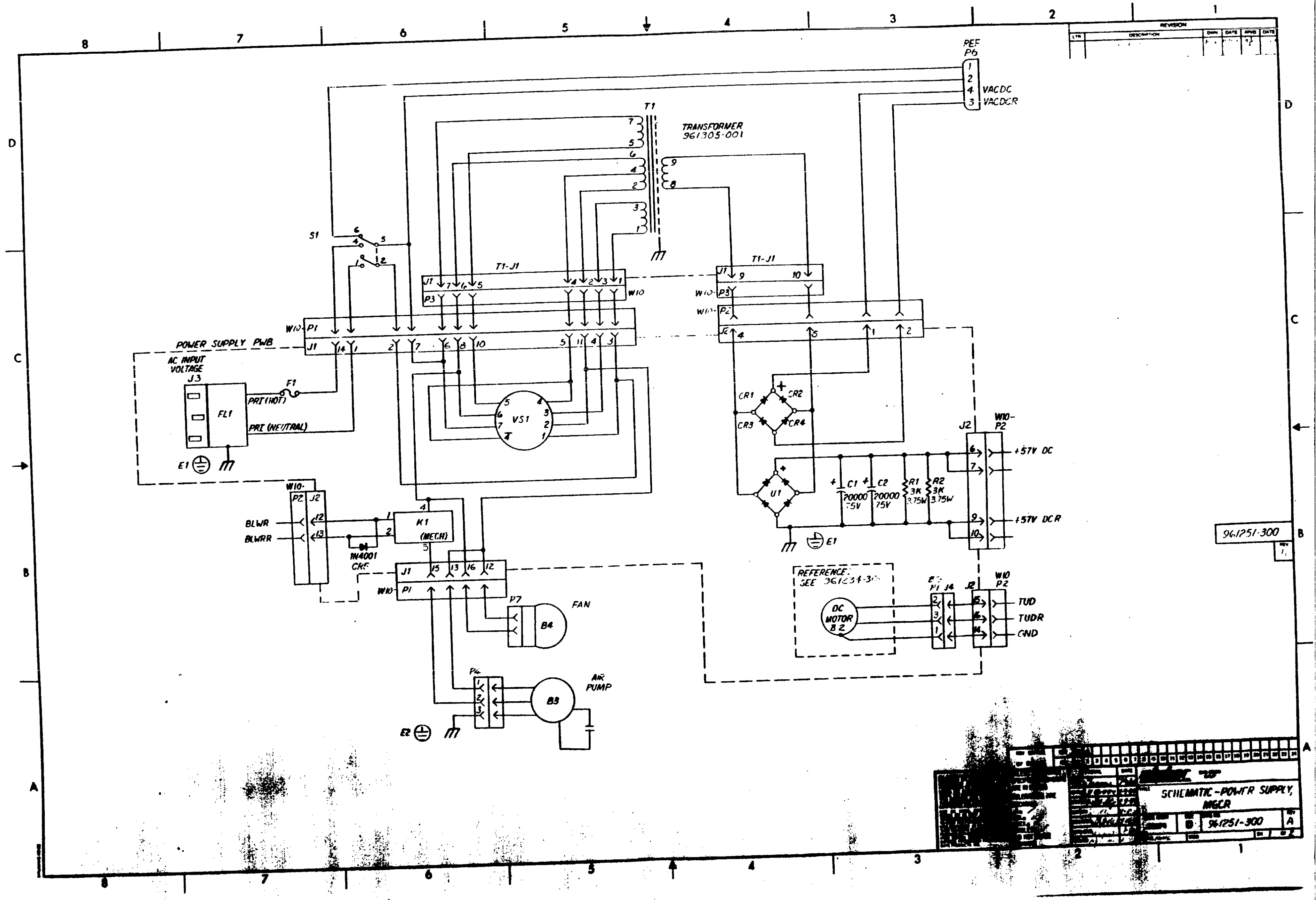
WLOE CIF	Write data latch output enable.
WR TACH SERVO	Tach pulse.
WRC ADDL CPU	Clock cache ADDR to MMU.
WRITE ADV CIF	Advance cache address.
WRITE CAS CPU	Enable address column to write to cache.
WRITE OP DATA	Write operation in progress.
WRT CIF	Write command bit.
WRTEN/TEST SERVO	Push button/LED front panel.
WSTR CIF	Interface write strobe.
WSTREN CIF	Enable CIF write strobe.
WTEST CIF	Test mode, Z8000 directs output to write data latches.
Y0-Y17 CPU	Cache address output bits from MMU.
Z2C1 SERVO	Watchdog refresh clock (10Mhz).
ZAD0-ZAD15 CPU	Z8002 address/data lines.
ZAS CPU	Z8002 address strobe.
ZCLK CPU	5.4Mhz clock to Z8002.
ZDS CPU	Z8002 data strobe.
ZI/O CPU	Z8002 IO operation.

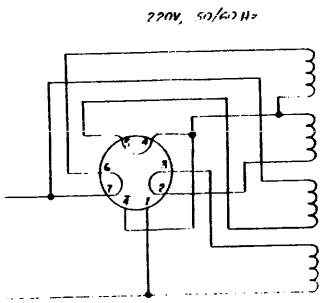
ZIORD CPU	IO read data strobe.
ZIOWR CPU	IO write data strobe.
ZMREO CPU	Memory request. Low indicates A/D lines contain an address.
ZR/W* CPU	Indicates CPU is reading from or writing to memory or I/O.

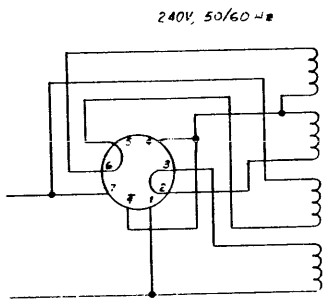


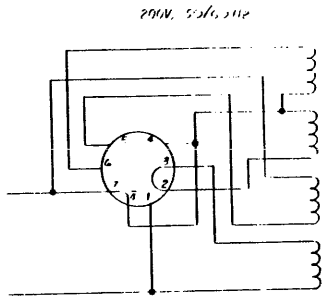
FAN
B4
AIR PUMP
B3
P4
T1
POWER XFMR
W10-P3
W10
AC INPUT VOLTAGE
REF DES PREFIX
PS1
A1
POWER SUPPLY
W10-P1
W10-P2
TAKE UP MOTOR
B2
SUPPLY MOTOR
B1
SENSE/SERVO
REF DES PREFIX
A1
W10-P5
W25
W26
W23
W22
REF DES PREFIX
PS2
A1
AUX 48VDC
AUXILIARY POWER SUPPLY
W10-P6
S1
PWR SWITCH
OPERATORS CONTROL PANEL
REF DES PREFIX
A5
W25-P2
DIAGNOSTIC DISPLAY
REF DES PREFIX
A13
W25-P3
ERASE BAR
PU2
(READ)
HEAD ASSY
(WRITE)
PU1
W27
W28
W28-P1
W27-P1
W27-P2
CIF / WRITE
REF DES PREFIX
A4
W23-P4
W22-P4
W21-P3
J5
J4
J3
J1
J2
J6
CPU/MMU
REF DES PREFIX
A3
W23-P3
W22-P3
W21-P2
DATA
REF DES PREFIX
A2
W23-P2
W22-P2
W21-P1
W28-P2
W21
BRLK SOL
L1
W25-P9
EEOT
REF DES PREFIX
A6
W25-P4
EOT/BOT
REF DES PREFIX
A7
W25-P5
L2
HBLK SOL
W25-P10
TIP EMITTER
REF DES PREFIX
A9
W25-P8
FP/RS
REF DES PREFIX
A8
W25-P6
TIP SENSOR
REF DES PREFIX
A10
W25-P7
TACHOMETER
REF DES PREFIX
A11
W26-P2
COMPLIANCE ARM POSITION SENSOR
REF DES PREFIX
A12
960956-001
REVISION
WIRING DIAGRAM-
MGCR
D
960956-001
A

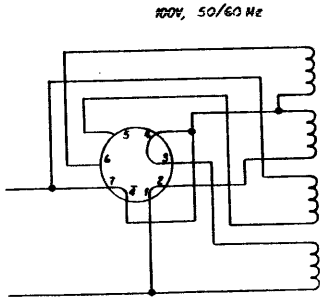

19.580 MAX
16.724±.03
2.34 X 9.87 X 16.71
MAX AREA REQ'D
FOR I/O HOST CABLE
31.125
21.625
18.110
MAX
17.710
MAXIMUM SPACE REQ'D FOR
MOVING MEMBERS
SLIDE/RACK
MOUNTING SURFACE
REF
.281 X .500 SLOT
4 PL
FULL RAD
8 PL
5.235
REF
2.25
1.750
1.125
.625
1.16
.04
.29
DETAIL A
(FRONT MOUNTING BRACKET)
CHASSIS/SLIDE
MOUNTING SURFACE
.281 X .562 SLOT
4 PL
FULL RAD
8 PL
5.235
REF
2.25
1.750
1.125
.625
1.27
.14
.39
SECTION B-B
(REAR MOUNTING BRACKET)
18.66 MAX
18.18 MIN
5.235
13.91 +.00 -.03
18.000
18.980
MOUNTING SLOTS
SEE DETAIL "A"
30.125 MAX
32.000
MAX
2.719
2.515
2.485
24.5
28.875 MAX
SLIDE/RACK
MOUNTING SURFACE
REF
BATTERY PACK OPTION
SLIDE MOUNTING
BRACKET
SLIDE
CHASSIS/UNIT ASSY
10-32 BAR NUT
SUPPLIED
TYP FRONT & REAR
RACK FRONT
MOUNTING RAIL
REF
SLIDE/RACK
MOUNTING
SURFACE
REF
.075
FRONT PANEL
2.629
2.485
17.720
TYPICAL INSTALLATION
THE M990 & M991 WITH SLIDES MOUNTED ARE DESIGNED
TO FIT INTO A STANDARD EIA RS-310-C-77 RACK
REVISION
LTR
DESCRIPTION
DWN
DATE
APVD
DATE
RACK MOUNT-INTERFACE,
M990/M991
981167-001
NOTES: UNLESS OTHERWISE SPECIFIED
1. DIMENSIONS SHOWN WILL VARY FROM A MAX OF 2.629 WITH A BINDER HEAD SCREW TO 2.485 WITH A FLUSH HEAD SCREW.
2. 17.720 IS THE MINIMUM CLEARANCE BETWEEN THE RACK'S FRONT MOUNTING RAILS PER E.I.A. RACK STD RS-310-C-77.
3. LOCATE UNIT IN RACK PER 5.235 DIM. AND ADJUST FOR PROPER CLEARANCE.
4. MIN DIM. AT SLIDES FULL EXTENSION

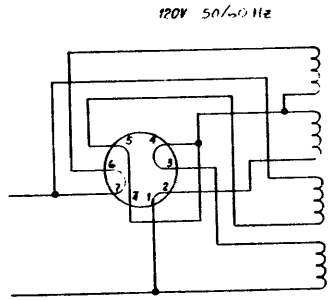

PEF P6
VACDC
VACDCR
T1
TRANSFORMER 961305-001
S1
T1-J1
W10
POWER SUPPLY PWB
AC INPUT VOLTAGE
J3
F1
FL1
PRI (HOT)
PRI (NEUTRAL)
E1
VS1
CR1
CR2
CR3
CR4
U1
C1 20000 75V
C2 20000 75V
R1 3K 3.75W
R2 3K 3.75W
J2
W10-P2
+57V DC
+57V DCR
BLWR
BLWRR
K1 (MECH)
1N4001 CR5
J1
P1
P7
FAN
B4
REFERENCE: SEE 961234-3
DC MOTOR B2
J4
TUD
TUDR
GND
P4
AIR PUMP
B3
E2
961251-300
SCHEMATIC-POWER SUPPLY, MGCR
961251-300

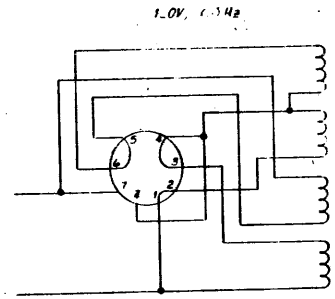












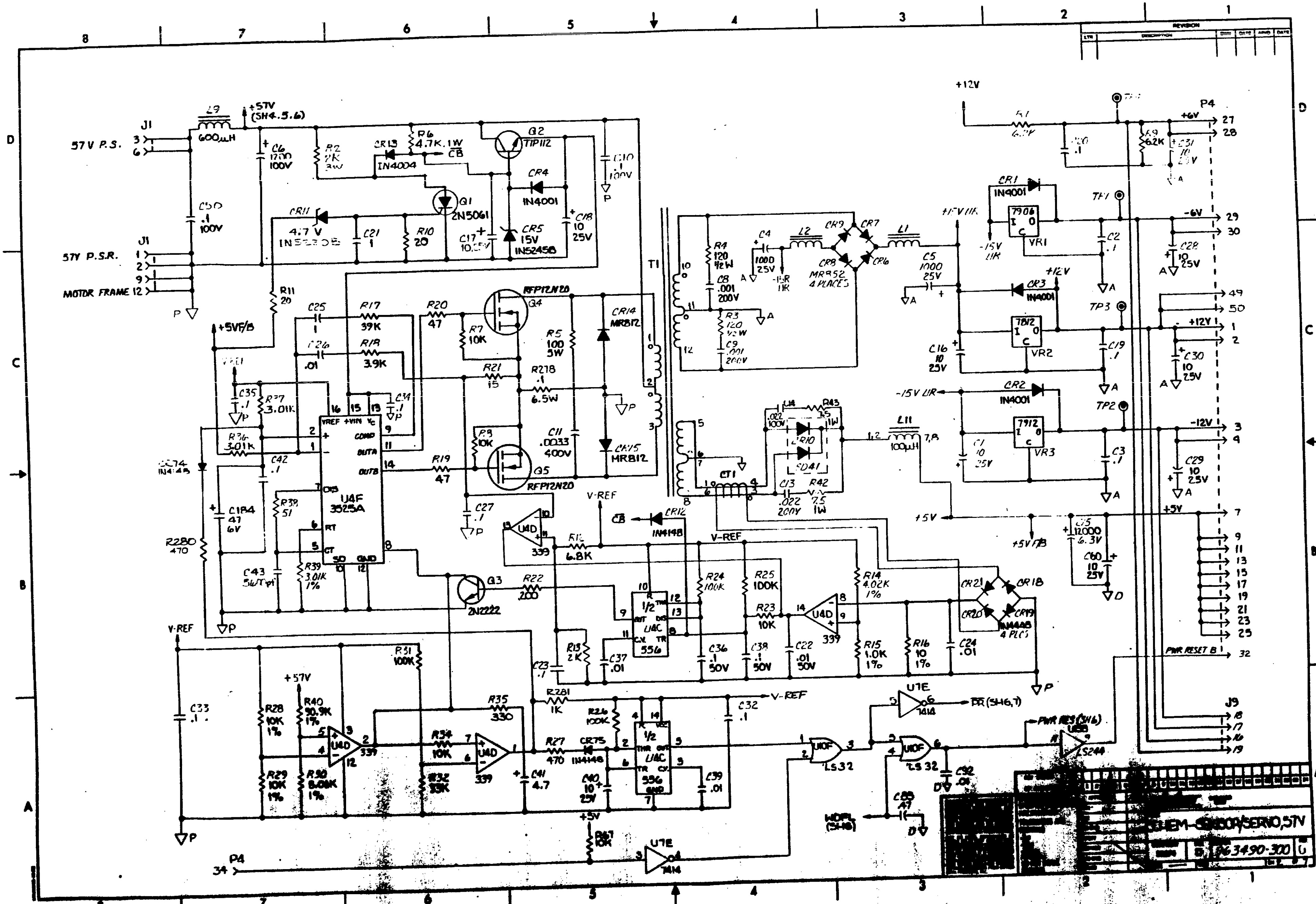
361251 300

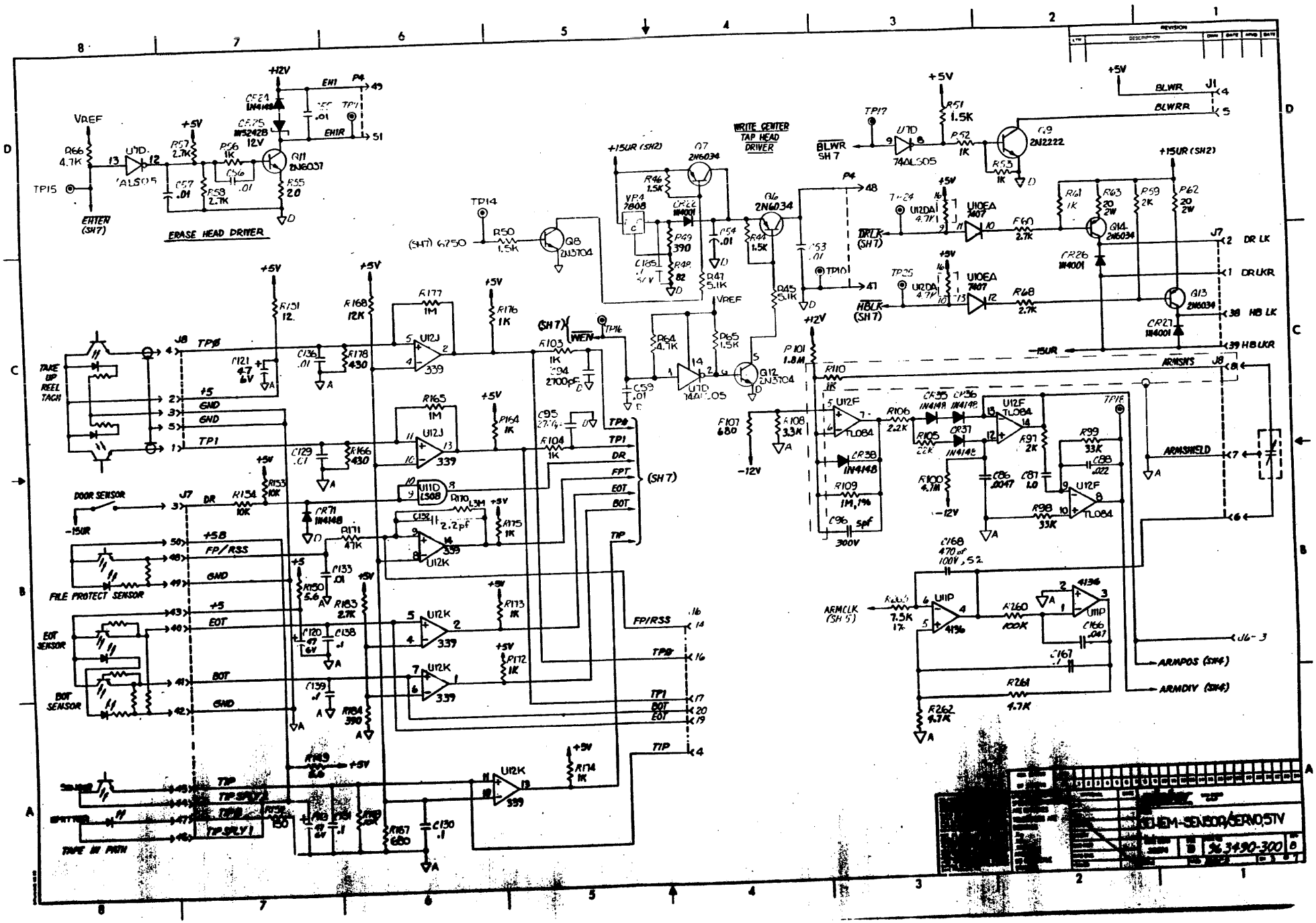
REVISION

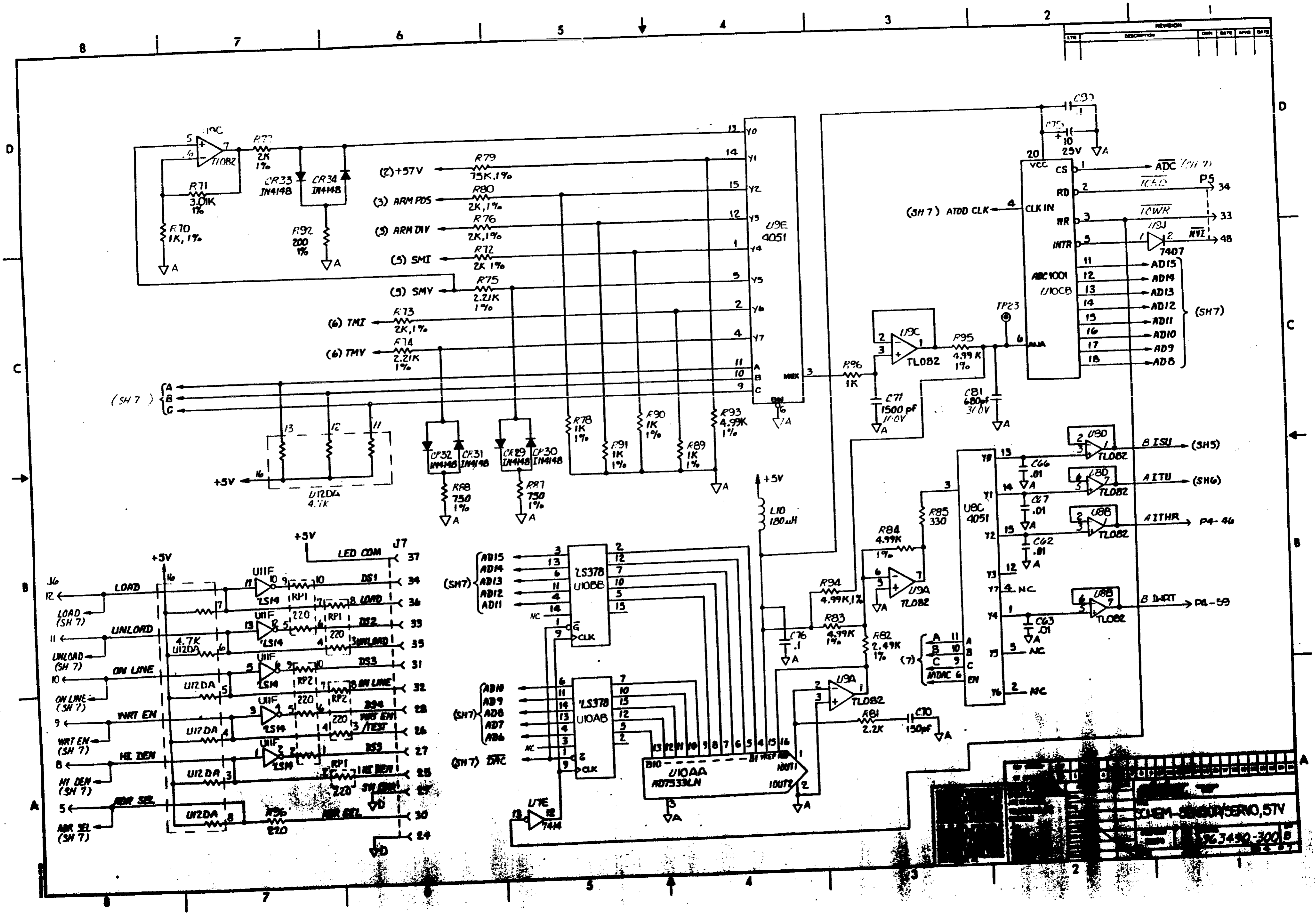
LTR	DESCRIPTION	ENGR	DATE	APVD	DATE

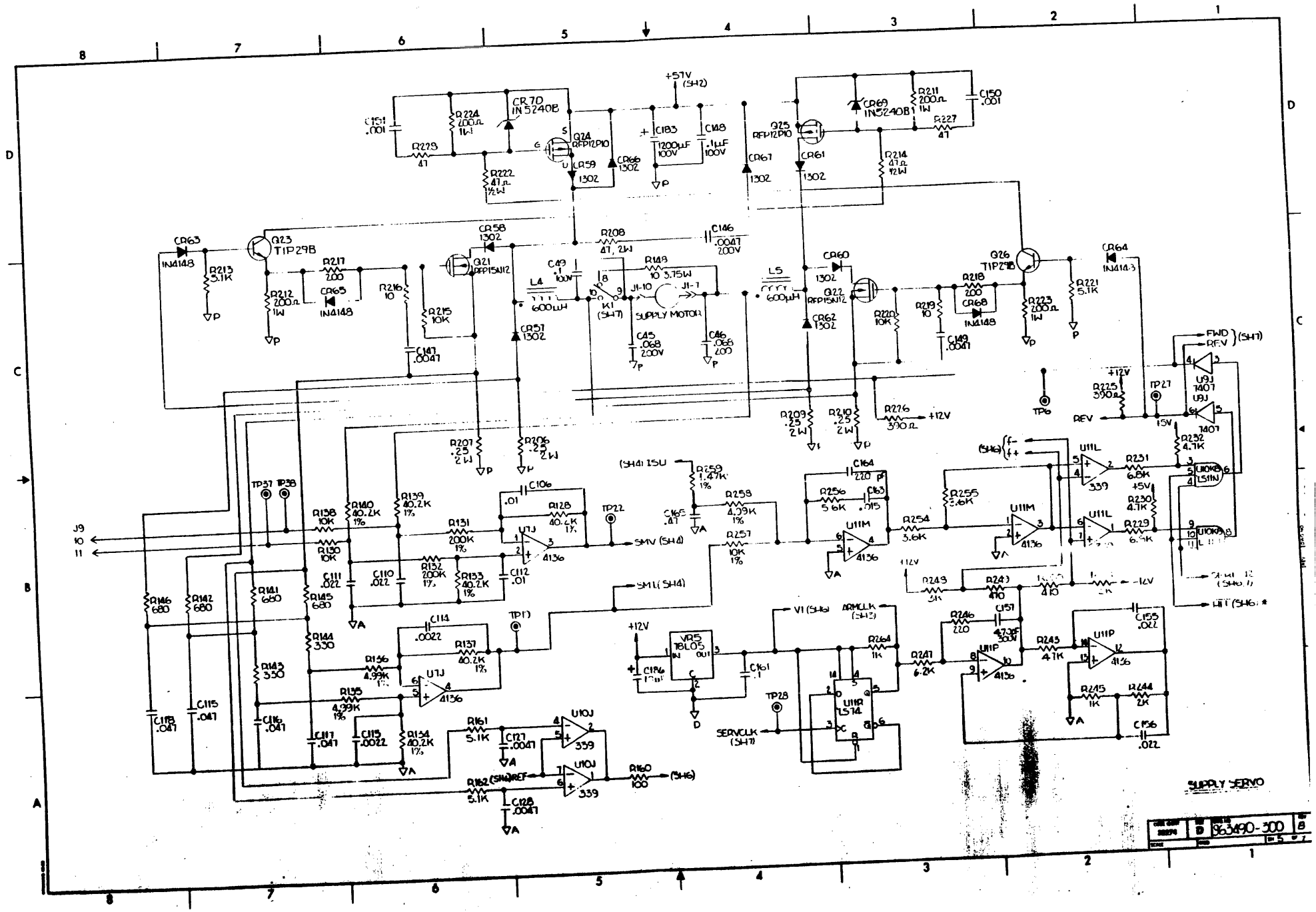
SCHEMATIC - POWER SUPPLY, MSCR

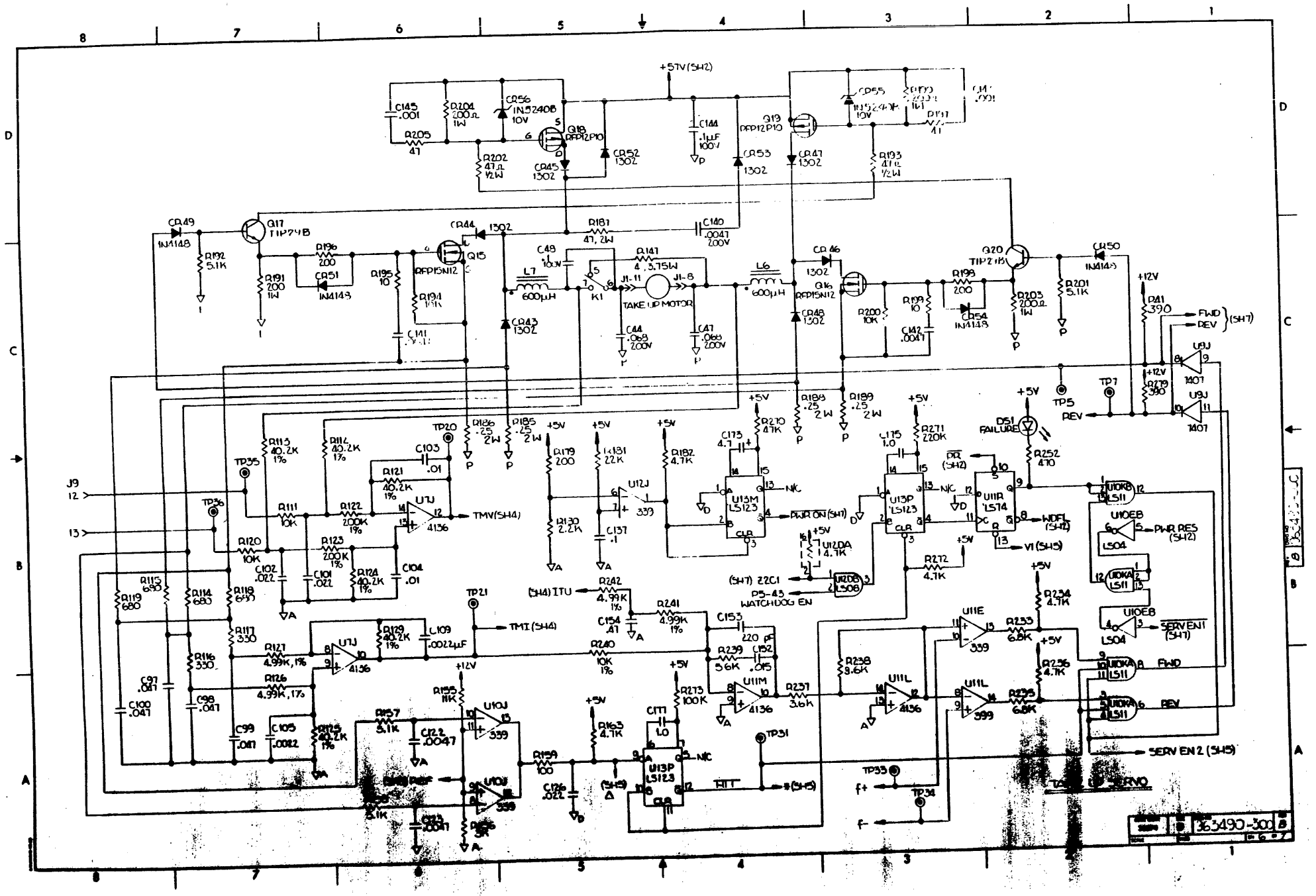
SIZE B | DWG NO. PSU-300 | REV A

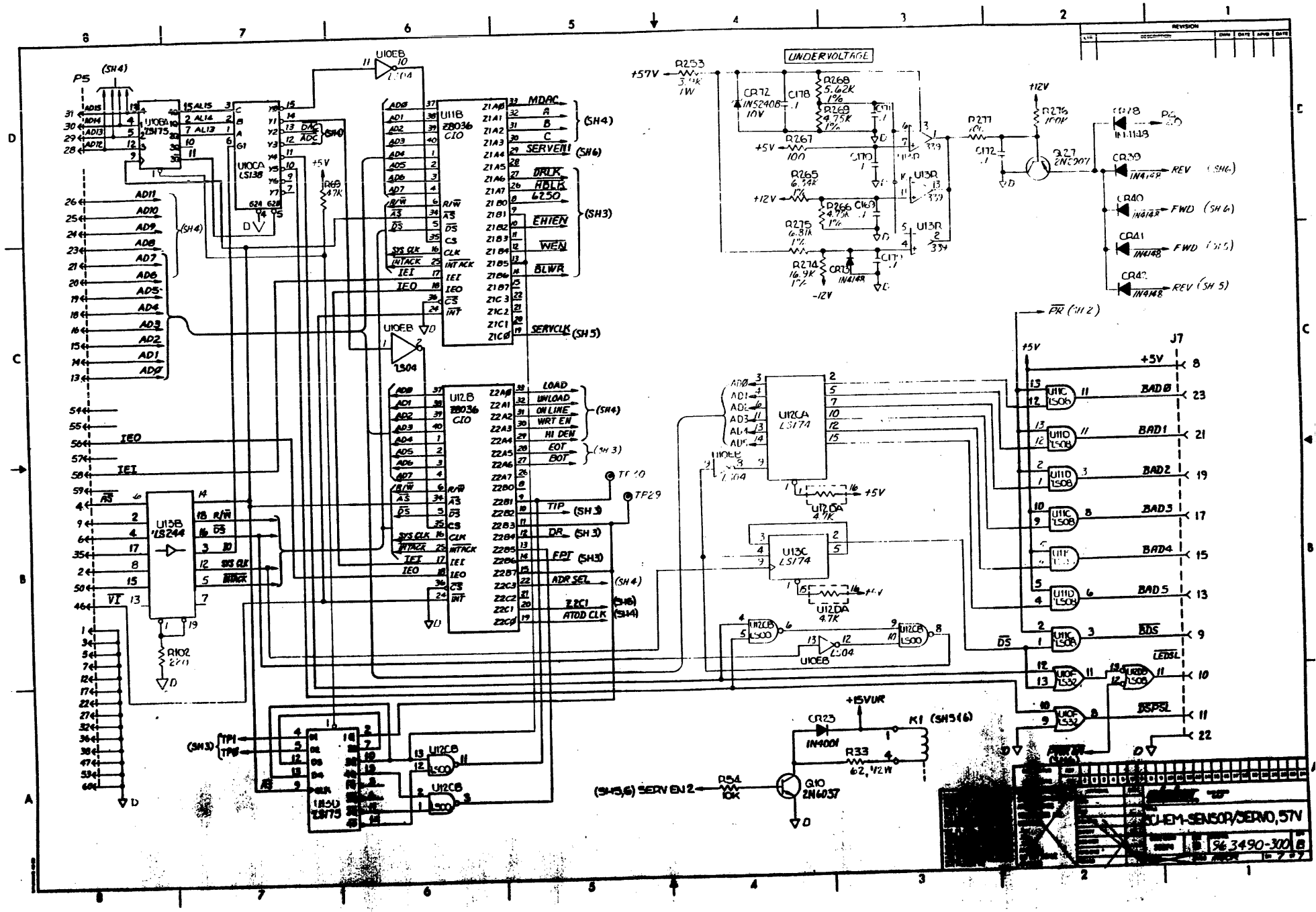

57V P.S.
57V P.S.R.
MOTOR FRAME 12
J1
L9 600μH
+57V (SH4.5.6)
C6 1200 100V
C50 .1 100V
R2 2K 3W
CR13 IN4004
R6 4.7K,1W
CB
Q2 TIP112
CR4 IN4001
Q1 2N5061
CR11 4.7V
C21 1
R10 20
C17
CR5 15V IN5245B
C18 10 25V
C10 .1 100V
R11 20
+5VF/B
C25 1
R17 39K
R20 47
RFP12N20
Q4
C26 .01
R18 3.9K
R7 10K
R5 100 5W
CR14 MR812
R21 15
R278 .1 6.5W
C35 .1
R37 3.01K
R36 3.01K
VREF +VIN VC
COMP
OUTA
OUTB
U4F 3525A
RT
CT
SD
GND
R19 47
R8 10K
C11 .0033 400V
CR15 MR812
Q5
C42 .1
C184 47 6V
R38 51
C43 560pf
R39 3.01K 1%
R280 470
C27 .1
U4D 339
V-REF
CR12 IN4148
R12 6.8K
Q3 2N2222
R22 200
1/2 U4C 556
R24 100K
R25 100K
R23 10K
R14 4.02K 1%
R15 1.0K 1%
R16 10 1%
C24 .01
CR21
CR18
CR20
CR19
IN4448 4 PLCS
R13 2K
C37 .01
C36 .1 50V
C38 .1 50V
C22 .01 50V
C23 .1
T1
R4 120 1/2W
C4 1000 25V
L2
CR9
CR7
L1
+15V UR
CR8
CR6
MR852 4 PLACES
C5 1000 25V
C8 .001 200V
R3 120 1/2W
C9 .001 200V
L14
R43 15 1W
CR10
SD41
L11 100μH
C13 .022 200V
R42 7.5 1W
CT1
+5V
+5VF/B
+12V
R1
C20 .1
R9 6.2K
C31 10 25V
TP4
P4
+6V
CR1 IN4001
7906
VR1
TP1
-6V
C2 .1
C28 10 25V
-15V UR
CR3 IN4001
TP3
7812
VR2
+12V
C16 10 25V
C19 .1
C30 10 25V
CR2 IN4001
TP2
-15V UR
7912
VR3
-12V
C1 10 25V
C3 .1
C29 10 25V
C15 12000 6.3V
C60 10 25V
PWR RESET B
V-REF
C33 .1
R31 100K
+57V
R28 10K 1%
R40 90.9K 1%
R29 10K 1%
R30 8.06K 1%
R35 330
R34 10K
R32 33K
C41 4.7
R281 1K
R27 470
CR75 IN4148
R26 100K
1/2 U4C 556
C40 10 25V
C39 .01
C32 .1
U1E 1414
PR (SH6,7)
U10F LS32
PWR RES (SH6)
LS244
C92 .01
C88 .47
WDFL (SH6)
+5V
R67 10K
P4
34
J9

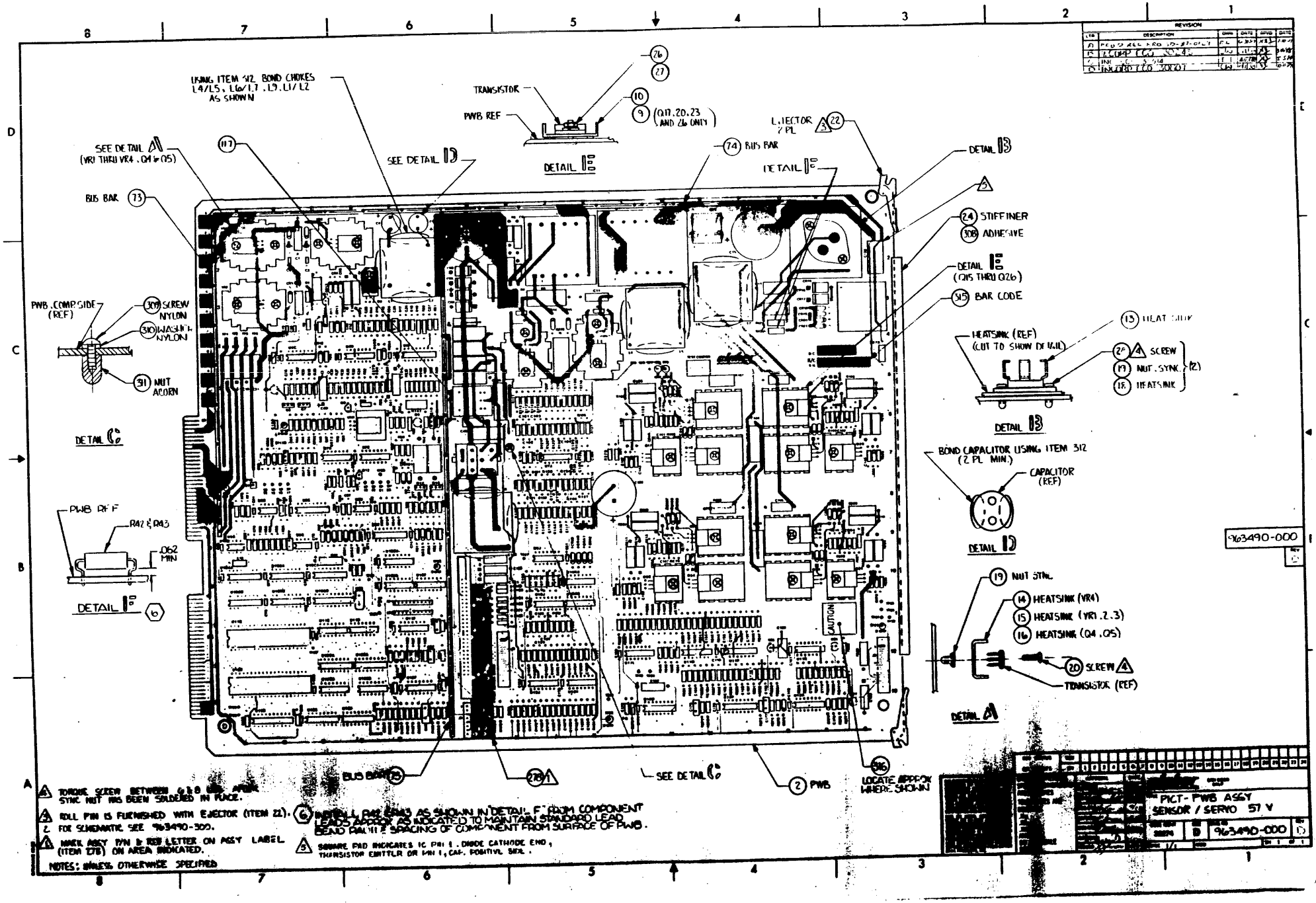

ERASE HEAD DRIVER
WRITE CENTER TAP HEAD DRIVER
ENTER (SH7)
TAPE UP REEL TACH
DOOR SENSOR
FILE PROTECT SENSOR
EOT SENSOR
BOT SENSOR
TAPE IN PATH
ARMCLK (SH 5)
ARMPOS (SH4)
ARMDIV (SH4)
ARMSHIELD
DR LK
DR LKR
HB LK
HB LKR
FP/RSS
EOT
BOT
TIP
WEN
BLWR
BLWRR
DRLK (SH7)
HBLK (SH7)
SCHEM-SENSOR/SERVO,STV
%3490-300


U9E
4051
R79
75K,1%
(2) +57V
R80
2K,1%
(3) ARM POS
R76
2K,1%
(5) ARM DIV
R72
2K 1%
(5) SMI
R75
2.21K
1%
(5) SMY
R73
2K,1%
(6) TMI
R74
2.21K
1%
(6) TMY
R77
2K
1%
R71
3.01K
1%
R70
1K,1%
CR33
1N4148
CR34
1N4148
R92
200
1%
CR32
1N4148
CR31
1N4148
CR29
1N4148
CR30
1N4148
R88
750
1%
R87
750
1%
R78
1K
1%
R91
1K
1%
R90
1K
1%
R89
1K
1%
R93
4.99K
1%
U12DA
4.7K
+5V
(SH 7)
MUX
R96
1K
C71
1500 pF
100V
U9C
TL082
R95
4.99 K
1%
TP23
C81
680pF
300V
C93
.1
C75
10
25V
VCC
CS
RD
WR
INTR
CLK IN
ADC1001
U10CB
(SH 7) ATOD CLK
ADC (SH 7)
IORD
IOWR
NVI
7407
P5
34
33
48
AD15
AD14
AD13
AD12
AD11
AD10
AD9
AD8
(SH7)
U8C
4051
C66
.01
C67
.01
C62
.01
C63
.01
U8D
TL082
B ISU
(SH5)
A ITU
(SH6)
A ITHR
P4-46
U8B
B IHRT
P4-59
R85
330
R84
4.99K
1%
U9A
TL082
R94
4.99K,1%
R83
4.99K
1%
R82
2.49K
1%
MDAC
EN
NC
L10
180 µH
C76
.1
R81
2.2K
C70
150pF
U10AA
AD7533LN
IOUT1
IOUT2
VREF
'LS378
U10BB
U10AB
CLK
(SH7)
DAC
U7E
7414
+5V
LED COM
J7
J6
LOAD
LOAD (SH 7)
UNLOAD
UNLOAD (SH 7)
ON LINE
ON LINE (SH 7)
WRT EN
WRT EN (SH 7)
HI DEN
HI DEN (SH 7)
ADR SEL
ADR SEL (SH 7)
U11F
'LS14
RP1
RP2
220
DS1
DS2
DS3
DS4
/TEST
R56
220
SCHEM-SENSOR/SERVO,57V
963430-300


SUPPLY SERVO
863490-300


+57V (SH2)
TAKE UP MOTOR
+5V
+12V
TMV (SH4)
TMI (SH4)
PWR ON (SH7)
WDFL (SH7)
VI (SH5)
FWD
REV
SERV EN1 (SH7)
SERV EN 2 (SH5)
FAILURE
TP5
TP7
TP20
TP21
TP31
TP34
TP35
TP36
J9
363490-300


UNDERVOLTAGE
SCHEM-SENSOR/SERVO,57V
%3490-300



TORQUE SCREW BETWEEN 6 & 8 IN-LBS AFTER SYNC NUT HAS BEEN SOLDERED IN PLACE.

ROLL PIN IS FURNISHED WITH EJECTOR (ITEM 22).

FOR SCHEMATIC SEE 963490-300.

MARK ASSY P/N & REV LETTER ON ASSY LABEL (ITEM 278) ON AREA INDICATED.

INSTALL PWB LEADS AS SHOWN IN DETAIL F FROM COMPONENT LEADS APPROX AS INDICATED TO MAINTAIN STANDARD LEAD BEND RADIUS & SPACING OF COMPONENT FROM SURFACE OF PWB.

SQUARE PAD INDICATES IC PIN 1, DIODE CATHODE END, TRANSISTOR EMITTER OR PIN 1, CAP. POSITIVE SIDE.

NOTES: UNLESS OTHERWISE SPECIFIED

BILL OF MATERIAL

AS OF 12/30/93

CLASS CODE GROUP: 1 UNCLASSIFIED
CLASS CODE: 3400 G.C.R. UNIQUE BOARD ASSY

963490-001 OPCODE: 4 REV: E PWB ASSY-SENSOR SERVO,57V
MODEL:
ECO NO: 30807
DATE OF LAST ECO: 9/07/88

OP: ORDER POLICY CODE
REQ: N=PART OPTIONAL
Y=PART REQUIRED
PF: N=PART DOES NOT PRINT ON SALES ORDER
Y=PART PRINTS ON SALES ORDER W/O PRICE
P=PART PRINTS ON SALES ORDER WITH PRICE

PART NUMBER	DESCRIPTION	OP	RV	ITEM NO.	QTY PER ASSEMBLY	YIELD FACTR	UM	SC	REQ	P F	DEFAULT QUANTITY	DAYS OFF SET	SEQ	REFERENCE DESIGNATOR	EFFECTIV DATE	OBSOLETE DATE
963490-000	PICT-PWB ASSY,SENSOR SERVO,57V	3	D	1	0.000	1.000	EA	F	Y	N	0.000	0	0		11/14/85	99/99/99
963491-101	PWB-SENSOR/SERVO,37V,57V	1	C	2	1.000	1.000	EA	B	Y	N	1.000	0	0		11/14/85	99/99/99
961234-400	SPECIFICATION-TEST.	3	A	3	0.000	1.000	EA	F	N	N	0.000	0	0		00/00/00	99/99/99
963490-300	SCHEM-SENSOR SERVO,57V	3	C	4	0.000	1.000	EA	F	Y	N	0.000	0	0		11/14/85	99/99/99
964398-001	INDUCTOR-DUAL,1500UH	1	A	5	1.000	1.000	EA	B	Y	N	1.000	0	0	L1,2	4/02/87	99/99/99
970440-180	INDUCTOR-180UH,+-10%,	3	B	6	1.000	1.000	EA	B	N	N	1.000	0	0	L10	00/00/00	99/99/99
962906-001	INDUCTOR-EMI FILTER	1	A	7	1.000	1.000	EA	B	Y	N	1.000	0	0	L9	00/00/00	99/99/99
962904-001	XFMR-CURRENT,SENSE	1	B	8	1.000	1.000	EA	B	Y	N	1.000	0	0	CT1	00/00/00	99/99/99
971037-001	HEATSINK-STUD MOUNT	3	A	9	4.000	1.000	EA	B	Y	N	4.000	0	0	Q17,20,23,26	3/25/87	99/99/99
971037-002	HEATSINK-STUD MOUNT	3	A	10	8.000	1.000	EA	B	Y	N	8.000	0	0	Q15,16,18.19,21,22,24,25	3/25/87	99/99/99
962903-001	CHOKE-DUAL MOTOR	3	A	11	2.000	1.000	EA	B	Y	N	2.000	0	0	L4/L5,L6/L7 ECO#30189	11/23/87	99/99/99
962908-003	XFMR-PWM,57 VOLT	1	C	12	1.000	1.000	EA	B	Y	N	1.000	0	0	T1	3/25/87	99/99/99
971015-001	HEATSINK-TO-3,TOP MOUNT GOLD	3	A	13	1.000	1.000	EA	B	Y	N	1.000	0	0	CR10	3/12/87	99/99/99
970388-001	HEATSINK-"U" BLACK	3	C	14	1.000	1.000	EA	B	N	N	1.000	0	0	VR4	00/00/00	99/99/99
970281-002	HEATSINK-TO-127/TO-220,	3	C	15	3.000	1.000	EA	B	Y	N	3.000	0	0	VR1-3 ECO#30189	11/23/87	99/99/99
970281-001	HEATSINK-TO-127/TO-220,	3	C	16	2.000	1.000	EA	B	Y	N	2.000	0	0	Q4,Q5	00/00/00	99/99/99
970287-001	HEATSINK-TO-3,6.4,C/W	3	C	18	1.000	1.000	EA	B	N	N	1.000	0	0	CR10	00/00/00	99/99/99
970460-001	NUT-SYNC,6-32,HEATSINK,.220MAX	3	D	19	8.000	1.000	EA	B	Y	N	8.000	0	0	VR1-4,Q2,4 5,CR10 ECO #30189	11/23/87	99/99/99
213271-605	SCREW-PHP,ZINC,6-32X5/16	3	G	20	6.000	1.000	EA	F	Y	N	6.000	0	0		12/13/85	99/99/99
964400-001	CHOKE-+5V	1	A	21	1.000	1.000	EA	B	Y	N	1.000	0	0	L11	3/25/87	99/99/99
970083-001	INJECTOR/EJECTOR-1/16"	3	B	22	2.000	1.000	EA	B	N	N	2.000	0	0		00/00/00	99/99/99
961707-002	STIFFENER-EDGE,PCB	3	B	24	1.000	1.000	EA	B	Y	N	1.000	0	0		00/00/00	99/99/99
213271-603	SCREW-PHP,ZINC,6-32X3/16	3	G	25	1.000	1.000	EA	F	Y	N	1.000	0	0		3/27/86	99/99/99
207602-011	WASHER-SPLIT LOCK #6	3	C	26	12.000	1.000	EA	F	Y	N	12.000	0	0		4/02/87	99/99/99
207604-081	NUT-HEX RADIO PATTERN	3	B	27	12.000	1.000	EA	F	Y	N	12.000	0	0		4/02/87	99/99/99
213271-606	SCREW-PHP,ZINC,6-32X3/8	3	G	28	2.000	1.000	EA	F	Y	N	2.000	0	0		4/02/87	99/99/99
201114-274	CAP-CER,2700PF,50V,10%,X7R	3	J	30	2.000	1.000	EA	B	Y	N	2.000	0	0	CR10	00/00/00	99/99/99
201114-224	CAP-CER,2200PF,50V,10%,X7R	3	J	33	4.000	1.000	EA	B	Y	N	4.000	0	0	95,94	00/00/00	99/99/99
201191-025	CAP-ELEC,10MF,25V, ,ALUM	3	H	34	14.000	1.000	EA	B	Y	N	14.000	0	0	105,109,113,114 C1,16-18,28-31,40,60 75,162,180 186	00/00/00	99/99/99

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963490-001 OPCODE: 4 REV: E PWB ASSY-SENSOR SERVO,57V
MODEL:
ECO NO: 30807
DATE OF LAST ECO: 9/07/88

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201114-106	CAP-CER,100000PF,50V,10%,X7R	3	J	35	17.000	1.000	EA	B	Y	N	17.000	0	0	C23,27,36,38,42,130,131,137-139,167,169-172,179,185 ECO#30189	11/23/87	99/99/99
201158-100	CAP-MYLAR..1MF,100V,10%	3	E	36	6.000	1.000	EA	B	Y	N	6.000	0	0	C10,48-50,144,148	12/09/86	99/99/99
970565-001	CAP-ELEC,1000MF,25V,-20+50%	3	A	37	2.000	1.000	EA	B	Y	N	2.000	0	0	C4,5	00/00/00	99/99/99
971031-102	CAP-ELEC,1000-1200 MF,100V,LOW	3	B	38	2.000	1.000	EA	B	Y	N	2.000	0	0	C6,183	3/16/87	99/99/99
971034-103	CAP-ELEC,10000-12000 MF 6.3V*	3	B	39	1.000	1.000	EA	B	Y	N	1.000	0	0	C15	3/16/87	99/99/99
201114-564	CAP-CER,5600PF,50V,10%,X7R	3	J	41	1.000	1.000	EA	B	Y	N	1.000	0	0	C43	3/12/87	99/99/99
201114-220	CAP-CER,.022MF,50V,10%	3	J	42	8.000	1.000	EA	B	Y	N	8.000	0	0	88,101,102,110,111,126,155,156	00/00/00	99/99/99
201123-151	CAP-DM,1500PF,100V,5%	3	E	43	1.000	1.000	EA	B	N	N	1.000	0	0	C71	00/00/00	99/99/99
201160-472	CAP-TANT,4.7MF,10V,10%	3	D	44	2.000	1.000	EA	B	Y	N	2.000	0	0	C41,173	00/00/00	99/99/99
970712-002	CAP-POLY..001MF,200V MIN,5%	3	C	45	2.000	1.000	EA	B	Y	N	2.000	0	0	C8,9	12/04/85	99/99/99
970712-004	CAP-POLYPRO,.022UF,200-250V+-*	3	A	48	2.000	1.000	EA	B	N	N	2.000	0	0	C13,14	00/00/00	99/99/99
201204-153	CAP-CER,150PF,50V,5%,NPO	3	R	49	1.000	1.000	EA	B	Y	N	1.000	0	0	C70	00/00/00	99/99/99
201114-105	CAP-CER,10000PF,50V,10%,X7R	3	J	50	23.000	1.000	EA	B	Y	N	23.000	0	0	C22,24,26,37,39,53-57,59,62,63,66,67,92,103,104,106,112,129,133,136	12/04/85	99/99/99
970712-001	CAP-POLY,.0033MF,250-400V,5%	3	A	51	1.000	1.000	EA	B	Y	N	1.000	0	0	C11	3/12/87	99/99/99
201161-470	CAP-TANT,47MF,6V,10%	3	P	52	4.000	1.000	EA	B	N	N	4.000	0	0	C119-121,184	00/00/00	99/99/99
201120-500	CAP-DM,5PF,300V,+-1/2PF,	3	C	53	1.000	1.000	EA	B	N	N	1.000	0	0	C96	00/00/00	99/99/99
201114-155	CAP-CER,15000PF,50V,10%,X7R	3	J	57	2.000	1.000	EA	B	Y	N	2.000	0	0	152,163	3/11/87	99/99/99
201114-475	CAP-CER,47000PF,50V,10%,X7R	3	J	58	9.000	1.000	EA	B	Y	N	9.000	0	0	115-118,97-100,166	00/00/00	99/99/99
970712-003	CAP-POLY,.068MF,200VDC,5%	3	D	60	4.000	1.000	EA	B	Y	N	4.000	0	0	C44-47	12/04/85	99/99/99
201106-107	CAP-CER,1MF,50V,10%	3	M	61	5.000	1.000	EA	B	Y	N	5.000	0	0	C21,25,87,175,177	00/00/00	99/99/99
201113-470	CAP-CER,.0047MF,50V,10%	3	H	62	9.000	1.000	EA	B	Y	N	9.000	0	0	86,122,123,127,128,141,142,149	00/00/00	99/99/99

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970712-005	CAP-POLYPRO.0047UF,200-250V,**	3	A	63	2.000	1.000	EA	B	N	N	2.000	0	0	C140,146	00/00/00	99/99/99
201204-221	CAP-CER,2.2PF,50V,5%,NPO	3	R	64	1.000	1.000	EA	B	Y	N	1.000	0	0	C132	4/02/87	99/99/99
201204-473	CAP-CER,470PF,50V,5%,NPO	3	R	65	2.000	1.000	EA	B	N	N	2.000	0	0	C168,157	00/00/00	99/99/99
970784-104	CAP-CER,.1UF,50V,-20+80%,AX,*	3	E	67	44.000	1.000	EA	B	Y	N	44.000	0	0	C2,3,12,19 20,32-35,5 1,58,61,64 65,69,68,7 2-74,76-80 82-84,89-9 1,93,107,1 08,124,125 134,135,15 8-161,174, 176,178	1/09/87	99/99/99
201114-104	CAP-CER,1000PF,50V,10%,X7R	3	J	68	4.000	1.000	EA	B	Y	N	4.000	0	0	C143,145,1 50,151	00/00/00	99/99/99
201112-220	CAP-CER,220PF,50V,10%	3	E	69	2.000	1.000	EA	B	Y	N	2.000	0	0	153,164	3/11/87	99/99/99
970085-001	CAP-DM,680PF,300V,1%	3	B	70	1.000	1.000	EA	B	N	N	1.000	0	0	C81	00/00/00	99/99/99
201105-474	CAP-CER,.47MF,50V,10%	3	N	72	3.000	1.000	EA	B	Y	N	3.000	0	0	85,165,154	00/00/00	99/99/99
962003-001	SPEC-8" PWR & GND BUS BAR	1	A	73	1.000	1.000	EA	B	Y	N	1.000	0	0		00/00/00	99/99/99
962002-001	SPEC-15" PWR & GND BUS BAR	1	B	74	1.000	1.000	EA	B	Y	N	1.000	0	0		00/00/00	99/99/99
970551-002	BUS BAR STIFFENER-INSULATED	3	B	75	1.000	1.000	EA	B	Y	N	1.000	0	0		00/00/00	99/99/99
970724-001	DIODE-1N4448,FAST SWITCHING	3	A	87	4.000	1.000	EA	B	Y	N	4.000	0	0	CR18-21	00/00/00	99/99/99
202033	DIODE-RECTIFIER,	3	F	88	2.000	1.000	EA	B	N	N	2.000	0	0	CR14,15	00/00/00	99/99/99
970562-001	DIODE-RECTIFIER,POWER	3	C	89	4.000	1.000	EA	B	Y	N	4.000	0	0	CR6-9	00/00/00	99/99/99
202032-300	DIODE-ZENER	3	C	90	1.000	1.000	EA	B	Y	N	1.000	0	0	CR25	00/00/00	99/99/99
202018-100	DIODE-SWITCHING,IN4148	3	E	91	29.000	1.000	EA	B	Y	N	29.000	0	0	CR12,24,28 -42,49-51, 54,63-65,6 8,71,73-75	00/00/00	99/99/99
971049-001	DIODE-1N5230B,ZENER,4.7V,5%	3	A	92	1.000	1.000	EA	B	Y	N	1.000	0	0	CR11	5/15/87	99/99/99
202005-500	RECTIFIER-PWR,HI EFF,6A	3	C	93	16.000	1.000	EA	B	N	N	16.000	0	0	CR43-48,52 ,53,57-62, 66,67	00/00/00	99/99/99
202011	DIODE-RECTIFIER 1 AMP	3	G	94	1.000	1.000	EA	B	Y	N	1.000	0	0	CR13	3/11/87	99/99/99
202009-999	DIODE RECTIFIER,1 AMP	3	D	95	8.000	1.000	EA	B	Y	N	8.000	0	0	CR1-4,22, 23,26,27	3/27/86	99/99/99
202031	DIODE-ZENER	3	E	96	5.000	1.000	EA	B	Y	N	5.000	0	0	CR55,56,69 70,72	12/09/86	99/99/99
202032	DIODE-ZENER	3	E	98	1.000	1.000	EA	B	N	N	1.000	0	0	CR5	00/00/00	99/99/99
970238-001	DIODE-RECTIFIER,DUAL	3	C	99	1.000	1.000	EA	B	N	N	1.000	0	0	CR10	00/00/00	99/99/99

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963490-001 OPCODE: 4 REV: E PWB ASSY-SENSOR SERVO,57V
MODEL:
ECO NO: 30807
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202006-100	DIODE-LIGHT EMITTING	3	H	101	1.000	1.000	EA	B	N	N	1.000	0	0	DS1	00/00/00	99/99/99
970208-001	CONNECTOR HEADER SOCKET-	3	A	107	1.000	1.000	EA	B	N	N	1.000	0	0	J1	00/00/00	99/99/99
970288-001	CONN-HEADER,50 POSN,PIN,	3	B	109	1.000	1.000	EA	B	N	N	1.000	0	0	J7	00/00/00	99/99/99
970291-001	CONN-HEADER,8 POSN,PIN,	3	A	110	1.000	1.000	EA	B	N	N	1.000	0	0	J8	00/00/00	99/99/99
970581-001	RECTIFIER-.8AMP 60V	3	A	115	1.000	1.000	EA	B	Y	N	1.000	0	1	Q1	00/00/00	99/99/99
970563-001	TRANSISTOR-NPN,SILICON	3	A	118	1.000	1.000	EA	B	Y	N	1.000	0	0	Q2	00/00/00	99/99/99
970249-001	TRANSISTOR-PNP,SILICON,	3	C	119	1.000	1.000	EA	B	N	N	1.000	0	0	Q27	00/00/00	99/99/99
204007-500	TRANSISTOR-NPN SILICON	3	J	120	2.000	1.000	EA	B	N	N	2.000	0	0	Q3,9	00/00/00	99/99/99
970582-001	TRANSISOR-N CHANNEL	3	A	121	2.000	1.000	EA	B	Y	N	2.000	0	0	Q4,5	00/00/00	99/99/99
204027-037	TRANSISTOR-NPN SILICON	3	E	122	2.000	1.000	EA	B	Y	N	2.000	0	0	Q10,11	00/00/00	99/99/99
204027-034	TRANSISTOR-PNP SILICON	3	E	123	4.000	1.000	EA	B	N	N	4.000	0	0	Q6,7,13,14	00/00/00	99/99/99
970545-001	TRANSISTOR-POWER, MOS FET	3	A	124	4.000	1.000	EA	B	Y	N	4.000	0	0	Q15,16,21,22	00/00/00	99/99/99
971033-001	TRANS-TIP29B,NPN TO-220	3	B	126	4.000	1.000	EA	B	Y	N	4.000	0	0	Q17,20,23,26	3/16/87	99/99/99
204013-999	TRANSISTOR-NPN SILICON	3	E	127	2.000	1.000	EA	B	Y	N	2.000	0	0	Q8,12	3/25/87	99/99/99
970546-001	TRANSISTOR-POWER, MOS FET	3	A	128	4.000	1.000	EA	B	Y	N	4.000	0	0	Q18,19,24,25	12/09/86	99/99/99
200076-100	RES-1.0 MOHM 1/4W 5% CF	3	AC	129	2.000	1.000	EA	F	Y	N	2.000	0	0	R165,177	00/00/00	99/99/99
200120-400	RES-4.0 OHM 3.0W 5% WW	3	H	130	1.000	1.000	EA	F	Y	N	1.000	0	0	R147	00/00/00	99/99/99
200121-100	RES-10 OHM 3.0W 5% WW	3	H	131	1.000	1.000	EA	F	Y	N	1.000	0	0	R148	00/00/00	99/99/99
200013-562	RES-5.62 KOHM 1/4W 1% FF	3	R	135	1.000	1.000	EA	F	Y	N	1.000	0	0	R268	00/00/00	99/99/99
200013-200	RES-2.0 KOHM 1/4W 1% FF	3	R	136	5.000	1.000	EA	B	N	N	5.000	0	0	R72,73,76.77,80	00/00/00	99/99/99
200014-750	RES-75.0 KOHM 1/4W 1% FF	3	R	137	1.000	1.000	EA	B	Y	N	1.000	0	0	R79	11/14/85	99/99/99
200073-100	RES-1.0 KOHM 1/4W 5% CF	3	AC	138	17.000	1.000	EA	F	Y	N	17.000	0	0	R52,53,56,61,86,103,104,110,164,172-176,245,264,281 ECO#30189	11/23/87	99/99/99
200013-634	RES-6.34 KOHM 1/4W 1% FF	3	R	139	1.000	1.000	EA	F	N	N	1.000	0	0	R265	00/00/00	99/99/99
200013-100	RES-1.00 KOHM 1/4W 1% FF	3	R	140	6.000	1.000	EA	F	N	N	6.000	0	0	R15,70,78,89-91	00/00/00	99/99/99
200073-470	RES-4.7 KOHM 1/4W 5% CF	3	AC	141	12.000	1.000	EA	F	Y	N	12.000	0	0	R64,66,69,163,182,230,232,234,236,262,261,272	00/00/00	99/99/99
200016-100	RES-1.00 MOHM 1/8W 1% FF	3	R	143	1.000	1.000	EA	F	Y	N	1.000	0	0	R109	00/00/00	99/99/99

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200013-499	RES-4.99 KOHM 1/4W 1% FF	3	R	144	13.000	1.000	EA	F	N	N	13.000	0	0	R83,84,93-95,126,127,135,136,241,242,258,259	00/00/00	99/99/99
200072-390	RES-390 OHM 1/4W 5% CF	3	AC	145	6.000	1.000	EA	F	N	N	6.000	0	0	R41,49,184,225,226,279	00/00/00	99/99/99
200071-820	RES-82 OHM 1/4W 5% CF	3	AC	146	1.000	1.000	EA	F	N	N	1.000	0	0	R48	00/00/00	99/99/99
200013-221	RES-2.21 KOHM 1/4W 1% FF	3	R	147	2.000	1.000	EA	F	N	N	2.000	0	0	R74,75	00/00/00	99/99/99
971030-025	RES-FUSIBLE..25 OHM,2W+5%	3	A	148	8.000	1.000	EA	B	Y	N	8.000	0	0	R185,186,188,189,206,207,209,210	3/16/87	99/99/99
970536-047	RES-47 OHM,2W,5%,CF,FIXED	3	C	149	2.000	1.000	EA	B	Y	N	2.000	0	0	R187,208	00/00/00	99/99/99
200014-402	RES-40.2 KOHM 1/4W 1% FF	3	R	150	12.000	1.000	EA	F	Y	N	12.000	0	0	R112,113,121,124,125,128,129,133,134,137,139,140	00/00/00	99/99/99
200013-402	RES-4.02 KOHM 1/4W 1% FF	3	R	151	1.000	1.000	EA	B	Y	N	1.000	0	0	R14	11/21/85	99/99/99
200013-249	RES-2.49 KOHM 1/4W 1% FF	3	R	152	1.000	1.000	EA	F	N	N	1.000	0	0	R82	00/00/00	99/99/99
200073-220	RES-2.2 KOHM 1/4W 5% CF	3	AC	153	3.000	1.000	EA	F	N	N	3.000	0	0	R81,106,180	00/00/00	99/99/99
200072-330	RES-330 OHM 1/4W 5% CF	3	AC	155	6.000	1.000	EA	F	Y	N	6.000	0	0	R35,85,116,117,143,144	00/00/00	99/99/99
200073-270	RES-2.7 KOHM 1/4W 5% CF	3	AC	156	5.000	1.000	EA	F	Y	N	5.000	0	0	R57,58,60,68,183 ECO #30189	11/23/87	99/99/99
200071-200	RES-20 OHM 1/4W 5% CF	3	AC	157	3.000	1.000	EA	F	Y	N	3.000	0	0	R10,11,55	00/00/00	99/99/99
200071-510	RES-51 OHM 1/4W 5% CF	3	AC	158	1.000	1.000	EA	F	Y	N	1.000	0	0	R38	00/00/00	99/99/99
200073-150	RES-1.5 KOHM 1/4W 5% CF	3	AC	159	5.000	1.000	EA	F	Y	N	5.000	0	0	R44,46,50,51,65	00/00/00	99/99/99
200073-510	RES-5.1 KOHM 1/4W 5% CF	3	AC	160	10.000	1.000	EA	F	Y	N	10.000	0	0	R45,47,162,157,158,161,213,221,192,201	00/00/00	99/99/99
200082-120	RES-120 OHM 1/2W 5% CF	3	L	161	2.000	1.000	EA	B	N	N	2.000	0	0	R3,4	00/00/00	99/99/99
970969-047	RES-FUSIBLE,47OHM,1/2W,5% MF	3	C	162	6.000	1.000	EA	B	Y	N	6.000	0	0	R19,20,193,202,214,22	3/16/87	99/99/99

BILL OF MATERIAL

AS OF 12/30/93

CLASS CODE GROUP: 1 UNCLASSIFIED
CLASS CODE: 3400 G.C.R. UNIQUE BOARD ASSY

963490-001 OPCODE: 4 REV: E PWB ASSY-SENSOR SERVO.57V
MODEL:
ECO NO: 30807
DATE OF LAST ECO: 9/07/88

OP: ORDER POLICY CODE
REQ: N=PART OPTIONAL
Y=PART REQUIRED
PF: N=PART DOES NOT PRINT ON SALES ORDER
Y=PART PRINTS ON SALES ORDER W/O PRICE
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PART NUMBER	DESCRIPTION	OP	RV	ITEM NO.	QTY PER ASSEMBLY	YIELD FACTR	UM	SC	REQ	PF	DEFAULT QUANTITY	DAYS OFF SET	SEQ	REFERENCE DESIGNATOR	EFFECTIV DATE	OBSOLETE DATE
970969-047	RES-FUSIBLE,470HM,1/2W.5% MF	3	C	162	6.000	1.000	EA	B	Y	N	6.000	0	0	2	3/16/87	99/99/99
200071-470	RES-47 OHM 1/4W 5% CF	3	AC	163	4.000	1.000	EA	F	Y	N	4.000	0	0	R197.205.227,228	00/00/00	99/99/99
200123-200	RES-2K OHM,3.0W,5%,WW	3	H	164	1.000	1.000	EA	B	Y	N	1.000	0	0	R2	3/25/87	99/99/99
970568-472	RES-4.7 KOHM 1W 5% CF	3	D	165	1.000	1.000	EA	B	Y	N	1.000	0	0	R6	00/00/00	99/99/99
970271-002	RES-20 OHM 2W 5% FC	3	A	166	2.000	1.000	EA	B	N	N	2.000	0	0	R62,63	00/00/00	99/99/99
200070-560	RES-5.6 OHM 1/4W 5% CF	3	AC	167	2.000	1.000	EA	F	N	N	2.000	0	0	R149,150	00/00/00	99/99/99
200074-100	RES-10 KOHM 1/4W 5% CF	3	AC	168	17.000	1.000	EA	F	Y	N	17.000	0	0	R7,8,23,34,54,67,111,120.130,138,153,154,169.194,200,215,220	00/00/00	99/99/99
200081-620	RES-62 OHM 1/2W 5% CF	3	L	169	1.000	1.000	EA	B	Y	N	1.000	0	0	R33	3/16/87	99/99/99
200074-220	RES-22 KOHM 1/4W 5% CF	3	AC	170	2.000	1.000	EA	F	N	N	2.000	0	0	R105.181	00/00/00	99/99/99
200013-750	RES-7.50 KOHM 1/4W 1% FF	3	R	171	1.000	1.000	EA	F	Y	N	1.000	0	0	R263	00/00/00	99/99/99
200074-560	RES-56 KOHM 1/4W 5% CF	3	AC	172	2.000	1.000	EA	F	Y	N	2.000	0	0	R239.256	3/11/87	99/99/99
200073-360	RES-3.6 KOHM 1/4W 5% CF	3	AC	173	4.000	1.000	EA	F	Y	N	4.000	0	0	R237,238,254,255	00/00/00	99/99/99
971416-750	RES-7.5 OHM,5%,1W,CF	3	A	174	2.000	1.000	EA	F	Y	N	2.000	0	0	R42,R43 ECO#30807	9/06/88	99/99/99
200072-430	RES-430 OHM 1/4W 5% CF	3	AC	175	2.000	1.000	EA	F	Y	N	2.000	0	0	R166.178	00/00/00	99/99/99
200074-120	RES-12 KOHM 1/4W 5% CF	3	AC	176	1.000	1.000	EA	F	Y	N	1.000	0	0	R168	2/21/86	99/99/99
200013-301	RES-3.01 KOHM 1/4W 1% FF	3	R	177	4.000	1.000	EA	F	Y	N	4.000	0	0	R36,37,39.71	00/00/00	99/99/99
200072-220	RES-220 OHM 1/4W 5% CF	3	AC	178	3.000	1.000	EA	F	Y	N	3.000	0	0	R96,102.246	00/00/00	99/99/99
970568-392	RES-3.9 KOHM 1W 5% CF	3	D	179	1.000	1.000	EA	B	Y	N	1.000	0	0	R253	00/00/00	99/99/99
200076-130	RES-1.3 MOHM 1/4W 5% CF	3	AC	180	1.000	1.000	EA	F	Y	N	1.000	0	0	R170	12/09/86	99/99/99
200075-100	RES-100 KOHM 1/4W 5% CF	3	AC	182	7.000	1.000	EA	F	Y	N	7.000	0	0	R24,25,26,31,260,273,276	00/00/00	99/99/99
200072-100	RES-100 OHM 1/4W 5% CF	3	AC	183	4.000	1.000	EA	F	Y	N	4.000	0	0	R159,160,267,277	00/00/00	99/99/99
200075-220	RES-220 KOHM 1/4W 5% CF	3	AC	184	1.000	1.000	EA	F	Y	N	1.000	0	0	R271	00/00/00	99/99/99
200072-470	RES-470 OHM 1/4W 5% CF	3	AC	185	5.000	1.000	EA	F	Y	N	5.000	0	0	R27.249,250,252,280	00/00/00	99/99/99
200074-330	RES-33 KOHM 1/4W 5% CF	3	AC	186	3.000	1.000	EA	F	N	N	3.000	0	0	R32,98,99	00/00/00	99/99/99
200076-470	RES-4.7 MOHM 1/4W 5% CF	3	AC	187	1.000	1.000	EA	F	N	N	1.000	0	0	R100	00/00/00	99/99/99
200072-200	RES-200 OHM 1/4W 5% CF	3	AC	188	6.000	1.000	EA	F	Y	N	6.000	0	0	R22,179,196,198,217,	11/23/87	99/99/99

ORIGINAL

BILL OF MATERIAL

AS OF 12/30/93

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963490-001 OPCODE: 4 REV: E PWB ASSY-SENSOR SERVO,57V
MODEL:
ECO NO: 30807
DATE OF LAST ECO: 9/07/88

PART NUMBER	DESCRIPTION	OP	RV	ITEM NO.	QTY PER ASSEMBLY	YIELD FACTR	UM	SC	REQ	PF	DEFAULT QUANTITY	DAYS OFF SET	SEQ	REFERENCE DESIGNATOR	EFFECTIV DATE	OBSOLETE DATE
200072-200	RES-200 OHM 1/4W 5% CF	3	AC	188	6.000	1.000	EA	F	Y	N	6.000	0	0	218 ECO#30189	11/23/87	99/99/99
200071-150	RES-15 OHM 1/4W 5% CF	3	AC	189	1.000	1.000	EA	F	N	N	1.000	0	0	R21	00/00/00	99/99/99
200072-150	RES-150 OHM 1/4W 5% CF	3	AC	190	1.000	1.000	EA	F	Y	N	1.000	0	0	R152	00/00/00	99/99/99
200015-200	RES-200 KOHM 1/4W 1% FF	3	R	192	4.000	1.000	EA	B	Y	N	4.000	0	0	R122,123,131,132	11/06/85	99/99/99
200074-470	RES-47 KOHM 1/4W 5% CF	3	AC	193	3.000	1.000	EA	F	Y	N	3.000	0	0	R171,243,270	00/00/00	99/99/99
200071-120	RES-12 OHM 1/4W 5% CF	3	AC	194	1.000	1.000	EA	F	N	N	1.000	0	0	R151	00/00/00	99/99/99
200013-475	RES-4.75 KOHM 1/4W 1% FF	3	R	195	2.000	1.000	EA	F	N	N	2.000	0	0	R266.269	00/00/00	99/99/99
200014-169	RES-16.9 KOHM 1/4W 1% FF	3	R	196	1.000	1.000	EA	B	N	N	1.000	0	0	R274	00/00/00	99/99/99
200073-300	RES-3 KOHM 1/4W 5% CF	3	AC	197	3.000	1.000	EA	F	Y	N	3.000	0	0	R156.248.251	00/00/00	99/99/99
200073-680	RES-6.8 KOHM 1/4W 5% CF	3	AC	200	5.000	1.000	EA	F	N	N	6.000	0	0	R12.233,235,229,231	00/00/00	99/99/99
200074-110	RES-11 KOHM 1/4W 5% CF	3	AC	201	1.000	1.000	EA	F	N	N	1.000	0	0	R155	00/00/00	99/99/99
970537-002	RES-100 OHM 5% 5W WW	3	A	202	1.000	1.000	EA	B	Y	N	1.000	0	0	R5	00/00/00	99/99/99
200071-100	RES-10 OHM 1/4W 5% CF	3	AC	204	4.000	1.000	EA	F	Y	N	4.000	0	0	R195,199,216,219	00/00/00	99/99/99
200148-100	RES-0.10 OHM 6.5W 5% WW	3	D	205	1.000	1.000	EA	F	N	N	1.000	0	0	R278	00/00/00	99/99/99
200074-390	RES-39 KOHM 1/4W 5% CF	3	AC	206	1.000	1.000	EA	F	N	N	1.000	0	0	R17	00/00/00	99/99/99
200073-390	RES-3.9 KOHM 1/4W 5% CF	3	AC	207	1.000	1.000	EA	F	Y	N	1.000	0	0	R18	00/00/00	99/99/99
200014-909	RES-90.9 KOHM 1/4W 1% FF	3	R	208	1.000	1.000	EA	F	N	N	1.000	0	0	R40	00/00/00	99/99/99
200011-100	RES-10.0 OHM 1/4W 1% FF	3	R	209	1.000	1.000	EA	B	Y	N	1.000	0	0	R16	11/21/85	99/99/99
200013-806	RES-8.06 KOHM 1/4W 1% FF	3	R	210	1.000	1.000	EA	F	N	N	1.000	0	0	R30	00/00/00	99/99/99
200014-100	RES-10.0 KOHM 1/4W 1% FF	3	R	211	4.000	1.000	EA	F	Y	N	4.000	0	0	R28.29.240257	00/00/00	99/99/99
200013-681	RES-6.81 KOHM 1/4W 1% FF	3	R	212	1.000	1.000	EA	F	Y	N	1.000	0	0	R275	00/00/00	99/99/99
200073-200	RES-2 KOHM 1/4W 5% CF	3	AC	213	4.000	1.000	EA	F	Y	N	4.000	0	0	R13,59,97,244 ECO#30189	11/23/87	99/99/99
200012-200	RES-200 OHM 1/4W 1% FF	3	R	214	1.000	1.000	EA	B	N	N	1.000	0	0	R92	00/00/00	99/99/99
970568-201	RES-200 OHM 1W 5% CF	3	D	215	8.000	1.000	EA	B	Y	N	8.000	0	0	R190,191,203,204,211212,223,224	00/00/00	99/99/99
200072-680	RES-680 OHM 1/4W 5% CF	3	AC	216	10.000	1.000	EA	F	Y	N	10.000	0	0	R107,114,115,118,119141,142,145,146,167	00/00/00	99/99/99
200073-330	RES-3.3 KOHM 1/4W 5% CF	3	AC	217	1.000	1.000	EA	F	N	N	1.000	0	0	R108	00/00/00	99/99/99

BILL OF MATERIAL
AS OF 12/30/93

CLASS CODE GROUP: 1 UNCLASSIFIED
CLASS CODE: 3400 G.C.R. UNIQUE BOARD ASSY

963490-001 OPCODE: 4 REV: E PWB ASSY-SENSOR SERVO,57V
MODEL:
ECO NO: 30807
DATE OF LAST ECO: 9/07/88

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200076-180	RES-1.8 MOHM 1/4W 5% CF	3	AC	218	1.000	1.000	EA	B	N	N	1.000	0	0	R10i	00/00/00	99/99/99
200012-750	RES-750 OHM 1/4W 1% FF	3	R	219	2.000	1.000	EA	B	N	N	2.000	0	0	R87.88	00/00/00	99/99/99
200073-620	RES-6.2 KOHM 1/4W 5% CF	3	AC	220	3.000	1.000	EA	F	Y	N	3.000	0	0	R1,9,247	2/21/86	99/99/99
205248-200	RES-NTWK 4.7 KOHM DIP	3	B	222	1.000	1.000	EA	B	Y	N	1.000	0	0	U12DA	5/15/86	99/99/99
970843-001	RES-NET-SIP,220 OHM,ISOL	3	B	223	2.000	1.000	EA	B	Y	N	2.000	0	0	RP1,RP2	5/16/86	99/99/99
970267-001	PIN-TEST,.040SQ X .360LG	3	A	245	39.000	1.000	EA	F	Y	N	39.000	0	0	TP1-39	00/00/00	99/99/99
970989-001	IC-74ALS05,INVERTER,OPEN COLTR	3	A	249	1.000	1.000	EA	B	Y	N	1.000	0	0	U7D	3/12/87	99/99/99
203007-700	IC-339 VOLT COMP QUAD	3	J	250	6.000	1.000	EA	B	N	N	6.000	0	0	U4D,U10J,U11L,U12J,U12K,U13R	00/00/00	99/99/99
970554-001	IC-3525 MOD PULSE WIDT	3	C	251	1.000	1.000	EA	B	Y	N	1.000	0	0	U4F	00/00/00	99/99/99
203052-051	IC-4051 MUX 8 CH	3	C	252	2.000	1.000	EA	B	N	N	2.000	0	0	U8C.U9E	00/00/00	99/99/99
970025-001	IC-556 TIMER DUAL	3	C	253	1.000	1.000	EA	B	Y	N	1.000	0	0	U4C	00/00/00	99/99/99
203130-999	IC-082 OP AMP JFET IN	3	F	254	4.000	1.000	EA	B	N	N	4.000	0	0	U8B,U8D,U9A,U9C	00/00/00	99/99/99
203550-501	IC-1001 CONV A-D 10BIT 170NS	3	E	255	1.000	1.000	EA	B	Y	N	1.000	0	0	U10CB	00/00/00	99/99/99
970454-001	IC-7533 CONV D-A 10BIT	3	C	256	1.000	1.000	EA	B	N	N	1.000	0	0	U10AA	00/00/00	99/99/99
203082-500	IC-7407N BUF DRV HEX	3	E	258	2.000	1.000	EA	B	N	N	2.000	0	0	U9J.U10EA	00/00/00	99/99/99
203012-136	IC-4136 OP AMP QUAD	3	J	259	3.000	1.000	EA	B	N	N	3.000	0	0	U7J.U11M,U11P	00/00/00	99/99/99
203555-111	IC-8036 CIO 16BIT 6MHZ	3	C	265	2.000	1.000	EA	B	N	N	2.000	0	0	U11B,U12D	00/00/00	99/99/99
970010-001	IC-74LS08 AND 2IN QUAD	3	B	266	3.000	1.000	EA	B	N	N	3.000	0	0	U11C,U11D,U12DB	00/00/00	99/99/99
203085-001	IC-74LS14 INV SCHMITT HEX	3	J	267	1.000	1.000	EA	B	Y	N	1.000	0	0	U11F	00/00/00	99/99/99
203029-003	IC-74LS11 AND 3IN TRIP	3	F	269	2.000	1.000	EA	B	N	N	2.000	0	0	U10KA,U10KB	00/00/00	99/99/99
203039-001	IC-74LS74 FF D DUAL	3	M	270	1.000	1.000	EA	B	N	N	1.000	0	0	U11R	00/00/00	99/99/99
970221-001	IC-74LS00 NAND 2IN POS QUAD	3	E	272	1.000	1.000	EA	B	N	N	1.000	0	0	U12CB	00/00/00	99/99/99
203046-001	IC-74LS123 MLTV DUAL	3	G	273	2.000	1.000	EA	B	N	N	2.000	0	0	U13M.U13P	00/00/00	99/99/99
203051-100	IC-74LS175 FF D QUAD	3	G	274	2.000	1.000	EA	B	N	N	2.000	0	0	U10BA,U13D	00/00/00	99/99/99
731006-800	LABEL-ASSY	3	B	278	1.000	1.000	EA	F	N	N	1.000	0	0		00/00/00	99/99/99
203046-148	IC-74LS138 DCDR 3-8 LINE	3	K	279	1.000	1.000	EA	B	N	N	1.000	0	0	U10CA	00/00/00	99/99/99
203035-032	IC-74LS32 OR 2IN QUAD	3	J	280	1.000	1.000	EA	B	N	N	1.000	0	0	U10F	00/00/00	99/99/99
203029-500	IC-7414 INV HEX SCHMITT TRIP.	3	C	281	1.000	1.000	EA	B	Y	N	1.000	0	0	U7E	00/00/00	99/99/99
203052-378	IC-74LS378 FF D HEX	3	D	282	2.000	1.000	EA	B	N	N	2.000	0	0	U10AB,U10BB	00/00/00	99/99/99
203051-174	IC-74LS174,FF,D,HEX	3	L	283	2.000	1.000	EA	B	Y	N	2.000	0	0	U12CA,U13C	5/15/86	99/99/99
970011-001	IC-74LS04 INV HEX	3	D	284	1.000	1.000	EA	B	N	N	1.000	0	0	U10EB	00/00/00	99/99/99
203052-244	IC-74LS244 BFR OCT 3S	3	L	285	1.000	1.000	EA	B	N	N	1.000	0	0	U13B	00/00/00	99/99/99
203009-005	IC-084 OP AMP BIFET	3	F	291	1.000	1.000	EA	B	Y	N	1.000	0	0	U12F	12/09/86	99/99/99
203013-317	IC-78L05 VOLT REG +5V 5%	3	E	296	1.000	1.000	EA	B	N	N	1.000	0	0	VR5	00/00/00	99/99/99

FINAL

BILL OF MATERIAL

AS OF 12/30/93

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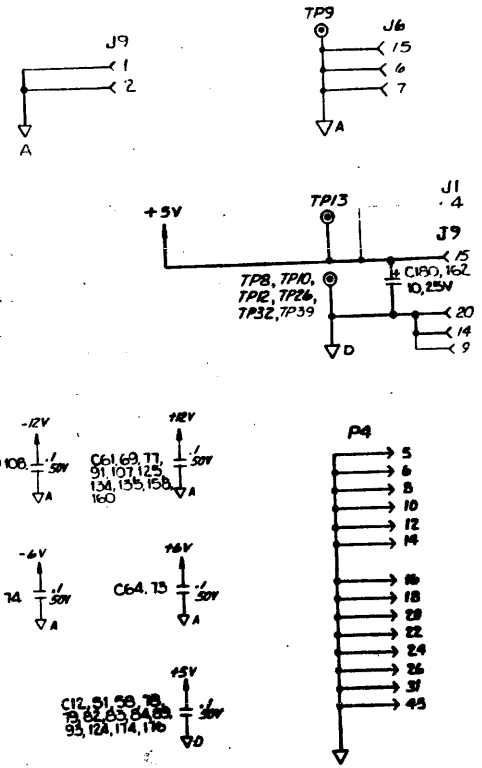
203013-210	IC-7812 VOLT REG -12V 1A	3	F	297	1.000	1.000	EA	B	N	N	1.000	0	0	VR2	00/00/00	99/99/99
203013-300	IC-7912 VOLT REG,12V,1.5AMPS	3	L	298	1.000	1.000	EA	B	N	N	1.000	0	0	VR3	00/00/00	99/99/99
970002-001	IC-7906 VOLT REG -6V	3	A	300	1.000	1.000	EA	B	N	N	1.000	0	0	VR1	00/00/00	99/99/99
970255-001	IC-7808 VOLT REG +8V 1A	3	B	301	1.000	1.000	EA	B	N	N	1.000	0	0	VR4	00/00/00	99/99/99
209990-071	ADHESIVE-SUPERBONDER	3	C	308	0.000	1.000	EA	F	Y	N	0.000	0	0		11/22/85	99/99/99
213020-605	SCREW- 6-32X5/16,BDR HD,SLOT	3	A	309	1.000	1.000	EA	F	Y	N	1.000	0	0		3/27/86	99/99/99
213700-609	WASHER-FLAT,NYLON,SM PAT	3	C	310	1.000	1.000	EA	F	Y	N	1.000	0	0		12/04/85	99/99/99
970559-001	NUT-ACORN CAP 6-32 NYLON	3	A	311	1.000	1.000	EA	B	Y	N	1.000	0	0		12/04/85	99/99/99
209990-063	ADHESIVE-DOW CORNING 3145	3	A	312	.001	1.000	EA	F	Y	N	.001	0	0	ECO#30707	6/23/88	99/99/99
970548-002	RELAY-DPDT,7.5 AMP,12V,PC	3	C	313	1.000	1.000	EA	B	Y	N	1.000	0	0	K1	3/12/87	99/99/99
971041-001	LABEL-BAR CODE,1.425LX.25W,9.*	3	B	315	1.000	1.000	EA	F	Y	N	1.000	0	0		00/00/00	99/99/99
965042-001	LABEL-CAUTION	3	A	316	1.000	1.000	EA	F	Y	N	1.000	0	0	ECO#30243	1/27/88	99/99/99

UNUSED GATES		
TYPE	REF DESIG	INPUT (OUTPUT)
339		8,9(14)
339		8,9 (14)
4136		1,2 (3)
7406		3(4)-11(10)
7407		1(2)-3(4)-5(6)-9(8)
7407		13(12)
74LS08		1,2(3)-4,5(6)-9,10(8)
74LS14		9(8)
74LS123		6,7,9,10,11(5,12)
74LS32		1,2(3)
7414		9(8)-11(10)-13(12)

REFERENCE DESIGNATION		
LTR	LAST USED	NOT USED
C		
CR		
DS		
J		
K		
L		
Q		
R		
T		
U		
VR		
TP		

⚠3 IC TYPE	REFERENCE DESIGNATOR	+5V	DGND	+12	-12	+6	-6	PGND	AGND
74LS08	U11D, U11C, U12DB	14	7						
74LS11	U10KB, U10KA	14	7						
74LS14	U11F	14	7						
74LS04	U10EB								7
74LS74	U11R								
74LS123	U13M, U13P	16	8						
74LS138	U10CA	16	8						
74LS175	U10BA, U13D	16	8						
74LS377B	U10AB, U10BB	16	8						
74LS244	U13B	20	10						
74LS00	U12CB	14	7						
74LS32	U10F	14	7						
LM339	U4D							12	
14ALS05	U7D	14	7						
7407	U10EA, U9J	14	7						
7414	U7E	14	7						
LM339			12						
LM339	U11L			3	12				
TL082	U8B, U8D, U9A, U9C			8	4				
LM339	U10J, U12J U12K U13R			3					12
NE556N	U4C							7	
TL084	U12F			4	11				
RC4136	U7J, U11M, U11P			11	7				8
MDI4051	U8C, U9E					16	7		3
AD7533LN	U10AA			14					7,8
ADC1001	U10CB		10						
74LS174	U12CA, U13C	16	8						
LM336	U11B, U12B	23	7						



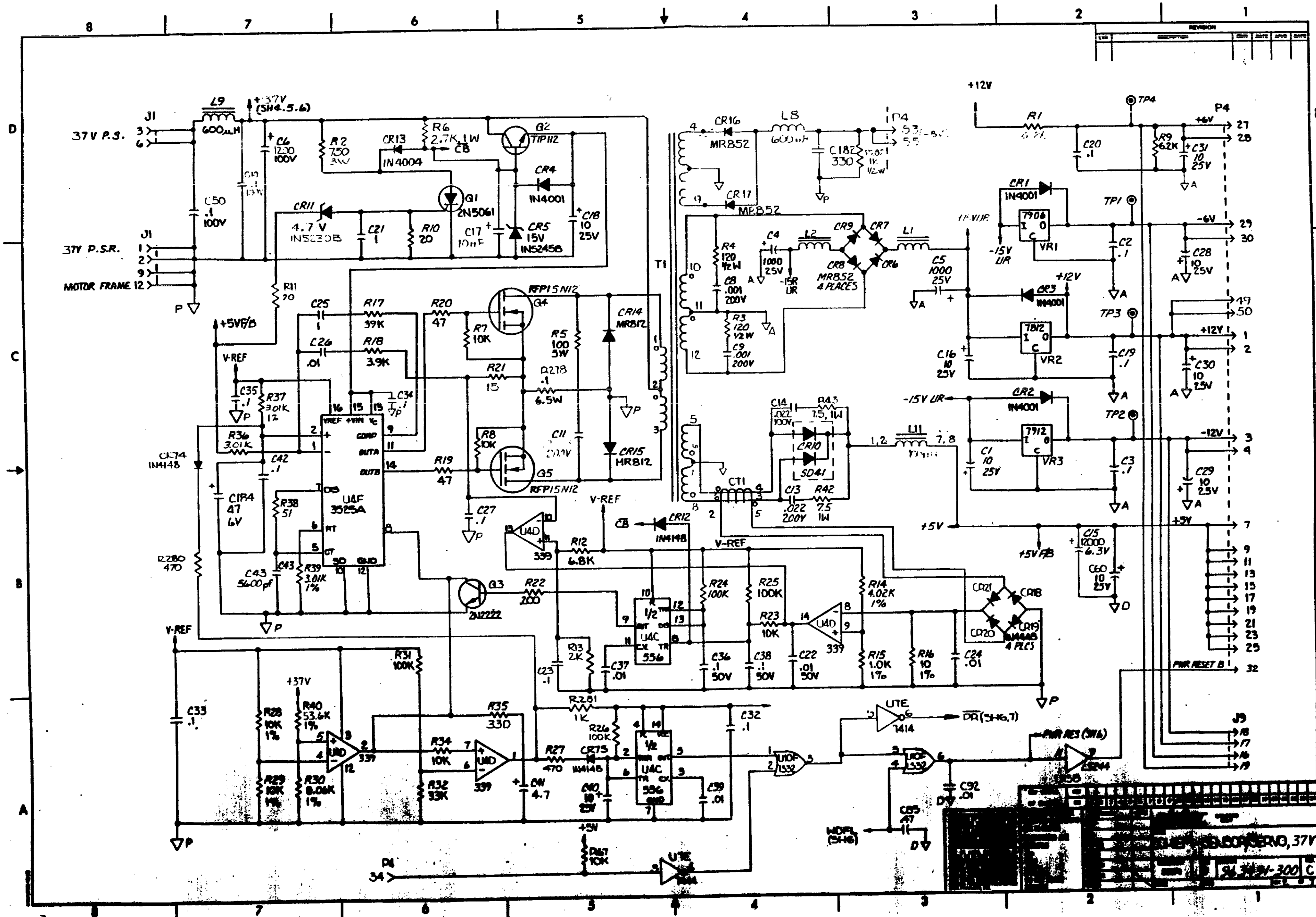
4. 1/8 W RESISTORS ARE ASSIGNED 1% TOL.

⚠3 IC VOLTAGE AND GND ASSIGNMENTS

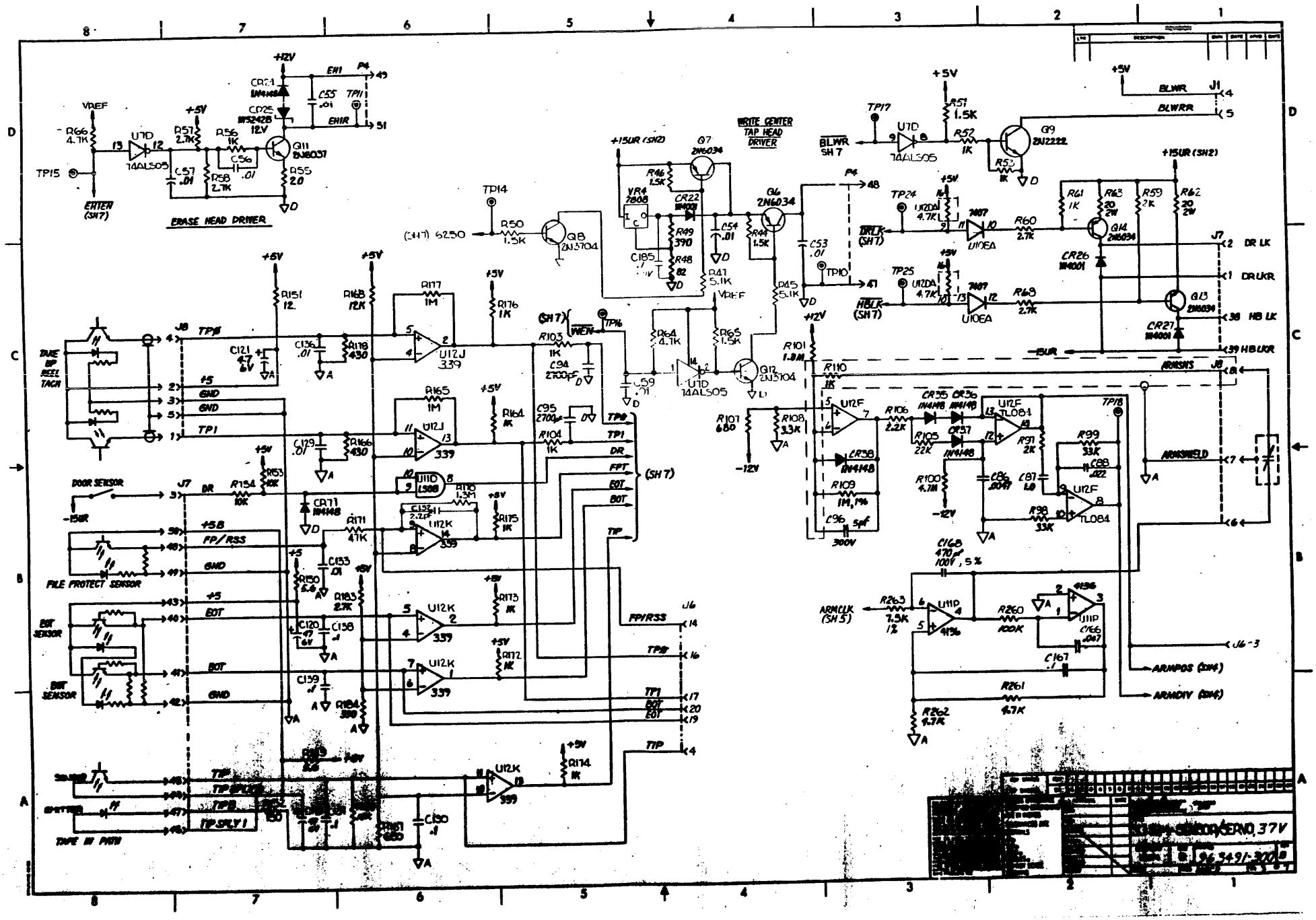
2. CAPACITOR VALUES ARE IN MICROFARADS, 50V.

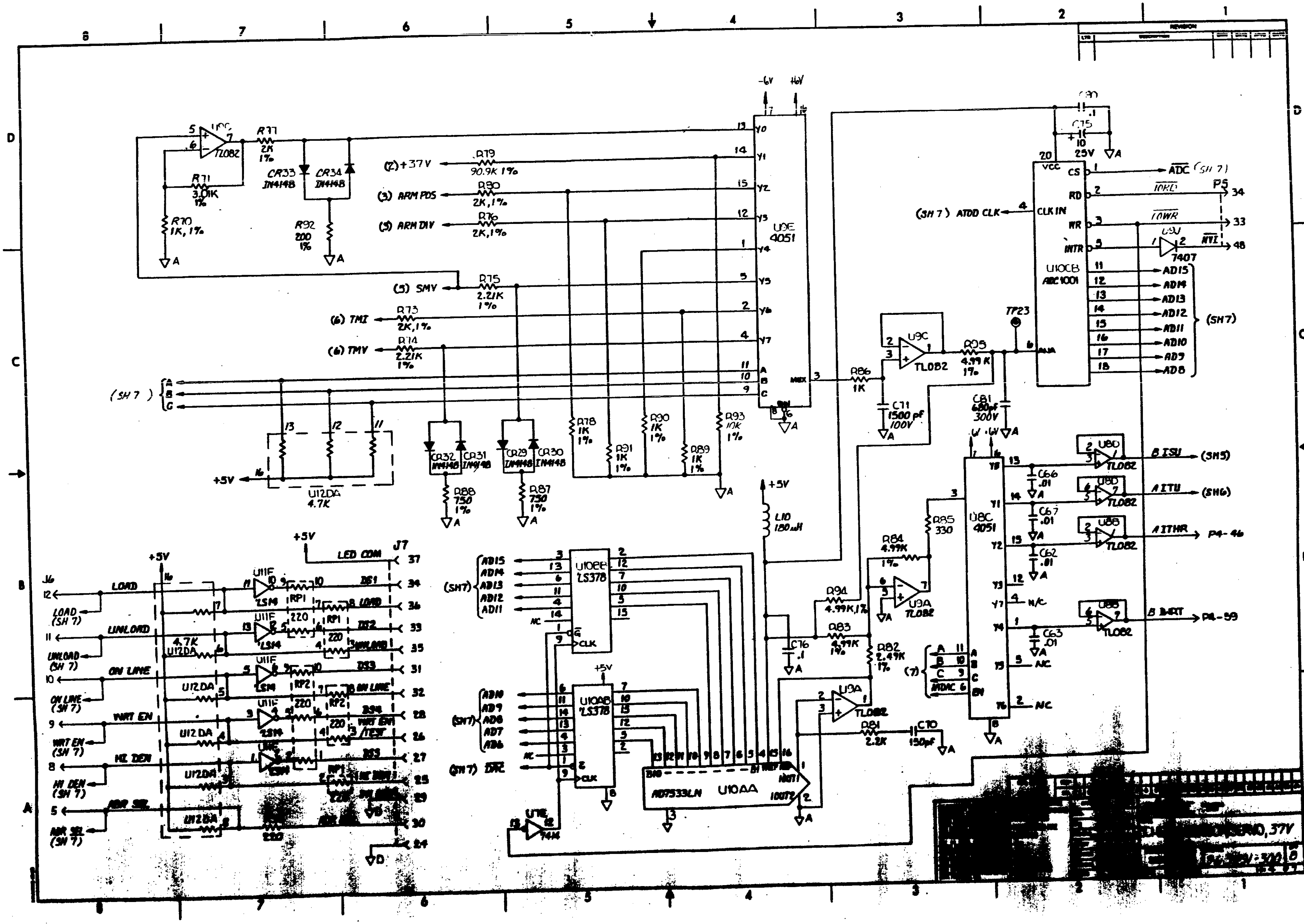
1. RESISTOR VALUES ARE IN OHMS, 1/4W, 5%

NOTES: UNLESS OTHERWISE SPECIFIED.

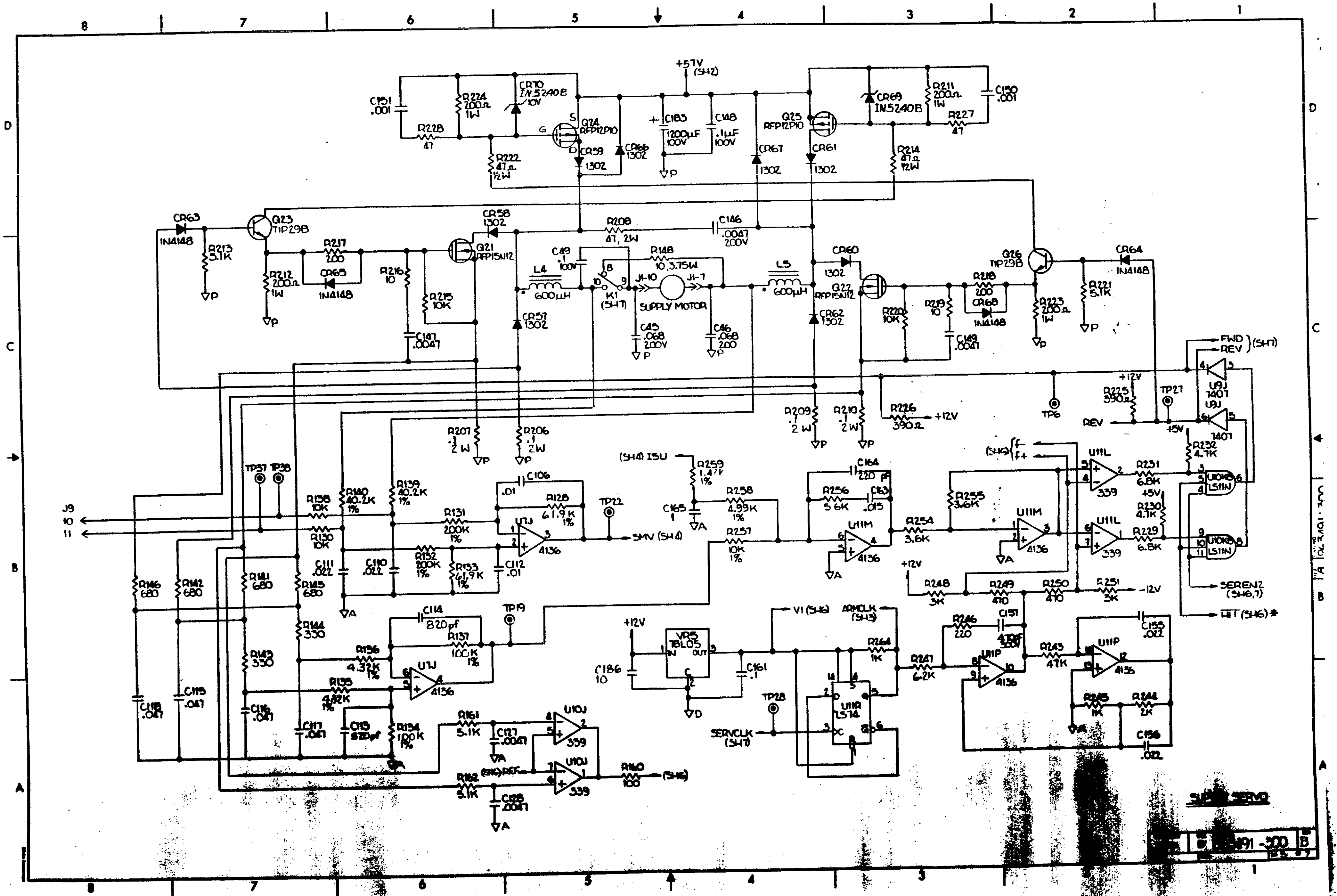


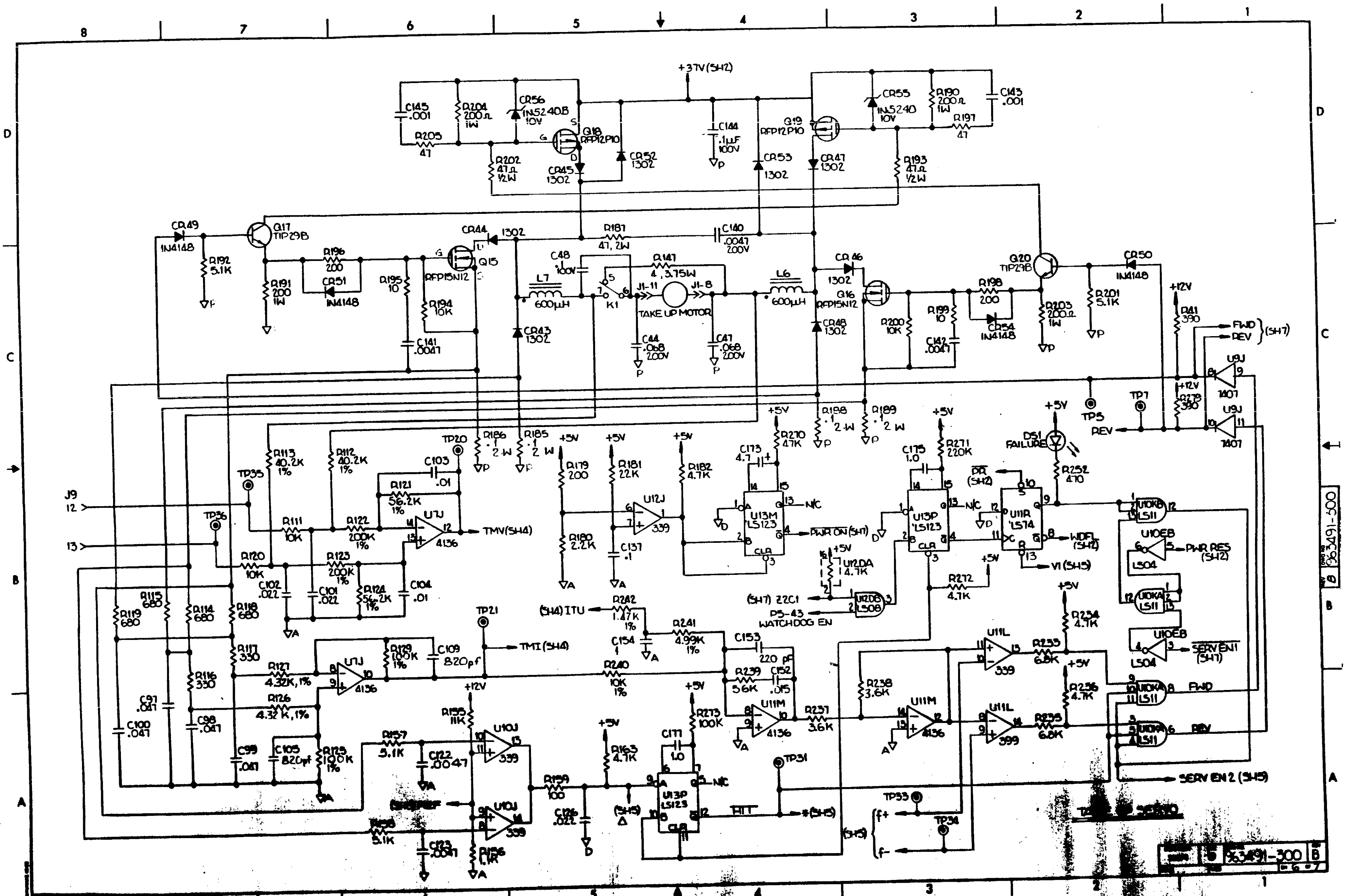
37V P.S.
37V P.S.R.
MOTOR FRAME
J1
L9 600μH
+37V (SH4,5,6)
C6 1200 100V
C50 .1 100V
R2 750 3W
CR13 IN4004
R6 2.7K 1W
Q2 TIP112
Q1 2N5061
CR4 IN4001
CR11 4.7 V IN5230B
C21 1
R10 20
C17 10μF
CR5 15V IN5245B
C18 10 25V
R11 70
+5VF/B
V-REF
C25 .1
R17 39K
C26 .01
R18 3.9K
R20 47
R7 10K
Q4 RFP15N12
R21 15
R5 100 5W
R278 .1 6.5W
CR14 MR812
CR15 MR812
R8 10K
Q5 RFP15N12
R19 47
C27 .1
C35 .1
R37 3.01K 1%
R36 3.01K
CR74 IN4148
C42 .1
C184 47 6V
R38 51
U4F 3525A
C43 5600pf
R39 3.01K 1%
R280 470
Q3 2N2222
R22 200
U4D 339
R12 6.8K
CR12 IN4148
V-REF
R24 100K
R25 100K
R23 10K
R14 4.02K 1%
R15 1.0K 1%
R16 10 1%
C24 .01
C36 .1 50V
C38 .1 50V
C22 .01 50V
C37 .01
R13 2K
1/2 U4C 556
T1
CR16 MR852
CR17 MR852
L8 600μH
C182 330
R4 120 1/2W
C4 1000 25V
L2
CR9
CR7
CR8
CR6
MR852 4 PLACES
L1
C5 1000 25V
C8 .001 200V
R3 120 1/2W
C9 .001 200V
C14 .022 100V
R43 7.5 1W
CR10
SD41
L11
CT1
C13 .022 200V
R42 7.5 1W
+12V
R1
TP4
P4
+6V
R9 6.2K
C31 10 25V
C20 .1
CR1 IN4001
7906
VR1
TP1
-6V
-15V UR
C2 .1
C28 10 25V
CR3 IN4001
TP3
7812
VR2
+12V
C16 10 25V
C19 .1
C30 10 25V
-15V UR
CR2 IN4001
TP2
7912
VR3
-12V
C1 10 25V
C3 .1
C29 10 25V
+5V
C15 12000 6.3V
+5VFB
C60 10 25V
CR21
CR18
CR20
CR19
IN4148 4 PLCS
PWR RESET B
J9
V-REF
C33 .1
R31 100K
+37V
R28 10K 1%
R40 53.6K 1%
U1D 339
R29 10K 1%
R30 8.06K 1%
R35 330
R34 10K
R32 33K
U1D 339
C41 4.7
R27 470
CR75 IN4148
R281 1K
R26 100K
C40 10 25V
1/2 U4C 556
C39 .01
C32 .1
U1E 7414
DR (SH6,7)
U10F 7532
C92 .01
C85 .47
WDFL (SH6)
PWR RES (SH6)
75244
+5V
R67 10K
P4
34
SERVO,37V


ERASE HEAD DRIVER
WRITE CENTER TAP HEAD DRIVER
TAPE IN PATH
FILE PROTECT SENSOR
DOOR SENSOR
ARMCLK (SH5)
ARMPOS (SH4)
ARMDIV (SH6)
ARMSHIELD
DR LK
DR LKR
HB LK
HB LKR
(SH7)

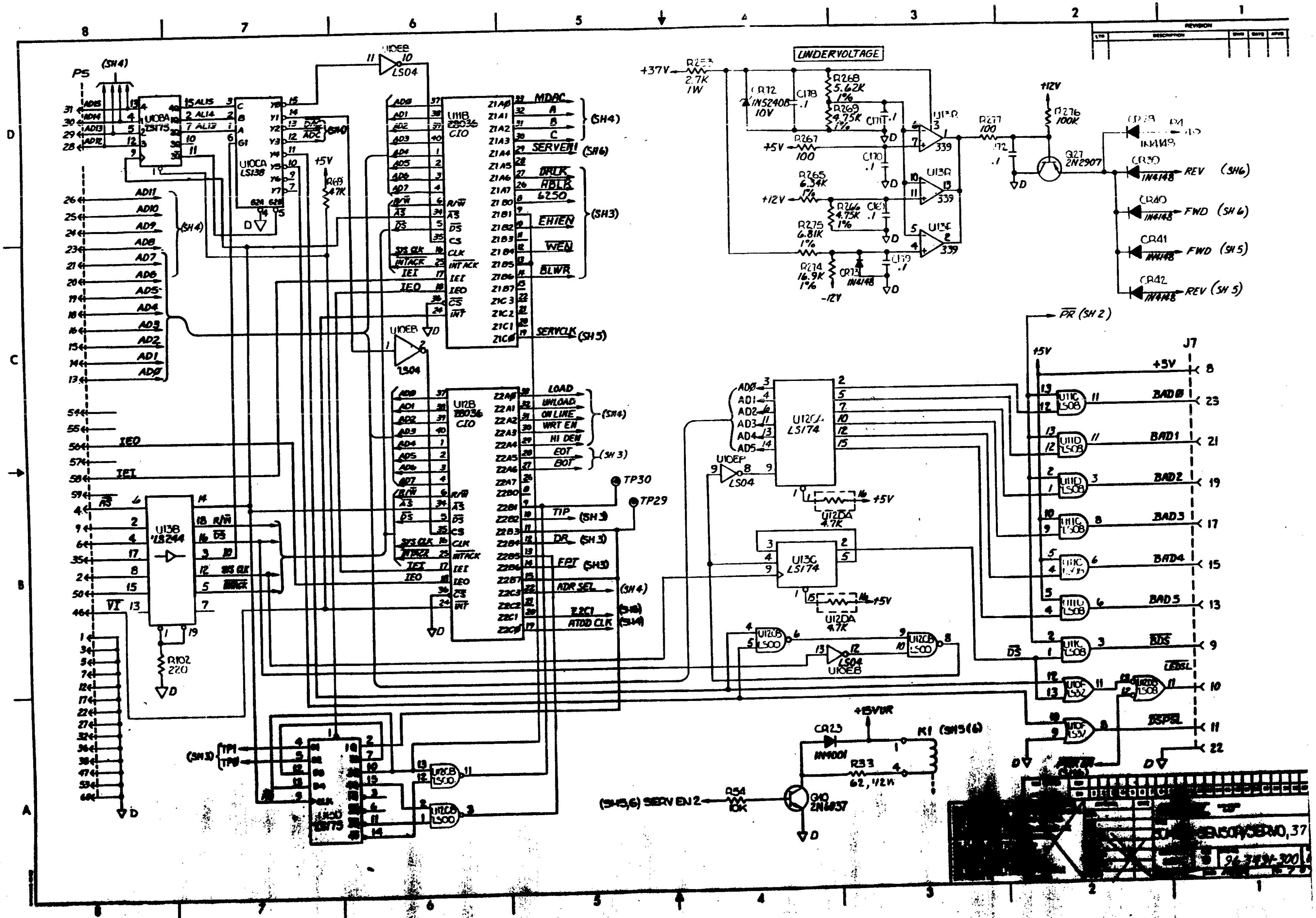


U9C TL082
R77 2K 1%
R71 3.01K 1%
R70 1K, 1%
CR33 1N4148
CR34 1N4148
R92 200 1%
(2) +37V
R79 90.9K 1%
(3) ARM POS
R80 2K, 1%
(5) ARM DIV
R76 2K, 1%
(5) SMV
R75 2.21K 1%
(6) TMI
R73 2K, 1%
(6) TMV
R74 2.21K 1%
(SH 7)
U12DA 4.7K
CR32 1N4148
CR31 1N4148
CR29 1N4148
CR30 1N4148
R88 750 1%
R87 750 1%
R78 1K 1%
R91 1K 1%
R90 1K 1%
R89 1K 1%
R93 10K 1%
U9E 4051
-6V +6V
R86 1K
C71 1500 pF 100V
U9C TL082
R95 4.99K 1%
TP23
C81 680pF 300V
C80 .1
C75 10 25V
U10CB ADC1001
ADC (SH 7)
IORD
IOWR
P5
U9J 7407
NMI
(SH 7) ATOD CLK
AD15 AD14 AD13 AD12 AD11 AD10 AD9 AD8
(SH7)
+5V
L10 180 µH
U8C 4051
R85 330
R84 4.99K 1%
U9A TL082
R94 4.99K 1%
R83 4.99K 1%
R82 2.49K 1%
C76 .1
U9A TL082
R81 2.2K
C70 150pF
C66 .01
C67 .01
C62 .01
C63 .01
U8D TL082
U8B TL082
B ISU (SH5)
A ITU (SH6)
A ITHR P4-46
B IHRT P4-59
N/C
(7) A B C MDAC
U10EB LS378
U10AB LS378
AD7533LN U10AA
IOUT1 IOUT2
(SH7) DAC
U11E 7414
J7
LED COM
J6
LOAD
LOAD (SH 7)
UNLOAD
UNLOAD (SH 7)
ON LINE
ON LINE (SH 7)
WRT EN
WRT EN (SH 7)
HI DEN
HI DEN (SH 7)
ABR SEL
ABR SEL (SH 7)
U11F LS14
RP1 220
RP2 220
U12DA 4.7K
DS1 DS2 DS3 DS4 DS5
B LOAD
B UNLOAD
B ON LINE
WRT EN /TEST
+5V

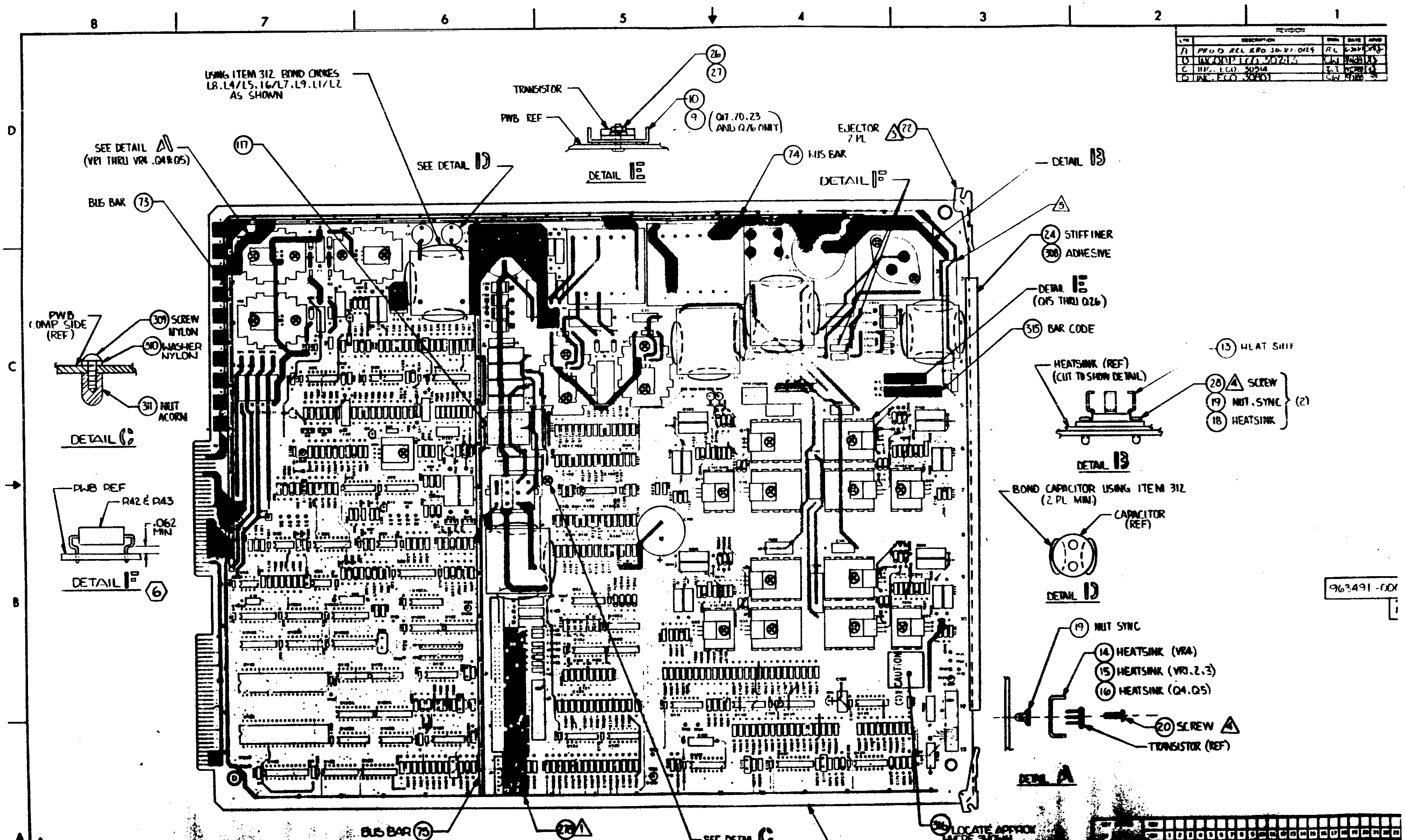

+57V (SH2)
C151 .001
R224 200Ω 1W
CR70 IN5240B 10V
R228 47
R222 47Ω ½W
Q24 RFP12P10
CR59 1302
CR66 1302
C183 1200µF 100V
C148 .1µF 100V
Q25 RFP12P10
CR67 1302
CR61 1302
CR69 IN5240B
R211 200Ω 1W
C150 .001
R227 47
R214 47Ω ½W
CR63 1N4148
Q23 TIP29B
R213 5.1K
R212 200Ω 1W
R217 200
CR65 1N4148
CR58 1302
Q21 RFP15N12
R216 10
R215 10K
C147 .0047
R208 47, 2W
C146 .0047 200V
C49 .1 100V
R148 10, 3.75W
L4 600µH
K1 (SH7)
J1-10
J1-7
SUPPLY MOTOR
CR57 1302
C45 .068 200V
C46 .068 200
L5 600µH
CR60 1302
Q22 RFP15N12
CR62 1302
R220 10K
R219 10
C149 .0047
R218 200
CR68 1N4148
Q26 TIP29B
CR64 1N4148
R223 200Ω 1W
R221 5.1K
FWD
REV
(SH7)
U9J 7407
+12V
R225 390Ω
TP27
TP6
REV
+5V
R209 .1 2W
R210 .1 2W
R226 390Ω
+12V
R207 .1 2W
R206 .1 2W
(SH4) ISU
R259 1.47K 1%
TP37
TP38
J9
10
11
R138 10K
R130 10K
R140 40.2K 1%
R139 40.2K 1%
C106 .01
R128 61.9K 1%
TP22
R131 200K 1%
U7J 4136
SMV (SH4)
C111 .022
C110 .022
R132 200K 1%
R133 61.9K 1%
C112 .01
C165 1
R258 4.99K 1%
R257 10K 1%
C164 220pF
R256 5.6K
C163 .015
U11M 4136
R254 3.6K
R255 3.6K
U11M 4136
(SH6) f- f+
U11L 339
R231 6.8K
R232 4.7K
U10K LS11N
R230 4.7K
R229 6.8K
SERENZ (SH6,7)
HIT (SH6)
R146 680
R142 680
R141 680
R145 680
R144 330
R143 330
C114 820pF
TP19
R136 4.32K 1%
R137 100K 1%
U7J 4136
R135 4.32K 1%
R134 100K 1%
C118 .047
C115 .047
C116 .047
C117 .047
C119 820pF
+12V
R248 3K
R249 410
R250 410
R251 3K
-12V
V1 (SH6)
ARMCLK (SH3)
VR5 78L05
IN OUT
C186 10
C161 .1
R264 1K
R246 220
C157 470pF 50V
R247 6.2K
U11P 4136
R243 47K
C155 .022
R245 1K
R244 2K
C156 .022
TP28
SERVCLK (SH7)
U11R LS74
R161 5.1K
C127 .0047
U10J 339
(SH6) REF
R160 100
(SH6)
R162 5.1K
C128 .0047
SUPPLY SERVO
91-300
B



+37V (SH2)
C145 .001
R204 200Ω 1W
CR56 1N5240B 10V
R205 47
R202 47Ω 1/2W
Q18 RFP12P10
CR45 1302
CR52 1302
C144 .1µF 100V
CR53 1302
Q19 RFP12P10
CR47 1302
CR55 1N5240 10V
R190 200Ω 1W
C143 .001
R197 47
R193 47Ω 1/2W
CR49 1N4148
Q17 TIP29B
R192 5.1K
R191 200 1W
R196 200
CR51 1N4148
R195 10
CR44 1302
Q15 RFP15N12
R194 10K
C141 .0047
C48 100V
L7 600µH
CR43 1302
R187 47, 2W
R147 4, 3.75W
K1
J1-11
J1-8
TAKE UP MOTOR
C44 .068 200V
C47 .068 200V
C140 .0047 200V
L6 600µH
CR46 1302
Q16 RFP15N12
CR48 1302
R200 10K
R199 10
C142 .0047
R198 200
CR54 1N4148
Q20 TIP29B
R203 200Ω 1W
R201 5.1K
CR50 1N4148
+12V
R41 390
FWD
REV
(SH7)
U9J 7407
TP5
TP7
REV
R278 390
R188 .1 2W
R189 .1 2W
R186 .1 2W
R185 .1 2W
TP20
C103 .01
R121 56.2K 1%
R113 40.2K 1%
R112 40.2K 1%
TP35
J9
12
13
TP36
R111 10K
R122 200K 1%
U7J 4136
TMV (SH4)
R120 10K
R123 200K 1%
R124 56.2K 1%
C102 .022
C101 .022
C104 .01
+5V
R179 200
R180 2.2K
R181 22K
C137 .1
U12J 339
R182 4.7K
C173 4.7
R270 47K
U13M 'LS123
N/C
PWR ON (SH7)
U12DA 4.7K
(SH7) ZZC1
U20B LS08
P5-43 WATCHDOG EN
C175 1.0
R271 220K
U13P 'LS123
DR (SH2)
U11R 'LS74
WDFL (SH2)
VI (SH5)
R272 4.7K
DS1 FAILURE
R252 470
U10KB LS11
U10EB LS04
PWR RES (SH2)
U10KA LS11
SERV EN1 (SH7)
R119 680
R115 680
R114 680
R118 680
R117 330
R116 330
C97 .047
C100 .047
C98 .047
C99 .047
C105 820pf
R125 100K 1%
R127 4.32K, 1%
R126 4.32K, 1%
R129 100K 1%
C109 820pf
TP21
TMI (SH4)
(SH4) ITU
R242 1.47K 1%
R241 4.99K 1%
C154 .1
C153 220 pF
R240 10K 1%
R239 5.6K
C152 .015
U11M 4136
R237 3.6K
R238 3.6K
U11L 339
R233 6.8K
R234 4.7K
R236 4.7K
R235 6.8K
FWD
REV
SERV EN 2 (SH5)
+12V
R155 11K
U10J 339
R157 5.1K
C122 .0047
R158 5.1K
C123 .0047
R156 1.1K
R159 100
C126 .022
R163 4.7K
C171 1.0
R273 100K
U13P 'LS123
HIT
TP31
(SH5)
TP33
TP34
f+
f-
TAKE UP SERVO
963491-300 B



UNDERVOLTAGE
P5 (SH4)
U10BA LS175
U10CA LS138
U10EB LS04
U11B Z8036 CIO
U12B Z8036 CIO
U13B 'LS244
U12CA LS174
U13C LS174
U12DA 4.7K
U13D LS175
MDAC
SERVEN (SH6)
(SH3)
(SH4)
SERVCLK (SH5)
LOAD
UNLOAD
ON LINE
WRT EN
HI DEN
EOT
BOT
TIP (SH3)
DR (SH3)
FPT (SH3)
ADR SEL (SH4)
ATOD CLK (SH4)
TP30
TP29
IEO
IEI
+37V
R253 2.7K 1W
CR12 1N5240B 10V
R268 5.62K 1%
R269 4.75K 1%
R267 100
R265 6.34K 1%
R266 4.75K 1%
R275 6.81K 1%
R274 16.9K 1%
CR13 1N4148
-12V
+12V
+5V
R276 100K
Q27 2N2907
REV (SH6)
FWD (SH6)
FWD (SH5)
REV (SH5)
PR (SH2)
J7
BAD0
BAD1
BAD2
BAD3
BAD4
BAD5
BDS
+15VUR
CR23 1N4001
R33 62, 1/2W
K1 (SH5,6)
(SH5,6) SERV EN 2
R54 10K
Q10 2N6037
SENSOR/SERVO,37



4. TORQUE SCREW BETWEEN ... AFTER SYNC NUT HAS BEEN SOLDERED IN PLACE.
5. ROLL PIN IS FURNISHED WITH EJECTOR (ITEM 22).
2. FOR SCHEMATIC SEE 963491-300.
1. MARK ASSY P/N & REV LETTER ON ASSY LABEL (ITEM 278) ON AREA INDICATED.

NOTES: UNLESS OTHERWISE SPECIFIED

6. INSTALL R42 & R43 AS SHOWN IN "DETAIL F" FROM COMPONENT LEADS APPROX AS INDICATED TO MAINTAIN STANDOFF LEAD BEND RADII & SPACING OF COMPONENT FROM SURFACE OF PWB.

3. SQUARE PAD INDICATES IC PIN 1, DIODE CATHODE END, TRANSISTOR EMITTER OR PIN 1, CAP. POSITIVE SIDE.

PICT- PWB ASSY SENSOR/ SERVO 37V

963491-000

BILL OF MATERIAL
AS OF 12/30/93

CLASS CODE GROUP: 1 UNCLASSIFIED
CLASS CODE: 3400 G.C.R. UNIQUE BOARD ASSY

OP: ORDER POLICY CODE
REQ: N=PART OPTIONAL
Y=PART REQUIRED
PF: N=PART DOES NOT PRINT ON SALES ORDER
Y=PART PRINTS ON SALES ORDER W/O PRICE
P=PART PRINTS ON SALES ORDER WITH PRICE

963491-001 OPCODE: 4 REV: E PWB ASSY-SENSOR SERVO,37V
MODEL:
ECO NO: 30807
DATE OF LAST ECO: 9/07/88

PART NUMBER	DESCRIPTION	OP	RV	ITEM NO.	QTY PER ASSEMBLY	YIELD FACTR	UM	SC	REQ	PF	DEFAULT QUANTITY	DAYS OFF SET	SEQ	REFERENCE DESIGNATOR	EFFECTIV DATE	OBSOLETE DATE
															11/14/85	99/99/99
963491-000	PICT-PWB ASSY,SENSOR SERVO,37V	3	D	1	0.000	1.000	EA	F	Y	N	0.000	0	0		11/14/85	99/99/99
963491-101	PWB-SENSOR/SERVO,37V,57V	1	C	2	1.000	1.000	EA	B	Y	N	1.000	0	0		00/00/00	99/99/99
961234-400	SPECIFICATION-TEST,	3	A	3	0.000	1.000	EA	F	N	N	0.000	0	0		12/12/85	99/99/99
963491-300	SCHEM-SENSOR SERVO,37V	3	C	4	0.000	1.000	EA	F	Y	N	0.000	0	0		4/02/87	99/99/99
964398-001	INDUCTOR-DUAL,1500UH	1	A	5	1.000	1.000	EA	B	Y	N	1.000	0	0	L1,2	00/00/00	99/99/99
970440-180	INDUCTOR-180UH,+-10%,	3	B	6	1.000	1.000	EA	B	N	N	1.000	0	0	L10	00/00/00	99/99/99
962906-001	INDUCTOR-EMI FILTER	1	A	7	1.000	1.000	EA	B	Y	N	1.000	0	0	L9	00/00/00	99/99/99
962904-001	XFMR-CURRENT,SENSE	1	B	8	1.000	1.000	EA	B	Y	N	1.000	0	0	CT1	3/25/87	99/99/99
971037-001	HEATSINK-STUD MOUNT	3	A	9	4.000	1.000	EA	B	Y	N	4.000	0	0	Q17,20,23,26		
971037-002	HEATSINK-STUD MOUNT	3	A	10	8.000	1.000	EA	B	Y	N	8.000	0	0	Q15,16,18,19,21,22,24,25	3/25/87	99/99/99
962903-001	CHOKE-DUAL MOTOR	3	A	11	2.000	1.000	EA	B	Y	N	2.000	0	0	L4/L5,L6/L7 ECO#30189	11/23/87	99/99/99
															3/25/87	99/99/99
962908-004	XFMR-PWM,37 VOLT	1	C	12	1.000	1.000	EA	B	Y	N	1.000	0	0	T1	3/12/87	99/99/99
971015-001	HEATSINK-TO-3,TOP MOUNT GOLD	3	A	13	1.000	1.000	EA	B	Y	N	1.000	0	0	CR10	00/00/00	99/99/99
970388-001	HEATSINK-"U" BLACK	3	C	14	1.000	1.000	EA	B	N	N	1.000	0	0	VR4	00/00/00	99/99/99
970281-002	HEATSINK-TO-127/TO-220,	3	C	15	3.000	1.000	EA	B	Y	N	3.000	0	0	VR1-3	00/00/00	99/99/99
970281-001	HEATSINK-TO-127/TO-220,	3	C	16	2.000	1.000	EA	B	Y	N	2.000	0	0	Q4,Q5	3/25/87	99/99/99
964399-001	INDUCTOR-600UH	1	A	17	1.000	1.000	EA	B	Y	N	1.000	0	0	L8	00/00/00	99/99/99
970287-001	HEATSINK-TO-3,6.4,C/W	3	C	18	1.000	1.000	EA	B	N	N	1.000	0	0	CR10	11/23/87	99/99/99
970460-001	NUT-SYNC,6-32,HEATSINK,.220MAX	3	D	19	8.000	1.000	EA	B	Y	N	8.000	0	0	VR1-4,Q2,4,5,CR10 ECO #30189		
															00/00/00	99/99/99
213271-605	SCREW-PHP,ZINC,6-32X5/16	3	G	20	6.000	1.000	EA	F	Y	N	6.000	0	0		3/25/87	99/99/99
964400-001	CHOKE-+5V	1	A	21	1.000	1.000	EA	B	Y	N	1.000	0	0	L11	00/00/00	99/99/99
970083-001	INJECTOR/EJECTOR-1/16"	3	B	22	2.000	1.000	EA	B	N	N	2.000	0	0		00/00/00	99/99/99
961707-002	STIFFENER-EDGE,PCB	3	B	24	1.000	1.000	EA	B	Y	N	1.000	0	0		3/27/86	99/99/99
213271-603	SCREW-PHP,ZINC,6-32X3/16	3	G	25	1.000	1.000	EA	F	Y	N	1.000	0	0		4/02/87	99/99/99
207602-011	WASHER-SPLIT LOCK #6	3	C	26	12.000	1.000	EA	F	Y	N	12.000	0	0		4/02/87	99/99/99
207604-081	NUT-HEX RADIO PATTERN	3	B	27	12.000	1.000	EA	F	Y	N	12.000	0	0		4/02/87	99/99/99
213271-606	SCREW-PHP,ZINC,6-32X3/8	3	G	28	2.000	1.000	EA	F	Y	N	2.000	0	0	ECO#30189	11/23/87	99/99/99
201114-274	CAP-CER,2700PF,50V,10%,X7R	3	J	30	2.000	1.000	EA	B	Y	N	2.000	0	0	C94,95	00/00/00	99/99/99
201112-820	CAP-CER,820PF,50V,10%	3	L	33	4.000	1.000	EA	B	Y	N	4.000	0	0	C105,109,113,114	12/09/85	99/99/99
201191-025	CAP-ELEC,10MF,25V, ,ALUM	3	H	34	14.000	1.000	EA	B	Y	N	14.000	0	0	C1,16-18,28-31,40,6075,162,180186	00/00/00	99/99/99

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963491-001 OPCODE: 4 REV: E PWB ASSY-SENSOR SERVO,37V
MODEL:
ECO NO: 30807
DATE OF LAST ECO: 9/07/88

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201191-025	CAP-ELEC,10MF,25V, ,ALUM	3	H	34	14.000	1.000	EA	B	Y	N	14.000	0	0	186	00/00/00	99/99/99
201114-106	CAP-CER,100000PF,50V,10%,X7R	3	J	35	17.000	1.000	EA	B	Y	N	17.000	0	0	C23,27, 36,38,42,1 30,131,137 ,138,139,1 67,169,170 ,171,172,1 79,185	5/30/86	99/99/99
201158-100	CAP-MYLAR,.1MF,100V,10%	3	E	36	6.000	1.000	EA	B	Y	N	6.000	0	0	C10,48-50, 144,148	4/02/87	99/99/99
970565-001	CAP-ELEC,1000MF,25V,-20+50%	3	A	37	2.000	1.000	EA	B	Y	N	2.000	0	0	C4,5	00/00/00	99/99/99
971031-102	CAP-ELEC,1000-1200 MF,100V,LOW	3	B	38	2.000	1.000	EA	B	Y	N	2.000	0	0	C6,183	3/16/87	99/99/99
971034-103	CAP-ELEC,10000-12000 MF 6.3V*	3	B	39	1.000	1.000	EA	B	Y	N	1.000	0	0	C15	3/16/87	99/99/99
201114-564	CAP-CER,5600PF,50V,10%,X7R	3	J	41	1.000	1.000	EA	B	Y	N	1.000	0	0	C43	3/12/87	99/99/99
201114-220	CAP-CER,.022MF,50V,10%	3	J	42	8.000	1.000	EA	B	Y	N	8.000	0	0	C88,101,10 2,110,111, 126,155,15 6	00/00/00	99/99/99
201123-151	CAP-DM,1500PF,100V,5%	3	E	43	1.000	1.000	EA	B	N	N	1.000	0	0	C71	00/00/00	99/99/99
201160-472	CAP-TANT,4.7MF,10V,10%	3	D	44	2.000	1.000	EA	B	Y	N	2.000	0	0	C41,173	00/00/00	99/99/99
970712-001	CAP-POLY,.0033MF,250-400V,5%	3	A	45	1.000	1.000	EA	B	Y	N	1.000	0	0	C11	12/09/85	99/99/99
970712-004	CAP-POLYPRO,.022UF,200-250V+-*	3	A	48	2.000	1.000	EA	B	N	N	2.000	0	0	C13,14	00/00/00	99/99/99
201204-153	CAP-CER,150PF,50V,5%,NPO	3	R	49	1.000	1.000	EA	B	Y	N	1.000	0	0	C70	00/00/00	99/99/99
201114-105	CAP-CER,10000PF,50V,10%,X7R	3	J	50	23.000	1.000	EA	B	Y	N	23.000	0	0	C22,24,26, 37,39,53-5 7,59,62,63 66,67,92,1 03,104,106 112,129,13 3,136	12/04/85	99/99/99
201161-470	CAP-TANT,47MF,6V,10%	3	P	52	4.000	1.000	EA	B	N	N	4.000	0	0	C119-121,1 84	00/00/00	99/99/99
201120-500	CAP-DM,5PF,300V,+-1/2PF,	3	C	53	1.000	1.000	EA	B	N	N	1.000	0	0	C96	00/00/00	99/99/99
201114-155	CAP-CER,15000PF,50V,10%,X7R	3	J	57	2.000	1.000	EA	B	Y	N	2.000	0	0	C152,163	3/11/87	99/99/99
201114-475	CAP-CER,47000PF,50V,10%,X7R	3	J	58	9.000	1.000	EA	B	Y	N	9.000	0	0	C97,98,99, 100,115,11 6,117,118, 166	00/00/00	99/99/99
971032-331	CAP-ELEC,330 MF,25V	3	A	59	1.000	1.000	EA	B	Y	N	1.000	0	0	C182	3/16/87	99/99/99
970712-003	CAP-POLY,.068MF,200VDC,5%	3	D	60	4.000	1.000	EA	B	Y	N	4.000	0	0	C44-47	12/04/85	99/99/99
201106	CAP-CER,1MF,50V,10%	3	M	61	7.000	1.000	EA	B	Y	N	7.000	0	0	C21,25,87,	00/00/0	/99/99

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201106-107	CAP-CER,1MF,50V,10%	3	M	61	7.000	1.000	EA	B	Y	N	7.000	0	0	154,165,175,177	00/00/00	99/99/99
201113-470	CAP-CER,.0047MF,50V,10%	3	H	62	9.000	1.000	EA	B	Y	N	9.000	0	0	C86,122,123,127,128,141,142,147,149	00/00/00	99/99/99
970712-005	CAP-POLYPRO.0047UF,200-250V,+*	3	A	63	2.000	1.000	EA	B	N	N	2.000	0	0	C140,146	00/00/00	99/99/99
970712-002	CAP-POLY,.001MF,200V MIN,5%	3	C	64	2.000	1.000	EA	B	Y	N	2.000	0	0	C8,9	5/19/86	99/99/99
201204-473	CAP-CER,470PF,50V,5%,NPO	3	R	65	2.000	1.000	EA	B	N	N	2.000	0	0	C168,157	00/00/00	99/99/99
201204-221	CAP-CER,2.2PF,50V,5%,NPO	3	R	66	1.000	1.000	EA	B	Y	N	1.000	0	0	C132	4/02/87	99/99/99
970784-104	CAP-CER,.1UF,50V,-20+80%,AX,*	3	E	67	44.000	1.000	EA	B	Y	N	44.000	0	0	C2,3,12,19,20,32-35,51,58,61,64,65,68,69,72-74,76-80,82-84,89-91,93,107,108,124,125,134,135,158-161,174,176,178	11/23/87	99/99/99
201114-104	CAP-CER,1000PF,50V,10%,X7R	3	J	68	4.000	1.000	EA	B	Y	N	4.000	0	0	C143,145,150,151	00/00/00	99/99/99
201112-220	CAP-CER,220PF,50V,10%	3	E	69	2.000	1.000	EA	B	Y	N	2.000	0	0	C153,164	3/11/87	99/99/99
970085-001	CAP-DM,680PF,300V,1%	3	B	70	1.000	1.000	EA	B	N	N	1.000	0	0	C81	00/00/00	99/99/99
201105-474	CAP-CER,.47MF,50V,10%	3	N	72	1.000	1.000	EA	B	Y	N	3.000	0	0	C85	00/00/00	99/99/99
962003-001	SPEC-8" PWR & GND BUS BAR	1	A	73	1.000	1.000	EA	B	Y	N	1.000	0	0		00/00/00	99/99/99
962002-001	SPEC-15" PWR & GND BUS BAR	1	B	74	1.000	1.000	EA	B	Y	N	1.000	0	0		00/00/00	99/99/99
970551-002	BUS BAR STIFFENER-INSULATED	3	B	75	1.000	1.000	EA	B	Y	N	1.000	0	0		00/00/00	99/99/99
970724-001	DIODE-1N4448,FAST SWITCHING	3	A	87	4.000	1.000	EA	B	Y	N	4.000	0	0	CR18-21	00/00/00	99/99/99
202033	DIODE-RECTIFIER,	3	F	88	2.000	1.000	EA	B	N	N	2.000	0	0	CR14,15	00/00/00	99/99/99
970562-001	DIODE-RECTIFIER,POWER	3	C	89	6.000	1.000	EA	B	Y	N	6.000	0	0	CR6-9,16,17	00/00/00	99/99/99
202032-300	DIODE-ZENER	3	C	90	1.000	1.000	EA	B	Y	N	1.000	0	0	CR25	00/00/00	99/99/99
202018-100	DIODE-SWITCHING,IN4148	3	E	91	29.000	1.000	EA	B	Y	N	29.000	0	0	CR12,24,28-42,49-51,54,63-65,68,71,73-75 ECO#30189	11/23/87	99/99/99
971049-001	DIODE-1N5230B,ZENER,4.7V,5%	3	A	92	1.000	1.000	EA	B	Y	N	1.000	0	0	CR11	5/15/87	99/99/99
202005-500	RECTIFIER-PWR,HI EFF,6A	3	C	93	16.000	1.000	EA	B	N	N	16.000	0	0	CR43-48,52	00/00/00	99/99/99

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202005-500	RECTIFIER-PWR,HI EFF,6A	3	C	93	16.000	1.000	EA	B	N	N	16.000	0	0	,53,57-62, 66,67	00/00/00	99/99/99
202011	DIODE-RECTIFIER 1 AMP	3	G	94	1.000	1.000	EA	B	Y	N	1.000	0	0	CR13	3/11/87	99/99/99
202009-999	DIODE RECTIFIER,1 AMP	3	D	95	8.000	1.000	EA	B	Y	N	8.000	0	0	CR1-4,22,2 3,26,27	3/27/86	99/99/99
202031	DIODE-ZENER	3	E	96	5.000	1.000	EA	B	Y	N	5.000	0	0	CR55,56,69 70,72 ECO# 30189	11/23/87	99/99/99
202032	DIODE-ZENER	3	E	98	1.000	1.000	EA	B	N	N	1.000	0	0	CR5	00/00/00	99/99/99
970238-001	DIODE-RECTIFIER,DUAL	3	C	99	1.000	1.000	EA	B	N	N	1.000	0	0	CR10	00/00/00	99/99/99
202006-100	DIODE-LIGHT EMITTING	3	H	101	1.000	1.000	EA	B	N	N	1.000	0	0	DS1	00/00/00	99/99/99
970208-001	CONNECTOR HEADER SOCKET-	3	A	107	1.000	1.000	EA	B	N	N	1.000	0	0	J1	00/00/00	99/99/99
970288-001	CONN-HEADER,50 POSN,PIN,	3	B	109	1.000	1.000	EA	B	N	N	1.000	0	0	J7	00/00/00	99/99/99
970291-001	CONN-HEADER,8 POSN,PIN,	3	A	110	1.000	1.000	EA	B	N	N	1.000	0	0	J8	00/00/00	99/99/99
970581-001	RECTIFIER-.8AMP 60V	3	A	115	1.000	1.000	EA	B	Y	N	1.000	0	1	Q1	00/00/00	99/99/99
970563-001	TRANSISTOR-NPN,SILICON	3	A	118	1.000	1.000	EA	B	Y	N	1.000	0	0	Q2	00/00/00	99/99/99
970249-001	TRANSISTOR-PNP,SILICON,	3	C	119	1.000	1.000	EA	B	N	N	1.000	0	0	Q27	00/00/00	99/99/99
204007-500	TRANSISTOR-NPN SILICON	3	J	120	2.000	1.000	EA	B	Y	N	2.000	0	0	Q3,9 ECO#3 0189	11/23/87	99/99/99
970546-001	TRANSISTOR-POWER, MOS FET	3	A	121	4.000	1.000	EA	B	Y	N	4.000	0	0	Q18,19,24, 25	12/09/86	99/99/99
204027-037	TRANSISTOR-NPN SILICON	3	E	122	2.000	1.000	EA	B	Y	N	2.000	0	0	Q10,i1	00/00/00	99/99/99
204027-034	TRANSISTOR-PNP SILICON	3	E	123	4.000	1.000	EA	B	N	N	4.000	0	0	Q6,7,13,14	00/00/00	99/99/99
970545-001	TRANSISTOR-POWER, MOS FET	3	A	124	6.000	1.000	EA	B	Y	N	6.000	0	0	Q4,5,15,16 21,22	00/00/00	99/99/99
971033-001	TRANS-TIP29B,NPN TO-220	3	B	126	4.000	1.000	EA	B	Y	N	4.000	0	0	Q17,20,23, 26	3/16/87	99/99/99
204013-999	TRANSISTOR-NPN SILICON	3	E	127	2.000	1.000	EA	B	Y	N	2.000	0	0	Q8,12	3/25/87	99/99/99
200076-100	RES-1.0 MOHM 1/4W 5% CF	3	AC	129	2.000	1.000	EA	F	Y	N	2.000	0	0	R177,165	00/00/00	99/99/99
200120-400	RES-4.0 OHM 3.0W 5% WW	3	H	130	1.000	1.000	EA	F	Y	N	1.000	0	0	R148	00/00/00	99/99/99
200120-100	RES-1.0 OHM 3.0W 5% WW	3	H	131	1.000	1.000	EA	F	Y	N	1.000	0	0	R147	12/09/85	99/99/99
200013-562	RES-5.62 KOHM 1/4W 1% FF	3	R	135	1.000	1.000	EA	F	Y	N	1.000	0	0	R268	00/00/00	99/99/99
200013-200	RES-2.0 KOHM 1/4W 1% FF	3	R	136	4.000	1.000	EA	B	N	N	5.000	0	0	R77,76,80, 73	00/00/00	99/99/99
200073-100	RES-1.0 KOHM 1/4W 5% CF	3	AC	138	17.000	1.000	EA	F	Y	N	17.000	0	0	R52,53,56, 61,86,103, 104,110,16 4,172-176, 245,264,28 1 ECO#3018 9	11/23/87	99/99/99

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200013-634	RES-6.34 KOHM 1/4W 1% FF	3	R	139	1.000	1.000	EA	F	N	N	1.000	0	0	R265	00/00/00	99/99/99
200013-100	RES-1.00 KOHM 1/4W 1% FF	3	R	140	6.000	1.000	EA	F	N	N	6.000	0	0	R15,70,78,89,90,91	00/00/00	99/99/99
200073-470	RES-4.7 KOHM 1/4W 5% CF	3	AC	141	12.000	1.000	EA	F	Y	N	12.000	0	0	R64,66,69,163,182,230,232,234,236,261,262,272	2/21/86	99/99/99
200015-100	RES-100 KOHM 1/4W 1% FF	3	R	142	4.000	1.000	EA	F	Y	N	4.000	0	0	R125,129,134,137	12/09/85	99/99/99
200016-100	RES-1.00 MOHM 1/8W 1% FF	3	R	143	1.000	1.000	EA	F	Y	N	1.000	0	0	R109	00/00/00	99/99/99
200013-499	RES-4.99 KOHM 1/4W 1% FF	3	R	144	6.000	1.000	EA	F	N	N	6.000	0	0	R83,84,94,95,241,258	00/00/00	99/99/99
200072-390	RES-390 OHM 1/4W 5% CF	3	AC	145	6.000	1.000	EA	F	Y	N	6.000	0	0	R41,49,184,225,226,279	00/00/00	99/99/99
200071-820	RES-82 OHM 1/4W 5% CF	3	AC	146	1.000	1.000	EA	F	N	N	1.000	0	0	R48	00/00/00	99/99/99
200013-221	RES-2.21 KOHM 1/4W 1% FF	3	R	147	2.000	1.000	EA	F	N	N	2.000	0	0	R74,75	00/00/00	99/99/99
971030-010	RES-FUSIBLE .1 OHM 2W+5%	3	A	148	8.000	1.000	EA	B	Y	N	8.000	0	0	R185,186,188,189,206207,209,210	3/16/87	99/99/99
970536-047	RES-47 OHM,2W,5%,CF,FIXED	3	C	149	2.000	1.000	EA	B	Y	N	2.000	0	0	R187,208	00/00/00	99/99/99
200014-402	RES-40.2 KOHM 1/4W 1% FF	3	R	150	4.000	1.000	EA	F	Y	N	12.000	0	0	R112,113,139,140	00/00/00	99/99/99
200013-402	RES-4.02 KOHM 1/4W 1% FF	3	R	151	1.000	1.000	EA	B	Y	N	1.000	0	0	R14	11/21/85	99/99/99
200013-249	RES-2.49 KOHM 1/4W 1% FF	3	R	152	1.000	1.000	EA	F	N	N	1.000	0	0	R82	00/00/00	99/99/99
200073-220	RES-2.2 KOHM 1/4W 5% CF	3	AC	153	3.000	1.000	EA	F	N	N	3.000	0	0	R81,106,180	00/00/00	99/99/99
200014-562	RES-56.2 KOHM 1/4W 1% FF	3	R	154	2.000	1.000	EA	B	Y	N	2.000	0	0	R121,124	12/12/85	99/99/99
200072-330	RES-330 OHM 1/4W 5% CF	3	AC	155	6.000	1.000	EA	F	Y	N	6.000	0	0	R35,05,116,117,143,144	00/00/00	99/99/99
200073-270	RES-2.7 KOHM 1/4W 5% CF	3	AC	156	6.000	1.000	EA	F	Y	N	6.000	0	0	R13,57,58,60,68,183 ECO#30189	11/23/87	99/99/99
200071-200	RES-20 OHM 1/4W 5% CF	3	AC	157	3.000	1.000	EA	F	Y	N	3.000	0	0	R10,11,55	00/00/00	99/99/99
200071-510	RES-51 OHM 1/4W 5% CF	3	AC	158	1.000	1.000	EA	F	Y	N	1.000	0	0	R38	00/00/00	99/99/99
200073-150	RES-1.5 KOHM 1/4W 5% CF	3	AC	159	5.000	1.000	EA	F	Y	N	5.000	0	0	R44,46,5051,65	00/00/00	99/99/99
200073-510	RES-5.1 KOHM 1/4W 5% CF	3	AC	160	10.000	1.000	EA	F	Y	N	10.000	0	0	R45,47,157	00/00/00	99/99/99

BILL OF MATERIAL
AS OF 12/30/93

CLASS CODE GROUP: 1 UNCLASSIFIED
CLASS CODE: 3400 G.C.R. UNIQUE BOARD ASSY

963491-001 OPCODE: 4 REV: E PWB ASSY-SENSOR SERVO,37V
MODEL:
ECO NO: 30807
DATE OF LAST ECO: 9/07/88

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200073-510	RES-5.1 KOHM 1/4W 5% CF	3	AC	160	10.000	1.000	EA	F	Y	N	10.000	0	0	,158,161,162,192,201 213,221	00/00/00	99/99/99
200082-120	RES-120 OHM 1/2W 5% CF	3	L	161	2.000	1.000	EA	B	N	N	2.000	0	0	R3,4	00/00/00	99/99/99
200071-470	RES-47 OHM 1/4W 5% CF	3	AC	163	4.000	1.000	EA	F	Y	N	4.000	0	0	R197,205,227,228	00/00/00	99/99/99
200122-750	RES-750 OHM 3.0W 5% WW	3	H	164	1.000	1.000	EA	F	Y	N	1.000	0	0	R2	3/11/87	99/99/99
200093-270	RES-2.7 KOHM 1W 5% FC	3	A	165	2.000	1.000	EA	F	Y	N	2.000	0	0	R6,253	12/09/85	99/99/99
970271-002	RES-20 OHM 2W 5% FC	3	A	166	2.000	1.000	EA	B	N	N	2.000	0	0	R62,63	00/00/00	99/99/99
200070-560	RES-5.6 OHM 1/4W 5% CF	3	AC	167	2.000	1.000	EA	F	N	N	2.000	0	0	R150,149	00/00/00	99/99/99
200074-100	RES-10 KOHM 1/4W 5% CF	3	AC	168	17.000	1.000	EA	F	Y	N	17.000	0	0	R7,8,23,34,54,67,111,120,130,138,153,154,169,194,200,215,220	00/00/00	99/99/99
200014-619	RES-61.9 KOHM 1/4W 1% FF	3	R	169	2.000	1.000	EA	B	Y	N	2.000	0	0	R128,133	12/12/85	99/99/99
200074-220	RES-22 KOHM 1/4W 5% CF	3	AC	170	2.000	1.000	EA	F	N	N	2.000	0	0	R105,181	00/00/00	99/99/99
200013-750	RES-7.50 KOHM 1/4W 1% FF	3	R	171	1.000	1.000	EA	F	Y	N	1.000	0	0	R263	00/00/00	99/99/99
200074-560	RES-56 KOHM 1/4W 5% CF	3	AC	172	2.000	1.000	EA	F	Y	N	2.000	0	0	R239,256	3/11/87	99/99/99
200073-360	RES-3.6 KOHM 1/4W 5% CF	3	AC	173	4.000	1.000	EA	F	Y	N	4.000	0	0	R237,238,254,255	00/00/00	99/99/99
971416-750	RES-7.5 OHM,5%,1W,CF	3	A	174	2.000	1.000	EA	F	Y	N	2.000	0	0	R42,R43 ECO#30807	9/06/88	99/99/99
200072-430	RES-430 OHM 1/4W 5% CF	3	AC	175	2.000	1.000	EA	F	Y	N	2.000	0	0	R166,178	00/00/00	99/99/99
200074-120	RES-12 KOHM 1/4W 5% CF	3	AC	176	1.000	1.000	EA	F	Y	N	1.000	0	0	R168	2/21/86	99/99/99
200013-301	RES-3.01 KOHM 1/4W 1% FF	3	R	177	4.000	1.000	EA	F	Y	N	4.000	0	0	R36,37,39,71	00/00/00	99/99/99
200072-220	RES-220 OHM 1/4W 5% CF	3	AC	178	3.000	1.000	EA	F	Y	N	3.000	0	0	R96,102,246	00/00/00	99/99/99
200013-147	RES-1.47 KOHM 1/4W 1% FF	3	R	179	2.000	1.000	EA	F	Y	N	2.000	0	0	R259,242	12/09/85	99/99/99
200013-432	RES-4.32 KOHM 1/4W 1% FF	3	R	180	4.000	1.000	EA	F	Y	N	4.000	0	0	R126,127,135,136	12/09/85	99/99/99
200081-620	RES-62 OHM 1/2W 5% CF	3	L	181	1.000	1.000	EA	B	Y	N	1.000	0	0	R33	4/02/87	99/99/99
200075-100	RES-100 KOHM 1/4W 5% CF	3	AC	182	7.000	1.000	EA	F	Y	N	7.000	0	0	R24-26,31,260,273,276	00/00/00	99/99/99
200072-100	RES-100 OHM 1/4W 5% CF	3	AC	183	4.000	1.000	EA	F	Y	N	4.000	0	0	R159,160,267,277	00/00/00	99/99/99
200075-220	RES-220 KOHM 1/4W 5% CF	3	AC	184	1.000	1.000	EA	F	Y	N	1.000	0	0	R271	00/00/00	99/99/99
200072-470	RES-470 OHM 1/4W 5% CF	3	AC	185	5.000	1.000	EA	F	Y	N	5.000	0	0	R27,249,25	00/00/00	99/99/99

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963491-001 OPCODE: 4 REV: E PWB ASSY-SENSOR SERVO,37V
MODEL:
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DATE OF LAST ECO: 9/07/88

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200072-470	RES-470 OHM 1/4W 5% CF	3	AC	185	5.000	1.000	EA	F	Y	N	5.000	0	0	0,252,280	00/00/00	99/99/99
200074-330	RES-33 KOHM 1/4W 5% CF	3	AC	186	3.000	1.000	EA	F	N	N	3.000	0	0	R32,98,99	00/00/00	99/99/99
200076-470	RES-4.7 MOHM 1/4W 5% CF	3	AC	187	1.000	1.000	EA	F	N	N	1.000	0	0	R100	00/00/00	99/99/99
200072-200	RES-200 OHM 1/4W 5% CF	3	AC	188	6.000	1.000	EA	F	Y	N	6.000	0	0	R22,179,196,198,217,218 ECO#30189	11/23/87	99/99/99
200071-150	RES-15 OHM 1/4W 5% CF	3	AC	189	1.000	1.000	EA	F	N	N	1.000	0	0	R21	00/00/00	99/99/99
200072-150	RES-150 OHM 1/4W 5% CF	3	AC	190	1.000	1.000	EA	F	Y	N	1.000	0	0	R152	12/11/85	99/99/99
970969-047	RES-FUSIBLE,47OHM,1/2W,5% MF	3	C	191	6.000	1.000	EA	B	Y	N	6.000	0	0	R19,20,193,202,214,222	3/16/87	99/99/99
200015-200	RES-200 KOHM 1/4W 1% FF	3	R	192	4.000	1.000	EA	B	Y	N	4.000	0	0	R122,123,131,132	11/06/85	99/99/99
200074-470	RES-47 KOHM 1/4W 5% CF	3	AC	193	3.000	1.000	EA	F	Y	N	3.000	0	0	R171,243,270	00/00/00	99/99/99
200071-120	RES-12 OHM 1/4W 5% CF	3	AC	194	1.000	1.000	EA	F	N	N	1.000	0	0	R151	00/00/00	99/99/99
200013-475	RES-4.75 KOHM 1/4W 1% FF	3	R	195	2.000	1.000	EA	F	N	N	2.000	0	0	R266.269	00/00/00	99/99/99
200014-169	RES-16.9 KOHM 1/4W 1% FF	3	R	196	1.000	1.000	EA	B	N	N	1.000	0	0	R274	00/00/00	99/99/99
200073-300	RES-3 KOHM 1/4W 5% CF	3	AC	197	2.000	1.000	EA	F	Y	N	2.000	0	0	R248,251	00/00/00	99/99/99
200073-110	RES-1.1 KOHM 1/4W 5% CF	3	AC	198	1.000	1.000	EA	F	Y	N	1.000	0	0	R156	12/11/85	99/99/99
200073-680	RES-6.8 KOHM 1/4W 5% CF	3	AC	200	5.000	1.000	EA	F	N	N	6.000	0	0	R12,229,231,233,235	00/00/00	99/99/99
200074-110	RES-11 KOHM 1/4W 5% CF	3	AC	201	1.000	1.000	EA	F	Y	N	1.000	0	0	R155 ECO#30189	11/23/87	99/99/99
970537-002	RES-100 OHM 5% 5W WW	3	A	202	1.000	1.000	EA	B	Y	N	1.000	0	0	R5	00/00/00	99/99/99
200076-130	RES-1.3 MOHM 1/4W 5% CF	3	AC	203	1.000	1.000	EA	F	Y	N	1.000	0	0	R170	12/09/86	99/99/99
200071-100	RES-10 OHM 1/4W 5% CF	3	AC	204	4.000	1.000	EA	F	Y	N	4.000	0	0	R195,199,216,219	00/00/00	99/99/99
200148-100	RES-0.10 OHM 6.5W 5% WW	3	D	205	1.000	1.000	EA	F	N	N	1.000	0	0	R278	00/00/00	99/99/99
200074-390	RES-39 KOHM 1/4W 5% CF	3	AC	206	1.000	1.000	EA	F	N	N	1.000	0	0	R17	00/00/00	99/99/99
200073-390	RES-3.9 KOHM 1/4W 5% CF	3	AC	207	2.000	1.000	EA	F	Y	N	2.000	0	0	R18	00/00/00	99/99/99
200014-909	RES-90.9 KOHM 1/4W 1% FF	3	R	208	1.000	1.000	EA	F	N	N	1.000	0	0	R79	00/00/00	99/99/99
200011-100	RES-10.0 OHM 1/4W 1% FF	3	R	209	1.000	1.000	EA	B	Y	N	1.000	0	0	R16	11/21/85	99/99/99
200013-806	RES-8.06 KOHM 1/4W 1% FF	3	R	210	1.000	1.000	EA	F	N	N	1.000	0	0	R30	00/00/00	99/99/99
200014-100	RES-10.0 KOHM 1/4W 1% FF	3	R	211	5.000	1.000	EA	F	Y	N	4.000	0	0	R28,29,93,240,257	00/00/00	99/99/99
200013-681	RES-6.81 KOHM 1/4W 1% FF	3	R	212	1.000	1.000	EA	F	Y	N	1.000	0	0	R275	00/00/00	99/99/99
200073-200	RES-2 KOHM 1/4W 5% CF	3	AC	213	3.000	1.000	EA	F	Y	N	3.000	0	0	R59,97,244 ECO#30189	11/23/87	99/99/99
200012-200	RES-200 OHM 1/4W 1% FF	3	R	214	1.000	1.000	EA	B	N	N	1.000	0	0	R92	00/00/00	99/99/99

ORIGINAL

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963491-001 OPCODE: 4 REV: E PWB ASSY-SENSOR SERVO,37V
MODEL:
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DATE OF LAST ECO: 9/07/88

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970568-201	RES-200 OHM 1W 5% CF	3	D	215	8.000	1.000	EA	B	Y	N	8.000	0	0	R190,191,203,204,211 212,223,224 ECO#30189	11/23/87	99/99/99
200072-680	RES-680 OHM 1/4W 5% CF	3	AC	216	10.000	1.000	EA	F	Y	N	10.000	0	0	R107,114,115,118,119 141,142,145,146,167 ECO#30189	11/23/87	99/99/99
200073-330	RES-3.3 KOHM 1/4W 5% CF	3	AC	217	1.000	1.000	EA	F	N	N	1.000	0	0	R108	00/00/00	99/99/99
200076-180	RES-1.8 MOHM 1/4W 5% CF	3	AC	218	1.000	1.000	EA	B	N	N	1.000	0	0	R101	00/00/00	99/99/99
200012-750	RES-750 OHM 1/4W 1% FF	3	R	219	2.000	1.000	EA	B	N	N	2.000	0	0	R87,88	00/00/00	99/99/99
200073-620	RES-6.2 KOHM 1/4W 5% CF	3	AC	220	3.000	1.000	EA	F	Y	N	3.000	0	0	R1,9,247	2/21/86	99/99/99
200014-536	RES-53.6 KOHM 1/4W 1% FF	3	R	221	1.000	1.000	EA	F	Y	N	1.000	0	0	R40	12/09/85	99/99/99
205248-200	RES-NTWK 4.7 KOHM DIP	3	B	222	1.000	1.000	EA	B	Y	N	1.000	0	0	U12DA	5/19/86	99/99/99
970843-001	RES-NET-SIP,220 OHM,ISOL	3	B	223	2.000	1.000	EA	B	Y	N	2.000	0	0	RP1,RP2	5/19/86	99/99/99
200083-100	RES-1.0 KOHM 1/2W 5% CF	3	L	224	1.000	1.000	EA	F	Y	N	1.000	0	0	R282 ECO#30189	11/23/87	99/99/99
970267-001	PIN-TEST,.040SQ X .360LG	3	A	245	39.000	1.000	EA	F	Y	N	39.000	0	0	TP1-39 ECO #30189	11/23/87	99/99/99
970989-001	IC-74ALS05,INVERTER,OPEN COLTR	3	A	249	1.000	1.000	EA	B	Y	N	1.000	0	0	U7D	3/12/87	99/99/99
203007-700	IC-339 VOLT COMP QUAD	3	J	250	6.000	1.000	EA	B	N	N	6.000	0	0	U4D,10J,11L,12J,12K,13R	00/00/00	99/99/99
970554-001	IC-3525 MOD PULSE WIDT	3	C	251	1.000	1.000	EA	B	Y	N	1.000	0	0	U4F	00/00/00	99/99/99
203052-051	IC-4051 MUX 8 CH	3	C	252	2.000	1.000	EA	B	N	N	2.000	0	0	U8C,9E	00/00/00	99/99/99
970025-001	IC-556 TIMER DUAL	3	C	253	1.000	1.000	EA	B	Y	N	1.000	0	0	U4C	00/00/00	99/99/99
203130-999	IC-082 OP AMP JFET IN	3	F	254	4.000	1.000	EA	B	N	N	4.000	0	0	U8B,8D,9A,9C	00/00/00	99/99/99
203550-501	IC-1001 CONV A-D 10BIT 170NS	3	E	255	1.000	1.000	EA	B	Y	N	1.000	0	0	U10CB	00/00/00	99/99/99
970454-001	IC-7533 CONV D-A 10BIT	3	C	256	1.000	1.000	EA	B	N	N	1.000	0	0	U10AA	00/00/00	99/99/99
203082-500	IC-7407N BUF DRV HEX	3	E	258	2.000	1.000	EA	B	N	N	2.000	0	0	U9J,10EA	00/00/00	99/99/99
203012-136	IC-4136 OP AMP QUAD	3	J	259	3.000	1.000	EA	B	N	N	3.000	0	0	U7J,11M,11P	00/00/00	99/99/99
203555-111	IC-8036 CIO 16BIT 6MHZ	3	C	265	2.000	1.000	EA	B	N	N	2.000	0	0	U11B,12B	00/00/00	99/99/99
970010-001	IC-74LS08 AND 2IN QUAD	3	B	266	3.000	1.000	EA	B	N	N	3.000	0	0	U11C,11D,12DB	00/00/00	99/99/99
203085-001	IC-74LS14 INV SCHMITT HEX	3	J	267	1.000	1.000	EA	B	Y	N	1.000	0	0	U11F	00/00/00	99/99/99
203029-003	IC-74LS11 AND 3IN TRIP	3	F	269	2.000	1.000	EA	B	N	N	2.000	0	0	U10KA,10KB	00/00/00	99/99/99
203039-001	IC-74LS74 FF D DUAL	3	M	270	1.000	1.000	EA	B	N	N	1.000	0	0	U11R	00/00/00	99/99/99

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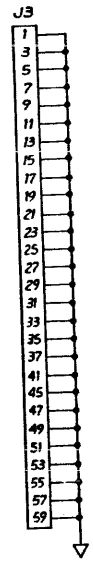
970221-001	IC-74LS00 NAND 2IN POS QUAD	3	E	272	1.000	1.000	EA	B	N	N	1.000	0	0	U12CB	00/00/00	99/99/99
203046-001	IC-74LS123 MLTV DUAL	3	G	273	2.000	1.000	EA	B	N	N	2.000	0	0	U13M,13P	00/00/00	99/99/99
203051-100	IC-74LS175 FF D QUAD	3	G	274	2.000	1.000	EA	B	N	N	2.000	0	0	U10BA,13D	00/00/00	99/99/99
731006-800	LABEL-ASSY	3	B	278	1.000	1.000	EA	F	N	N	1.000	0	0		00/00/00	99/99/99
203046-148	IC-74LS138 DCDR 3-8 LINE	3	K	279	1.000	1.000	EA	B	N	N	1.000	0	0	U10CA	00/00/00	99/99/99
203035-032	IC-74LS32 OR 2IN QUAD	3	J	280	1.000	1.000	EA	B	N	N	1.000	0	0	U10F	00/00/00	99/99/99
203029-500	IC-7414 INV HEX SCHMITT TRIP,	3	C	281	1.000	1.000	EA	B	Y	N	1.000	0	0	U7E	00/00/00	99/99/99
203052-378	IC-74LS378 FF D HEX	3	D	282	2.000	1.000	EA	B	N	N	2.000	0	0	U10AB,10BB	00/00/00	99/99/99
203051-174	IC-74LS174,FF,D,HEX	3	L	283	2.000	1.000	EA	B	Y	N	2.000	0	0	U12CA,13C	2/21/86	99/99/99
970011-001	IC-74LS04 INV HEX	3	D	284	1.000	1.000	EA	B	N	N	1.000	0	0	U10EB	00/00/00	99/99/99
203052-244	IC-74LS244 BFR OCT 3S	3	L	285	1.000	1.000	EA	B	N	N	1.000	0	0	U13B	00/00/00	99/99/99
203013-317	IC-78L05 VOLT REG +5V 5%	3	E	296	1.000	1.000	EA	B	N	N	1.000	0	0	VR5	00/00/00	99/99/99
203013-210	IC-7812 VOLT REG -12V 1A	3	F	297	1.000	1.000	EA	B	N	N	1.000	0	0	VR2	00/00/00	99/99/99
203013-300	IC-7912 VOLT REG,12V,1.5AMPS	3	L	298	1.000	1.000	EA	B	N	N	1.000	0	0	VR3	00/00/00	99/99/99
970002-001	IC-7906 VOLT REG -6V	3	A	300	1.000	1.000	EA	B	N	N	1.000	0	0	VR1	00/00/00	99/99/99
970255-001	IC-7808 VOLT REG +8V 1A	3	B	301	1.000	1.000	EA	B	N	N	1.000	0	0	VR4	00/00/00	99/99/99
203009-005	IC-084 OP AMP BIFET	3	F	307	1.000	1.000	EA	B	Y	N	1.000	0	0	U12F	12/09/86	99/99/99
209990-071	ADHESIVE-SUPERBONDER	3	C	308	0.000	1.000	EA	F	Y	N	0.000	0	0		11/22/85	99/99/99
213020-605	SCREW- 6-32X5/16,BDR HD,SLOT	3	A	309	1.000	1.000	EA	F	Y	N	1.000	0	0		3/27/86	99/99/99
213700-609	WASHER-FLAT,NYLON,SM PAT	3	C	310	1.000	1.000	EA	F	Y	N	1.000	0	0		12/04/85	99/99/99
970559-001	NUT-ACORN CAP 6-32 NYLON	3	A	311	1.000	1.000	EA	B	Y	N	1.000	0	0		12/04/85	99/99/99
209990-063	ADHESIVE-DOW CORNING 3145	3	A	312	.001	1.000	EA	F	Y	N	.001	0	0	ECO#30708	6/23/88	99/99/99
970548-002	RELAY-DPDT,7.5 AMP,12V,PC	3	C	313	1.000	1.000	EA	B	Y	N	1.000	0	0	K1	3/12/87	99/99/99
971041-001	LABEL-BAR CODE,1.425LX.25W,9.*	3	B	315	1.000	1.000	EA	F	Y	N	1.000	0	0		00/00/00	99/99/99
965042-001	LABEL-CAUTION	3	A	316	1.000	1.000	EA	F	Y	N	1.000	0	0	ECO#30243	1/27/88	99/99/99

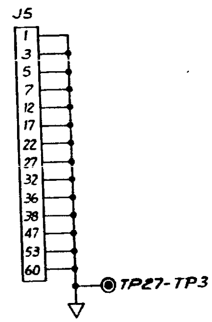
NOTES: (UNLESS OTHERWISE SPECIFIED)

1. IC V_{CC} & GND PINS WITH UNUSED PORTIONS:

IC TYPE	REFERENCE DESIGNATOR	+5V	GND	UNUSED
SN74LS00N	16N, 18H, 22D, 25E	14	7	
SN74LS01N	23H	14	7	C
SN74LS04N	23C, 17A	14	7	
SN74LS08N	22E, 27H	14	7	27H-D
SN74LS10N	18B, 14B	14	7	
SN74LS11N	14D, 6A	14	7	14L-[illegible]
SN74LS14N	3D	14	7	E,F
SN74LS28N	22H	14	7	
SN74LS32N	17D, 20D, 20J, 25H, 13A	14	7	
SN74LS42N	23D 23A	16	8	
SN74LS74N	15L, 16E, 16L, 17F, 18D, 22C	14	7	22C-A
SN74LS174	14A	8	16	
SN74LS109N	20C	16	8	
SN74LS125N	20H	14	7	
SN74LS138N	27J	16	8	
SN74LS139N	27E	16	8	
SN74LS153N	17H, 18D, 18F	16	8	
SN74LS244N	3B, 6D, 9B, 9C, 12D, 16C, 22B, 27B	20	10	16C-A 3B-G, 27A-C,E,G
SN74LS245N	23B, 25B	20	10	
SN74LS256N	14J	16	8	
SN74LS280N	22J, 23J	14	7	
SN74LS374N	17K, 17L, 17N	20	10	
74S112PC	16J	16	8	
DM74S135N	18J	16	8	
74S280N	6C, 9D	14	7	
74F32	U16B	14	7	U16B-B,C,D
74F00PC	15H.	14	7	
74F04PC	17J	14	7	
74F08PC	3C	14	7	B,C,D
74F74PC	12C, 15K, 16K, 17E, 23E	14	7	15K-B
74F86PC	14	14	7	
74F109PC	15D, 16D	16	8	15B-B
74F138PC	16H	16	8	
74F191PC	16F	16	8	
74F373PC	22F, 27F	20	10	
74F374PC	6B, 6J, 9J	20	10	
27128	20K, 22K, 23K, 25K,	28	14	
AM2901CPC	3K, 6K, 9K, 12K, 14K	10	30	
AM2947PC	23F, 25F	20	10	
AM2966PC	3J 12J 15E 15F 18M 27M 27P	20	10	15E-A,C,E,G
MK4164ANR-15	1E, 2E, 4E, 5E, 7E, 8E, 10E, 11E, 13E, 14E, 1F, 2F, 4F, 5F, 7F, 8F, 10F, 11F, 13F, 14F, 1G, 2G, 4G, 5G, 7G, 8G, 10G, 11G, 13G, 14G, 1H, 2H, 4H, 5H, 7H, 8H, 10H, 11H, 13H, 14H, 19M, 21M, 22M, 23M, 24M, 26M, 19N, 21N, 22N, 23N, 24N, 26N, 19P, 21P, 22P, 23P, 24P, 26P	8	16	
X22100	25J	18	8	
Z8002APS	25C	10	31	
Z8036APS	20E, 20A	23	7	
Z8581PS	27D, 17C	5	14	
LM3911N	14N	-	1	
PAL20L10	15A, 17A, 17A	24	12	
PAL20X10	16A	24	12	
898-5-R220/330	18A (RESISTOR NETWORK)	16	8	PINS 3,6,7,14

2. POWER & GND ON CONNECTORS:





3.

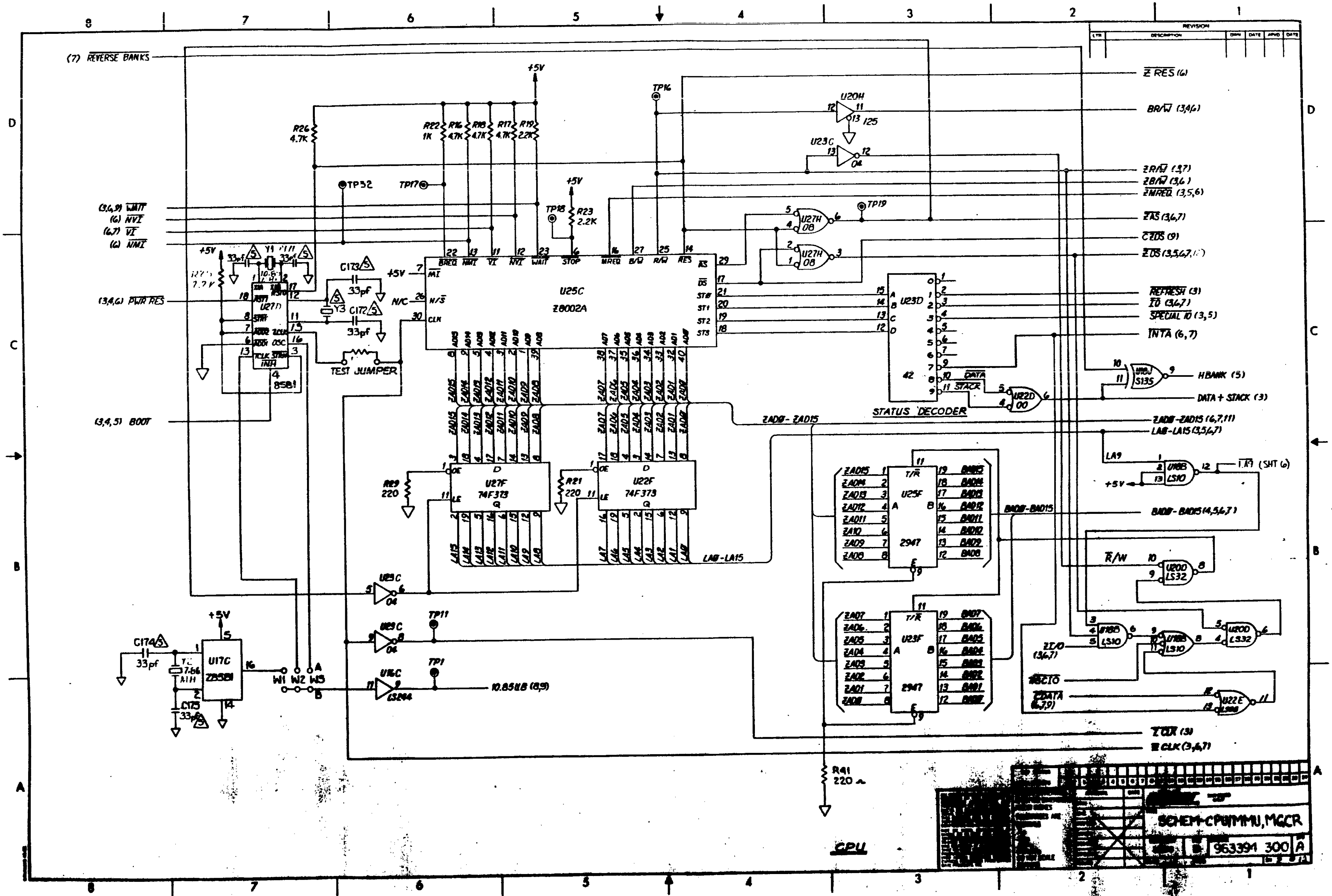
REFERENCE DESIGNATOR					
LTR	LAST USED	NOT USED	LTR	LAST USED	NOT USED
C	163		TP	34	13, 14, 21, 15, 33
CR	1		Y	1	
P	5	1, 2	U	27P	
Q	2				
R	47	27, 28, 32, 40			

4. RESISTOR VALUES ARE IN OHMS, 1/4 W, 5%

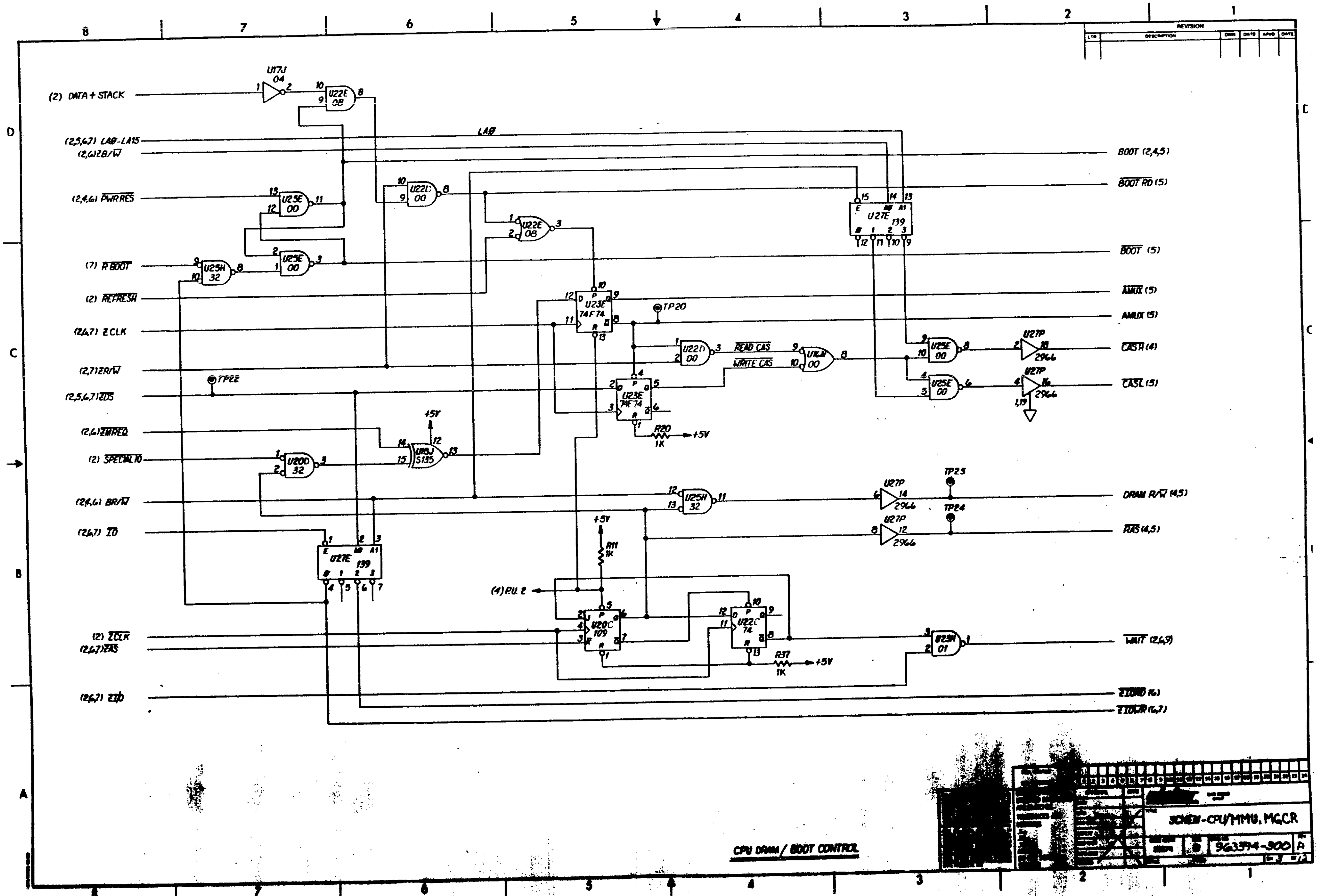
5. [illegible]

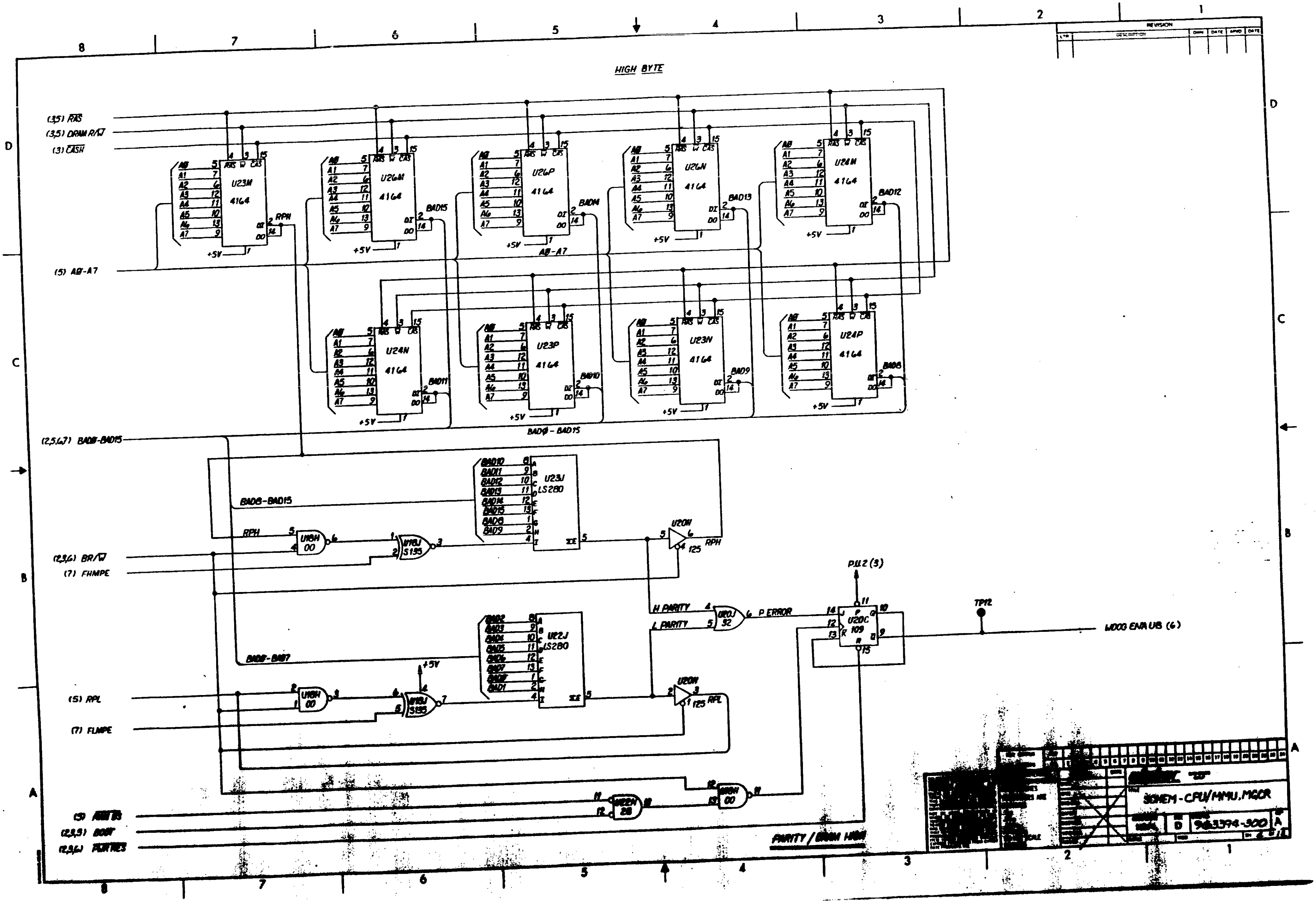
SCHEM-CPU/MMU, MGCR

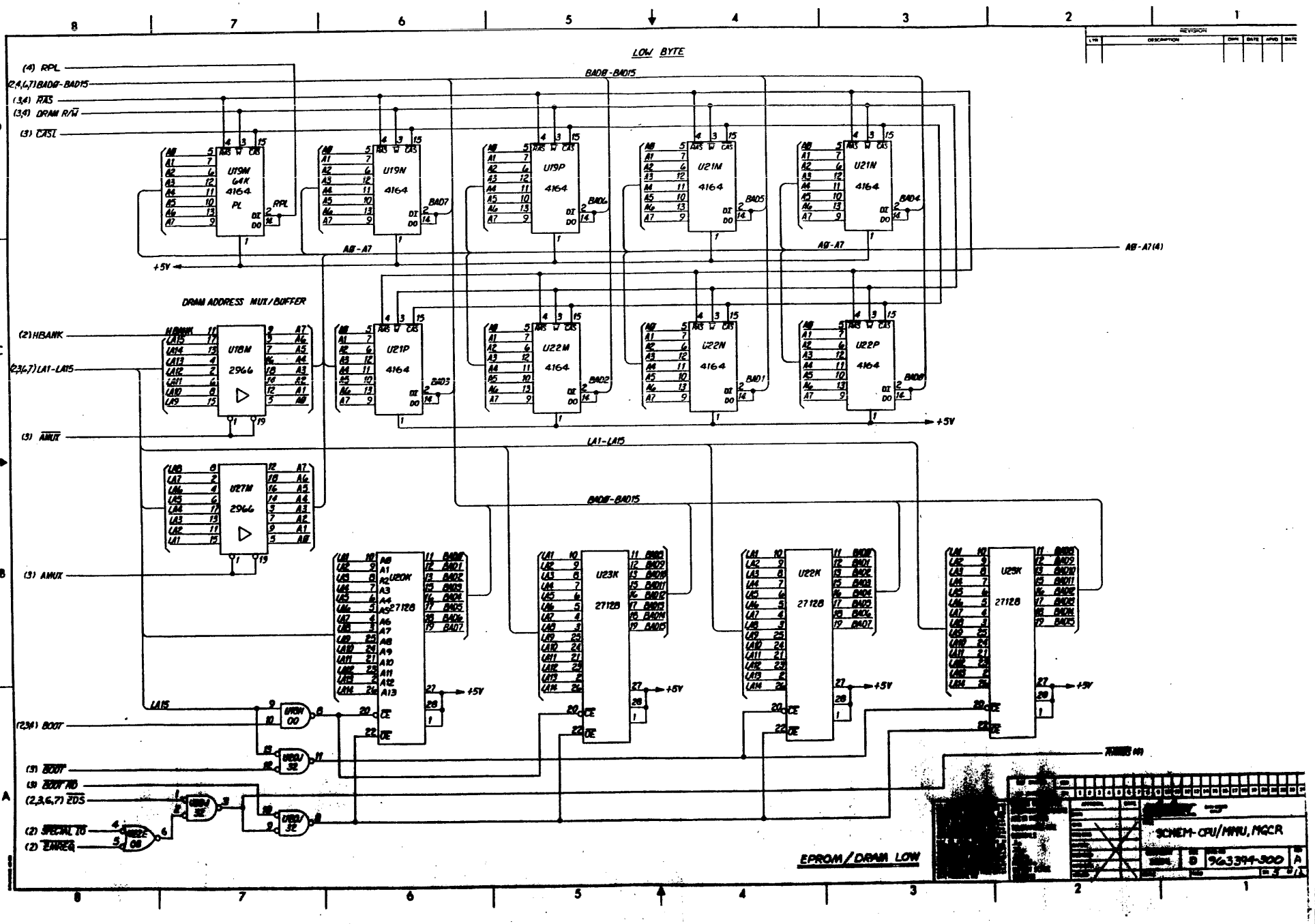
D 36239 1-300 B

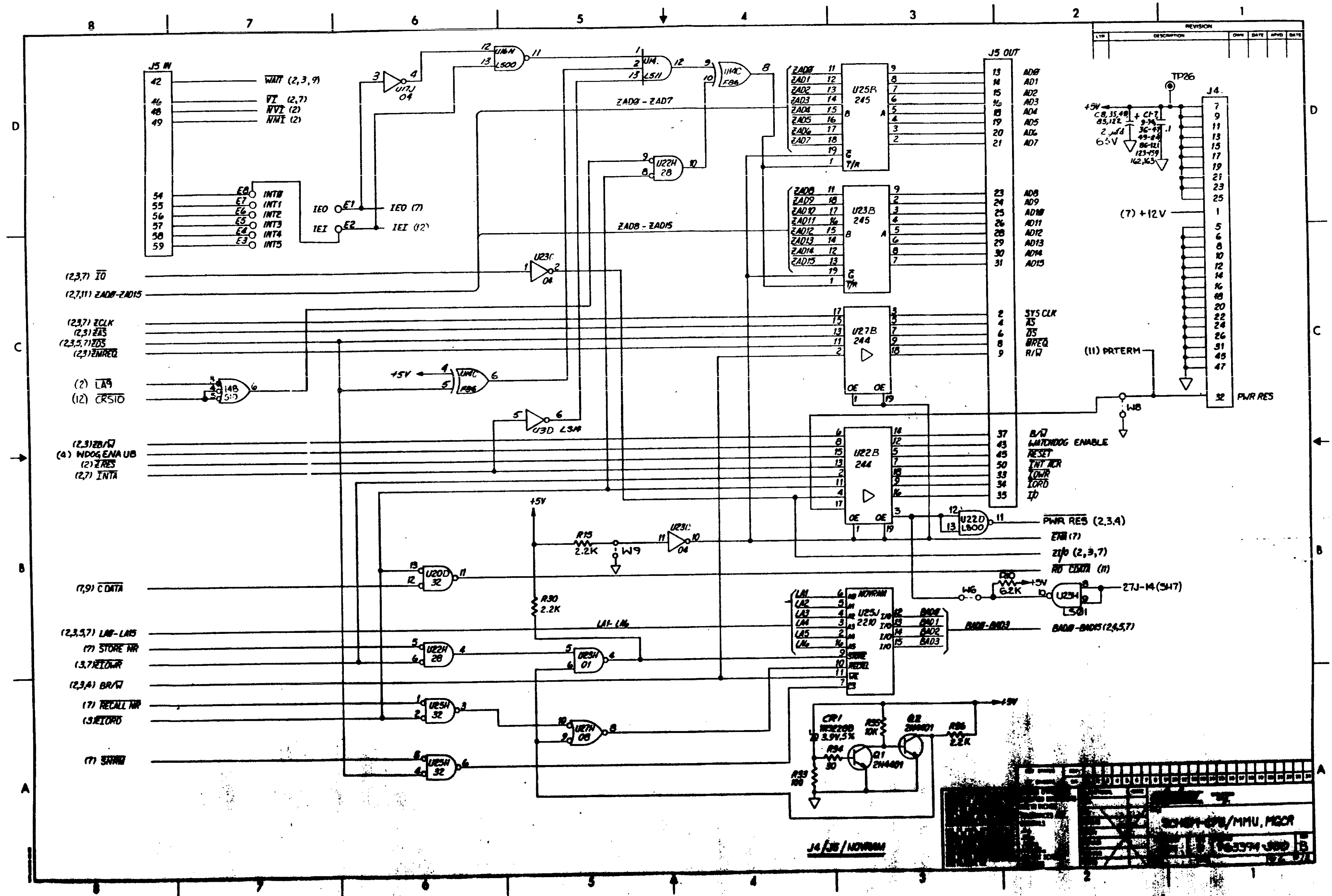


(7) REVERSE BANKS
Z RES (6)
BR/W (3,4,6)
ZR/W (3,7)
ZB/W (3,6)
ZMREQ (3,5,6)
ZAS (3,6,7)
CZDS (9)
ZDS (3,5,6,7)
REFRESH (3)
IO (3,6,7)
SPECIAL IO (3,5)
INTA (6,7)
HBANK (5)
DATA + STACK (3)
STATUS DECODER
ZAD0-ZAD15 (6,7,11)
LA0-LA15 (3,5,6,7)
BAD0-BAD15 (4,5,6,7)
(3,6,9) WAIT
(6) NVI
(6,7) VI
(6) NMI
(3,4,6) PWR RES
(3,4,5) BOOT
U25C
Z8002A
U27F
74F373
U22F
74F373
U25F
U23F
2947
TEST JUMPER
10.85MHz (8,9)
Z CLK (3)
CPU
SCHEM-CPU/MMU,MGCR
963391 300
A

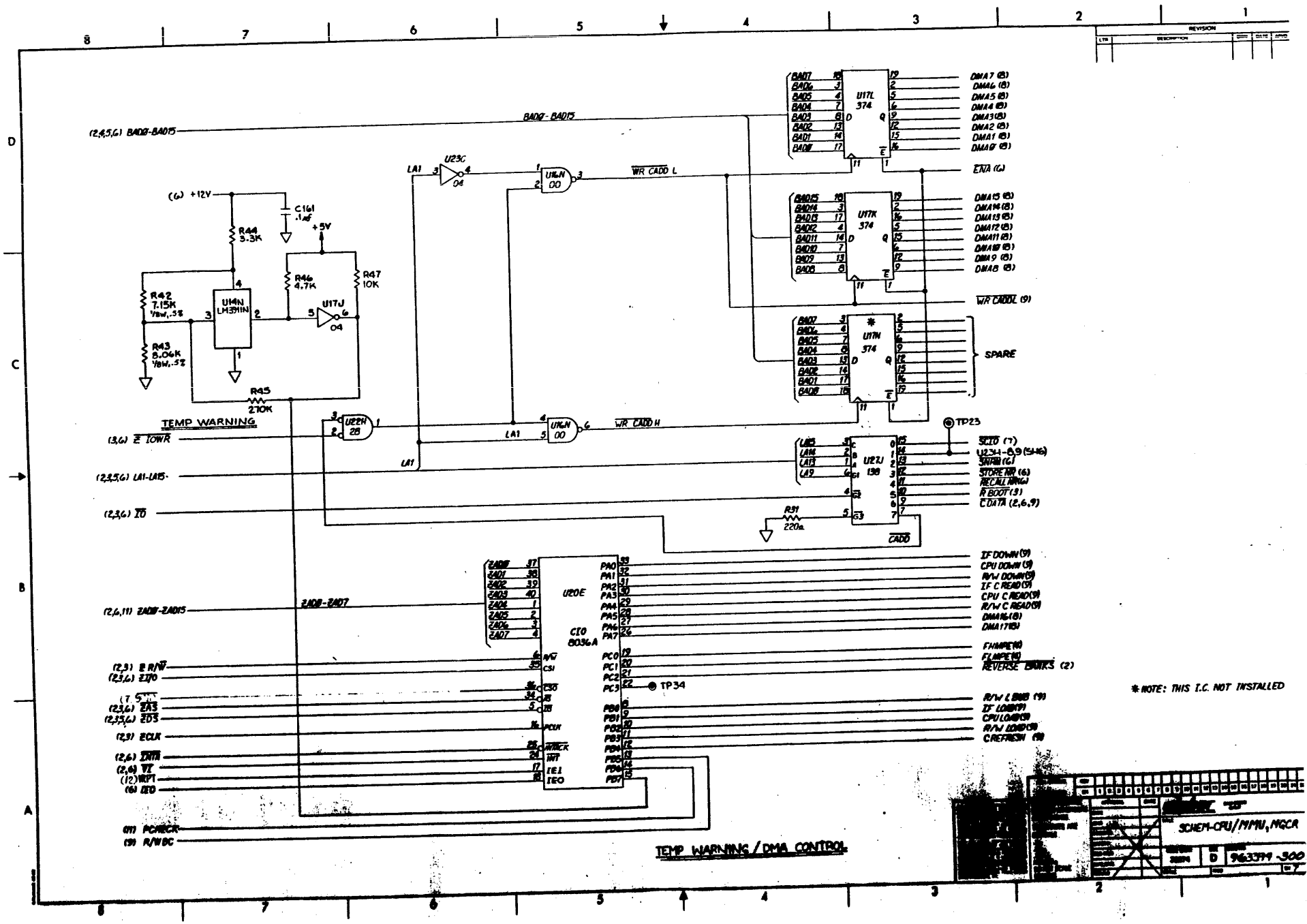

(2) DATA + STACK
(2,5,6,7) LA0-LA15
(2,6) ZB/W
(2,4,6) PWRRES
(7) RBOOT
(2) REFRESH
(2,4,7) ZCLK
(2,7) ZR/W
(2,5,6,7) ZDS
(2,6) ZMREQ
(2) SPECIAL IO
(2,4,6) BR/W
(2,4,7) IO
(2) ZCLK
(2,4,7) ZAS
(2,6,7) ZIO
U17J 04
U22E 08
U22D 00
U25E 00
U25H 32
U27E 139
U23E 74F74
U22D 00
U16H 00
U20D 32
U18J S135
U25H 32
U27P 2966
U20C 109
U22C 74
U23H 01
LA0
READ CAS
WRITE CAS
TP20
TP22
TP23
TP24
R20 1K
R11 1K
R37 1K
+5V
(4) RU. 2
BOOT (2,4,5)
BOOT RD (5)
BOOT (5)
AMUX (5)
AMUX (5)
CASH (4)
CASL (5)
DRAM R/W (4,5)
RAS (4,5)
WAIT (2,4,9)
ZIORD (6)
ZIOWR (6,7)
CPU DRAM / BOOT CONTROL
SCHEM-CPU/MMU, MGCR
963394-300
A

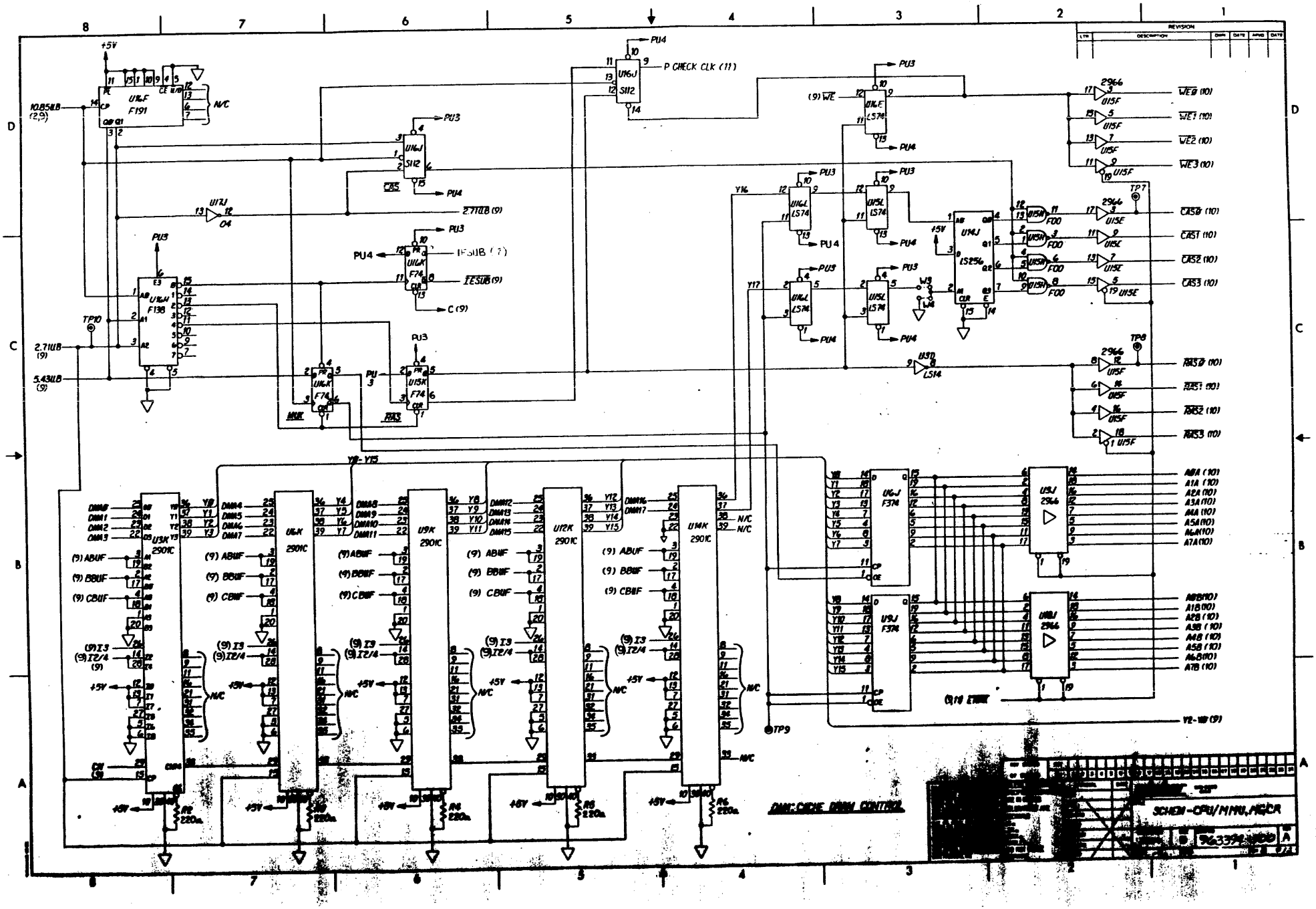

HIGH BYTE
(3,5) RAS
(3,5) DRAM R/W
(3) CASH
(5) A0-A7
U23M 4164
U26M 4164
U26P 4164
U26N 4164
U24M 4164
U24N 4164
U23P 4164
U23N 4164
U24P 4164
RPH
BAD15
BAD14
BAD13
BAD12
BAD11
BAD10
BAD9
BAD8
+5V
A0-A7
BAD0 - BAD15
(2,5,6,7) BAD0-BAD15
U23J LS280
BAD8-BAD15
U18H 00
U18J S135
U20H 125
(2,3,6) BR/W
(7) FHMPE
H PARITY
L PARITY
U20J 32
P ERROR
P112 (3)
U20C 109
TP12
WDOG ENAUB (6)
U22J LS280
BAD0-BAD7
(5) RPL
(7) FLMPE
RPL
U22H 28
SCHEM-CPU/MMU,MGCR
983394-300
PARITY / DRAM HIGH

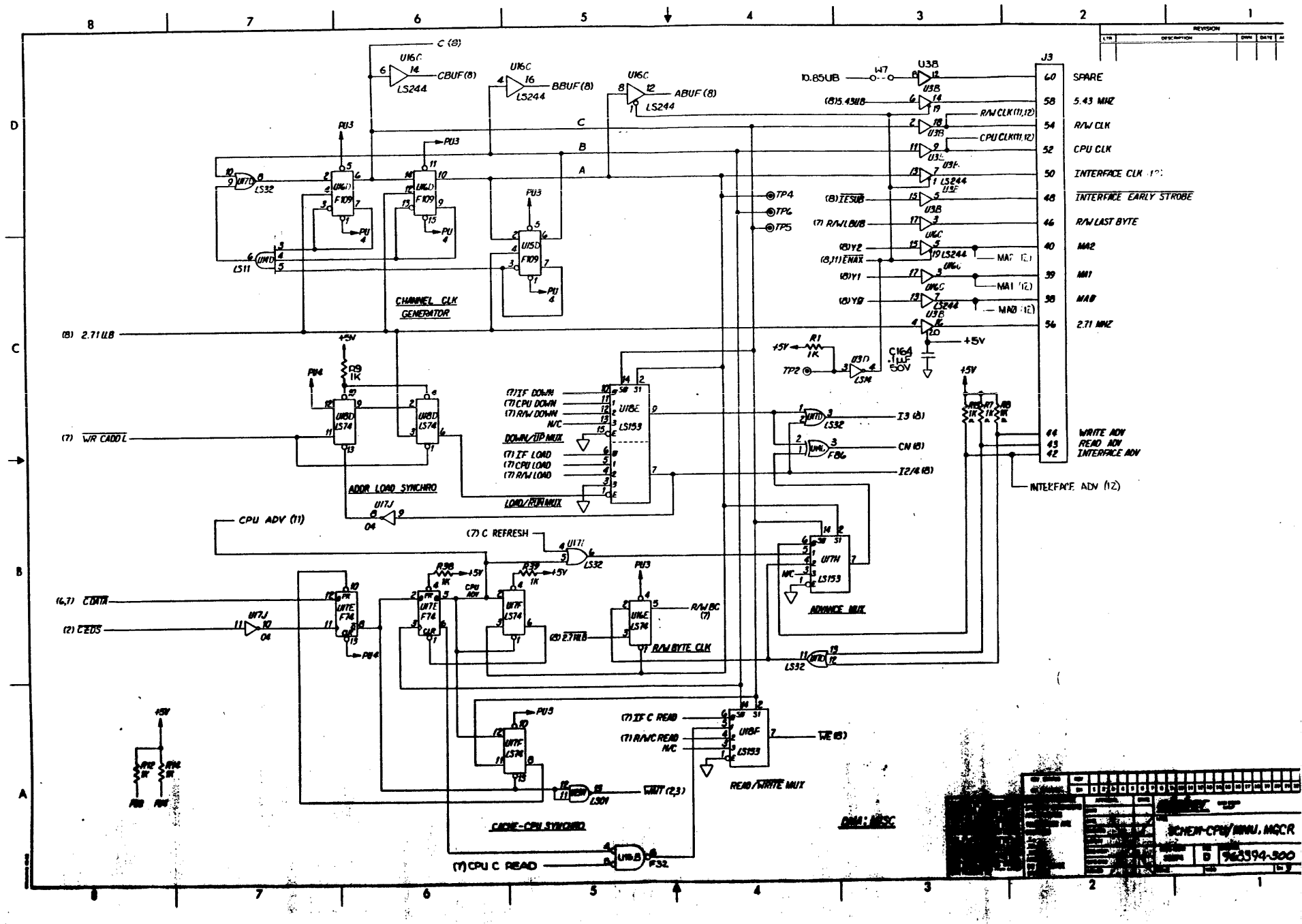

LOW BYTE
(4) RPL
(2,4,6,7) BAD0-BAD15
(3,4) RAS
(3,4) DRAM R/W
(3) CASL
BAD8-BAD15
U19M 64K 4164 PL
U19N 4164
U19P 4164
U21M 4164
U21N 4164
A0-A7
A0-A7(4)
+5V
DRAM ADDRESS MUX/BUFFER
(2) HBANK
(2,3,6,7) LA1-LA15
U18M 2966
U21P 4164
U22M 4164
U22N 4164
U22P 4164
(3) AMUX
LA1-LA15
U27M 2966
U20K 27128
U23K 27128
U22K 27128
U25K 27128
LA15
(2,3,4) BOOT
(3) BOOT
(3) BOOT A0
(2,3,6,7) CDS
(2) SPECIAL I/O
(2) EMREQ
EPROM/DRAM LOW
SCHEM-CPU/MMU, MGCR
963394-300

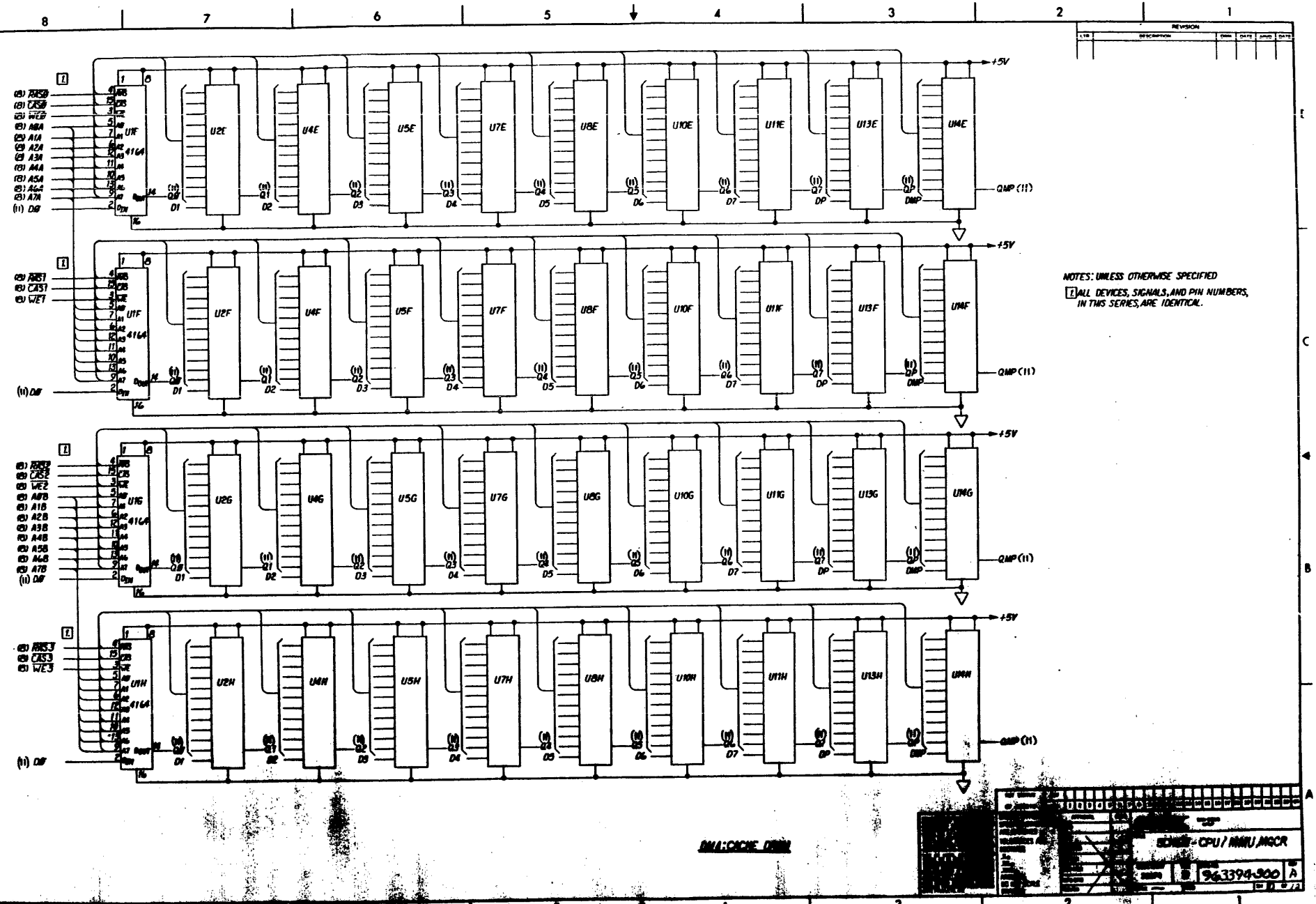


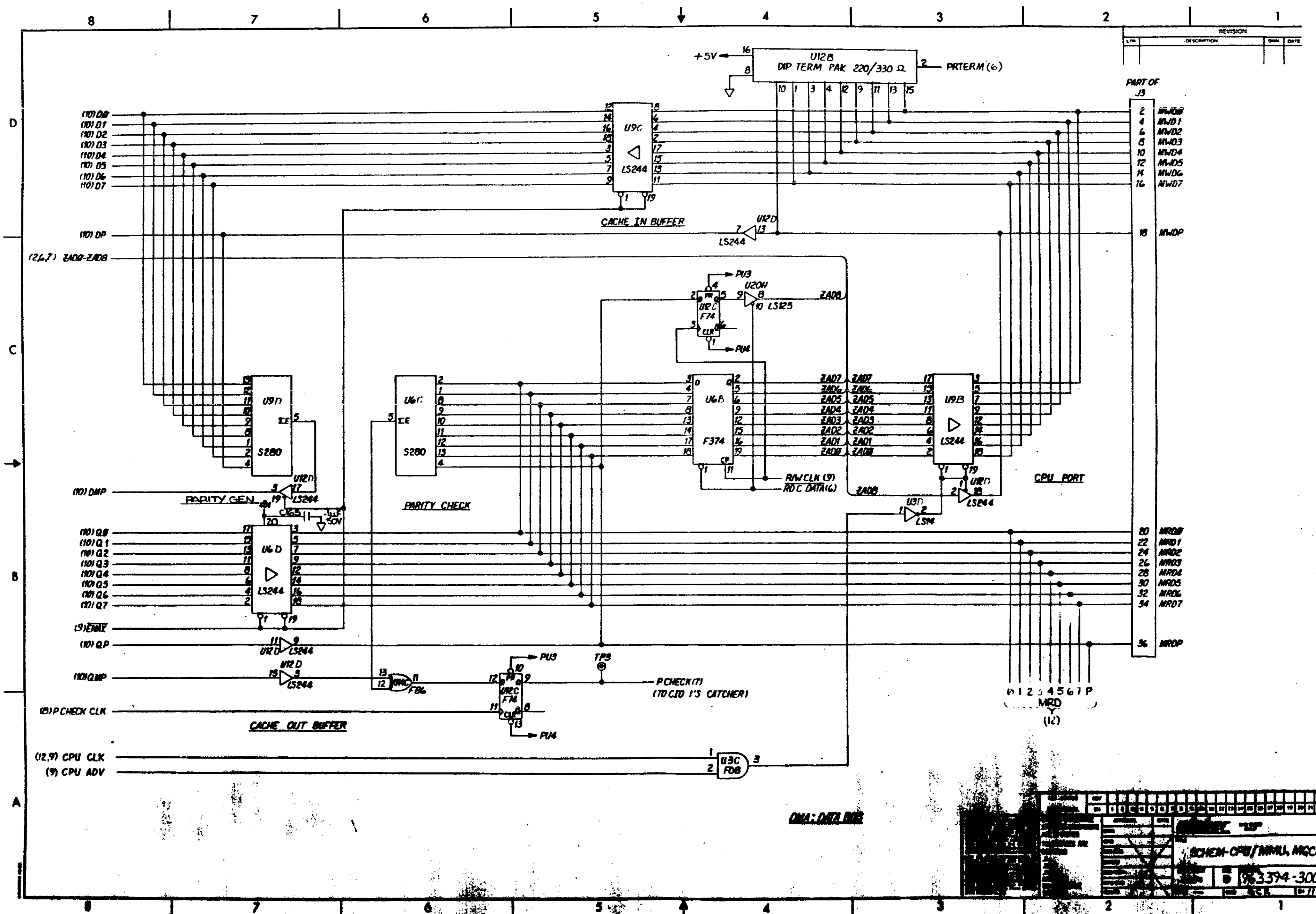
J5 IN
WAIT (2,3,9)
VI (2,7)
NVI (2)
NMI (2)
INT0
INT1
INT2
INT3
INT4
INT5
IEO (7)
IEI (12)
ZAD0 - ZAD7
ZAD8 - ZAD15
U25B 245
U23B 245
U27B 244
U22B 244
J5 OUT
SYS CLK
WATCHDOG ENABLE
RESET
INT ACK
PWR RES (2,3,4)
(7) +12V
(11) PRTERM
PWR RES
TP26
J4
(2,3,7) IO
(2,7,11) ZAD0-ZAD15
(2,3,7) ZCLK
(2,3) ZAS
(2,3,5,7) ZDS
(2,3) ZMREQ
(2) LA9
(12) CRSIO
(2,3) ZB/W
(4) WDOG ENA UB
(2) ZRES
(2,7) INTA
(7,9) C DATA
(2,3,5,7) LA0-LA15
(7) STORE NR
(3,7) ZIOWR
(2,3,4) BR/W
(7) RECALL NR
(3) ZIORD
(7) SNRM
LA1-LA6
BAD0-BAD3
BAD0-BAD15 (2,4,5,7)
RD CDATA (11)
27J-14 (SH7)
NOVRAM
U25J 2210
CR1
2N4401
J4/J5/NOVRAM
SCHEM-CPU/MMU, MGCR

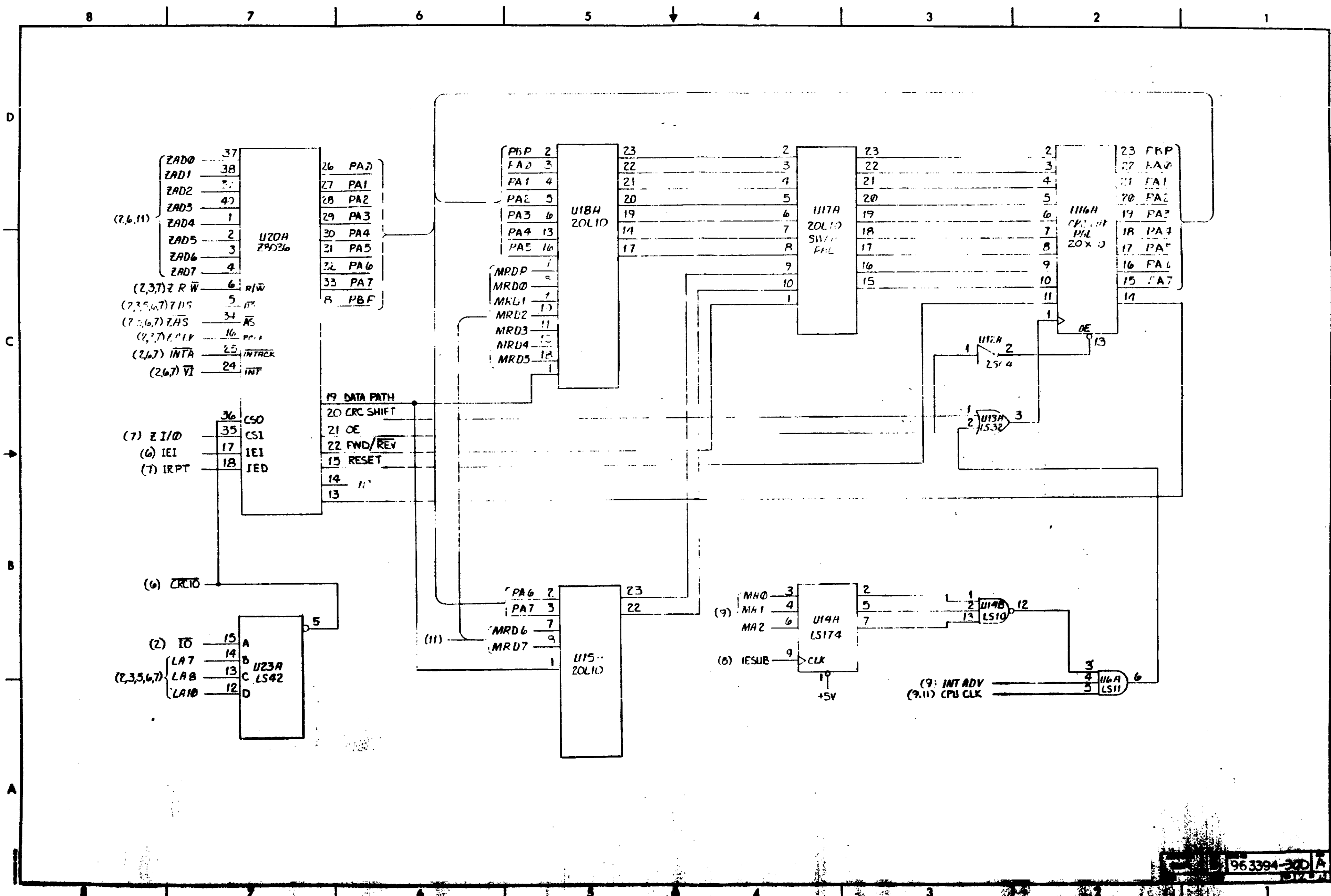

TEMP WARNING
TEMP WARNING / DMA CONTROL
* NOTE: THIS I.C. NOT INSTALLED
SCHEM-CPU/MMU,MGCR
963379-300


REVISION
DESCRIPTION
DMA CODE RAM CONTROL
SCHEM-CPU/MMU,MISC
96339

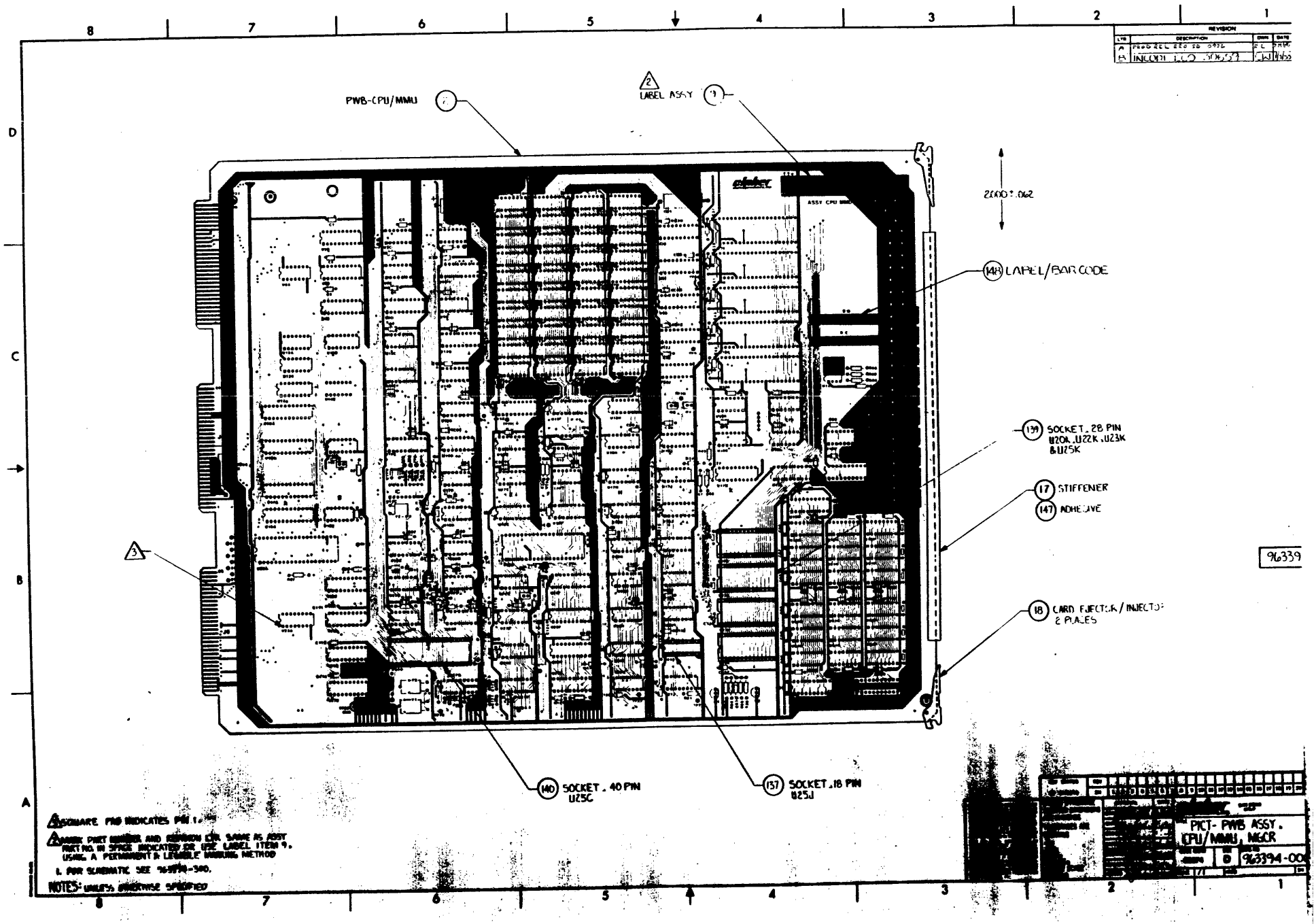

CHANNEL CLK GENERATOR
ADDR LOAD SYNCHRO
LOAD/RUN MUX
DOWN/UP MUX
ADVANCE MUX
R/W BYTE CLK
READ/WRITE MUX
CACHE-CPU SYNCHRO
J3
SPARE
5.43 MHZ
R/W CLK
CPU CLK
INTERFACE CLK
INTERFACE EARLY STROBE
R/W LAST BYTE
MA2
MA1
MA0
2.71 MHZ
WRITE ADV
READ ADV
INTERFACE ADV
INTERFACE ADV (12)
SCHEM-CPU/MMU, MSCR
963394-300


REVISION
NOTES: UNLESS OTHERWISE SPECIFIED
[1] ALL DEVICES, SIGNALS, AND PIN NUMBERS, IN THIS SERIES, ARE IDENTICAL.
+5V
QMP (11)
DM4: CACHE DRAM
CPU / MMU / MCR
9433394-900
A


U128
DIP TERM PAK 220/330 Ω
+5V
PRTERM (6)
PART OF J3
CACHE IN BUFFER
U9G
LS244
U12D
LS244
(10) DP
(2,4,7) ZAD0-ZAD8
U20H
LS125
U12C
F74
PU3
PU4
ZAD8
U9D
S280
U6C
S280
U6B
F374
U9B
LS244
PARITY GEN
PARITY CHECK
CPU PORT
RAW CLK (9)
RDC DATA (6)
(10) DMP
U6D
LS244
(9) ENMX
(10) QP
(10) QMP
(8) P CHECK CLK
CACHE OUT BUFFER
TP3
P CHECK (7)
(TO CIO 1'S CATCHER)
U3D
LS14
(12,9) CPU CLK
(9) CPU ADV
U3C
F08
MRD
(12)
DMA: DATA BUS
SCHEM-CPU/MMU, MCCR
963394-300


U20A
Z8036
ZAD0
ZAD1
ZAD2
ZAD3
ZAD4
ZAD5
ZAD6
ZAD7
(2,6,11)
PA0
PA1
PA2
PA3
PA4
PA5
PA6
PA7
PBF
R/W
INTACK
INT
19 DATA PATH
20 CRC SHIFT
21 OE
22 FWD/REV
15 RESET
CS0
CS1
IEI
IEO
(7) Z I/O
(6) IEI
(7) IRPT
(2,6,7) INTA
(2,6,7) VI
(6) CRCIO
(2) IO
LA7
LA8
LA10
(2,3,5,6,7)
U23A
LS42
U18A
ZOL10
PBP
MRDP
MRD0
MRD1
MRD2
MRD3
MRD4
MRD5
MRD6
MRD7
(11)
U15
ZOL10
U17A
ZOL10
U16A
20X10
U12A
U13A
LS32
MA0
MA1
MA2
(9)
U14A
LS174
CLK
(8) IESUB
+5V
U14B
LS10
U16A
LS11
(9) INT ADV
(9,11) CPU CLK
OE

963394-300 A


PWB-CPU/MMU
LABEL ASSY
2.000 ± .062
148 LABEL/BAR CODE
139 SOCKET, 28 PIN
U20L, U22K, U23K
& U25K
17 STIFFENER
147 ADHESIVE
96339
18 CARD EJECTOR/INJECTOR
2 PLACES
140 SOCKET, 40 PIN
U25C
137 SOCKET, 18 PIN
U25J
PICT-PWB ASSY,
CPU/MMU, MICR
D
963394-00
NOTES: UNLESS OTHERWISE SPECIFIED

BILL OF MATERIAL
AS OF 12/30/93

CLASS CODE GROUP: 1 UNCLASSIFIED
CLASS CODE: 3400 G.C.R. UNIQUE BOARD ASSY

963394-002 OPCODE: 4 REV: A PWB ASSY-CPU/MMU MGCR
MODEL:
ECO NO:
DATE OF LAST ECO: 00/00/00

OP: OPDER POLICY CODE
REQ: N=PART OPTIONAL
Y=PART REQUIRED
PF: N=PART DOES NOT PRINT ON SALES ORDER
Y=PART PRINTS ON SALES ORDER W/O PRICE
P=PART PRINTS ON SALES ORDER WITH PRICE

PART NUMBER	DESCRIPTION	OP	REV	ITEM NO.	QTY PER ASSEMBLY	YIELD FACTR	UM	SC	REQ	PF	DEFAULT QUANTITY	DAYS OFF SET	SEQ	REFERENCE DESIGNATOR	EFFECTIV DATE	OBSOLETE DATE
965483-000	PICT-PWB ASSY. CPU/MMU. MGCR	0	A	1	0.000	1.000	EA	F	N	N	0.000	0	0		00/00/00	99/99/99
963394-101	PWB-CPU/MMU.MGCR	1	B	2	1.000	1.000	EA	B	Y	N	1.000	0	0		00/00/00	99/99/99
965483-300	SCHEM-CPU/MMU. MGCR	0	A	3	0.000	1.000	EA	F	Y	N	0.000	0	0		00/00/00	99/99/99
931006-800	LABEL-ASSY	3	B	9	1.000	1.000	EA	F	N	N	1.000	0	0		00/00/00	99/99/99
961707-002	STIFFENER-EDGE.PCB	3	B	17	1.000	1.000	EA	B	Y	N	1.000	0	0		00/00/00	99/99/99
970083-001	INJECTOR/EJECTOR-1/16"	3	B	18	2.000	1.000	EA	B	N	N	2.000	0	0		00/00/00	99/99/99
201191-063	CAP-ELEC.22MF.6.3V.-10+50%.AL	3	H	25	5.000	1.000	EA	B	Y	N	5.000	0	0	C.8.35.48.85.122	00/00/00	99/99/99
970784-104	CAP-CER..1UF,50V,-20+80%.AX.*	3	E	26	157.000	1.000	EA	B	Y	N	157.000	0	0	C1-7.9-34.36-47.49-84.86-121.123-159.161-163	00/00/00	99/99/99
201114-105	CAP-CER.10000PF,50V,10%.X7R	3	J	27	2.000	1.000	EA	B	Y	N	2.000	0	0	C164.165	00/00/00	99/99/99
202013-228	DIODE-ZENER	3	D	32	1.000	1.000	EA	B	N	N	1.000	0	0	CR1	00/00/00	99/99/99
204010-533	TRANSISTOR-NPN,SILICON	3	F	40	2.000	1.000	EA	B	N	N	2.000	0	0	Q1.2	00/00/00	99/99/99
200000-806	RES-8.06 KOHM .5% 1/8W FF	3	B	41	1.000	1.000	EA	F	N	N	1.000	0	0	R43	00/00/00	99/99/99
200000-715	RES-7.15 KOHM 1/8W .5% FF	3	B	42	1.000	1.000	EA	F	N	N	1.000	0	0	R42	00/00/00	99/99/99
200073-100	RES-1.0 KOHM 1/4W 5% CF	3	AC	43	13.000	1.000	EA	F	N	N	15.000	0	0	R1.7-9.11-14.20.22.37-39	00/00/00	99/99/99
200072-220	RES-220 OHM 1/4W 5% CF	3	AC	44	9.000	1.000	EA	F	N	N	9.000	0	0	R2-6.21.29.31.41	00/00/00	99/99/99
200073-470	RES-4.7 KOHM 1/4W 5% CF	3	AC	45	5.000	1.000	EA	F	N	N	5.000	0	0	R16-18.26.46	00/00/00	99/99/99
200073-220	RES-2.2 KOHM 1/4W 5% CF	3	AC	46	6.000	1.000	EA	F	N	N	5.000	0	0	R19.23.25,30.36.15	00/00/00	99/99/99
200071-100	RES-10 OHM 1/4W 5% CF	3	AC	48	1.000	1.000	EA	F	N	N	1.000	0	0	R24	00/00/00	99/99/99
200073-330	RES-3.3 KOHM 1/4W 5% CF	3	AC	49	1.000	1.000	EA	F	N	N	1.000	0	0	R44	00/00/00	99/99/99
200072-100	RES-100 OHM 1/4W 5% CF	3	AC	50	1.000	1.000	EA	F	N	N	1.000	0	0	R33	00/00/00	99/99/99
200071-300	RES-30 OHM 1/4W 5% CF	3	AC	51	1.000	1.000	EA	B	N	N	1.000	0	0	R34	00/00/00	99/99/99
200074-100	RES-10 KOHM 1/4W 5% CF	3	AC	52	2.000	1.000	EA	F	N	N	2.000	0	0	R35.47	00/00/00	99/99/99
200075-270	RES-270 KOHM 1/4W 5% CF	3	AC	53	1.000	1.000	EA	F	N	N	1.000	0	0	R45	00/00/00	99/99/99
200073-620	RES-6.2 KOHM 1/4W 5% CF	3	AC	54	1.000	1.000	EA	F	Y	N	1.000	0	0	R10	00/00/00	99/99/99
970267-001	PIN-TEST..040SQ X .360LG	3	A	64	29.000	1.000	EA	F	Y	N	29.000	0	0	TP1-12.16-20.22-32,34 205026-999	00/00/00	99/99/99
970627-002	HEADER-UNSH,2 P DR,STR,..100	3	C	66	9.000	1.000	EA	B	Y	N	4.000	0	0	W1-9	00/00/00	99/99/99
970227-001	JUMPER-2POS,.100CTS.	3	C	67	2.000	1.000	EA	B	N	N	2.000	0	0	W1.W3	00/00/00	99/99/99
203051-174	IC-74LS174,FF.D.HEX	3	L	68	1.000	1.000	EA	B	Y	N	1.000	0	0	U14A	00/00/00	99/99/99

BILL OF MATERIAL
AS OF 12/30/93

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963394-002 OPCODE: 4 REV: A PWB ASSY-CPU/MMU MGCR
MODEL:
ECO NO:
DATE OF LAST ECO: 00/00/00

OP: ORDER POLICY CODE
REQ:N=PART OPTIONAL
Y=PART REQUIRED
PF: N=PART DOES NOT PRINT ON SALES ORDER
Y=PART PRINTS ON SALES ORDER W/O PRICE
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PART NUMBER	DESCRIPTION	OP	REV	ITEM NO.	QTY PER ASSEMBLY	YIELD FACTR	UM	SC	REQ	PF	DEFAULT QUANTITY	DAYS OFF SET	SEQ	REFERENCE DESIGNATOR	EFFECTIV DATE	OBSOLETE DATE
970369-001	IC-4164 MEM MOS RAM 64KX1	3	G	71	58.000	1.000	EA	B	N	N	58.000	0	0	1E,2.4,5.7.3.10,11.13.14,1F.2.4.5.7.8.10.11.13.14.1G.2.4,5.7,8.10.11,13,14.1H,2.4,5.7.8.10,11.13.14.19M.21-24.26.19N.21-24.26.19P.21-24.26	00/00/00	99/99/99
203052-244	IC-74LS244 BFR OCT 3S	3	L	72	8.000	1.000	EA	B	N	N	8.000	0	0	U3B.6D.9B.9C.12D.16C.22B,27B	00/00/00	99/99/99
203085-001	IC-74LS14 INV SCHMITT HEX	3	J	73	1.000	1.000	EA	B	N	N	1.000	0	0	U3D	00/00/00	99/99/99
970324-001	IC-2966 DRVR OCTAL DYNAMI	3	A	74	7.000	1.000	EA	B	N	N	7.000	0	0	U3J.12J,15E.15F.18M,27M.27P	00/00/00	99/99/99
970322-001	IC-2901 MICROPROCESSOR 4 BIT	3	A	75	5.000	1.000	EA	B	N	N	5.000	0	0	U3K.6K.9K.12K.14K	00/00/00	99/99/99
970321-001	IC-74F374 FF D 3S OCT	3	D	76	3.000	1.000	EA	B	N	N	3.000	0	0	U6B.6J.9J	00/00/00	99/99/99
970354-001	IC-74S280 GEN/CKR PARITY 9BIT	3	B	77	2.000	1.000	EA	B	N	N	2.000	0	0	U6C.9D	00/00/00	99/99/99
970350-001	IC-74F08 AND 2IN QUAD	3	C	78	1.000	1.000	EA	B	N	N	1.000	0	0	U3C	00/00/00	99/99/99
205255-500	RES-NTWK 220/330 OHM 5% 1.5	3	E	79	1.000	1.000	EA	B	N	N	1.000	0	0	U12B	00/00/00	99/99/99
970224-001	IC-3911 CTRL TEMP	3	A	80	1.000	1.000	EA	B	N	N	1.000	0	0	U14N	00/00/00	99/99/99
970349-001	IC-74F32 OR 2IN QUAD	3	B	81	1.000	1.000	EA	B	N	N	1.000	0	0	U16B	00/00/00	99/99/99
970341-001	IC-74F86 EXOR	3	B	82	1.000	1.000	EA	B	N	N	1.000	0	0	U14C	00/00/00	99/99/99
970325-001	IC-74F74 FF D DUAL	3	D	83	5.000	1.000	EA	B	N	N	5.000	0	0	U12C.15K,16K.17E.23E	00/00/00	99/99/99
203029-003	IC-74LS11 AND 3IN TRIP	3	F	84	2.000	1.000	EA	B	N	N	1.000	0	0	U14D.6A	00/00/00	99/99/99
970357-001	IC-74LS256 4-BIT ADDRESSABLE	3	D	85	1.000	1.000	EA	B	N	N	1.000	0	0	U14J	00/00/00	99/99/99
970344-001	IC-74F109 FF JK DUAL	3	A	86	2.000	1.000	EA	B	N	N	2.000	0	0	U15D.16D	00/00/00	99/99/99
970318-001	IC-74F00 NAND 2IN QUAD	3	B	87	1.000	1.000	EA	B	N	N	1.000	0	0	U15H	00/00/00	99/99/99
203039-001	IC-74LS74 FF D DUAL	3	M	88	6.000	1.000	EA	B	N	N	6.000	0	0	U15L,16E.16L.17F.18D,22C	00/00/00	99/99/99
970011-001	IC-74LS04 INV HEX	3	D	89	2.000	1.000	EA	B	N	N	2.000	0	0	U23C.12A	00/00/00	99/99/99
970365-001	IC-8581 GEN CLK 6 MHZ	3	B	90	2.000	1.000	EA	B	N	N	2.000	0	0	U17C.27D	00/00/00	99/99/99

BILL OF MATERIAL

AS OF 12/30/99

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963394-002 OPCODE: 4 REV: A PWB ASSY-CPU/MMU MGCR
MODEL:
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DATE OF LAST ECO: 00/00/00

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PART NUMBER	DESCRIPTION	OP	PU	ITEM NO.	QTY PER ASSEMBLY	YIELD FACTR	UM	SC	REQ	PF	DEFAULT QUANTITY	DAYS OFF SET	SEQ	REFERENCE DESIGNATOR	EFFECTIV DATE	OBSOLETE DATE
970319-001	IC-74F191 CNTR REVERSIBLE	3	B	93	1.000	1.000	EA	B	Y	N	1.000	0	0	U16F	00/00/00	99/99/99
970351-001	IC-74F138 DCDR/DEMUX 3-8 LINE	3	C	94	1.000	1.000	EA	B	N	N	1.000	0	0	U16H	00/00/00	99/99/99
970353-001	IC-74S112 FF EDGE	3	A	95	1.000	1.000	EA	B	N	N	1.000	0	0	U16J	00/00/00	99/99/99
970221-001	IC-74LS00 NAND 2IN POS QUAD	3	E	96	4.000	1.000	EA	B	N	N	4.000	0	0	U16N.18H.22D.25E	00/00/00	99/99/99
203035-032	IC-74LS32 OR 2IN QUAD	3	J	97	5.000	1.000	EA	B	N	N	4.000	0	0	U17D,20D,20J.25H.13A	00/00/00	99/99/99
203046-153	IC-74LS153 SEL/MLTP 4-1 LINE	3	G	98	3.000	1.000	EA	B	N	N	3.000	0	0	U17H,18E,18F	00/00/00	99/99/99
970342-001	IC-74F04 INV HEX	3	D	99	1.000	1.000	EA	B	Y	N	1.000	0	0	U17J	00/00/00	99/99/99
963147-001	S/W-GCR.ASSY.SELECT	3	A	100	2.000	1.000	EA	B	Y	N	2.000	0	0	U15A.18A	00/00/00	99/99/99
962957-001	S/W-GCR. ASSY. CRC GENERATOR	3	A	101	1.000	1.000	EA	B	Y	N	1.000	0	0	U16A	00/00/00	99/99/99
963142-001	S/W-GCR.ASSY.SWAP	3	A	102	1.000	1.000	EA	B	Y	N	1.000	0	0	U17A	00/00/00	99/99/99
203102-375	IC-74LS374 FF D OCT	3	F	104	2.000	1.000	EA	B	N	N	2.000	0	0	U17K,17L	00/00/00	99/99/99
203029-002	IC-74LS10 NAND 3IN TRIP	3	J	105	2.000	1.000	EA	B	N	N	1.000	0	0	U18B.14B	00/00/00	99/99/99
970358-001	IC-74S135 EXOR/NOR QUAD	3	C	106	1.000	1.000	EA	B	N	N	1.000	0	0	U18J	00/00/00	99/99/99
203094-500	IC-74LS109 FF JK POS EDGE	3	J	107	1.000	1.000	EA	B	N	N	1.000	0	0	U20C	00/00/00	99/99/99
203555-111	IC-8036 CIO 16BIT 6MHZ	3	C	108	2.000	1.000	EA	B	N	N	1.000	0	0	U20E.20A	00/00/00	99/99/99
203036-039	IC-74LS125 BUS BUF QUAD	3	F	109	1.000	1.000	EA	B	N	N	1.000	0	0	U20H	00/00/00	99/99/99
970010-001	IC-74LS08 AND 2IN QUAD	3	B	111	2.000	1.000	EA	B	N	N	2.000	0	0	U22E.27H	00/00/00	99/99/99
970320-001	IC-74F373 LATCH OCTAL	3	B	112	2.000	1.000	EA	B	N	N	2.000	0	0	U22F.27F	00/00/00	99/99/99
970352-001	IC-74LS28 NOR BUF	3	C	113	1.000	1.000	EA	B	N	N	1.000	0	0	U22H	00/00/00	99/99/99
962666-009	S/W-GCR. ASSY. CPU/MMU. U20K	0	A	114	1.000	1.000	EA	F	Y	N	1.000	0	0	U20K	00/00/00	99/99/99
962669-009	S/W-GCR. ASSY. CPU/MMU. U22K	0	A	115	1.000	1.000	EA	F	Y	N	1.000	0	0	U22K	00/00/00	99/99/99
962672-009	S/W-GCR.ASSY CPU/MMU,U23K	0	A	116	1.000	1.000	EA	F	Y	N	1.000	0	0	U23K	00/00/00	99/99/99
962675-009	S/W-GCR. ASSY. CPU/MMU. U25K	0	A	117	1.000	1.000	EA	F	Y	N	1.000	0	0	U25K	00/00/00	99/99/99
203061-280	IC-74LS280 PARITY TREE 9IN	3	C	118	2.000	1.000	EA	B	N	N	2.000	0	0	U22J.23J	00/00/00	99/99/99
203102-245	IC-74LS245 TRANSCEIVR BUS OCT	3	E	119	2.000	1.000	EA	B	N	N	2.000	0	0	U23B.25B	00/00/00	99/99/99
203046-150	IC-74LS42 DCDR BCD-DEC	3	C	121	2.000	1.000	EA	B	N	N	1.000	0	0	U23D.23A	00/00/00	99/99/99
970323-001	IC-2947 BIDIRECT OCT 3S	3	A	122	2.000	1.000	EA	B	N	N	2.000	0	0	U23F.25F	00/00/00	99/99/99
203115-001	IC-74LS01 NAND QUAD OPEN	3	A	123	1.000	1.000	EA	B	N	N	1.000	0	0	U23H	00/00/00	99/99/99
203575-111	IC-8002 CPU 16BIT 6 MHZ	3	C	124	1.000	1.000	EA	B	N	N	1.000	0	0	U25C	00/00/00	99/99/99
970348-001	IC-2210 MEM RAM STATIC-	3	C	129	1.000	1.000	EA	B	N	N	1.000	0	0	U25J	00/00/00	99/99/99
203046-156	IC-74LS139 1-4 DUAL	3	G	131	1.000	1.000	EA	B	N	N	1.000	0	0	U27E	00/00/00	99/99/99
203046-148	IC-74LS138 DCDR 3-8 LINE	3	K	132	1.000	1.000	EA	B	N	N	1.000	0	0	U27J	00/00/00	99/99/99
970555-018	SOCKET-IC 18 PIN..30	3	A	137	1.000	1.000	EA	B	Y	N	1.000	0	0	XU25J	00/00/00	99/99/99
205025-528	SOCKET-DIP.28 CONTACT	3	E	139	4.000	1.000	EA	B	Y	N	4.000	0	0	XU20K.22K.23K,25K	00/00/00	99/99/99
205025-540	SOCKET-DIP.40 CONTACT	3	E	140	1.000	1.000	EA	B	Y	N	1.000	0	0	XU25C	00/00/00	99/99/99
970370-001	CRYSTAL-HC18/U QTZ.PRL	3	C	144	1.000	1.000	EA	B	N	N	1.000	0	0	Y1	00/00/00	99/99/99
210111-768	CRYSTAL-7.680MHZ.HC-18/U.	3	F	145	1.000	1.000	EA	B	N	N	1.000	0	0	Y2	00/00/00	99/99/99

BILL OF MATERIAL

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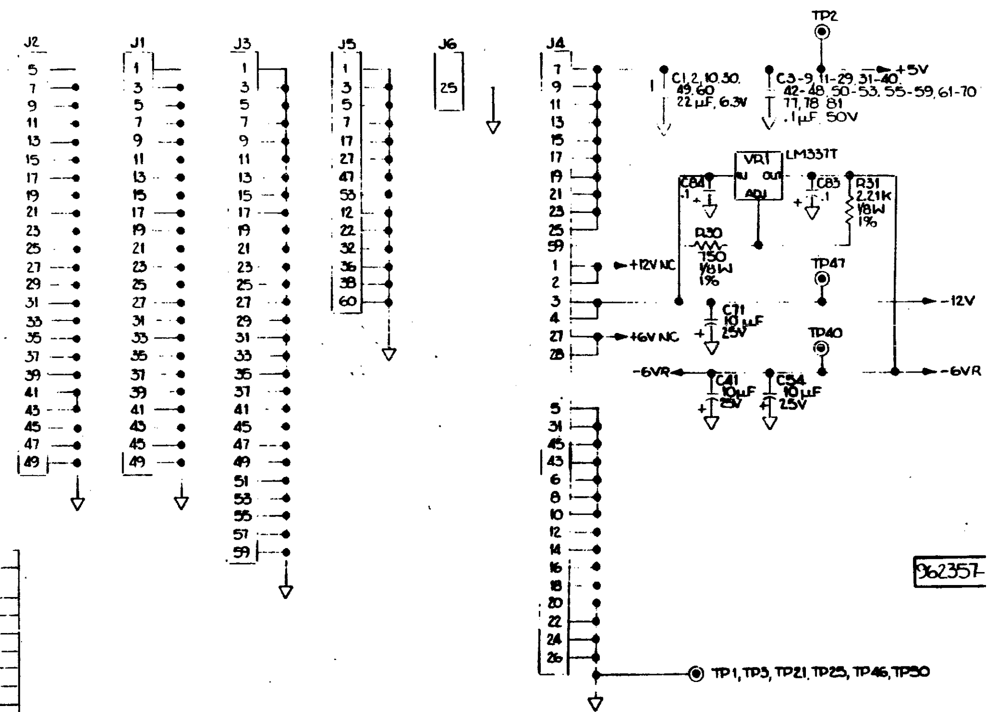
209990-108	ADHESIVE-CLEAR RTV	3	A	146	0.000	1.000	EA	F	Y	N	0.000	0	0		00/00/00	99/99/99
209990-071	ADHESIVE-SUPERBONDER	3	C	147	0.000	1.000	EA	F	Y	N	0.000	0	0		00/00/00	99/99/99
971041-001	LABEL-BAR CODE.1.425LX.25W.9.*	3	B	148	1.000	1.000	EA	F	Y	N	1.000	0	0		00/00/00	99/99/99
208430-999	WIRE-30AWG.BLUE KYNAR.	3	A	149	.001	1.000	FT	F	Y	N	.001	0	0		00/00/00	99/99/99

LTR	DESCRIPTION	DWN	DATE
A	[illegible]	[illegible]	[illegible]
B	INCORP. ECO 19478	CW	[illegible]
C	INCORP ECO 19479	CW	[illegible]
D	INCORP ECO M1508	CW	[illegible]
E	INCORP ECO 30009	CW	[illegible]

IC. TYPE	REFERENCE DESIGNATOR	+5V	-12V	GND	UNUSED
74LS00	7H, 12H, 8J, 10L, 8M	14		7	
74LS02	11H	14		7	11H-C
74LS04	9J, 4L, 9L, 5P, 10K	14		7	5P-A 10K-A,C,D
74LS08	8H, 6J, 7J, 6L, 6M, 10M, 10N, 3P, 7P, 5K	14		7	5K-D
74LS10	5J, 9K, 8P	14		7	
74LS11	8K, 7L, 9M, 8N, 9P	14		7	
74LS14	3L	14		7	3L-A,B,C,D,E
74LS32	7K, 7M, 11M, 4N, 5N, 10J	14		7	
74LS38	12C.	14		7	12C-A,B,D
74LS74	4K, 6K, 5L, 8L, 11L, 4M, 9M, 7N, 6P	14		7	1F-B,4K-A
74LS86	15F, 5H, 15L, 13P	14		7	15F-A,13P-B
74LS123	14P	16		8	
74LS125	2F, 11J, 2P	14		7	11J-D,2P-D
74LS138	9H, 10H	16		8	
74LS161A	4H, 4J, 13J	16		8	
74LS244	15D,4E,3F,4F,2L,12P,13R,1L	20		10	
74LS245	14E, 14F	20		10	
74LS280	12D, 3E	14		7	
74LS368	6H	16		8	
74LS373	12E, 13E, 15E, 9F, 10F, 11F, 12F	20		10	
74LS374	1N, 2N, 3N, 5E, 8E	20		10	
74F04	11K	14		7	11K-B,C,D,E,F
74F08	11P	14		7	11P-B
74F10	11N, 10P	14		7	11N-A
74F11	12J	14		7	12J-A
74F32	6N	14		7	6N-AC
74F74	1E, 4P	14		7	4P-A
74F240	1H	20		10	
74F244	1D, 2E, 7E	20		10	
74F374	1E, 1J, 3J, 3R	20		10	
7414	4D, 5D, 6D, 7D, 8D	14		7	
7438	9D, 10D, 11D, 9E, 10E, 11E	14		7	
7474	15H, 15J, 13K, 15K, 13L, 13M, 15M, 13N, 15N	14		7	
2732A	1M, 2M, 3M	24		12	
82S159	4R, 5R, 6R, 7R, 8R, 9R, 10R, 11R, 12R	20		10	
LM339	15P	3	12		15P-A,C,D
28036A	13F	23		7	
PAL20X8	5F	24		12	
PAL20X10	6F, 7F	24		12	
6349-2	1K, 2K, 3K	20		10	
74S374	2J	20		10	

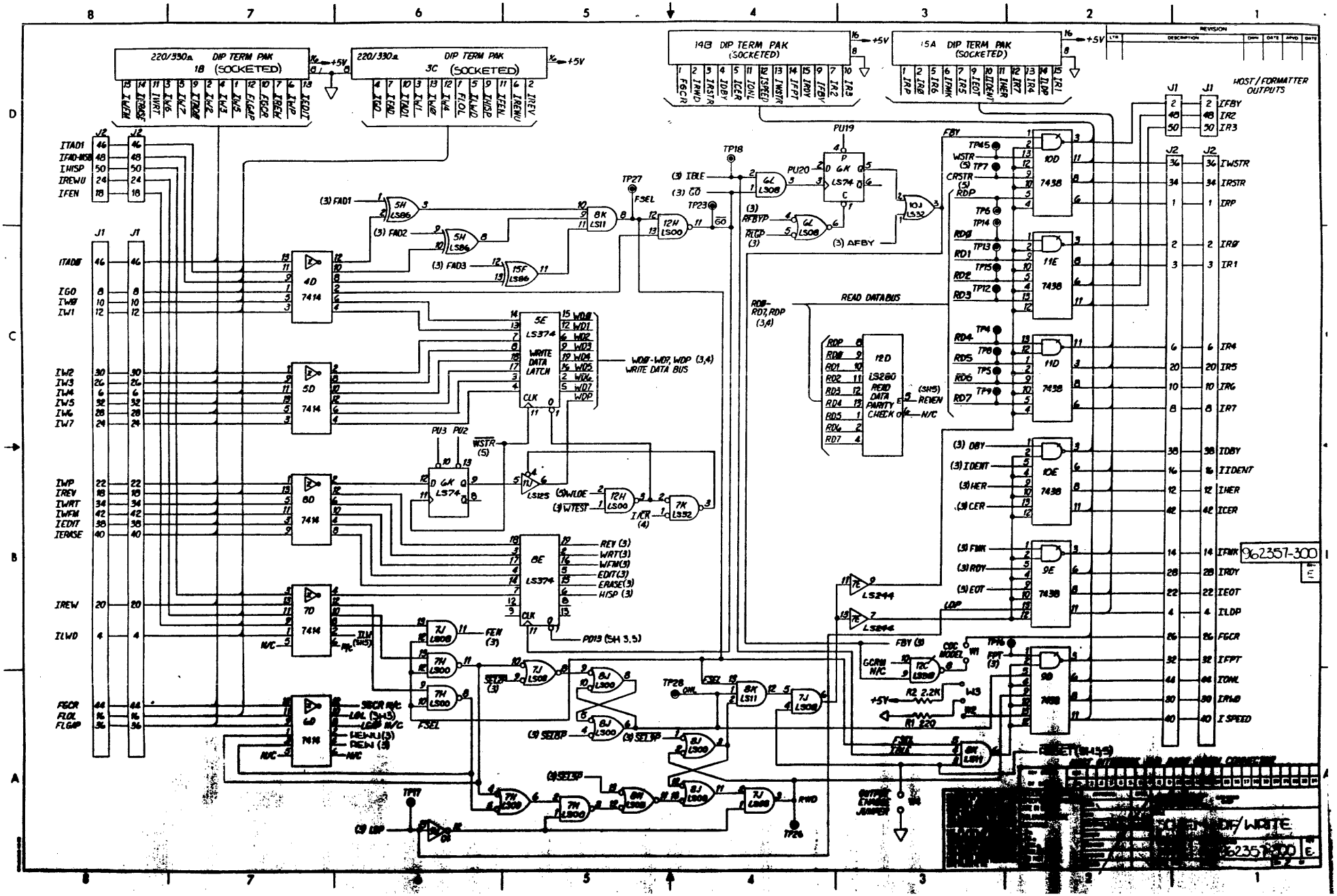


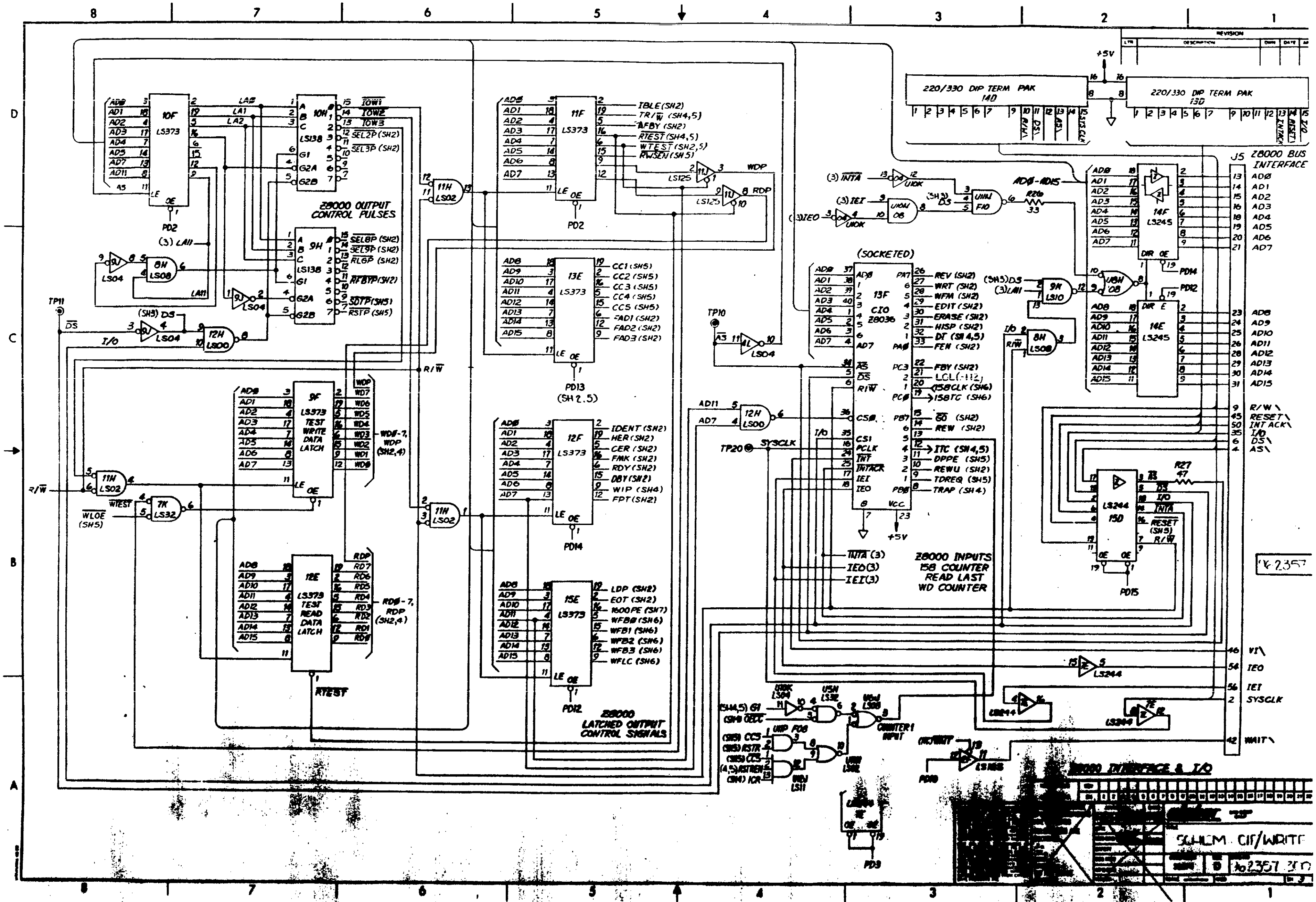
962357-

REFERENCE DESIGNATIONS					
LTR	LAST USED	NOT USED	LTR	LAST USED	NOT USED
C	85		S		
CR	303		TP	65	
DS			U	11R	
J	J6	1,2	VR		
K			Y		
L			W	4	
P			E		
Q	902				
R	31,908				

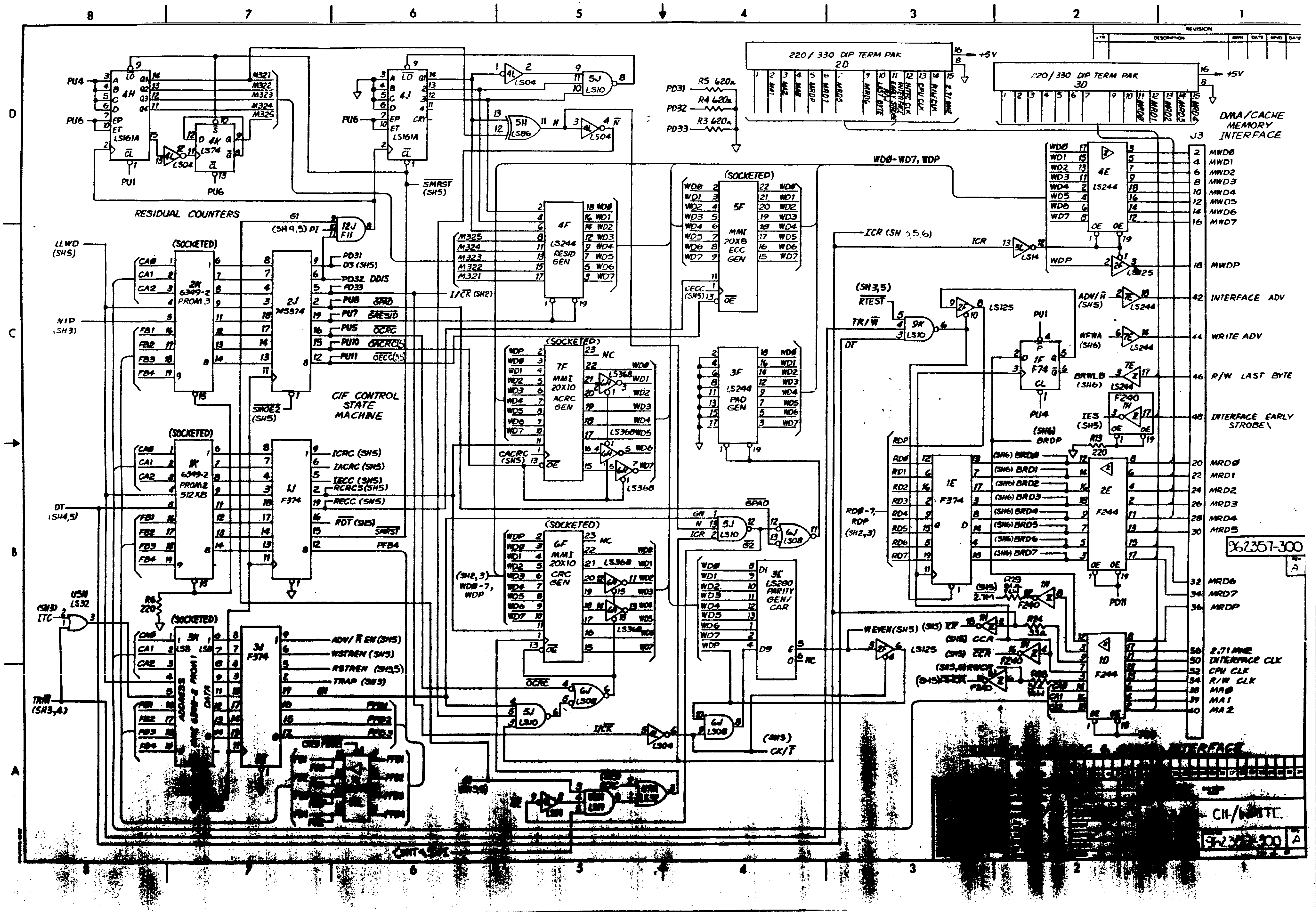
3. VALUES FOR [illegible] SEE PARTS LIST 962357-[illegible] FOR CORRECT VALUES FOR M991.
2. CAPACITOR VALUES ARE IN MICROFARADS.
1. RESISTOR VALUES ARE IN OHMS, 1/4 W, 5%.
NOTES: UNLESS OTHERWISE SPECIFIED.

SCHEM—CIF/WRITE
D 962357-30

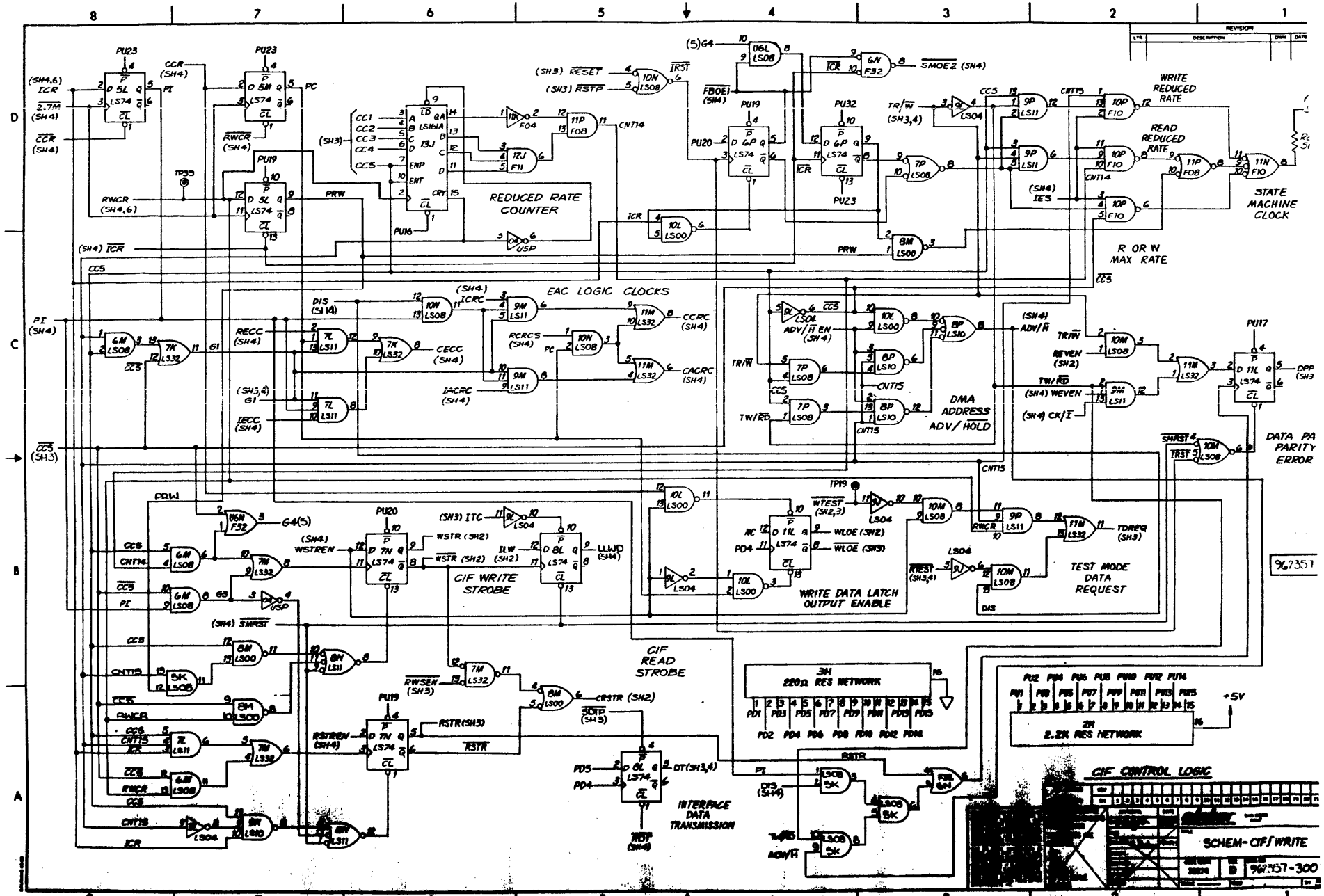

220/330Ω DIP TERM PAK 18 (SOCKETED)
220/330Ω DIP TERM PAK 3C (SOCKETED)
14B DIP TERM PAK (SOCKETED)
15A DIP TERM PAK (SOCKETED)
+5V
HOST/FORMATTER OUTPUTS
READ DATABUS
WDØ-WDP, WDP (3,4) WRITE DATA BUS
WRITE DATA LATCH
READ DATA PARITY CHECK
PD13 (SH 3,5)
962357-300
SCHEMATIC/WRITE

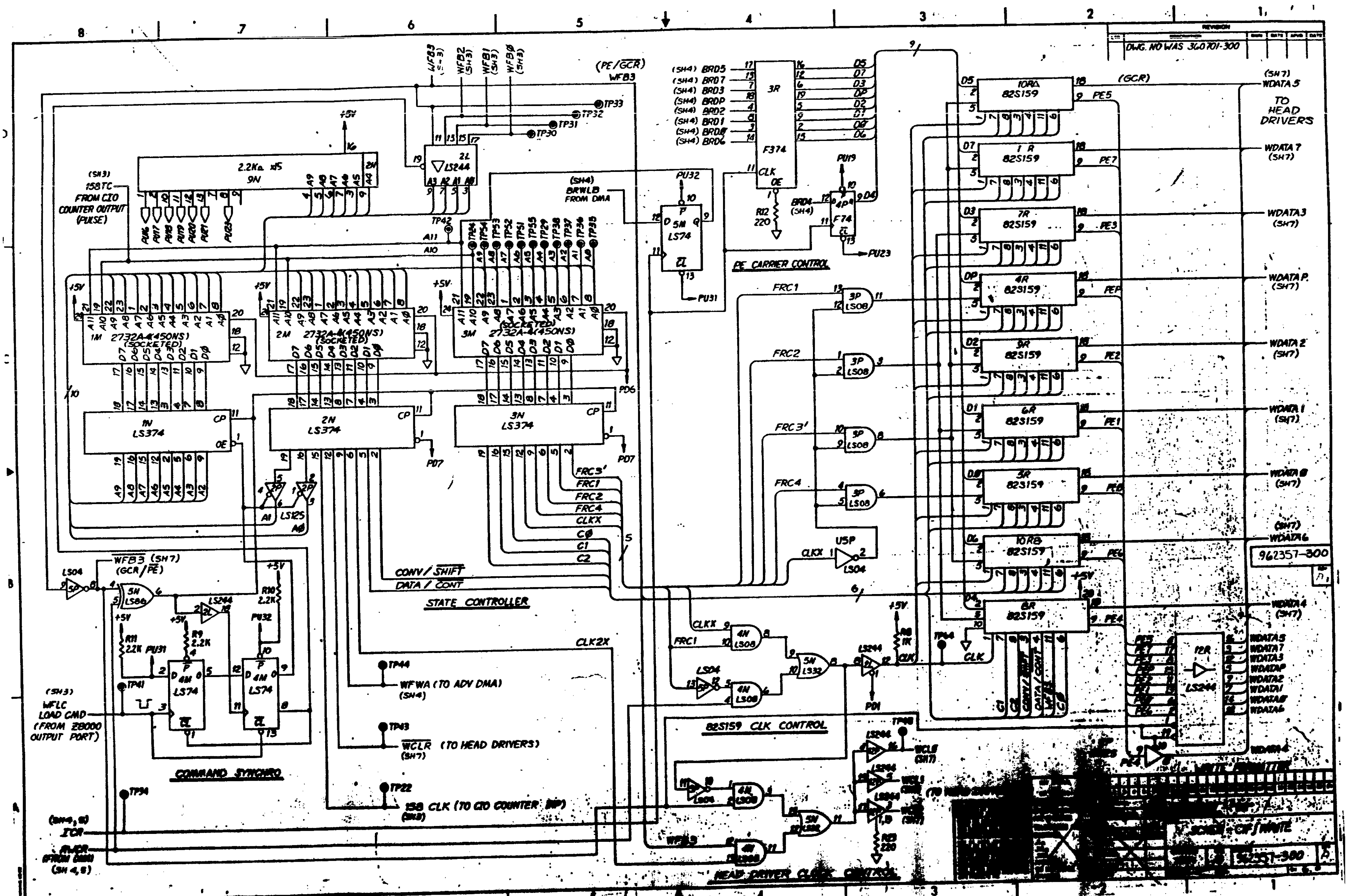


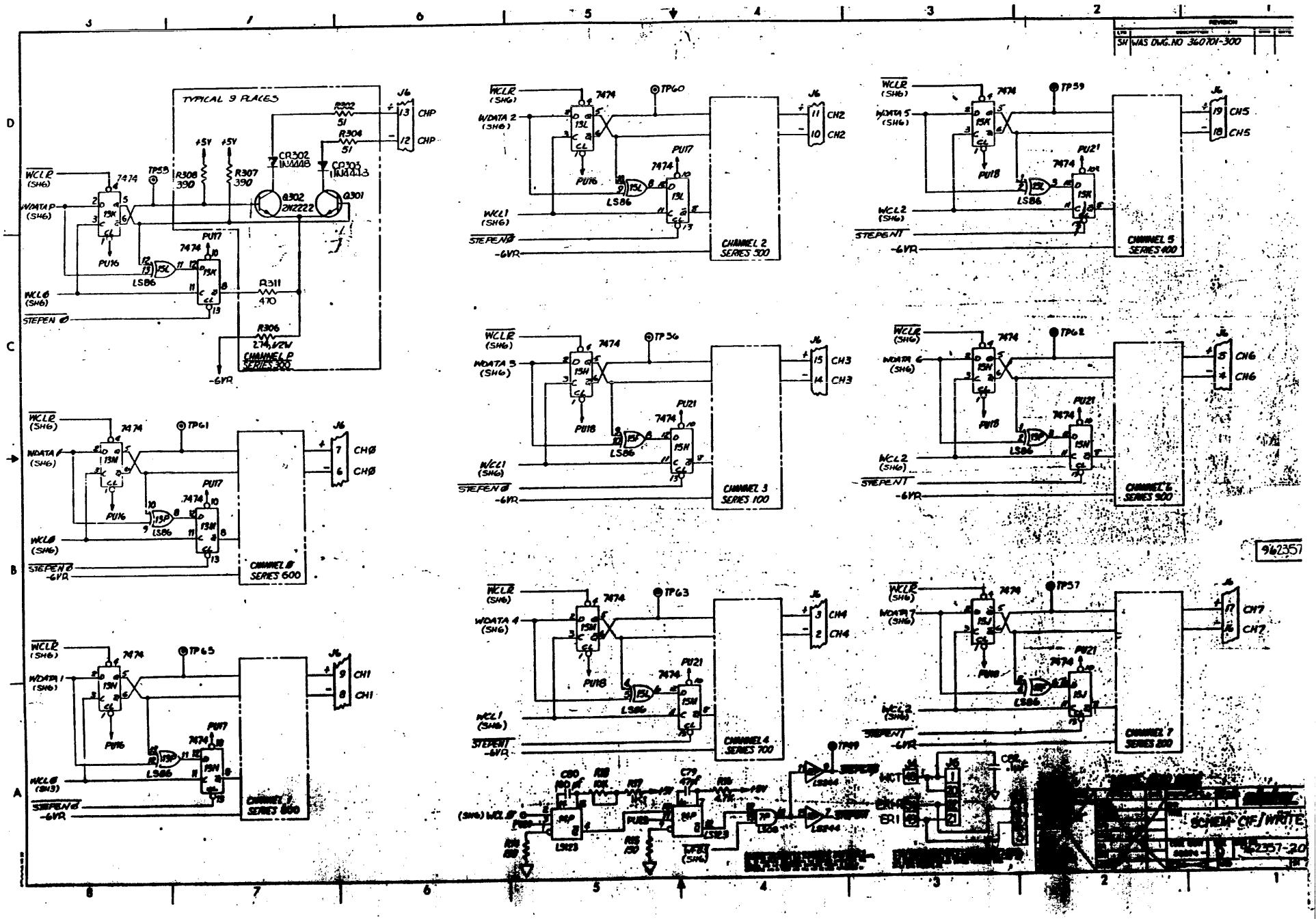
Z8000 OUTPUT CONTROL PULSES
10F LS373
10H LS138
9H LS138
11F LS373
13E LS373
12F LS373
15E LS373
9F LS373 TEST WRITE DATA LATCH
12E LS373 TEST READ DATA LATCH
WDØ-7, WDP (SH2,4)
RDØ-7, RDP (SH2,4)
Z8000 LATCHED OUTPUT CONTROL SIGNALS
(SOCKETED)
13F CIO Z8036
Z8000 INPUTS 158 COUNTER READ LAST WD COUNTER
220/330 DIP TERM PAK 14D
220/330 DIP TERM PAK 13D
J5 Z8000 BUS INTERFACE
14F LS245
14E LS245
LS244 15D
ADØ-AD15
R/W\
RESET\
INT ACK\
I/O
DS\
AS\
VI\
IEO
IEI
SYSCLK
WAIT\
TP11
TP10
TP20
+5V
COUNTER1 INPUT
Z8000 INTERFACE & I/O
SCHEM CIF/WRITE

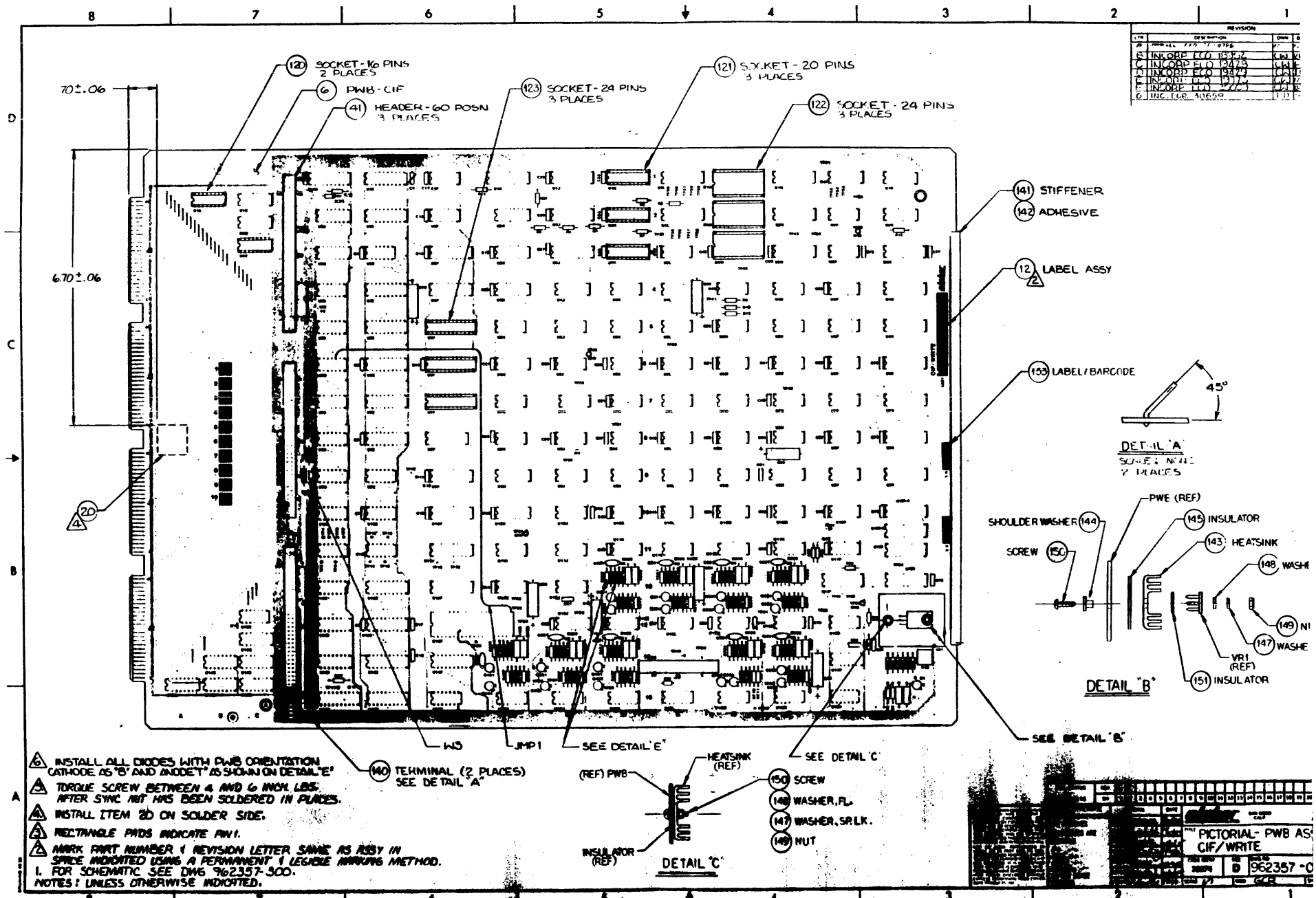


220/330 DIP TERM PAK
2D
3D
+5V
DMA/CACHE
MEMORY
INTERFACE
J3
RESIDUAL COUNTERS
4H
LS161A
4K
LS374
4J
LS161A
LS04
5J
LS10
5H
LS86
SMRST
(SH5)
(SOCKETED)
2K
6349-2
PROM 3
2J
74S374
4F
LS244
RESID
GEN
5F
MMI
20X8
ECC
GEN
4E
LS244
WDØ-WD7, WDP
ICR (SH 3,5,6)
3L
LS14
2F
LS125
MWDØ
MWD1
MWD2
MWD3
MWD4
MWD5
MWD6
MWD7
MWDP
INTERFACE ADV
WRITE ADV
R/W LAST BYTE
INTERFACE EARLY
STROBE\
C/F CONTROL
STATE
MACHINE
1K
6349-2
PROM2
512X8
1J
F374
ICRC (SH5)
IACRC (SH5)
IECC (SH5)
RCRCS(SH5)
RECC (SH5)
ROT (SH5)
7F
MMI
20X10
ACRC
GEN
LS368
3F
LS244
PAD
GEN
9K
LS10
1F
F74
RTEST
TR/W
DT
1E
F374
2E
F244
RDØ-7,
RDP
(SH2,3)
MRDØ
MRD1
MRD2
MRD3
MRD4
MRD5
MRD6
MRD7
MRDP
962357-300
6F
MMI
20X10
CRC
GEN
6J
LS08
3E
LS280
PARITY
GEN/
CAR
(SH2,3)
WDØ-7,
WDP
LLWD
(SH5)
NIP
(SH3)
DT
(SH4,5)
U5N
LS32
ITC
TR/W
(SH3,4)
3K
3J
F374
ADV/R EN (SH5)
WSTREN (SH5)
RSTREN (SH3,5)
TRAP (SH3)
1D
F244
2.71 MHZ
INTERFACE CLK
CPU CLK
R/W CLK
MAØ
MA1
MA2
CK/T
F240
PU1
PU4
PU6
PD31
PD32
PD33
R5 620Ω
R4 620Ω
R3 620Ω
CH/WRITE


REVISION
REDUCED RATE COUNTER
EAC LOGIC CLOCKS
CIF WRITE STROBE
CIF READ STROBE
WRITE DATA LATCH OUTPUT ENABLE
TEST MODE DATA REQUEST
INTERFACE DATA TRANSMISSION
DMA ADDRESS ADV/HOLD
WRITE REDUCED RATE
READ REDUCED RATE
STATE MACHINE CLOCK
R OR W MAX RATE
DATA PA PARITY ERROR
3H 220Ω RES NETWORK
2H 2.2K RES NETWORK
+5V
CIF CONTROL LOGIC
SCHEM-CIF/WRITE
9X7357-300
9X7357


DWG. NO WAS 360701-300
TO HEAD DRIVERS
2.2Kn x15
9N
LS244
2L
27324-4(450NS)
(SOCKETED)
1M
2M
3M
1N
LS374
2N
3N
LS125
3R
F374
5N
LS74
F74
4P
PE CARRIER CONTROL
FRC1
FRC2
FRC3'
FRC4
3P
LS08
U5P
LS04
10RA
82S159
1R
7R
4R
9R
6R
5R
10RB
8R
12R
STATE CONTROLLER
CONV/SHIFT
DATA/CONT
CLK2X
COMMAND SYNCHRO
WFLC LOAD CMD (FROM Z8000 OUTPUT PORT)
158TC FROM CIO COUNTER OUTPUT (PULSE)
WFWA (TO ADV DMA)
WCLR (TO HEAD DRIVERS)
158 CLK (TO CIO COUNTER I/P)
82S159 CLK CONTROL
HEAD DRIVER CLOCK CONTROL
BRWLB FROM DMA
962357-300


REVISION
SH WAS DWG.NO 360701-300
TYPICAL 9 PLACES
CHANNEL P SERIES 300
CHANNEL 2 SERIES 300
CHANNEL 5 SERIES 400
CHANNEL 3 SERIES 100
CHANNEL 6 SERIES 500
CHANNEL 8 SERIES 600
CHANNEL 4 SERIES 700
CHANNEL 7 SERIES 800
962357
SCREW OFF WRITE
962357-20



REVISION

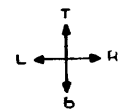
LTR	DESCRIPTION	DWN
B	INCORP ECO [illegible]	[illegible]
C	INCORP ECO 13473	[illegible]
D	INCORP ECO 13479	[illegible]
E	INCORP ECO 13774	[illegible]
F	INCORP ECO 14261	[illegible]
G	INC. ECO 14669	[illegible]

4. INSTALL ALL DIODES WITH PWB ORIENTATION CATHODE AS "B" AND ANODE "A" AS SHOWN ON DETAIL "E"
5. TORQUE SCREW BETWEEN 4 AND 6 INCH LBS. AFTER SYNC NUT HAS BEEN SOLDERED IN PLACES.
4. INSTALL ITEM 20 ON SOLDER SIDE.
3. RECTANGLE PADS INDICATE PIN 1.
2. MARK PART NUMBER & REVISION LETTER SAME AS ASSY IN SPACE INDICATED USING A PERMANENT & LEGIBLE MARKING METHOD.
1. FOR SCHEMATIC SEE DWG 962357-300.

NOTES: UNLESS OTHERWISE INDICATED.

COMPONENT ADDED					
REF LEVEL	REF DES	FROM	TO	COMP SIDE	SLD SIDE
	CR102	Q102	J6-15	X	
	CR202	Q202	J6-17	X	
	CR302	Q302	J6-13	X	
	CR402	Q402	J6-19	X	
	CR502	Q502	J6-11	X	
	CR602	Q602	J6-1	X	
	CR702	Q702	J6-3	X	
	CR802	Q802	J6-9	X	
	CR902	Q902	J6-5	X	
	CR103	Q103	J6-14	X	
	CR203	Q203	J6-16	X	
	CR303	Q303	J6-12	X	
	CR403	Q403	J6-18	X	
	CR503	Q503	J6-10	X	
	CR603	Q603	J6-6	X	
	CR703	Q703	J6-2	X	
	CR803	Q803	J6-8	X	
	CR903	Q903	J6-4	X	

JUMPER LIST							
ASSEMBLY LEVEL	JUMP NO.	FROM	TO	COMP SIDE	SLD SIDE	WIRE GAUGE	WIRE LENGTH
362357-000 REV D	1	U6D-10	U13F-21	X		30	152



PWB ORIENTATION

DETAIL "E" 6

362357-000 E

BILL OF MATERIAL

AS OF 12/30/93

CLASS CODE GROUP: 1 UNCLASSIFIED
CLASS CODE: 3400 G.C.R. UNIQUE BOARD ASSY

OP: ORDER POLICY CODE
REQ: N=PART OPTIONAL
Y=PART REQUIRED
PF: N=PART DOES NOT PRINT ON SALES ORDER
Y=PART PRINTS ON SALES ORDER W/O PRICE
P=PART PRINTS ON SALES ORDER WITH PRICE

962357-001 OPCODE: 3 REV: M PWB ASSY-CIF/WRITE
MODEL:
ECO NO: 30659
DATE OF LAST ECO: 5/26/88

PART NUMBER	DESCRIPTION	OP	RV	ITEM NO.	QTY PER ASSEMBLY	YIELD FACTR	UM	SC	REQ	P F	DEFAULT QUANTITY	DAYS OFF SET	SEQ	REFERENCE DESIGNATOR	EFFECTIV DATE	OBSOLETE DATE
962357-000	PICT-PWB ASSY,CIF/WRITE	3	G	1	0.000	1.000	EA	F	Y	N	0.000	0	0	ECO#18756	1/08/86	99/99/99
962357-300	SCHEM-CIF/WRITE	3	E	2	0.000	1.000	EA	F	Y	N	0.000	0	0	ECO#18756	1/08/86	99/99/99
460700-003	TEST SPEC CIF PWB	3		4	0.000	1.000	EA	F	N	N	0.000	0	0		00/00/00	99/99/99
962357-101	PWB-CIF/WRITE	3	A	6	1.000	1.000	EA	B	Y	N	1.000	0	0	ECO#18756	1/08/86	99/99/99
970267-001	PIN-TEST,.040SQ X .360LG	3	A	10	65.000	1.000	EA	F	Y	N	65.000	0	0	TP1-65 205026-999 ECO#18952	3/27/86	99/99/99
731006-800	LABEL-ASSY	3	B	12	1.000	1.000	EA	F	Y	N	1.000	0	0		8/28/85	99/99/99
970572-001	MOUNT-CABLE TIE,SMALL	3	A	20	1.000	1.000	EA	B	Y	N	1.000	0	0		8/28/85	99/99/99
970724-001	DIODE-1N4448,FAST SWITCHING	3	A	25	18.000	1.000	EA	B	Y	N	18.000	0	0	CR102-902, 103-903 ECO#19428	11/17/86	99/99/99
204007-500	TRANSISTOR-NPN SILICON	3	J	28	18.000	1.000	EA	B	N	N	18.000	0	0	Q101-901,102-902	00/00/00	99/99/99
970652-001	IC-337 VOLT REG	3	A	29	1.000	1.000	EA	B	Y	N	1.000	0	0	VR1	4/24/85	99/99/99
201191-063	CAP-ELEC,22MF,6.3V,-10+50%,AL	3	H	31	6.000	1.000	EA	B	Y	N	6.000	0	0	C1,2,10,30,49,60 ECO#19609	4/27/87	99/99/99
970784-104	CAP-CER,.1UF,50V,-20+80%,AX,*	3	E	32	69.000	1.000	EA	B	Y	N	69.000	0	0	C3-9,11-29 31-40,42-48,50-53,55-59,61-70, 72-75,77,78,81,82 ECO#19931 CRA#0036	7/25/86	99/99/99
201112-100	CAP-CER,100PF,50V,10%	3	G	33	1.000	1.000	EA	B	N	N	1.000	0	0	C80	00/00/00	99/99/99
201204-472	CAP-CER,47PF,50V,5%,NPO	3	R	34	1.000	1.000	EA	B	Y	N	1.000	0	0	C79	00/00/00	99/99/99
201244-104	CAP-CER,.1MF,50V,20%	3	E	35	2.000	1.000	EA	B	Y	N	2.000	0	0	C83,84	4/23/85	99/99/99
201191-025	CAP-ELEC,10MF,25V, ,ALUM	3	H	36	3.000	1.000	EA	B	Y	N	3.000	0	0	C41,54,71 ECO#19608	4/27/87	99/99/99
970303-060	CONN-HEADER,60 POSN,STR,	3	C	41	3.000	1.000	EA	B	Y	N	3.000	0	0	J3,4,5	8/28/85	99/99/99
970961-026	CONN-LOCK/EJECT,26POS,.100CTRS	3	B	42	1.000	1.000	EA	B	Y	N	1.000	0	0	U6 ECO#19500	7/24/87	99/99/99
200072-220	RES-220 OHM 1/4W 5% CF	3	AB	43	6.000	1.000	EA	F	N	N	6.000	0	0	R1,6,7,12, 13,23	00/00/00	99/99/99
200073-220	RES-2.2 KOHM 1/4W 5% CF	3	AB	44	4.000	1.000	EA	F	N	N	4.000	0	0	R2,9-11	00/00/00	99/99/99
200072-620	RES-620 OHM 1/4W 5% CF	3	AB	45	3.000	1.000	EA	F	N	N	3.000	0	0	R3-5	00/00/00	99/99/99
200073-100	RES-1.0 KOHM 1/4W 5% CF	3	AB	46	2.000	1.000	EA	F	Y	N	2.000	0	0	R8,17	00/00/00	99/99/99
200072-150	RES-150 OHM 1/4W 5% CF	3	AB	47	2.000	1.000	EA	F	N	N	2.000	0	0	R14,15	00/00/00	99/99/99
200073-470	RES-4.7 KOHM 1/4W 5% CF	3	AB	48	1.000	1.000	EA	F	N	N	1.000	0	0	R16	00/00/00	99/99/99

BILL OF MATERIAL

AS OF 12/30/93

CLASS CODE GROUP: 1 UNCLASSIFIED
CLASS CODE: 3400 G.C.R. UNIQUE BOARD ASSY

962357-001 OPCODE: 3 REV: M PWB ASSY-CIF/WRITE
MODEL:
ECO NO: 30659
DATE OF LAST ECO: 5/26/88

OP: ORDER POLICY CODE
REQ:N=PART OPTIONAL
Y=PART REQUIRED
PF: N=PART DOES NOT PRINT ON SALES ORDER
Y=PART PRINTS ON SALES ORDER W/O PRICE
P=PART PRINTS ON SALES ORDER WITH PRICE

PART NUMBER	DESCRIPTION	OP	RV	ITEM NO.	QTY PER ASSEMBLY	YIELD FACTR	UM	SC	REQ	PF	DEFAULT QUANTITY	DAYS OFF SET	SEQ	REFERENCE DESIGNATOR	EFFECTIV DATE	OBSOLETE DATE
200215-103	RES-POT,10K	3	D	49	1.000	1.000	EA	B	N	N	1.000	0	0	R18	00/00/00	99/99/99
200012-750	RES-750 OHM 1/4W 1% FF	3	R	52	1.000	1.000	EA	B	Y	N	1.000	0	0	R30	4/23/85	99/99/99
200071-510	RES-51 OHM 1/4W 5% CF	3	AB	53	21.000	1.000	EA	F	Y	N	21.000	0	0	R25,28,29,102-902,104-904	00/00/00	99/99/99
200013-221	RES-2.21 KOHM 1/4W 1% FF	3	R	54	1.000	1.000	EA	F	Y	N	1.000	0	0	R31	4/23/85	99/99/99
970657-001	RES-274 OHM 1W 1% MF	3	B	55	9.000	1.000	EA	F	Y	N	9.000	0	0	R106-R906 970656-001	5/02/85	99/99/99
200072-390	RES-390 OHM 1/4W 5% CF	3	AB	56	18.000	1.000	EA	F	N	N	18.000	0	0	R107-907,108-908	00/00/00	99/99/99
200072-470	RES-470 OHM 1/4W 5% CF	3	AB	58	9.000	1.000	EA	F	Y	N	9.000	0	0	R111-911	00/00/00	99/99/99
205255-500	RES-NTWK 220/330 OHM 5% 1.5	3	E	59	6.000	1.000	EA	B	N	N	6.000	0	0	1B,2D,3C,3D,13D,14D	00/00/00	99/99/99
970345-001	RES-NTWK 2.2 KOHM DIP 16P	3	D	61	2.000	1.000	EA	B	N	N	2.000	0	0	2H,9N	00/00/00	99/99/99
970345-002	RES-NTWK 220 OHM DIP 16P	3	D	62	1.000	1.000	EA	B	N	N	1.000	0	0	3H	00/00/00	99/99/99
200071-470	RES-47 OHM 1/4W 5% CF	3	AB	63	1.000	1.000	EA	F	N	N	1.000	0	0	R27	00/00/00	99/99/99
200071-330	RES-33 OHM 1/4W 5% CF	3	AB	64	2.000	1.000	EA	F	N	N	2.000	0	0	R24,26	00/00/00	99/99/99
208500-300	WIRE,BUS TND COPPER 26AWG	3	B	66	0.000	1.000	EA	F	Y	N	0.000	0	0	W3 ECO#18952	3/27/86	99/99/99
970406-001	IC-74S374 FF D OCT	3	B	70	1.000	1.000	EA	B	N	N	1.000	0	0	U2J	00/00/00	99/99/99
203052-244	IC-74LS244 BFR OCT 3S	3	L	71	9.000	1.000	EA	B	N	N	9.000	0	0	U1L,2L,3F,4E,4F,7E,12P,12R,15D	00/00/00	99/99/99
203102-375	IC-74LS374 FF D OCT	3	F	72	5.000	1.000	EA	B	N	N	5.000	0	0	1N,2N,3N,5E,8E	00/00/00	99/99/99
203039-001	IC-74LS74 FF D DUAL	3	M	73	9.000	1.000	EA	B	N	N	9.000	0	0	U4K,4M,5L,5M,6K,6P,7N,8L,11L	00/00/00	99/99/99
970347-001	IC-74F240 INV BUF 3S OCT	3	C	74	1.000	1.000	EA	B	N	N	1.000	0	0	U1H	00/00/00	99/99/99
970346-001	IC-74F244 DRVR OCTAL BUF	3	C	77	2.000	1.000	EA	B	N	N	2.000	0	0	U1D,2E	00/00/00	99/99/99
203036-039	IC-74LS125 BUS BUF QUAD	3	F	78	3.000	1.000	EA	B	N	N	3.000	0	0	U2F,2P,11J	00/00/00	99/99/99
203061-280	IC-74LS280 PARITY TREE 9IN	3	C	79	2.000	1.000	EA	B	N	N	2.000	0	0	U3E,12D	00/00/00	99/99/99
203085-001	IC-74LS14 INV SCHMITT HEX	3	J	80	1.000	1.000	EA	B	N	N	1.000	0	0	U3L	00/00/00	99/99/99
970010-001	IC-74LS08 AND 2IN QUAD	3	B	81	11.000	1.000	EA	B	N	N	11.000	0	0	U3P,4N,5K,6L,6J,6M,7J,7P,8H,10M,10N	00/00/00	99/99/99
970321-001	IC-74F374 FF D 3S OCT	3	D	82	4.000	1.000	EA	B	N	N	4.000	0	0	U1E,1J,3J,3R	00/00/00	99/99/99
203029-500	IC-7414 INV HEX SCHMITT TRIP,	3	C	83	5.000	1.000	EA	B	N	N	5.000	0	0	U4D,5D,6D,7D,8D	00/00/00	99/99/99

BILL OF MATERIAL

AS OF 12/30/93

CLASS CODE GROUP: 1 UNCLASSIFIED
CLASS CODE: 3400 G.C.R. UNIQUE BOARD ASSY

OP: ORDER POLICY CODE
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PF: N=PART DOES NOT PRINT ON SALES ORDER
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962357-001 OPCODE: 3 REV: M PWB ASSY-CIF/WRITE
MODEL:
ECO NO: 30659
DATE OF LAST ECO: 5/26/88

PART NUMBER	DESCRIPTION	OP	RV	ITEM NO.	QTY PER ASSEMBLY	YIELD FACTR	UM	SC	REQ	PF	DEFAULT QUANTITY	DAYS OFF SET	SEQ	REFERENCE DESIGNATOR	EFFECTIV DATE	OBSOLETE DATE
203048-100	IC-74LS161 CNTR 4BIT SYNC	3	L	84	3.000	1.000	EA	B	N	N	3.000	0	0	U4H,4J,13J	00/00/00	99/99/99
970011-001	IC-74LS04 INV HEX	3	D	85	5.000	1.000	EA	B	N	N	5.000	0	0	U4L,5P,9J, 9L,10K	00/00/00	99/99/99
203035-032	IC-74LS32 OR 2IN QUAD	3	J	86	5.000	1.000	EA	B	N	N	5.000	0	0	U5N,7K,7M, 10J,11M	00/00/00	99/99/99
970325-001	IC-74F74 FF D DUAL	3	D	87	2.000	1.000	EA	B	N	N	2.000	0	0	U1F,4P	00/00/00	99/99/99
203102-373	IC-74LS373 LATCH D OCT	3	G	89	7.000	1.000	EA	B	N	N	8.000	0	0	U9F,10F,11 F,12E,12F, 13E,15E	00/00/00	99/99/99
203042-001	IC-74LS86 XOR QUAD	3	K	91	4.000	1.000	EA	B	N	N	4.000	0	0	U5H,13P,15 F,15L	00/00/00	99/99/99
203029-002	IC-74LS10 NAND 3IN TRIP	3	J	92	3.000	1.000	EA	B	N	N	3.000	0	0	U5J,8P,9K	00/00/00	99/99/99
203122-368	IC-74LS368 HEX BUS DRIVER	3	L	94	1.000	1.000	EA	B	N	N	1.000	0	0	6H	00/00/00	99/99/99
970349-001	IC-74F32 OR 2IN QUAD	3	B	95	1.000	1.000	EA	B	N	N	1.000	0	0	U6N	00/00/00	99/99/99
970221-001	IC-74LS00 NAND 2IN POS QUAD	3	E	96	5.000	1.000	EA	B	N	N	5.000	0	0	U7H,8J,8M, 10L,12H	00/00/00	99/99/99
203029-003	IC-74LS11 AND 3IN TRIP	3	F	97	5.000	1.000	EA	B	N	N	5.000	0	0	U7L,8K,8N, 9M,9P	00/00/00	99/99/99
203036	IC-7438 NAND 2IN BUF QUAD	3	E	99	6.000	1.000	EA	B	N	N	6.000	0	0	U9D,9E,10D ,10E,11D,1 1E	00/00/00	99/99/99
203046-148	IC-74LS138 DCDR 3-8 LINE	3	K	100	2.000	1.000	EA	B	N	N	2.000	0	0	U9H,10H	00/00/00	99/99/99
970356-001	IC-74F10 NAND	3	C	101	2.000	1.000	EA	B	N	N	2.000	0	0	U10P,11N	00/00/00	99/99/99
203081-001	IC-74LS02 NOR 2IN POS QUAD	3	J	102	1.000	1.000	EA	B	N	N	1.000	0	0	U11H	00/00/00	99/99/99
970342-001	IC-74F04 INV HEX	3	D	103	1.000	1.000	EA	B	N	N	1.000	0	0	U11K	00/00/00	99/99/99
970350-001	IC-74F08 AND 2IN QUAD	3	C	104	1.000	1.000	EA	B	N	N	1.000	0	0	U11P	00/00/00	99/99/99
203036-038	IC-74LS38 NAND 2IN POS BUF	3	H	105	1.000	1.000	EA	B	N	N	1.000	0	0	U12C	00/00/00	99/99/99
970355-001	IC-74F11 AND TRIP	3	C	106	1.000	1.000	EA	B	N	N	1.000	0	0	U12J	00/00/00	99/99/99
203555-111	IC-8036 CIO 16BIT 6MHZ	3	C	107	1.000	1.000	EA	B	N	N	1.000	0	0	U13F	00/00/00	99/99/99
203039	IC-7474 FF D POS EDGE DUAL	3	C	108	9.000	1.000	EA	B	N	N	9.000	0	0	U13K,13L,1 3M,13N,15H ,15J,15K,1 5M,15N	00/00/00	99/99/99
203102-245	IC-74LS245 TRANSCEIVR.BUS OCT	3	E	109	2.000	1.000	EA	B	N	N	2.000	0	0	U14E,14F	00/00/00	99/99/99
203046-001	IC-74LS123 MLTV DUAL	3	G	110	1.000	1.000	EA	B	N	N	1.000	0	0	U14P	00/00/00	99/99/99
211011-016	SOCKET-16 PIN LOW PROFILE	3	D	120	2.000	1.000	EA	B	Y	N	2.000	0	0	XU1B,3C	8/28/85	99/99/99
970555-020	SOCKET-IC 20 PIN,.30	3	A	121	3.000	1.000	EA	B	Y	N	3.000	0	0	XU1K,2K,3K	8/28/85	99/99/99
205025-524	SOCKET-DIP,24 CONTACTS	3	E	122	3.000	1.000	EA	B	Y	N	3.000	0	0	XU1M,2M,3M	8/28/85	99/99/99
970555-024	SOCKET-IC 24 PIN,.30	3	A	123	3.000	1.000	EA	B	N	N	3.000	0	0	XU5F,6F,7F	00/00/00	99/99/99
961243-001	S/W-GCR,ASSY,WRITE FMTR	1	A	126	1.000	1.000	EA	B	N	N	1.000	0	0	U1M	00/00/00	99/99/99
961244-001	S/W-GCR,ASSY,WRITE FMTR	1	A	127	1.000	1.000	EA	B	N	N	1.000	0	0	U2M	00/00/00	99/99/99

ORIGINAL

BILL OF MATERIAL

AS OF 12/30/93

CLASS CODE GROUP: 1 UNCLASSIFIED
CLASS CODE: 3400 G.C.R. UNIQUE BOARD ASSY

962357-001 OPCODE: 3 REV: M PWB ASSY-CIF/WRITE
MODEL:
ECO NO: 30659
DATE OF LAST ECO: 5/26/88

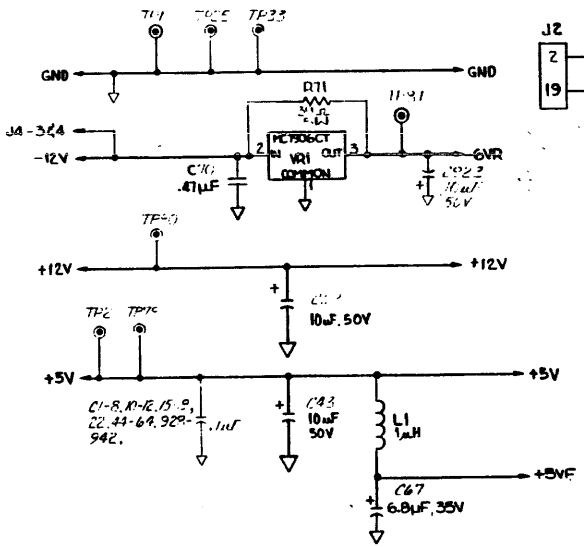
OP: ORDER POLICY CODE
REQ: N=PART OPTIONAL
Y=PART REQUIRED
PF: N=PART DOES NOT PRINT ON SALES ORDER
Y=PART PRINTS ON SALES ORDER W/O PRICE
P=PART PRINTS ON SALES ORDER WITH PRICE

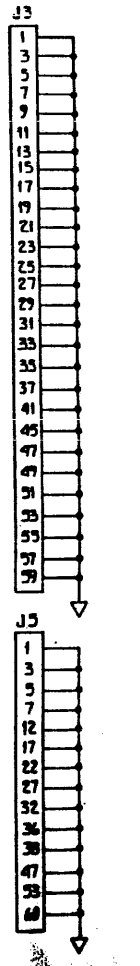
PART NUMBER	DESCRIPTION	OP	RV	ITEM NO.	QTY PER ASSEMBLY	YIELD FACTR	UM	SC	REQ	PF	DEFAULT QUANTITY	DAYS OFF SET	SEQ	REFERENCE DESIGNATOR	EFFECTIV DATE	OBSOLETE DATE
961245-001	S/W-GCR,ASSY,WRITE FMTR	1	A	128	1.000	1.000	EA	B	N	N	1.000	0	0	U3M	00/00/00	99/99/99
961246-001	S/W-GCR,ASSY,WRITE CHAN	1	A	129	3.000	1.000	EA	B	N	N	3.000	0	0	U4R,5R,10R A	00/00/00	99/99/99
961247-001	S/W-GCR,ASSY,WRITE CHAN	1	A	130	1.000	1.000	EA	B	N	N	1.000	0	0	U6R	00/00/00	99/99/99
961248-001	S/W-GCR,ASSY,WRITE CHAN	1	A	131	2.000	1.000	EA	B	N	N	2.000	0	0	U7R,8R	00/00/00	99/99/99
961249-001	S/W-GCR,ASSY,WRITE CHAN	1	A	132	3.000	1.000	EA	B	N	N	3.000	0	0	U9R,10RB,11R	00/00/00	99/99/99
961373-002	S/W-GCR,ASSY,INTERFACE	1	B	133	1.000	1.000	EA	B	N	N	1.000	0	0	U1K	00/00/00	99/99/99
961375-001	S/W-GCR,ASSY,INTERFACE	1	B	134	1.000	1.000	EA	B	N	N	1.000	0	0	U2K	00/00/00	99/99/99
961376-002	S/W-GCR,ASSY,INTERFACE	1	A	135	1.000	1.000	EA	B	N	N	1.000	0	0	U3K	00/00/00	99/99/99
961377-001	S/W-GCR,ASSY,ECC	1	B	136	1.000	1.000	EA	B	N	N	1.000	0	0	U5F	00/00/00	99/99/99
961371-001	S/W-GCR,ASSY,CRC	1	B	137	1.000	1.000	EA	B	N	N	1.000	0	0	U6F	00/00/00	99/99/99
961374-001	S/W-GCR,ASSY,ACRC	1	B	138	1.000	1.000	EA	B	N	N	1.000	0	0	U7F	00/00/00	99/99/99
970058-002	TERMINAL-MALE .250 TAB	3	C	140	2.000	1.000	EA	B	N	N	4.000	0	0		00/00/00	99/99/99
961707-002	STIFFENER-EDGE,PCB	3	B	141	1.000	1.000	EA	B	N	N	1.000	0	0		00/00/00	99/99/99
209990-071	ADHESIVE-SUPERBONDER	3	C	142	0.000	1.000	EA	F	N	N	.001	0	0		00/00/00	99/99/99
970281-003	HEATSINK-TO-127/TO-220,15.33*	3	C	143	1.000	1.000	EA	B	Y	N	1.000	0	0	(VR1) ECO#19167	8/04/86	99/99/99
216155-049	WASHER-SHOULDER,#4,	3	A	144	1.000	1.000	EA	F	Y	N	1.000	0	0		4/23/85	99/99/99
964421-001	INSULATOR-THERMALLY,CONDUCTIVE	3	A	145	1.000	1.000	EA	F	Y	N	1.000	0	0	ECO#19791	8/10/87	99/99/99
207403-011	WASHER-SPLIT LOCK #4	3	D	147	2.000	1.000	EA	F	Y	N	2.000	0	0		11/22/85	99/99/99
207403-021	WASHER-FLAT	3	C	148	2.000	1.000	EA	F	Y	N	2.000	0	0		11/22/85	99/99/99
207406-081	NUT-HEX RADIO PAT. #4	3	B	149	2.000	1.000	EA	F	Y	N	2.000	0	0		11/22/85	99/99/99
213271-407	SCREW-PHP,ZINC,4-40X 7/16	3	G	150	2.000	1.000	EA	F	Y	N	2.000	0	0	ECO#19773	4/24/87	99/99/99
210875-501	INSULATOR-THERMALLY	3	B	151	1.000	1.000	EA	B	Y	N	1.000	0	0	(VR1)	12/04/85	99/99/99
209430-900	WIRE-30AWG,KYNAR ROLL,UL	3	E	152	1.000	1.000	FT	F	Y	N	1.000	0	0	ECO#30009	8/26/87	99/99/99
971041-001	LABEL-BAR CODE,1.425LX.25W,9.*	3	B	153	1.000	1.000	EA	F	Y	N	1.000	0	0	ECO#30659	5/27/88	99/99/99

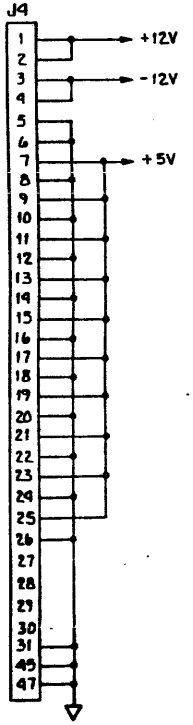
TYPE	REF DESG	+12V	+5V	-6V	GND
PAL 20 X 10	U1J U3J		24		12
74LS688	U1M, U3M		20		10
PAL 20X 8	U6J		24		12
SPARE	U20M U20S U16A U16B		16		8
SPARE	U19U		14		7
C-5061	U26B, U26D, U26F, U26H, U26K, U26M, U26P, U26S, U26U	6	10	1	5
74LS373	U5R, U2U		20		10
'LS74	U21B, U22B, U23B, U22D, U23D, U22S, U20G, U22F, U23F, U22H U23H, U21J, U22K, U23K, U22M, U23M, U21P, U22P, U23P, U21U, U23U, U10E, U23S, U22U, [illegible]		14		7
'S225	U20A, U21A, U20C, U21C, U20E, U21E, U20F, U21F, U20H, U21H, U21N, U20L, U20N, U21L, U20Q, U21R, U20T, U21T		20		10
74LS138	U5T		[illegible]		[illegible]
'LS273	U19A, U19C, U10C, U19E, U9F, U9P U19L, U19R, U6H, U19H, U19N, U19T		20		10
'LS174	U15B, U15C, U21D, U11H, U3H, U10H U12H, U21G, U21M, U21S, U15J, [illegible]		16		8
Z132A	U18A, U18C, U18E, U18F, U18J, U18L, U18N, U18R, U18T, U5G, U10G		24		12
MC4044	U23A, U23C, U23E, U23G, U23J, U23L, U23N, U23R, U23T		14		7
CD4066	U25A, U25C, U25E, U25G, U25J, U25L, U25N, U25R, U25T		14	7	
'LS139	U19D, U19G, U19S, U19M, U18U		16		8
'LS00	U20B, U20D, U20J, U20P, U20U, U6B		14		7
'LS08	U3C, U3G, U6C. U10B, U9B, U15J, U9P,		14		7
'LS244	U10A, U12A, U3A, U3B		20		10
'LS14	U1E, [illegible]		14		7
'LS245	U15A		20		10
'LS02	U15E., [illegible]		14		7
'LS04	U6E, U12E, [illegible]		14		7
'LS86	U1G		14		7
'LSM8	U12G		16		8
'LS109	U3F, U10F		16		8
'LS125	U1F, U13R		14		7
'LS21	U1A		14		7
'LS32	U1C, U3E		14		7
24541	U12J, U15H, U15G		18		9
8036	U12B		23		7
339	U12F		3		12
F74	U1B, U6F		14		7
6305-1	U15F		16		8
74221	U24B, U24D, U25D, U25F, U25B, U25K, U8F, U24H, U25H, U25M, U24P, U25P, U24S, U25S, U24U, U25U, U24K, U24M		16		8
74180	U6A		14		7
27S12	U2P, U5P		28		14
74LS42	U2T, U11P		16		8

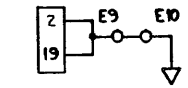
4. ALL RESISTORS 1% TO BE 1/8W, ALL 5% TO BE 1/4W
3. 'X' SERIES NO.(000-999) IN WHICH THE COMPONENTS APPEARS
2. ALL INDUCTORS ARE IN MICROHENRYS.
1. ALL CAPACITORS ARE IN MICROFIRADS.

NOTES: UNLESS OTHERWISE SPECIFIED



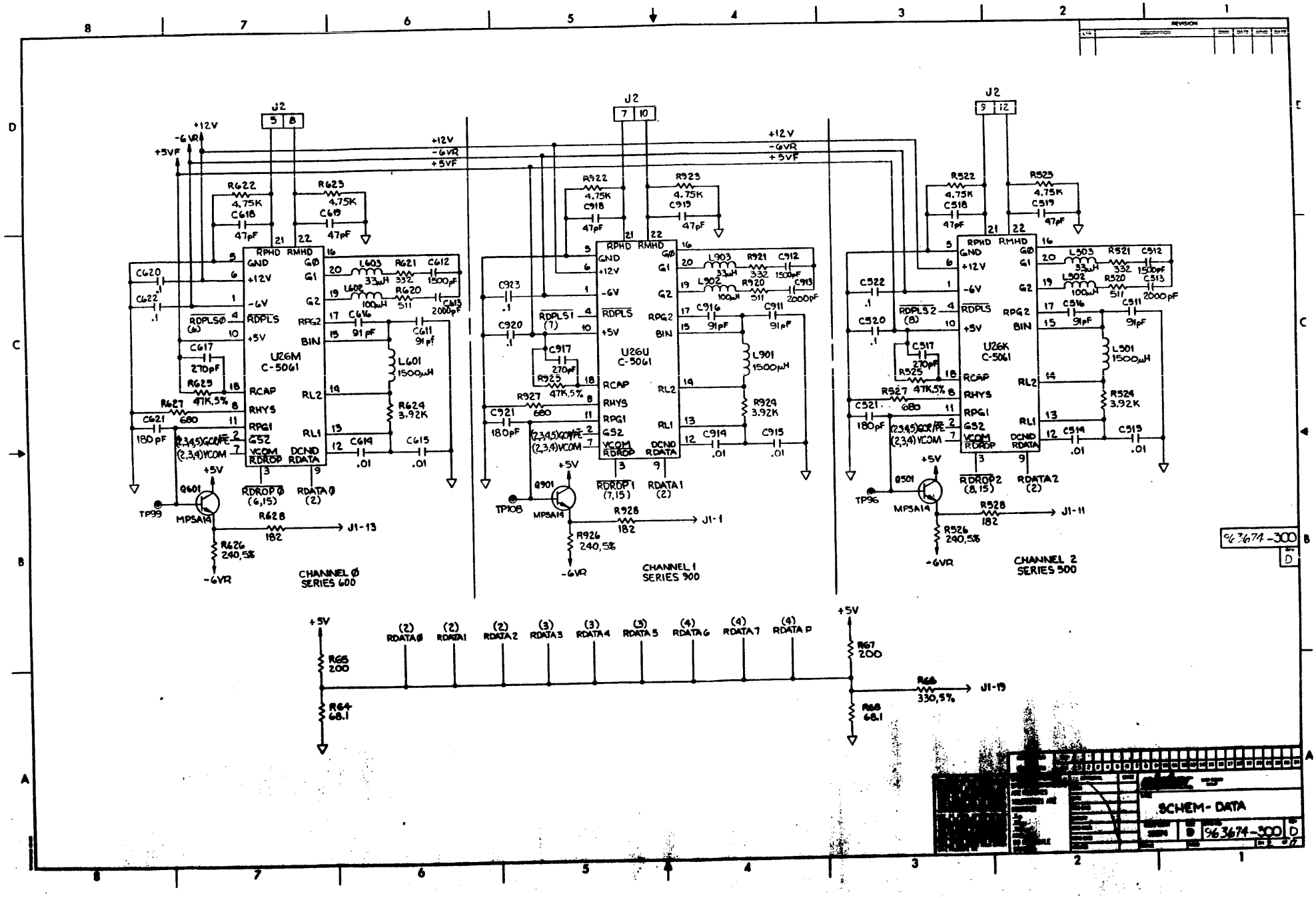


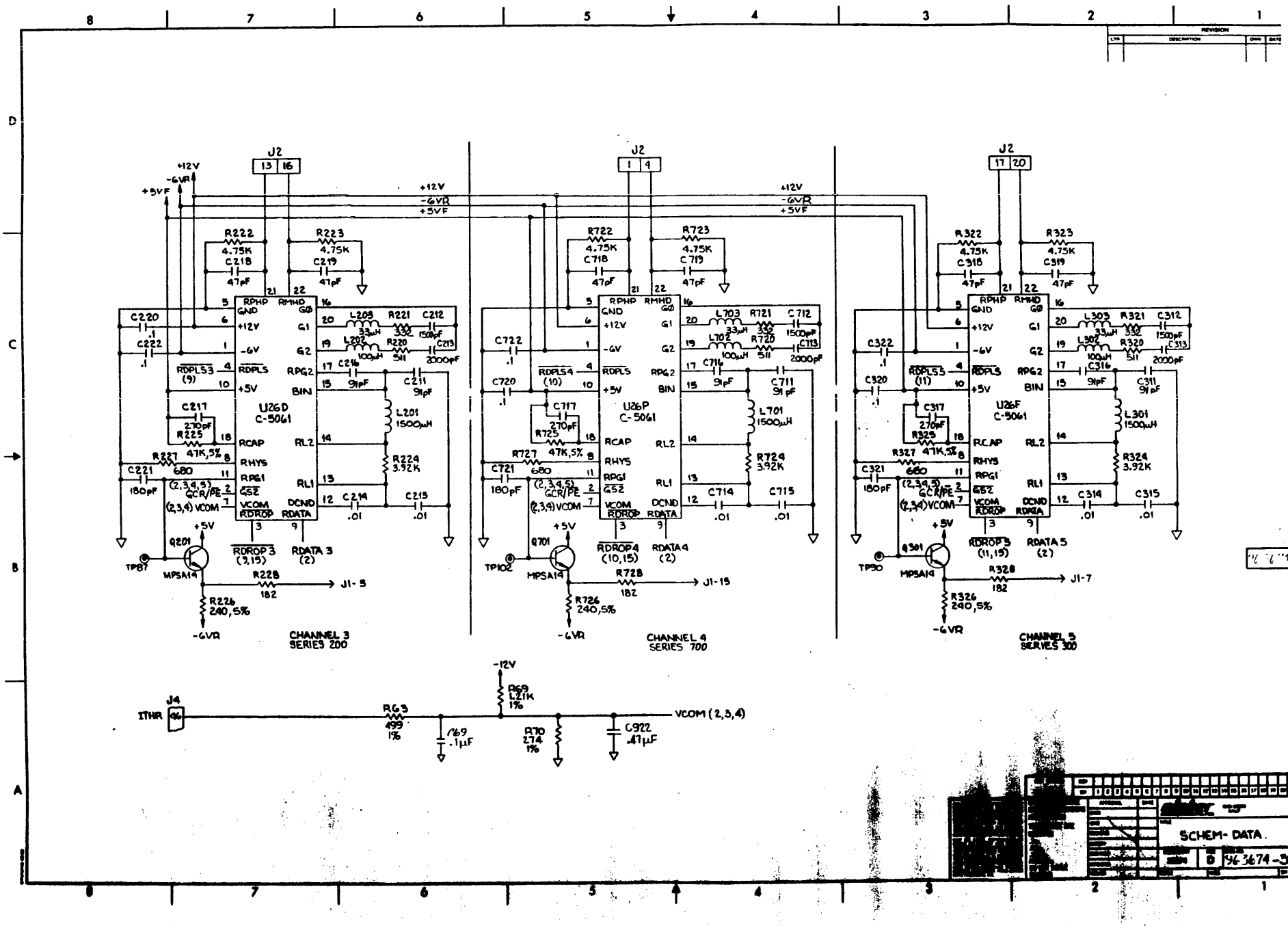


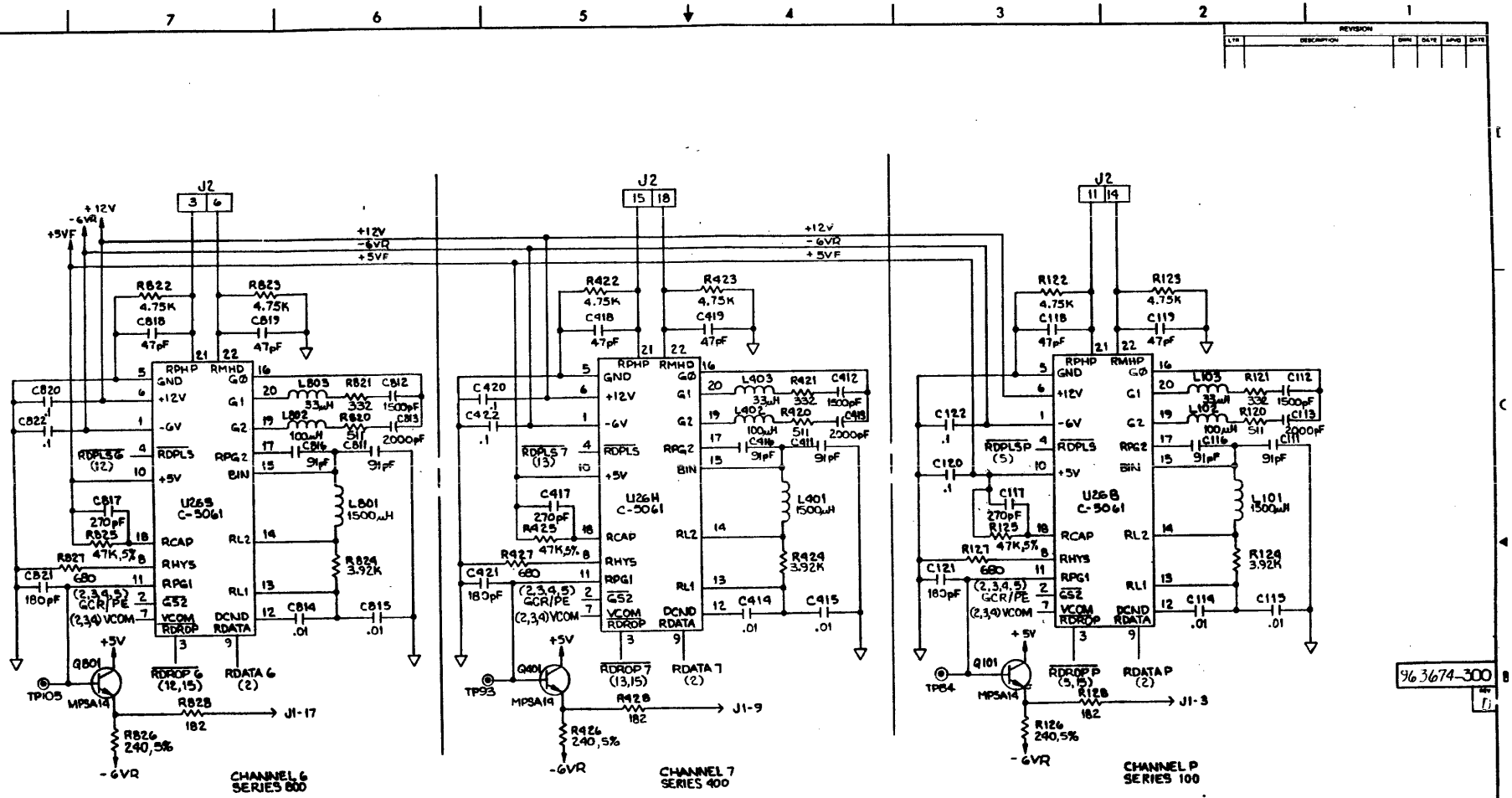


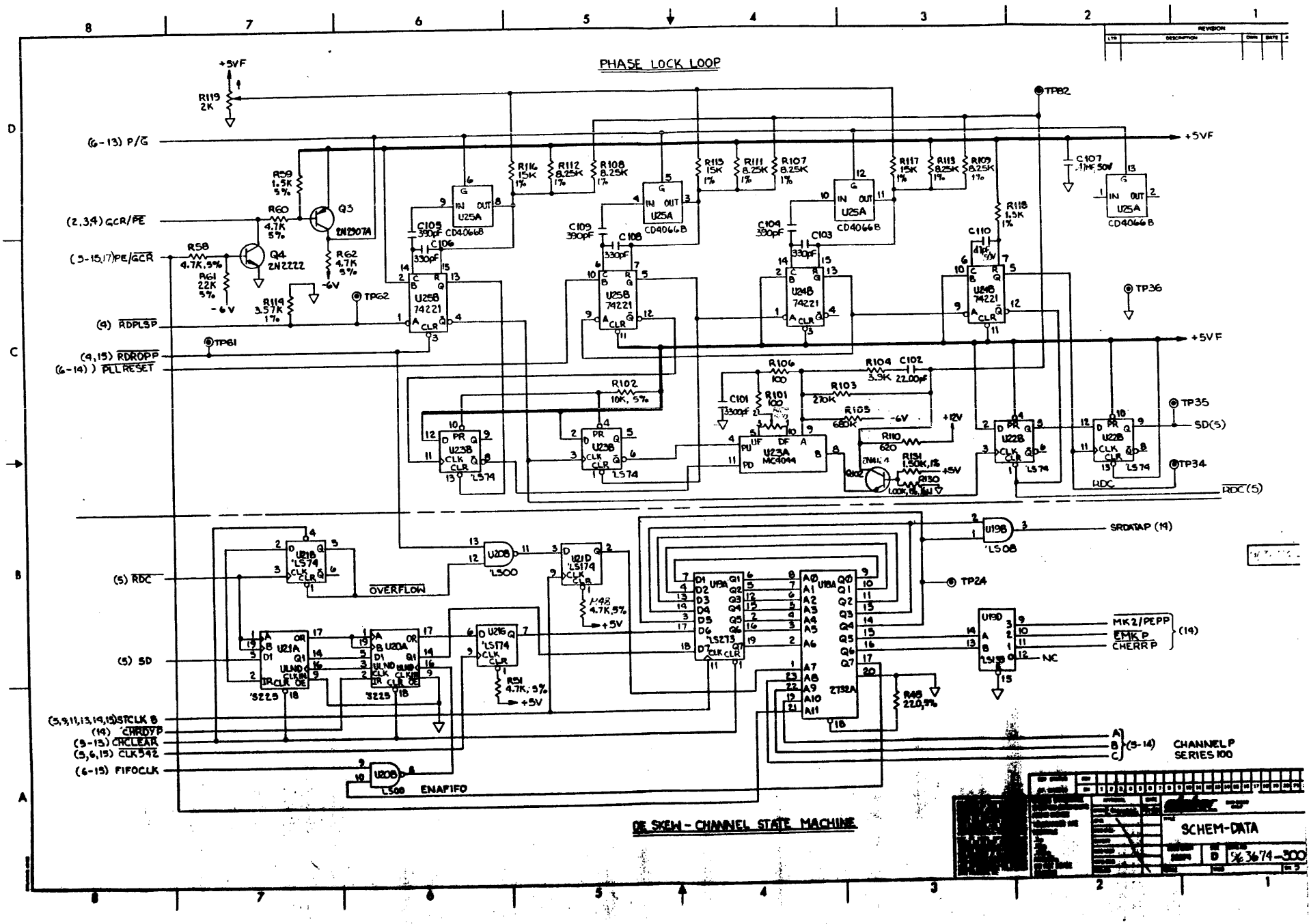
SCHEM- DATA

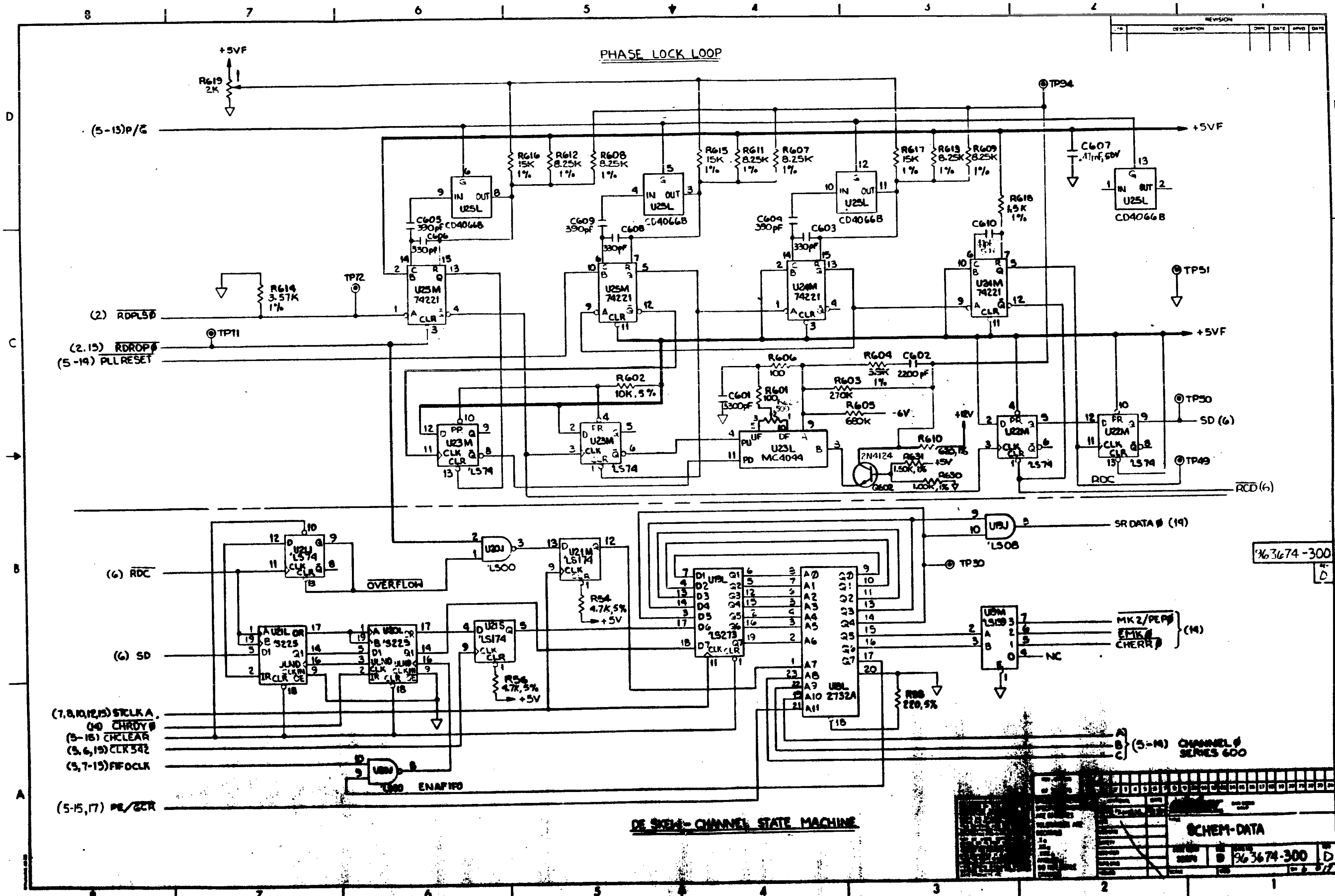
B %3674-300

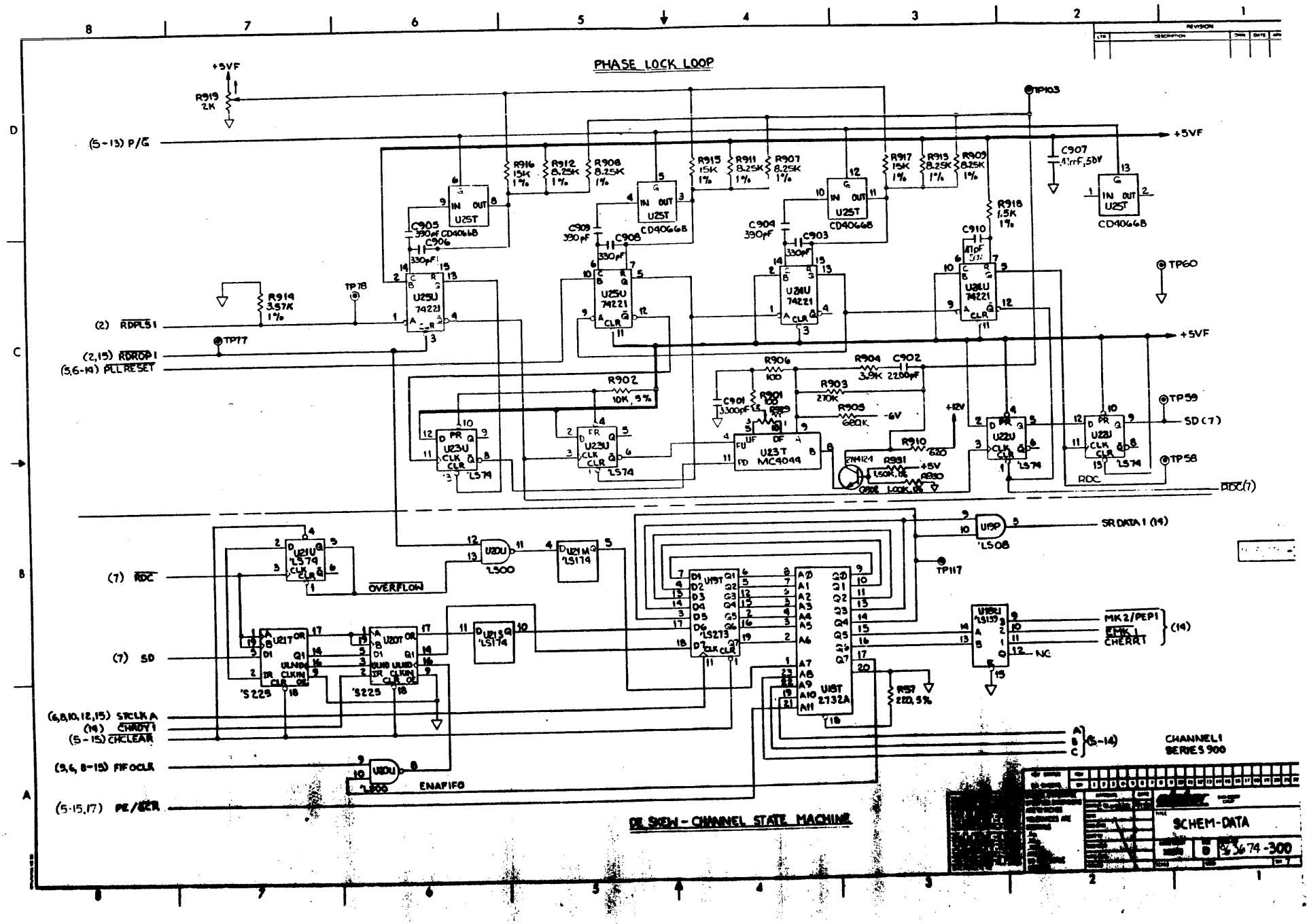

J2
+12V
-6VR
+5VF
R622 4.75K
R623 4.75K
C618 47pF
C619 47pF
U26M C-5061
RPHD RMHD
GND +12V -6V +5V
G0 G1 G2
RDPLS
RPG2 BIN
RCAP RHYS RPG1 GS2 VCOM DCND
RL2 RL1
RDROP0 (6,15)
RDATA0 (2)
L603 33µH
L602 100µH
L601 1500µH
R621 332
R620 511
R624 3.92K
R625 47K,5%
R627 680
R628 182
R626 240,5%
C620 .1
C622 .1
C617 270pF
C621 180pF
C611 91pF
C612 1500pF
C613 2000pF
C614 91pF
C615 .01
C616 .01
RDPLS0 (6)
(2,3,4,5)GCOMPE
(2,3,4)VCOM
TP99
Q601 MPSA14
J1-13
CHANNEL 0
SERIES 600
U26U C-5061
RDPLS1 (7)
RDROP1 (7,15)
RDATA1 (2)
R922 4.75K
R923 4.75K
C918 47pF
C919 47pF
C923 .1
C920 .1
C917 270pF
R925
R927 47K,5%
C921 680
C916 91pF
C911 91pF
L903 33µH
L902 100µH
L901 1500µH
R921 332
R920 511
C912 1500pF
C913 2000pF
R929 3.92K
C914 .01
C915 .01
180pF
TP108
Q901 MPSA14
R928 182
R926 240,5%
J1-1
CHANNEL 1
SERIES 900
U26K C-5061
RDPLS2 (8)
RDROP2 (8,15)
RDATA2 (2)
R522 4.75K
R523 4.75K
C518 47pF
C519 47pF
C522 .1
C520 .1
C517 270pF
R525
R527 47K,5%
C521 680
C516 91pF
C511 91pF
L503 33µH
L502 100µH
L501 1500µH
R521 332
R520 511
C512 1500pF
C513 2000pF
R524 3.92K
C514 .01
C515 .01
180pF
TP96
Q501 MPSA14
R528 182
R526 240,5%
J1-11
CHANNEL 2
SERIES 500
(2) RDATA0
(2) RDATA1
(2) RDATA2
(3) RDATA3
(3) RDATA4
(3) RDATA5
(4) RDATA6
(4) RDATA7
(4) RDATA P
R65 200
R64 68.1
R67 200
R66 330,5%
R68 68.1
J1-19
963674-300
SCHEM- DATA
D

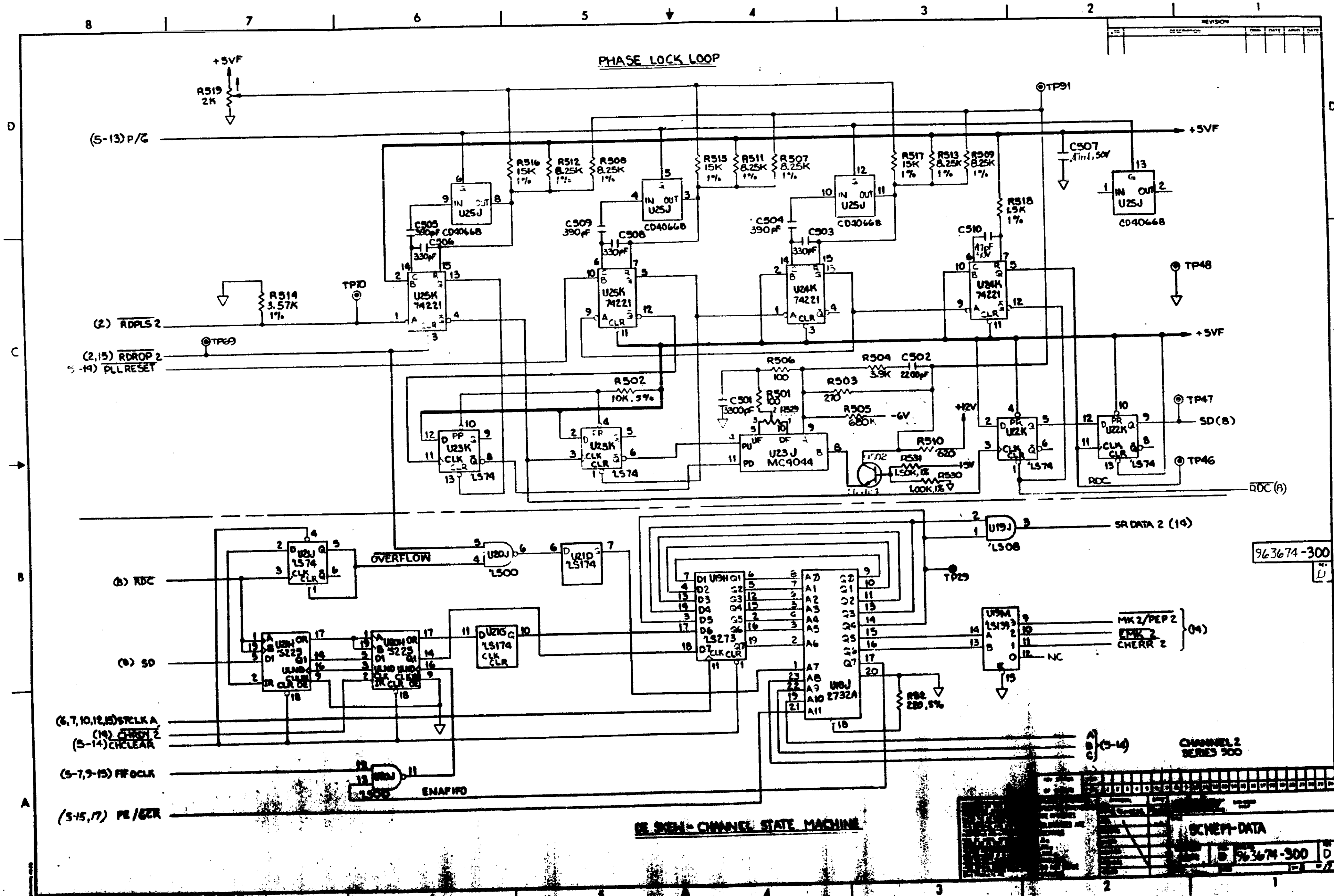

J2
+12V
-6VR
+5VF
R222
4.75K
C218
47pF
R223
4.75K
C219
47pF
U26D
C-5061
RPHP
RMHD
GND
GG
+12V
G1
-6V
G2
RDPLS
RPG2
+5V
BIN
RCAP
RL2
RHYS
RPG1
GCR/PE
GS2
VCOM
RDROP
DGND
RDATA
C220
.1
C222
.1
RDPLS3
(9)
C217
270pF
R225
R227
47K,5%
680
C221
180pF
(2,3,4,5)
(2,3,4) VCOM
C216
91pF
C211
91pF
L201
1500µH
R224
3.92K
C214
.01
C215
.01
L203
33µH
R221
332
C212
1500pF
L202
100µH
R220
511
C213
2000pF
RDROP3
(9,15)
RDATA 3
(2)
Q201
MPSA14
TP87
R228
182
J1-5
R226
240,5%
-6VR
CHANNEL 3
SERIES 200
R722
4.75K
C718
47pF
R723
4.75K
C719
47pF
U26P
C-5061
C722
.1
C720
.1
RDPLS4
(10)
C717
270pF
R725
R727
47K,5%
680
C721
180pF
C716
91pF
C711
91pF
L701
1500µH
R724
3.92K
C714
.01
C715
.01
L703
33µH
R721
332
C712
1500pF
L702
100µH
R720
511
C713
2000pF
RDROP4
(10,15)
RDATA4
(2)
Q701
MPSA14
TP102
R728
182
J1-15
R726
240,5%
-6VR
CHANNEL 4
SERIES 700
R322
4.75K
C318
47pF
R323
4.75K
C319
47pF
U26F
C-5061
C322
.1
C320
.1
RDPLS5
(11)
C317
270pF
R325
R327
47K,5%
680
C321
180pF
C316
91pF
C311
91pF
L301
1500µH
R324
3.92K
C314
.01
C315
.01
L303
33µH
R321
332
C312
1500pF
L302
100µH
R320
511
C313
2000pF
RDROP5
(11,15)
RDATA 5
(2)
Q301
MPSA14
TP90
R328
182
J1-7
R326
240,5%
-6VR
CHANNEL 5
SERIES 300
-12V
J4
ITHR
R63
499
1%
C69
.1µF
R69
1.21K
1%
R70
2.74
1%
C922
.47µF
VCOM (2,3,4)
SCHEM- DATA.
963674-300


J2
+12V
-6VR
+5VF
R822
4.75K
C818
47pF
R823
4.75K
C819
47pF
U26S
C-5061
RPHP
RMHD
GND
+12V
-6V
RDPLSS
(12)
+5V
RCAP
RHYS
RPG1
GS2
(2,3,4,5) GCR/PE
(2,3,4) VCOM
VCOM
RDROP
DGND
RDATA
RPG2
BIN
RL2
RL1
G0
G1
G2
C820
C822
.1
C817
270pF
R825
R827
47K,5%
680
C821
180pF
L803
33µH
R821
332
C812
1500pF
L802
100µH
R820
511
C813
2000pF
C816
91pF
C811
91pF
L801
1500µH
R824
3.92K
C814
.01
C815
.01
Q801
MPSA14
TP105
R828
182
J1-17
R826
240,5%
-6VR
RDROP 6
(12,15)
RDATA 6
(2)
CHANNEL 6
SERIES 800
U26H
C-5061
C420
C422
C417
270pF
R425
R427
47K,5%
680
C421
180pF
L403
33µH
R421
332
C412
1500pF
L402
100µH
R420
511
C418
2000pF
C416
91pF
C411
91pF
L401
1500µH
R424
3.92K
C414
.01
C415
.01
Q401
MPSA19
TP93
R428
182
J1-9
R426
240,5%
-6VR
RDROP 7
(13,15)
RDATA 7
(2)
CHANNEL 7
SERIES 400
U26B
C-5061
R122
4.75K
C118
47pF
R123
4.75K
C119
47pF
C122
.1
C120
.1
C117
270pF
R125
R127
47K,5%
680
C121
180pF
L103
33µH
R121
332
C112
1500pF
L102
100µH
R120
511
C113
2000pF
C116
91pF
C111
91pF
L101
1500µH
R124
3.92K
C114
.01
C115
.01
Q101
MPSA14
TP84
R128
182
J1-3
R126
240,5%
-6VR
RDROP P
(5,15)
RDATA P
(2)
CHANNEL P
SERIES 100
REVISION
SCHEM- DATA
963674-300
D

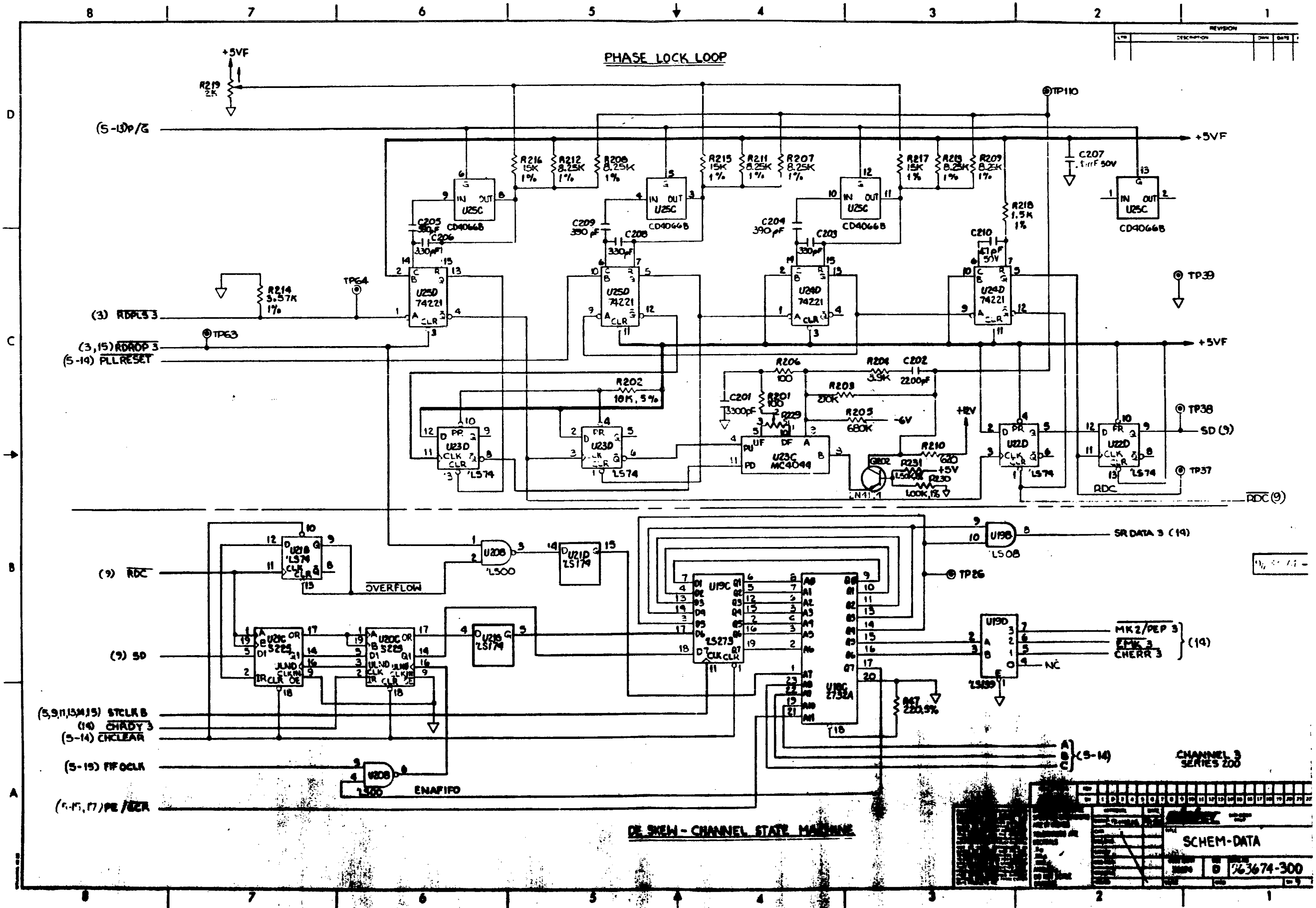

PHASE LOCK LOOP
+5VF
R119 2K
(6-13) P/G
(2,34) GCR/PE
(5-15,17) PE/GCR
(4) RDPLSP
(9,15) RDROPP
(6-14) PLLRESET
TP82
TP62
TP61
TP36
TP35
TP34
TP24
SD(5)
RDC(5)
RDC
R59 1.5K 5%
R60 4.7K 5%
R58 4.7K, 5%
R61 22K 5%
R62 4.7K 5%
R119 3.57K 1%
Q3 2N2907A
Q4 2N2222
-6V
R116 15K 1%
R112 8.25K 1%
R108 8.25K 1%
R115 15K 1%
R111 8.25K 1%
R107 8.25K 1%
R117 15K 1%
R113 8.25K 1%
R109 8.25K 1%
R118 1.5K 1%
C107 .1MF, 50V
C105 390pF
C106 330pF
C109 390pF
C108 330pF
C104 390pF
C103 330pF
C110 470pF 50V
U25A CD4066B
U25B 74221
R102 10K, 5%
R106 100
R104 3.9K
C102 22.00pF
R103 270K
C101 3300pF
R101 100
R105 665K
+12V
R110 620
U23A MC4044
2N4124
R131 1.50K, 1%
R130 1.00K, 1%
+5V
U22B 'LS74
RDC
U21B 'LS74
U20B 'LS00
U21D 'LS174
OVERFLOW
R48 4.7K, 5%
U19B 'LS08
SRDATAP (14)
U19D 'LS139
MK2/PEPP
EMKP
CHERRP
(14)
NC
U19A 'LS273
2732A
R49 22.0, 5%
U21A 'S225
U20A 'S225
U21C 'LS174
R51 4.7K, 5%
(5) RDC
(5) SD
(5,9,11,13,14,15) STCLK B
(14) CHRDYP
(9-13) CHCLEAR
(5,6,15) CLK 5MZ
(6-15) FIFOCLK
U20B 'LS00 ENAFIFO
A
B
C
(3-14)
CHANNELP
SERIES 100
DESKEW - CHANNEL STATE MACHINE
SCHEM-DATA
D
%3674-300

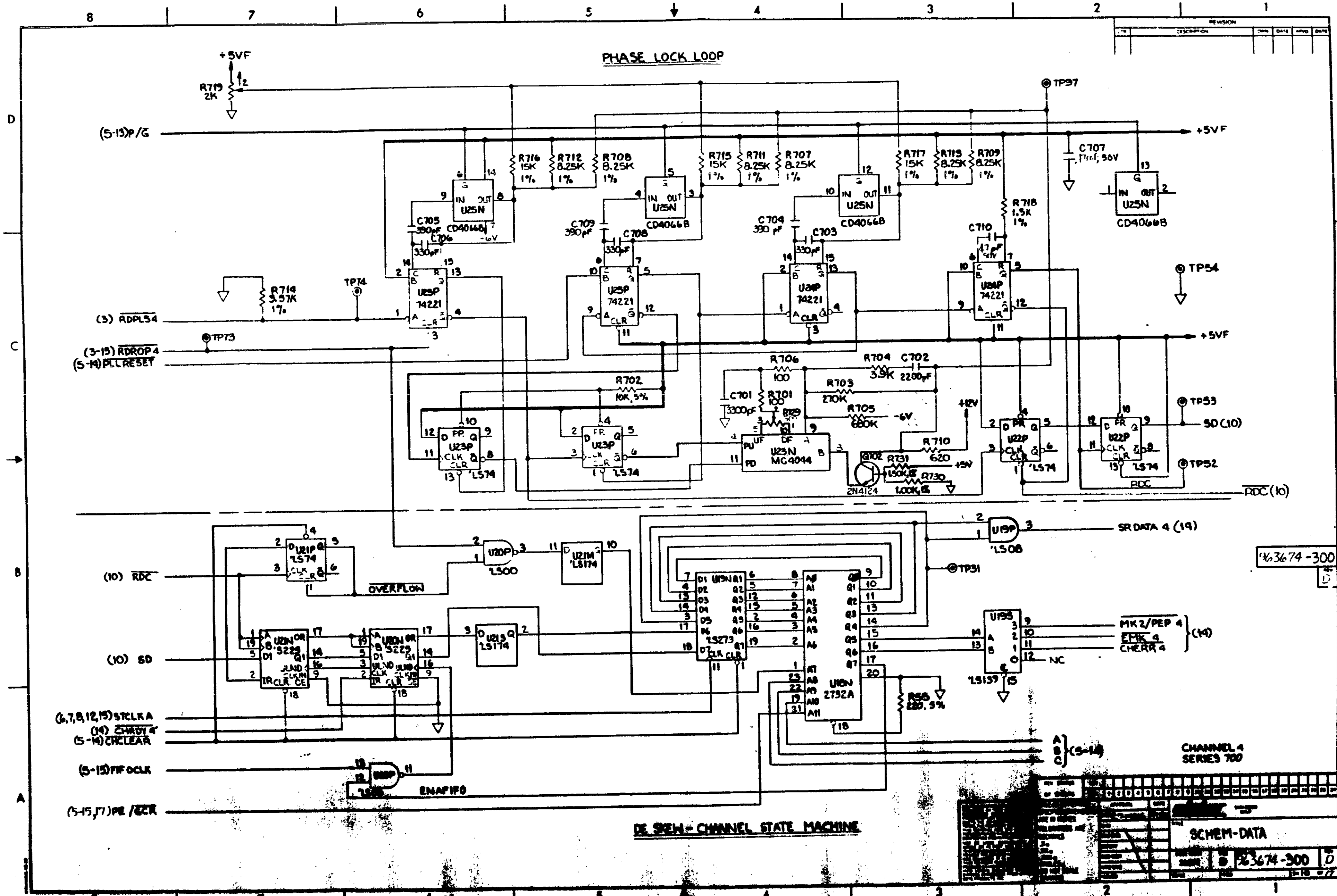

PHASE LOCK LOOP
DE SKEW - CHANNEL STATE MACHINE
(5-13) P/G
(2) RDPLSØ
(2,15) RDROPØ
(5-14) PLL RESET
+5VF
R619 2K
U25L CD4066B
U24M 74221
U25M 74221
U23M 'LS74
U22M 'LS74
U23L MC4044
2N4124
Q602
TP94
TP51
TP72
TP11
TP50
TP49
TP30
SD (6)
RCD (6)
RDC
(6) RDC
(6) SD
OVERFLOW
SR DATA Ø (19)
U19J 'LS08
U20J 'LS00
U21M 'LS174
U21J 'LS74
U19L 'LS273
U18L 2732A
U18L 5225
U17L 'LS174
U18M 'LS139
MK2/PEPØ
EMKØ
CHERRØ
(14)
NC
(7,8,10,12,15) STCLK A
(14) CHRDYØ
(5-16) CHCLEAR
(5,6,19) CLK 542
(5,7-15) FIFOCLK
(5-15,17) PE/GCR
ENAFIFO
(5-14) CHANNEL Ø SERIES 600
SCHEM-DATA
363674-300

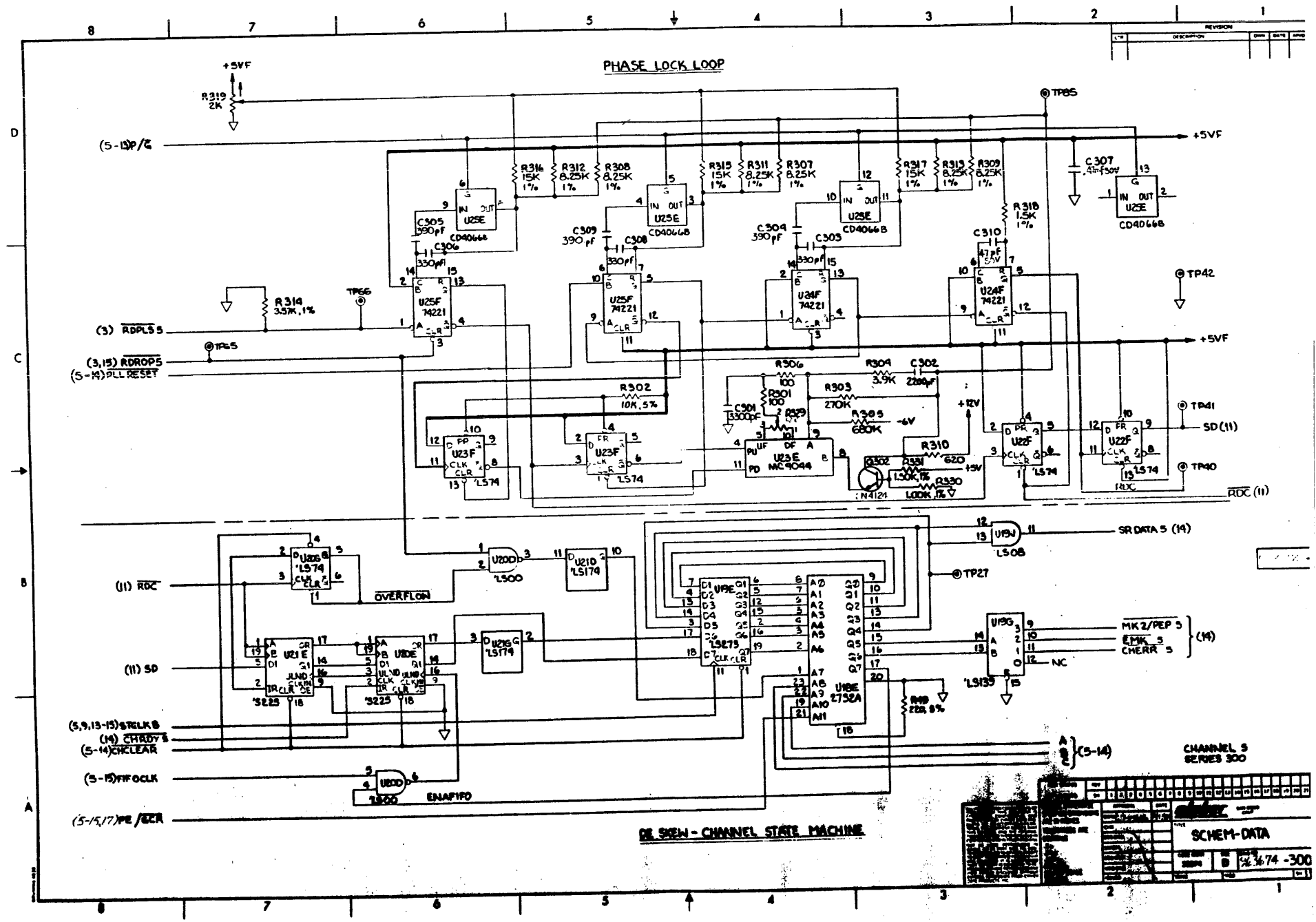

PHASE LOCK LOOP
+5VF
R919 2K
(5-13) P/G
R916 15K 1%
R912 8.25K 1%
R908 8.25K 1%
R915 15K 1%
R911 8.25K 1%
R907 8.25K 1%
R917 15K 1%
R913 8.25K 1%
R909 8.25K 1%
C907 .47mF,50V
TP103
R918 1.5K 1%
C905 390pF
C906 330pF
C909 390pF
C908 330pF
C904 390pF
C903 330pF
C910 47pF
CD40668
U25T
U25U 74221
U26U 74221
U24U 74221
TP60
R914 3.57K 1%
TP78
TP77
(2) RDPLS1
(2,15) RDROP1
(5,6-14) PLLRESET
R902 10K, 5%
R906 100
R904 3.9K
C902 2200pF
R903 270K
R905 680K
-6V
+12V
C901 3300pF
R901 100
R909
R910 620
2N4124
R991 1.50K, 1%
+5V
R990
Q901 LOCK DET
U23T MC4044
U23U 'LS74
U22U
U23U
TP59
SD (7)
TP58
RDC
RDC(7)
(7) RDC
OVERFLOW
U21U 'LS74
U20U 'LS00
U21M 'LS174
U19P 'LS08
SR DATA 1 (14)
TP117
(7) SD
U21T 'S225
U20T 'S225
U21S 'LS174
U19T 'LS273
U18T 2732A
R917 220, 5%
U18U 'LS157
MK2/PEP1
CHERRT
(14)
NC
(6,8,10,12,15) STCLK A
(14) CHADY1
(5-15) CHCLEAR
(5,6, 8-15) FIFOCLR
U20U 'LS00
ENAFIFO
(5-15,17) PE/ECR
A
B
C
(5-14)
CHANNEL1
SERIES 900
PE SKEW - CHANNEL STATE MACHINE
SCHEM-DATA
B
74-300

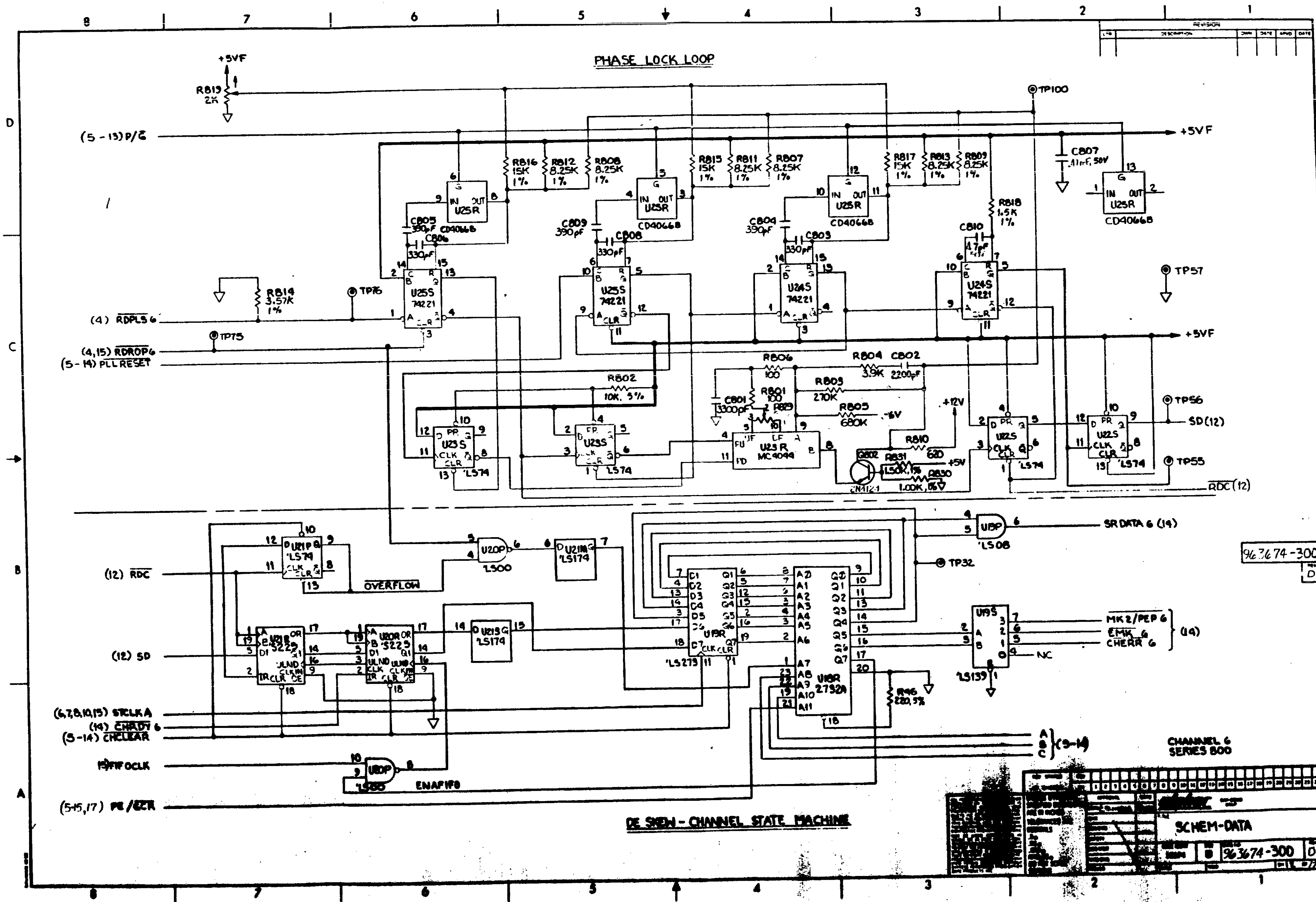


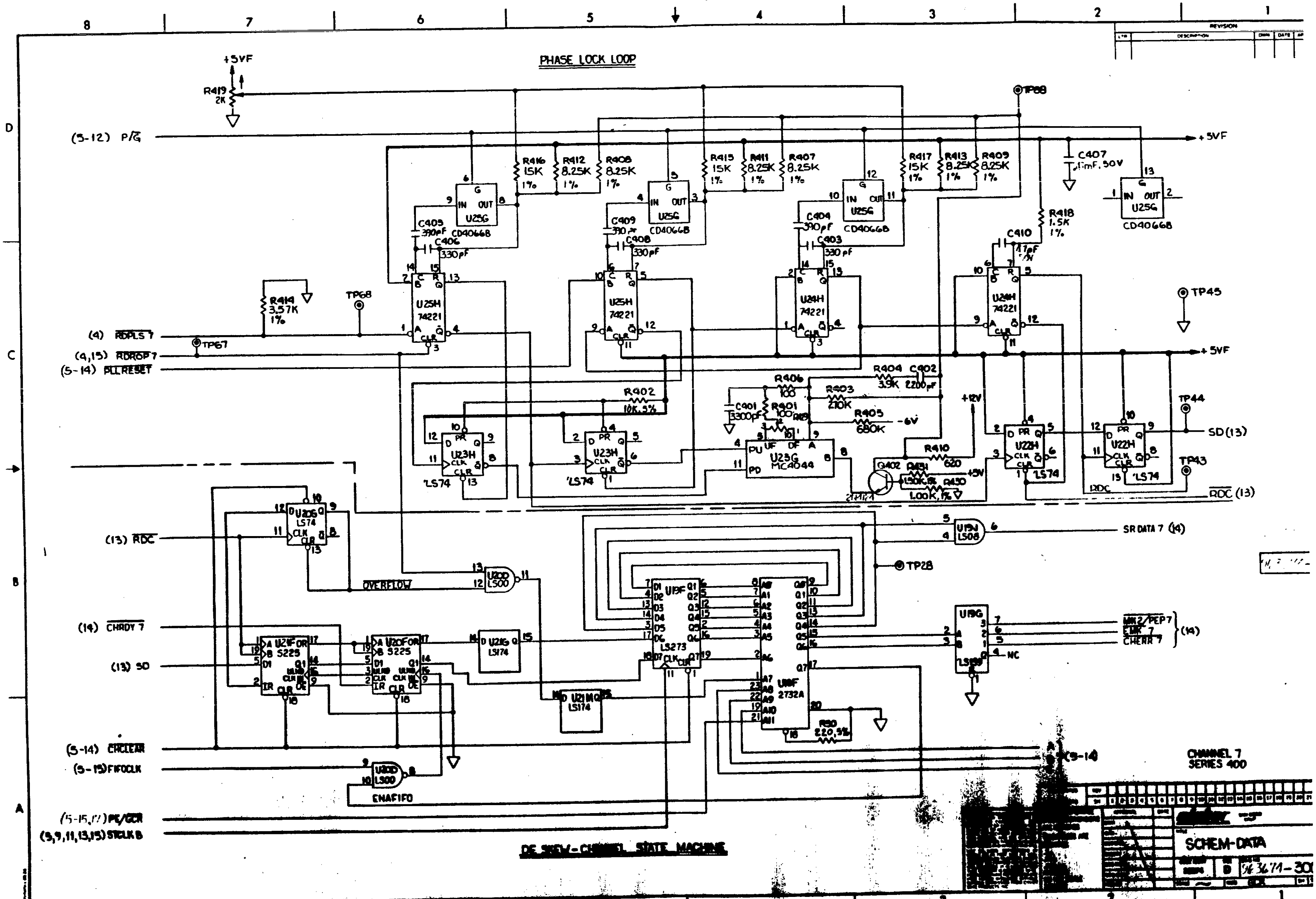
PHASE LOCK LOOP
+5VF
R519 2K
(5-13) P/G
R516 15K 1%
R512 8.25K 1%
R508 8.25K 1%
R515 15K 1%
R511 8.25K 1%
R507 8.25K 1%
R517 15K 1%
R513 8.25K 1%
R509 8.25K 1%
TP91
C507
U25J
CD40668
C505 390pF
C506 330pF
C509 390pF
C508 330pF
C504 390pF
C503 330pF
C510
R518 15K 1%
TP48
R514 3.57K 1%
TP70
U25K 74221
U24K 74221
(2) RDPLS 2
TP69
(2,15) RDROP 2
(5-14) PLL RESET
R502 10K, 5%
R506 100
R501 100
R529
C501 3300pF
R504 3.9K
C502 2200pF
R503 270
R505 680K
-6V
+12V
R510 620
R531 150K, 1%
R530 100K, 1%
+5V
U23K 'LS74
U23J MC4044
U22K 'LS74
TP47
SD (8)
TP46
RDC
RDC (8)
U19J 'LS08
SR DATA 2 (14)
U22J 'LS74
OVERFLOW
U20J 'LS00
U21D 'LS174
U19H 'LS273
U18J 2732A
TP29
963674-300
(8) RDC
(8) SD
U21H S225
U20H S225
U21G 'LS174
U19M 'LS139
MK 2/PEP 2
EMK 2
CHERR 2
NC
(14)
R82 220, 5%
(6,7,10,12,15) STCLK A
(14) CHRON 2
(5-14) CHCLEAR
(5-7,9-15) FIFOCLK
U20J 'LS00
ENAFIFO
(5-15,17) PE/CTR
A
B
C
(5-14)
CHANNEL 2
SERIES 500
DE SKEW - CHANNEL STATE MACHINE
SCHEM-DATA
963674-300
D

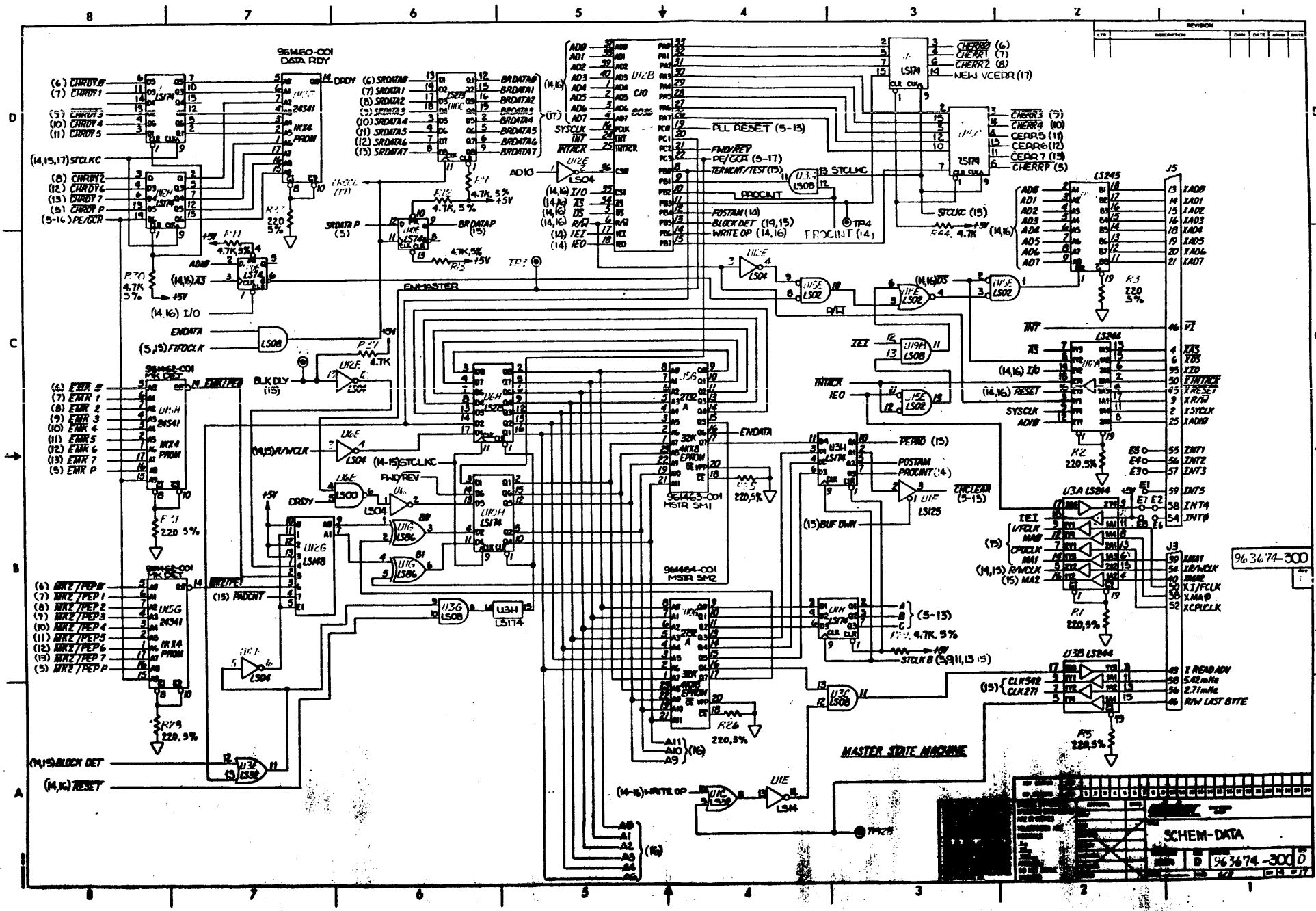

PHASE LOCK LOOP
+5VF
R219 2K
TP110
(5-13) P/G
C207 .1mF 50V
R216 15K 1%
R212 8.25K 1%
R208 8.25K 1%
R215 15K 1%
R211 8.25K 1%
R207 8.25K 1%
R217 15K 1%
R213 8.25K 1%
R209 8.25K 1%
R218 1.5K 1%
U25C
CD4066B
C205 390pF
C206 330pF
C209 390pF
C208 330pF
C204 390pF
C203 330pF
C210
TP64
R214 3.57K 1%
(3) RDPLS 3
TP63
(3,15) RDROP 3
(5-14) PLLRESET
U25D 74221
U24D 74221
TP39
TP38
TP37
R206 100
R204 3.9K
C202 2200pF
R202 10K, 5%
C201 3300pF
R201 100
R229
R203 210K
R205 680K
-6V
+12V
R210 620
R231
R230 100K, 1%
+5V
Q202
LN41
U23D 'LS74
U23C MC4044
U22D 'LS74
SD (9)
RDC
RDC (9)
U21B 'LS74
U20B 'LS00
U21D 'LS174
U19B 'LS08
SR DATA 3 (19)
TP26
(9) RDC
OVERFLOW
(9) SD
U21C S225
U20C S225
U21B 'LS174
U19C 'LS273
U18C 2732A
R47 220,5%
U19D 'LS139
MK2/PEP 3
EMK 3
CHERR 3
(14)
NC
(5,9,11,13,14,15) STCLK B
(14) CHRDY 3
(5-14) CHCLEAR
(5-15) FIFOCLK
U20B 'LS00
ENAFIFO
(5-15,17) PE/EER
A
B
C
(5-14)
CHANNEL 3 SERIES 200
DE SKEW - CHANNEL STATE MACHINE
SCHEM-DATA
D
763674-300

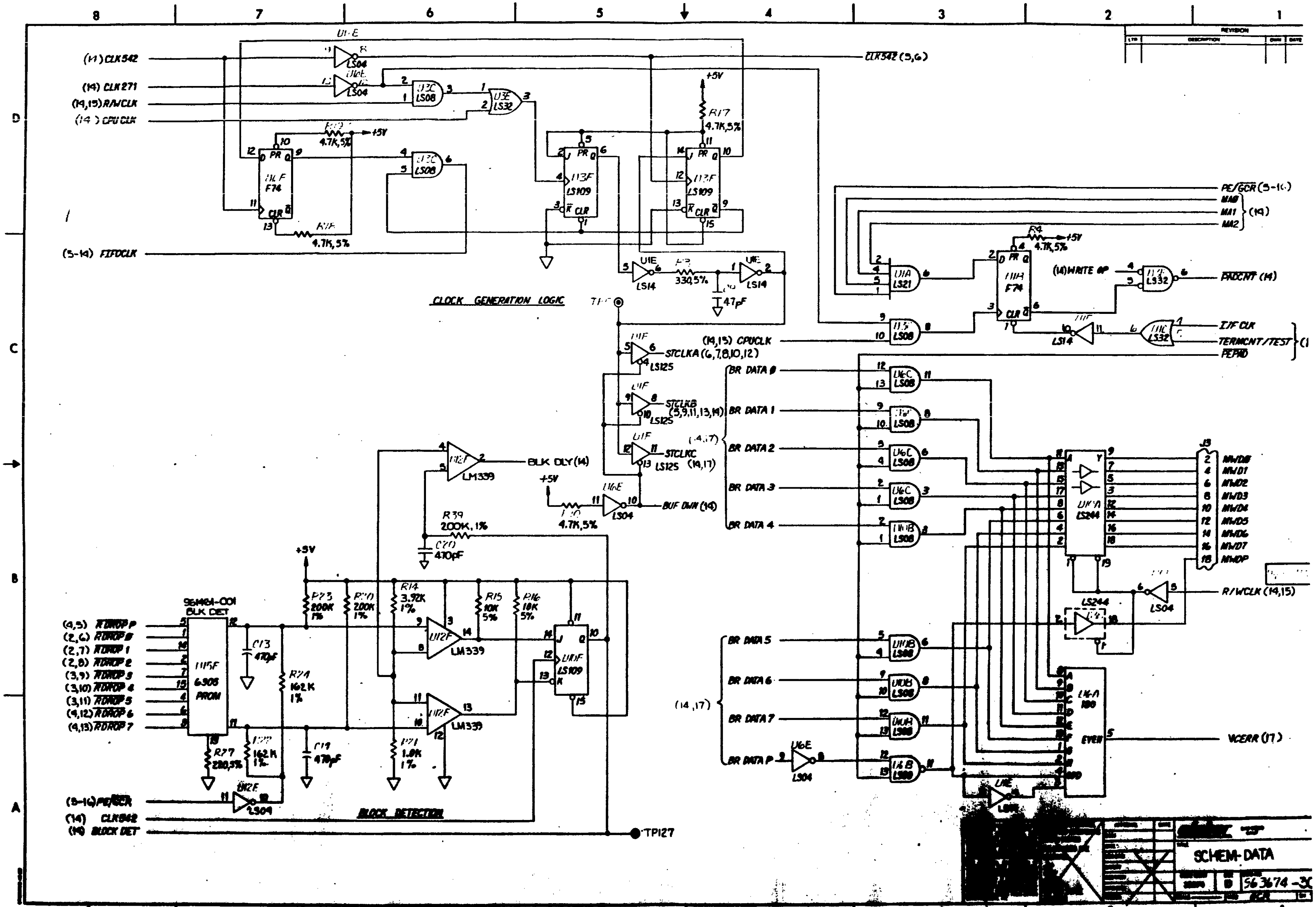

PHASE LOCK LOOP
+5VF
R719 2K
(5-13) P/G
R716 15K 1%
R712 8.25K 1%
R708 8.25K 1%
R715 15K 1%
R711 8.25K 1%
R707 8.25K 1%
R717 15K 1%
R713 8.25K 1%
R709 8.25K 1%
TP97
C707 1mf, 50V
U25N CD4066B
C705 390pF
C706 330pF
C709 390pF
C708
C704 390pF
C703
C710
R718 1.5K 1%
U25P 74221
U24P 74221
TP54
R714 3.57K 1%
TP74
(3) RDPLS4
TP73
(3-15) RDROP 4
(5-14) PLLRESET
R706 100
R704 3.9K
C702 2200pF
R702 10K, 5%
C701 3300pF
R701 100
R703 270K
R705 680K
-6V
+12V
U23P 'LS74
U23N MC4044
Q102 2N4124
R710 620
R731 150K
R730 100K
U22P 'LS74
TP53
SD (10)
TP52
RDC
RDC (10)
U21P 'LS74
U20P 'LS00
U21M 'LS174
U19P 'LS08
SR DATA 4 (19)
TP31
963674-300
(10) RDC
OVERFLOW
U21N S229
U20N S229
U21Q 'LS174
U19N 'LS273
U18N 2732A
U19S 'LS139
MK2/PEP 4
EMK 4
CHERR 4
(14)
NC
(10) SD
R58 220, 5%
(6,7,8,12,15) STCLKA
(14) CHRDY 4
(5-14) CHCLEAR
(5-15) FIFOCLK
ENAFIFO
(5-15,17) PE/ECR
A B C (5-14)
CHANNEL 4 SERIES 700
DE SKEW - CHANNEL STATE MACHINE
SCHEM-DATA
963674-300
D


PHASE LOCK LOOP
+5VF
R319 2K
(5-13)P/C
TP85
R316 15K 1%
R312 8.25K 1%
R308 8.25K 1%
R315 15K 1%
R311 8.25K 1%
R307 8.25K 1%
R317 15K 1%
R313 8.25K 1%
R309 8.25K 1%
C307 .47mF50V
R318 1.5K 1%
C305 390pF
C306 330pF
C309 390pF
C308 330pF
C304 390pF
C303 330pF
C310 47pF 6.3V
CD4066B
U25E
U25F 74221
U24F 74221
TP66
R314 3.57K, 1%
TP65
TP42
(3) RDPLS 5
(3,15) RDROP 5
(5-14) PLL RESET
R302 10K, 5%
R306 100
R301 100
R303 270K
R304 3.9K
C302 2200pF
C301 3300pF
R305 680K
-6V
+12V
U23F
U23E MC4044
R310 620
Q302 2N4124
1.50K, 1%
R330 100K, 1%
U22F
LS74
TP41
SD (11)
TP40
RDC
RDC (11)
(11) RDC
OVERFLOW
U20D
'LS00
U21D
'LS174
U19J
LS08
SR DATA 5 (14)
TP27
U21E
U22E
'S225
U21G
'LS174
U19E
'LS279
U18E 2732A
R319 220, 5%
U19G
'LS139
MK 2/PEP 5
EMK 5
CHERR 5
(14)
NC
(11) SD
(5,9,13-15) STELK B
(14) CHRDY 5
(5-14) CHCLEAR
(5-15) FIFOCLK
U20D
'LS00
ENAFIFO
(5-15,17) PE/ECR
A B C (5-14)
DE SIGN - CHANNEL STATE MACHINE
CHANNEL 5
SERIES 300
SCHEM-DATA
74-300

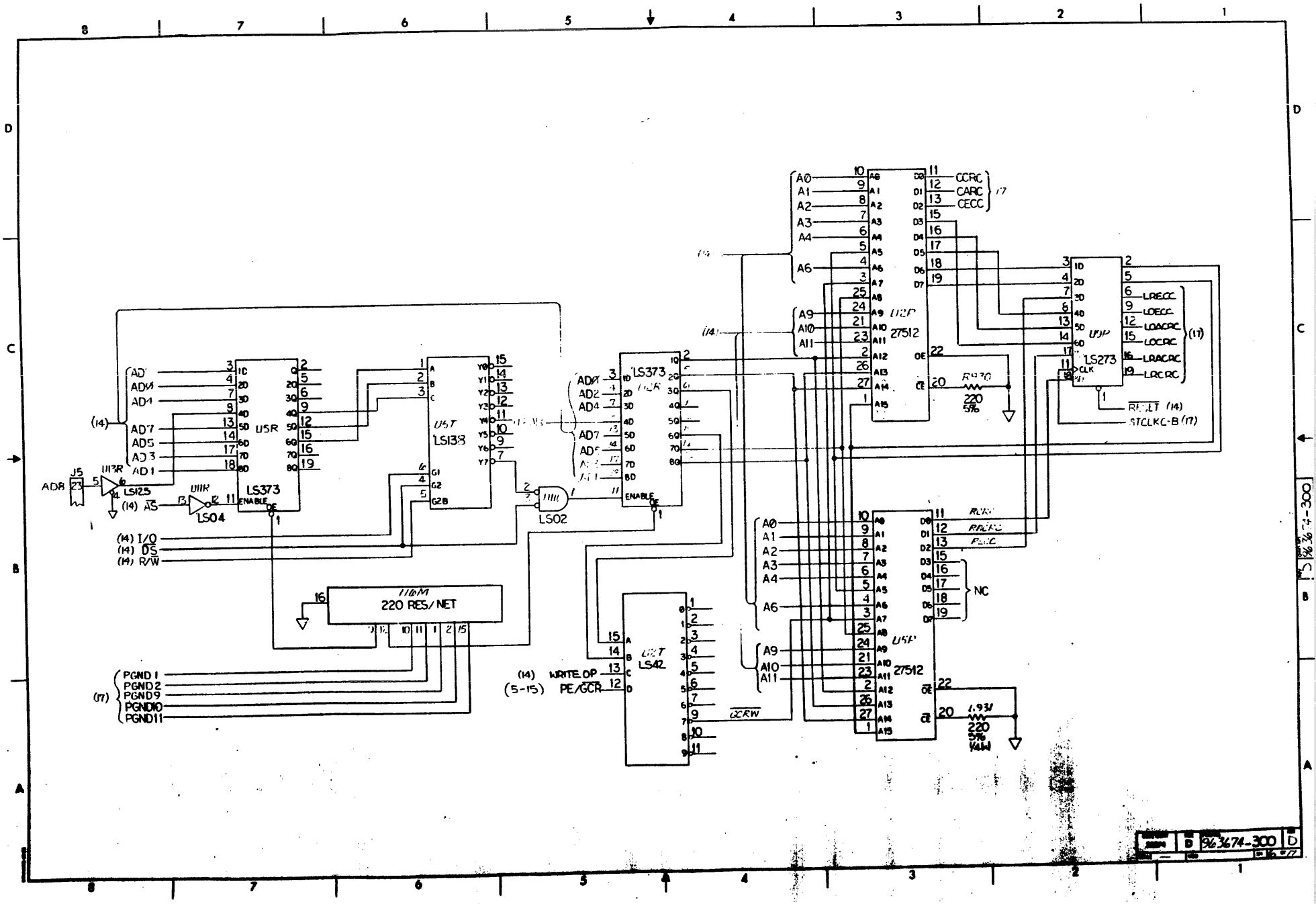

PHASE LOCK LOOP
+5VF
R819 2K
(5-13) P/E
TP100
+5VF
R816 15K 1%
R812 8.25K 1%
R808 8.25K 1%
R815 15K 1%
R811 8.25K 1%
R807 8.25K 1%
R817 15K 1%
R813 8.25K 1%
R809 8.25K 1%
C807 .41mF, 50V
U25R
CD4066B
R818 1.5K 1%
C805 390pF
C806 330pF
C809 390pF
C808 330pF
C804 390pF
C803 330pF
C810 4.7pF
U25S 74221
U24S 74221
TP57
TP76
R814 3.57K 1%
(4) RDPLS 6
TP75
(4,15) RDROP 6
(5-14) PLL RESET
+5VF
R806 100
R804 3.9K
C802 2200pF
R802 10K, 5%
C801 3300pF
R801 100
R803 270K
R805 680K
-6V
+12V
U23S
'LS74
U23R MC4044
R810 620
R831 1.50K, 1%
R830 1.00K, 1%
+5V
Q802 2N4121
U22S
TP56
SD (12)
TP55
RDC (12)
SR DATA 6 (14)
U18P
'LS08
963674-300
D
U21P 'LS74
(12) RDC
OVERFLOW
U20P 'LS00
U21N 'LS174
TP32
U19R 'LS273
U18R 2732A
U19S 'LS139
MK2/PEP 6
EMK 6
CHERR 6
(14)
NC
(12) SD
U21R S225
U20R S225
U21S 'LS174
R46 820, 5%
(6,7,8,10,15) STCLK A
(14) CHRDY 6
(5-14) CHCLEAR
(15) FIFOCLK
U10P 'LS00
ENAFIFO
(5-15,17) PE/ECR
A
B
C
(5-14)
CHANNEL 6
SERIES 800
DE SKEW - CHANNEL STATE MACHINE
SCHEM-DATA
963674-300
D

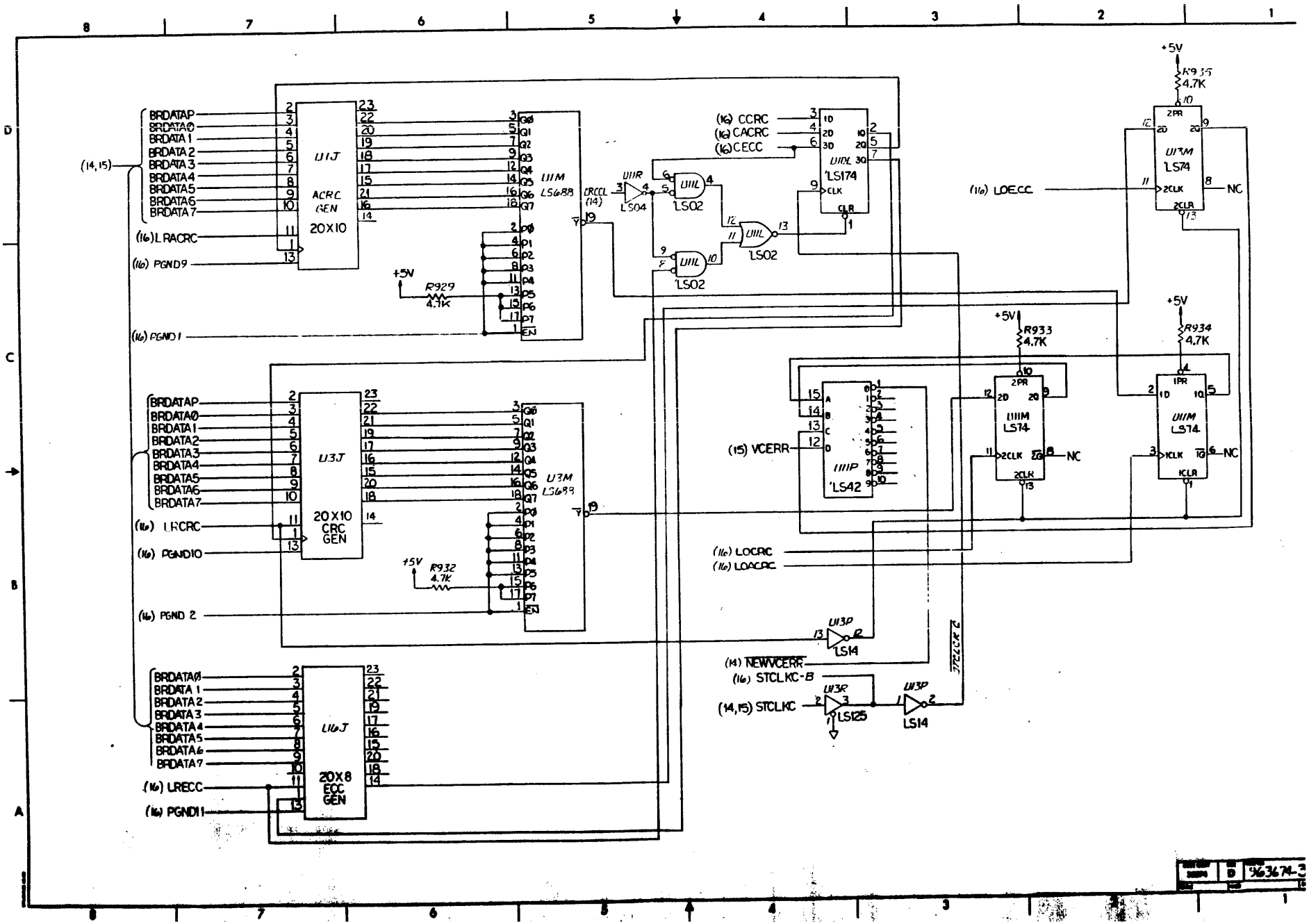

PHASE LOCK LOOP
+5VF
R419 2K
(5-12) P/G
(4) RDPLS 7
(4,15) RDROP 7
(5-14) PLLRESET
R414 3.57K 1%
TP68
TP67
TP88
TP45
TP44
TP43
TP28
U25H 74221
U25H 74221
U24H 74221
U24H 74221
U25G CD4066B
U25G MC4044
U23H 'LS74
U22H 'LS74
R416 15K 1%
R412 8.25K 1%
R408 8.25K 1%
R415 15K 1%
R411 8.25K 1%
R407 8.25K 1%
R417 15K 1%
R413 8.25K 1%
R409 8.25K 1%
R418 1.5K 1%
C407 .1mF, 50V
C405 390pF
C406 330pF
C409 390pF
C408 330pF
C404 390pF
C403 330pF
C410
R402 10K, 5%
R406 100
R401 100
C401 3300pF
R404 3.9K
C402 2200pF
R403 210K
R405 680K
-6V
+12V
R410 620
Q402
R450 1.00K, 1%
SD (13)
RDC (13)
(13) RDC
U20G LS74
OVERFLOW
U20D LS00
(14) CHRDY 7
(13) SD
U21F 5225
U20F 5225
U21G LS174
U21M LS174
U18F LS273
U18F 2732A
R90 220, 5%
U19J LS08
SR DATA 7 (14)
U19G LS139
MK2/PEP 7
EMK 7
CHERR 7
(14)
NC
(5-14) CHCLEAR
(5-15) FIFOCLK
U20D LS00
ENAFIFO
(5-15,17) PE/GCR
(5,9,11,13,15) STCLK B
DE SKEW-CHANNEL STATE MACHINE
(9-14)
CHANNEL 7
SERIES 400
SCHEM-DATA
D


MASTER STATE MACHINE
SCHEM-DATA
963674-300
D

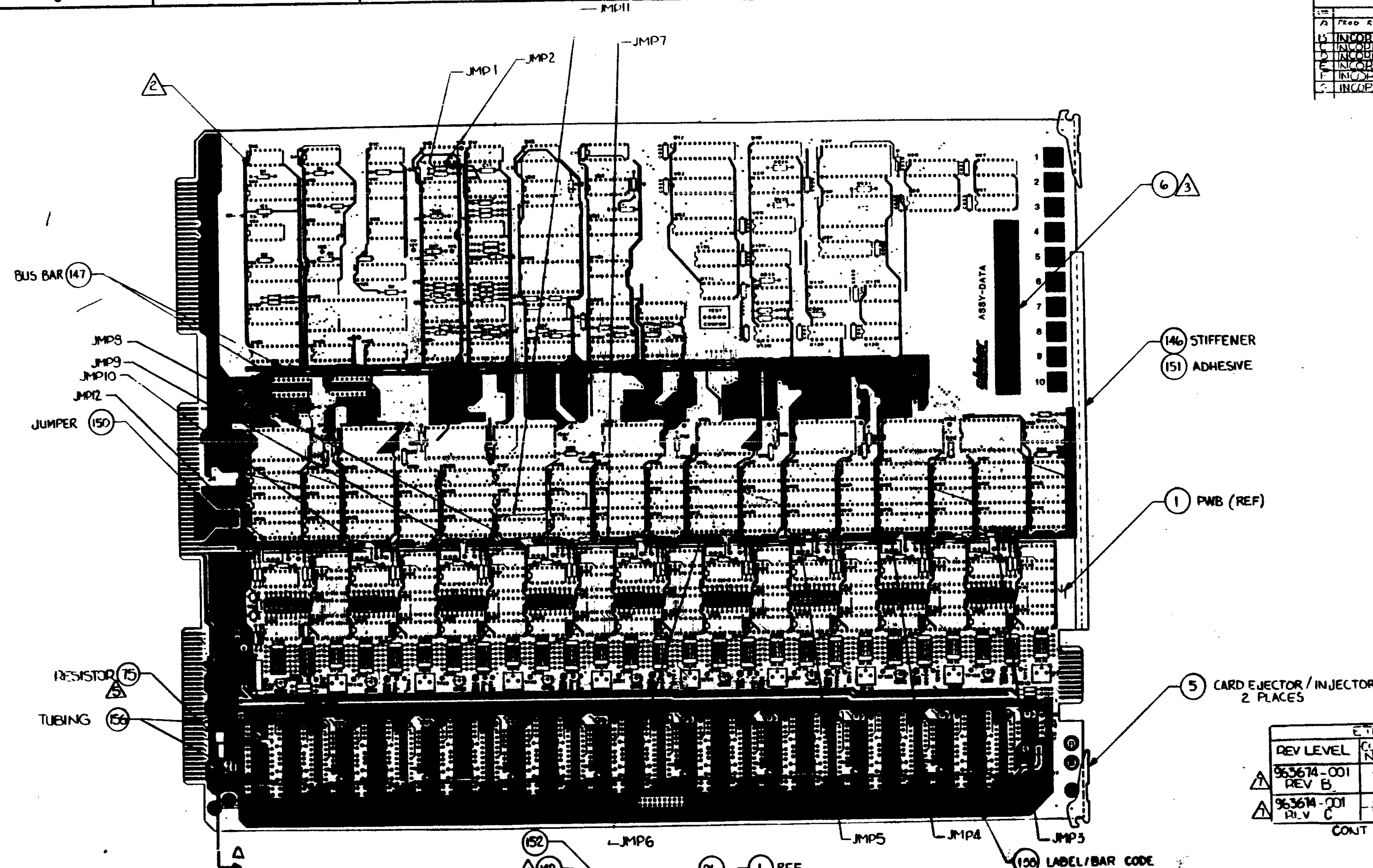


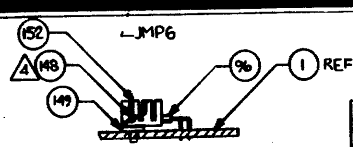
CLOCK GENERATION LOGIC
BLOCK DETECTION
(14) CLK542
(14) CLK271
(14,15) R/WCLK
(14) CPUCLK
(5-14) FIFOCLK
CLK542 (5,6)
PE/GCR (5-16)
MA0
MA1
MA2
(14) WRITE OP
FMDCNT (14)
I/F CLK
TERMCNT/TEST
PEMD
(14,15) CPUCLK
STCLKA (6,7,8,10,12)
STCLKB (5,9,11,13,14)
STCLKC (14,17)
BUF DWN (14)
BLK DLY (14)
BR DATA 0
BR DATA 1
BR DATA 2
BR DATA 3
BR DATA 4
BR DATA 5
BR DATA 6
BR DATA 7
BR DATA P
MWD0
MWD1
MWD2
MWD3
MWD4
MWD5
MWD6
MWD7
MWDP
R/WCLK (14,15)
VCERR (17)
96M61-001 BLK DET
6308 PROM
(4,5) RDROP P
(2,6) RDROP 0
(2,7) RDROP 1
(2,8) RDROP 2
(3,9) RDROP 3
(3,10) RDROP 4
(3,11) RDROP 5
(4,12) RDROP 6
(4,13) RDROP 7
(5-16) PE/GCR
(14) CLK542
(14) BLOCK DET
TP127
LM339
LS109
LS244
180
SCHEM-DATA
563674-3


LS373
LS138
LS125
LS04
LS02
LS42
27512
LS273
220 RES/NET
220
AD8
AD7
AD6
AD5
AD4
AD3
AD2
AD1
(14) AS
(14) I/O
(14) DS
(14) R/W
(17) PGND1
PGND2
PGND9
PGND10
PGND11
(14) WRITE OP
(5-15) PE/GCR
CCRW
A0
A1
A2
A3
A4
A6
A9
A10
A11
CCRC
CARC
CECC
LRECC
LOECC
LOACRC
LOCRC
LRACRC
LRCRC
NC
STCLKC-B (17)
D
96374-300


BRDATAP
BRDATA0
BRDATA1
BRDATA2
BRDATA3
BRDATA4
BRDATA5
BRDATA6
BRDATA7
(14,15)
(16) LRACRC
(16) PGND9
U1J
ACRC GEN
20X10
U1M
LS688
+5V
R929
4.7K
(16) PGND1
CRCCL (14)
U11R
LS04
U11L
LS02
(16) CCRC
(16) CACRC
(16) CECC
U10L
'LS174
CLK
CLR
(16) LOECC
U13M
LS74
2PR
2D
2CLK
2CLR
NC
R935
4.7K
R933
4.7K
R934
4.7K
U3J
20X10 CRC GEN
U3M
LS689
(16) LRCRC
(16) PGND10
R932
4.7K
(16) PGND 2
U11P
'LS42
(15) VCERR
U11M
LS74
(16) LOCRC
(16) LOACRC
U13P
LS14
(14) NEWVCERR
(16) STCLKC-B
(14,15) STCLKC
U13P
LS125
U13P
LS14
U16J
20X8 ECC GEN
(16) LRECC
(16) PGND11
963674-3

REV	DESCRIPTION		
A	PROD REL ECO 10-0977	RL	[illegible]
B	INCORP ECO 19979	CW	[illegible]
C	INCORP ECO 30214	CW	[illegible]
D	INCORP ECO 30131	CW	[illegible]
E	INCORP ECO 30237	CW	[illegible]
F	INCORP ECO [illegible]	JW	[illegible]
G	INCORP ECO 20559	TL	[illegible]





SECTION A-A
SCALE: NONE
ROTATED 90° CCW

ETCH CUT TABLE				
REV LEVEL	CUT NO.	FROM	TO	COMP SIDE
963674-001 REV B	1	U3F-6	U3F-14	X
963674-001 REV C	2	U3F-14	U1E-5	

CONT ON SH. 2

JUMPER TABLE						
REV LEVEL	JMP NO	FROM	TO	COMP SIDE	SLD SIDE	AWG
963674-001 REV B	1	U3F-14	U1E-5	X		30
963674-001 REV C	2	U3F-6	U1E-5	X		

CONT. ON SH. 2

6. WIRE ROUTING AND ETCH CUT SHOWN ON FACE OF DWG ARE REFERENCE ONLY. JUMPERS AND ETCH CUT SHOULD COMPLY WITH JUMPER AND ETCH CUT TABLES. SECURE JUMPERS EVERY 1.5 IN. USING ITEM 143.

5. USE ITEM 156 TO INSULATE BOTH ENDS OF RESISTOR AND TACK DOWN WITH ITEM 151. SOLDER RESISTOR LEADS TO VR1 PIN 2 AND PIN 3.

4. TORQUE SCREW BETWEEN 6&8 INCH LBS.

3. MARK PART NUMBER & REV LETTER THE SAME AS ASSY IN SPACE INDICATED USING A PERMANENT & LEGIBLE MARKING METHOD.

2. RECTANGULAR PADS INDICATE PIN 1, EMITTER, & POLARITY (+).

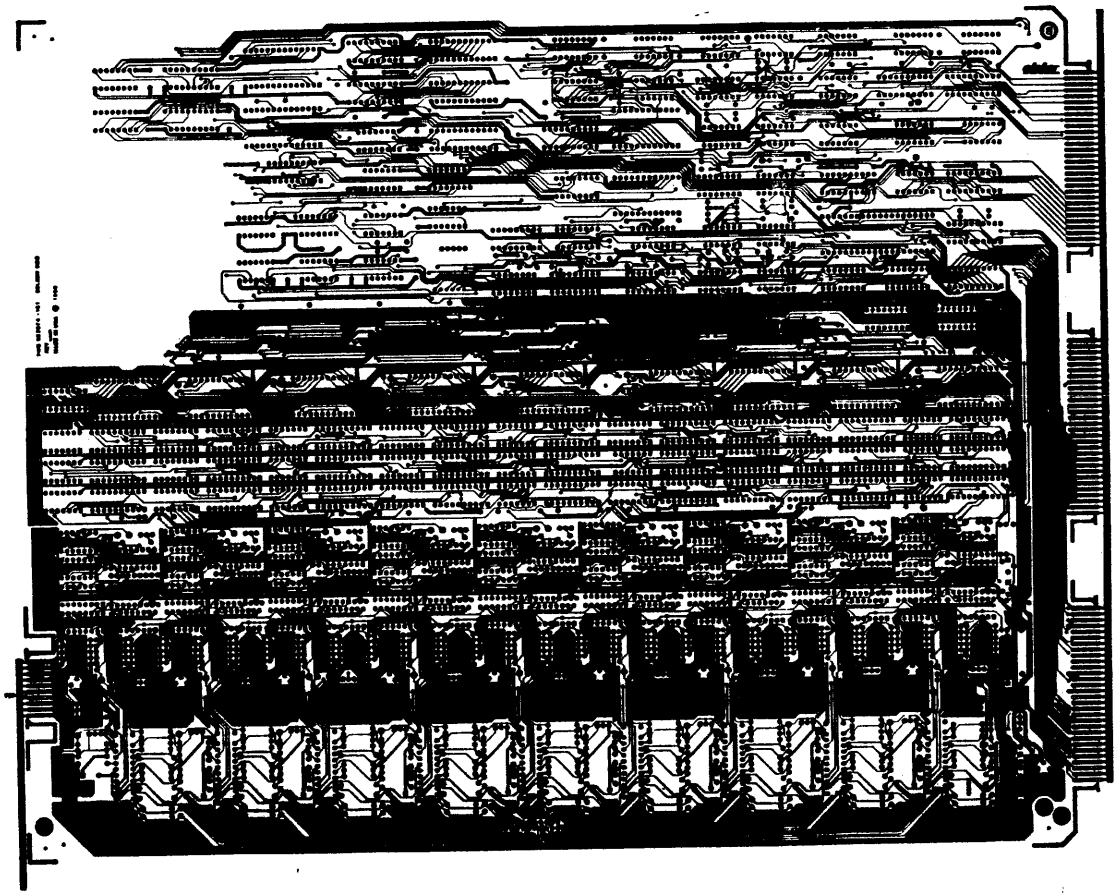
1. FOR SCHEMATIC SEE DWG 963674-300.

NOTES: UNLESS OTHERWISE SPECIFIED

COMPONENT SIDE

PICT - PWB ASSY, DAT[A]

D 963674-0C



ETCH CUT TABLE						
REV LEVEL	CUT NO	FROM	TO	COMP SIDE	SOLD SIDE	
963674-001 REV E	3	TP58	U21T-1	X		
	4	TP56	U21R-1	X		
	5	TP54	U21N-1	X		
	6	TP43	U21L-1	X		
	7	TP46	U21H-1	X		
	8	TP45	U21F-1	X		
	9	TP40	U21E-1	X		
	10	TP37	U21C-1	X		
	11	U20G-11	FIT-A	X		
	12	TP34	U21A-1		X	

JUMPER TABLE						
REV LEVEL	JMP NO	FROM	TO	COMP SIDE	SOLD SIDE	WIRE AWG
963674-001 REV E	3	U22U-1	U21T-1	X		30
	4	U22S-1	U21R-1	X		
	5	U22P-1	U21N-1	X		
	6	U22M-1	U21L-1	X		
	7	U22K-1	U21H-1	X		
	8	U22H-1	U21F-1	X		
	9	U22F-1	U21E-1	X		
	10	U22D-1	U21C-1	X		
	11	U20G-11	U21F-19	X		
	12	U22B-1	U21A-1	X		
	22	[illegible]	COMMON GND	X		22

⚠ THESE INCORP. HAVE BEEN MADE TO A/W 963674-200 COMP SIDE REV C, AND SOLDER SIDE REV C AND MUST ALSO BE MADE TO MASTER A/W AT NEXT UPDATE.

SIZE	DWG NO	REV
D	963674-000	F

SCALE [illegible] SHEET [illegible]

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AS OF 12/30/93

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963674-001 OPCODE: 4 REV: L PWB ASSY-DATA
MODEL:
ECO NO: 30797
DATE OF LAST ECO: 8/19/88

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963674-101	DRILL-PWB DATA	1	B	1	1.000	1.000	EA	B	Y	N	1.000	0	0		00/00/00	99/99/99
963674-000	PICT-PWB DATA	3	G	2	0.000	1.000	EA	F	Y	N	0.000	0	0		5/12/86	99/99/99
963674-300	SCHEM-PWB DATA	3	D	3	0.000	1.000	EA	F	Y	N	0.000	0	0		5/12/86	99/99/99
970083-001	INJECTOR/EJECTOR-1/16"	3	B	5	2.000	1.000	EA	B	N	N	2.000	0	0		00/00/00	99/99/99
731006-800	LABEL-ASSY	3	B	6	1.000	1.000	EA	F	N	N	1.000	0	0		00/00/00	99/99/99
970267-001	PIN-TEST,.040SQ X .360LG	3	A	7	74.000	1.000	EA	F	Y	N	74.000	0	0	TP1-6,24-61,63,65,6769,71,73,75,79-82,8485,87,88,90,91,93,9496,97,99,100,102,103105,108,110,117,127,128	5/12/86	99/99/99
970961-020	CONN-LOCK/EJECT,20POS,.100CTRS	3	B	8	1.000	1.000	EA	B	Y	N	1.000	0	0	J2 ECO#19500	7/24/87	99/99/99
201204-334	CAP-CER,3300PF,50V,5%,NPO	3	R	14	9.000	1.000	EA	B	Y	N	9.000	0	0	C101,201,301,401,501,601,701,801,901	10/10/85	99/99/99
970784-104	CAP-CER,.1UF,50V,-20+80%,AX,*	3	E	15	72.000	1.000	EA	B	Y	N	72.000	0	0	C1-8,10-12,15-19,22,44-64,69,120,220,320,420,520,620,720,820,920,122,222,322,422,522,622,722,822,923,928-942 ECO#30287	1/22/88	99/99/99
201114-105	CAP-CER,10000PF,50V,10%,X7R	3	J	16	18.000	1.000	EA	B	N	N	20.000	0	0	C114,214,314,414,514,614,714,814,914,115,215,315,415,515,615,715,815,9	00/00/00	99/99/99

ORIGINAL

BILL OF MATERIAL
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201114-105	CAP-CER,10000PF,50V,10%,X7R	3	J	16	18.000	1.000	EA	B	N	N	20.000	0	0	15	00/00/00	99/99/99
201171-100	CAP-ELEC,10MF,50V,	3	M	17	2.000	1.000	EA	B	Y	N	2.000	0	0	C43,68	1/22/88	99/99/99
201204-472	CAP-CER,47PF,50V,5%,NPO	3	R	18	28.000	1.000	EA	B	Y	N	28.000	0	0	ECO#30287 C9,118,218,318,418,518,618,718,818,918,119,219,319,419,519,619,719,819,919,110,210,310,410,510,610,710,810,910	1/22/88	99/99/99
201160-680	CAP-TANT,6.8MF,35V,10%	3	F	19	1.000	1.000	EA	B	N	N	1.000	0	0	ECO#30287 C67	00/00/00	99/99/99
201204-912	CAP-CER,91.0PF,50V,5%,NPO	3	R	20	18.000	1.000	EA	B	N	N	18.000	0	0	C111,211,311,411,511,611,711,811,911,116,216,316,416,516,616,716,816,916	00/00/00	99/99/99
201204-183	CAP-CER,180PF,50V,5%,NPO	3	R	21	9.000	1.000	EA	B	N	N	9.000	0	0	C121,221,321,421,521,621,721,821,921	00/00/00	99/99/99
201204-273	CAP-CER,270PF,50V,5%,NPO	3	R	22	9.000	1.000	EA	B	N	N	9.000	0	0	C117,217,317,417,517,617,717,817,917	00/00/00	99/99/99
201204-473	CAP-CER,470PF,50V,5%,NPO	3	R	23	3.000	1.000	EA	B	N	N	2.000	0	0	C13,14,20	00/00/00	99/99/99
201204-393	CAP-CER,390PF,50V,5%,NPO	3	R	24	27.000	1.000	EA	B	Y	N	27.000	0	0	C104,204,304,404,504,604,704,804,904,105,205,305,405,505,605,705,805,905,109,209	00/00/00	99/99/99

ORIGINAL

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963674-001 OPCODE: 4 REV: L PWB ASSY-DATA
MODEL:
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201204-393	CAP-CER,390PF,50V,5%,NPO	3	R	24	27.000	1.000	EA	B	Y	N	27.000	0	0	,309,409,509,609,709,809,909	00/00/00	99/99/99
201204-154	CAP-CER,1500PF,50V,5%,NPO	3	R	25	9.000	1.000	EA	B	N	N	9.000	0	0	C112,212,312,412,512,612,712,812,912	00/00/00	99/99/99
201204-204	CAP-CER,2000PF,50V,5%,NPO	3	R	26	9.000	1.000	EA	B	N	N	9.000	0	0	C113,213,313,413,513,613,713,813,913	00/00/00	99/99/99
201204-333	CAP-CER,330PF,50V,5%,NPO	3	R	27	27.000	1.000	EA	B	Y	N	27.000	0	0	C103,203,303,403,503,603,703,803,903,106,206,306,406,506,606,706,806,906,108,208,308,408,508,608,708,808,908	00/00/00	99/99/99
201204-224	CAP-CER,2200PF,50V,5%,NPO	3	R	28	9.000	1.000	EA	B	Y	N	9.000	0	0	C102,202,302,402,502,602,702,802,902	00/00/00	99/99/99
201105-474	CAP-CER,.47MF,50V,10%	3	N	29	11.000	1.000	EA	B	Y	N	11.000	0	0	C70,107,207,307,407,507,607,707,807,907,922 ECO#30287	1/22/88	99/99/99
970155-002	INDUCTOR-1.0UH +-10%,	3	J	34	1.000	1.000	EA	B	N	N	1.000	0	0	L1	00/00/00	99/99/99
970155-133	INDUCTOR-33UH,+-10%	3	J	35	9.000	1.000	EA	B	N	N	9.000	0	0	L103,203,303,403,503,603,703,803,903	00/00/00	99/99/99
970155-200	INDUCTOR-100UH,+-10%	3	J	36	9.000	1.000	EA	B	N	N	9.000	0	0	L102,202,302,402,502,602,702,802,902	00/00/00	99/99/99

ORIGINAL

BILL OF MATERIAL

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963674-001 OPCODE: 4 REV: L PWB ASSY-DATA
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970155-901	INDUCTOR-1500UH +-10%,	3	J	37	9.000	1.000	EA	B	N	N	9.000	0	0	L101,201,301,401,501,601,701,801,901	00/00/00	99/99/99
970854-001	TRANSISTOR-2N4124,NPN,TO-92	3	A	38	9.000	1.000	EA	B	Y	N	9.000	0	0	Q102,202,302,402,502,602,702,802,902	5/12/86	99/99/99
970249-001	TRANSISTOR-PNP,SILICON,	3	C	39	1.000	1.000	EA	B	N	N	1.000	0	0	Q3	00/00/00	99/99/99
204010-533	TRANSISTOR-NPN,SILICON	3	F	40	9.000	1.000	EA	B	Y	N	9.000	0	0	Q101,201,301,401,501,601,701,801,901	11/04/86	99/99/99
204007-500	TRANSISTOR-NPN SILICON	3	J	41	1.000	1.000	EA	B	Y	N	1.000	0	0	Q4	5/12/86	99/99/99
200012-511	RES-511 OHM 1/4W 1% FF	3	R	42	9.000	1.000	EA	B	N	N	9.000	0	0	R120,220,320,420,520,620,720,820,920	00/00/00	99/99/99
200200-501	RES-POT,500 OHM CERMET	3	C	44	9.000	1.000	EA	B	Y	N	9.000	0	0	R129,229,329,429,529,629,729,829,929	00/00/00	99/99/99
200214-202	RES-POT,2K	3	D	47	9.000	1.000	EA	B	Y	N	9.000	0	0	R119,219,319,419,519,619,719,819,919	3/27/86	99/99/99
200075-680	RES-680 KOHM 1/4W 5% CF	3	AC	48	9.000	1.000	EA	F	Y	N	9.000	0	0	R105,205,305,405,505,605,705,805,905	00/00/00	99/99/99
200011-681	RES-68.1 OHM 1/4W 1% FF	3	R	49	2.000	1.000	EA	B	N	N	2.000	0	0	R64,68	00/00/00	99/99/99
200072-680	RES-680 OHM 1/4W 5% CF	3	AC	50	9.000	1.000	EA	F	Y	N	9.000	0	0	R127,227,327,427,527,627,727,827,927	00/00/00	99/99/99
200012-332	RES-332 OHM 1/4W 1% FF	3	P	51	9.000	1.000	EA	B	N	N	9.000	0	0	R121,221,321,421,521,621,721,821,921	00/00/00	99/99/99
200012-182	RES-182 OHM 1/4W 1% FF	3	R	52	9.000	1.000	EA	B	N	N	9.000	0	0	R128,228,328,428,528	00/00/00	99/99/99

YAL

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200012-182	RES-182 OHM 1/4W 1% FF	3	R	52	9.000	1.000	EA	B	N	N	9.000	0	0	,628,728,828,928,	00/00/00	99/99/99
200012-200	RES-200 OHM 1/4W 1% FF	3	R	53	2.000	1.000	EA	B	N	N	11.000	0	0	R65,67	00/00/00	99/99/99
200012-499	RES-499 OHM 1/4W 1% FF	3	R	54	1.000	1.000	EA	B	Y	N	1.000	0	0	R63	00/00/00	99/99/99
200012-274	RES-274 OHM 1/4W 1% FF	3	R	55	1.000	1.000	EA	B	Y	N	19.000	0	0	R70	10/10/85	99/99/99
200072-330	RES-330 OHM 1/4W 5% CF	3	AC	56	2.000	1.000	EA	F	Y	N	2.000	0	0	R8,66	5/19/86	99/99/99
200013-121	RES-1.21 KOHM 1/4W 1% FF	3	R	57	1.000	1.000	EA	B	Y	N	1.000	0	0	R69	10/10/85	99/99/99
200014-150	RES-15.0 KOHM 1/4W 1% FF	3	R	59	27.000	1.000	EA	F	Y	N	27.000	0	0	R115,215,315,415,515,615,715,815,915,116,216,316,416,516,616,716,816,916,117,217,317,417,517,617,717,817,917	10/10/85	99/99/99
200013-825	RES-8.25 KOHM 1/4W 1% FF	3	R	60	54.000	1.000	EA	F	Y	N	54.000	0	0	R107,207,307,407,507,607,707,807,907,108,208,308,408,508,608,708,808,908,109,209,309,409,509,609,709,809,909,111,211,311,411,511,611,711,811,911,112,212,312,412,512,612,712,812,912,113,213,313,413,513,613,713,813,913	10/10/85	99/99/99
200013-100	RES-1.00 KOHM 1/4W 1% FF	3	R	61	10.000	1.000	EA	F	Y	N	10.000	0	0	R21,130,23	00/00/00	99/99/99

ORIGINAL

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200013-100	RES-1.00 KOHM 1/4W 1% FF	3	R	61	10.000	1.000	EA	F	Y	N	10.000	0	0	0,330,430,530,630,730,830,930	00/00/00	99/99/99
200013-150	RES-1.50 KOHM 1/4W 1% FF	3	R	62	18.000	1.000	EA	B	N	N	9.000	0	0	R118,218,318,418,518,618,718,818,918,131,231,331,431,531,631,731,831,931	00/00/00	99/99/99
200073-270	RES-2.7 KOHM 1/4W 5% CF	3	AC	64	9.000	1.000	EA	F	Y	N	9.000	0	0	R126,226,326,426,526626,726,826,926	11/04/86	99/99/99
200013-357	RES-3.57 KOHM 1/4W 1% FF	3	R	65	9.000	1.000	EA	B	N	N	9.000	0	0	R114,214,314,414,514,614,714,814,914	00/00/00	99/99/99
200013-392	RES-3.92 KOHM 1/4W 1% FF	3	R	68	10.000	1.000	EA	F	N	N	10.000	0	0	R14,124,224,324,424,524,624,724,824,924	00/00/00	99/99/99
200013-475	RES-4.75 KOHM 1/4W 1% FF	3	R	69	18.000	1.000	EA	F	N	N	45.000	0	0	R122,222,322,422,522,622,722,822,922,123,223,323,423,523,623,723,823,923	00/00/00	99/99/99
200073-390	RES-3.9 KOHM 1/4W 5% CF	3	AC	70	9.000	1.000	EA	F	Y	N	9.000	0	0	R104,204,304,404,504,604,704,804,904	00/00/00	99/99/99
200015-162	RES-162 KOHM 1/4W 1% FF	3	R	73	2.000	1.000	EA	B	N	N	2.000	0	0	R22,24	00/00/00	99/99/99
200015-200	RES-200 KOHM 1/4W 1% FF	3	R	74	3.000	1.000	EA	B	N	N	2.000	0	0	R20,23,39	00/00/00	99/99/99
971207-001	RES-39OHM,5W,5%	3	B	75	1.000	1.000	EA	B	Y	N	1.000	0	0	R71 ECO#30134	3/01/88	99/99/99
200072-100	RES-100 OHM 1/4W 5% CF	3	AC	76	18.000	1.000	EA	F	Y	N	18.000	0	0	R101,201,301,401,501	10/10/85	99/99/99

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963674-001 OPCODE: 4 REV: L PWB ASSY-DATA
MODEL:
ECO NO: 30797
DATE OF LAST ECO: 8/19/88

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200072-100	RES-100 OHM 1/4W 5% CF	3	AC	76	18.000	1.000	EA	F	Y	N	18.000	0	0	,601,701,801,901,106,206,306,406,506,606,706,806,906	10/10/85	99/99/99
200075-270	RES-270 KOHM 1/4W 5% CF	3	AC	77	9.000	1.000	EA	F	Y	N	9.000	0	0	R103,203,303,403,503,603,703,803,903	10/10/85	99/99/99
200072-620	RES-620 OHM 1/4W 5% CF	3	AC	78	9.000	1.000	EA	F	Y	N	9.000	0	0	R110,210,310,410,510,610,710,810,910	10/10/85	99/99/99
200072-220	RES-220 OHM 1/4W 5% CF	3	AC	80	21.000	1.000	EA	F	Y	N	21.000	0	0	R1-3,5,25-28,31,33,45-47,49,50 52,53,55,57,930,931	5/12/86	99/99/99
200073-470	RES-4.7 KOHM 1/4W 5% CF	3	AC	81	25.000	1.000	EA	F	Y	N	25.000	0	0	R4,7,10-13 17-19,29,30,37,44,48 51,54,56,58,60,62,929,932,933, 934,935	5/12/86	99/99/99
200074-100	RES-10 KOHM 1/4W 5% CF	3	AC	82	11.000	1.000	EA	F	Y	N	11.000	0	0	R15,16,102,202,302,402,502,602,702,802,902	3/27/86	99/99/99
200073-150	RES-1.5 KOHM 1/4W 5% CF	3	AC	83	1.000	1.000	EA	F	Y	N	1.000	0	0	R59	5/12/86	99/99/99
200074-220	RES-22 KOHM 1/4W 5% CF	3	AC	84	1.000	1.000	EA	F	Y	N	1.000	0	0	R61	5/12/86	99/99/99
200074-470	RES-47 KOHM 1/4W 5% CF	3	AC	85	9.000	1.000	EA	F	Y	N	9.000	0	0	R125,225,325,425,525 625,725,825,925	5/12/86	99/99/99
970345-002	RES-NTWK 220 OHM DIP 16P	3	D	90	1.000	1.000	EA	B	Y	N	1.000	0	0	U6M	5/19/86	99/99/99
970002-001	IC-7906 VOLT REG -6V	3	A	96	1.000	1.000	EA	B	Y	N	1.000	0	0	VR1	00/00/00	99/99/99
203007-700	IC-339 VOLT COMP QUAD	3	J	97	1.000	1.000	EA	B	N	N	1.000	0	0	U12F	00/00/00	99/99/99
961463-001	S/W-GCR,ASSY,RD MSTR	1	A	98	1.000	1.000	EA	B	N	N	1.000	0	0	U5G	00/00/00	99/99/99

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961464-001	S/W-GCR,ASSY,RD MSTR	1	A	99	1.000	1.000	EA	B	N	N	1.000	0	0	U10G	00/00/00	99/99/99
961462-001	S/W-GCR,ASSY,MARK	1	B	100	2.000	1.000	EA	B	N	N	2.000	0	0	U15G,15H	00/00/00	99/99/99
961460-001	S/W-GCR,ASSY,DATA READY	1	B	101	1.000	1.000	EA	B	N	N	1.000	0	0	U12J	00/00/00	99/99/99
962865-001	MASKED PROM-32K(4KX8)	3	A	102	9.000	1.000	EA	B	Y	N	9.000	0	0	U18A,18C,18E,18F,18J 18L,18N,18R,18T	12/19/85	99/99/99
203012-999	IC-4044 DET PHASE FREQ	3	C	103	9.000	1.000	EA	B	N	N	9.000	0	0	U23A,23C,23E,23G,23J ,23L,23N,23R,23T	00/00/00	99/99/99
970367-001	IC-4066 SW BILAT QUAD	3	C	104	9.000	1.000	EA	B	N	N	9.000	0	0	U25A,25C,25E,25G,25J ,25L,25N,25R,25T	00/00/00	99/99/99
961461-001	S/W-GCR,ASSY,BLOCK	3	A	105	1.000	1.000	EA	B	N	N	1.000	0	0	U15F	00/00/00	99/99/99
203555-111	IC-8036 CIO 16BIT 6MHZ	3	C	106	1.000	1.000	EA	B	N	N	1.000	0	0	U12B	00/00/00	99/99/99
961055-001	SPECIFICATION/ARTWORK-IC	3	C	107	9.000	1.000	EA	B	N	N	9.000	0	0	U26B,26D,26F,26H,26K ,26M,26P,26S,26U	00/00/00	99/99/99
970221-001	IC-74LS00 NAND 2IN POS QUAD	3	E	109	6.000	1.000	EA	B	N	N	6.000	0	0	U20B,20D,20J,20P,20U ,6B	00/00/00	99/99/99
203081-001	IC-74LS02 NOR 2IN POS QUAD	3	J	110	2.000	1.000	EA	B	N	N	2.000	0	0	U15E,11L	00/00/00	99/99/99
970011-001	IC-74LS04 INV HEX	3	D	111	3.000	1.000	EA	B	N	N	3.000	0	0	U6E,12E,11R	00/00/00	99/99/99
970010-001	IC-74LS08 AND 2IN QUAD	3	B	112	7.000	1.000	EA	B	N	N	11.000	0	0	U3C,3G,6C,10B,19B,19J,19P	00/00/00	99/99/99
203085-001	IC-74LS14 INV SCHMITT HEX	3	J	113	2.000	1.000	EA	B	N	N	2.000	0	0	U1E,13P	00/00/00	99/99/99
203031-600	IC-74LS21 AND 4IN DUAL	3	E	114	1.000	1.000	EA	B	N	N	1.000	0	0	U1A	00/00/00	99/99/99
203035-032	IC-74LS32 OR 2IN QUAD	3	J	115	2.000	1.000	EA	B	N	N	3.000	0	0	U1C,3E	00/00/00	99/99/99
203039-001	IC-74LS74 FF D DUAL	3	M	116	26.000	1.000	EA	B	N	N	26.000	0	0	U21B,22B,23B,22D,23D ,22S,20G,22F,23F,22H ,23H,21J,22K,23K,22M ,23M,21P,22P,23P,21U	00/00/00	99/99/99

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203039-001	IC-74LS74 FF D DUAL	3	M	116	26.000	1.000	EA	B	N	N	26.000	0	0	,22U,23U,10E,23S,11M 13M	00/00/00	99/99/99
203042-001	IC-74LS86 XOR QUAD	3	K	117	1.000	1.000	EA	B	N	N	4.000	0	0	U1G	00/00/00	99/99/99
203094-500	IC-74LS109 FF JK POS EDGE	3	J	118	2.000	1.000	EA	B	N	N	2.000	0	0	U3F,10F	00/00/00	99/99/99
203036-039	IC-74LS125 BUS BUF QUAD	3	F	119	2.000	1.000	EA	B	N	N	2.000	0	0	U1F,13R	00/00/00	99/99/99
203046-156	IC-74LS139 1-4 DUAL	3	G	120	5.000	1.000	EA	B	N	N	5.000	0	0	U19D,19G,19S,,19M,18U	00/00/00	99/99/99
970364-001	IC-74LS148 8-3 LINE OCT	3	A	121	1.000	1.000	EA	B	N	N	1.000	0	0	U12G	00/00/00	99/99/99
203051-174	IC-74LS174,FF,D,HEX	3	L	122	12.000	1.000	EA	B	Y	N	12.000	0	0	U15B,15C,21D,1H,3H,10H,,12H,21G,21M,21S,15J,10L EC O#30155	3/07/88	99/99/99
203062-225	IC-74S225 MEM FIFO 16X5 3S	3	C	123	18.000	1.000	EA	B	N	N	18.000	0	0	U20A,21A,20C,21C,20E,21E,20F,21F,20H,21H,21N,20L,,20N,21L,20R,21R,20T,21T	00/00/00	99/99/99
203052-244	IC-74LS244 BFR OCT 3S	3	L	124	4.000	1.000	EA	B	N	N	6.000	0	0	10A,12A,3A3B	00/00/00	99/99/99
203102-273	IC-74LS273 LATCH D OCT	3	C	125	12.000	1.000	EA	B	N	N	12.000	0	0	U19A,19C,10C,19E,19F,19L,19R,6H,19H,19N,19T,9P	00/00/00	99/99/99
970325-001	IC-74F74 FF D DUAL	3	D	126	2.000	1.000	EA	B	N	N	3.000	0	0	U1B,6F	00/00/00	99/99/99
203065	IC-74180 GEN CHK PAR 9BIT O/E	3	B	127	1.000	1.000	EA	B	N	N	1.000	0	0	U6A	00/00/00	99/99/99
203102-001	IC-74221 MLTV MNST DUAL	3	D	128	18.000	1.000	EA	B	N	N	18.000	0	0	U24B,,24D,25D,25F,25B,25K,24F,24H,25H,25M,24P,25P,24S,25S,24U,25U,24K,24M	00/00/00	99/99/99

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203102-245	IC-74LS245 TRANSCEIVR BUS OCT	3	E	129	1.000	1.000	EA	B	N	N	1.000	0	0	U15A	00/00/00	99/99/99
970824-001	IC-74LS688	3	A	130	2.000	1.000	EA	B	Y	N	2.000	0	0	U1M,U3M	5/19/86	99/99/99
962952-001	S/W-GCR,ASSY,ACRC GENERATOR	3	A	131	1.000	1.000	EA	B	Y	N	1.000	0	0	U1J ECO#30797	8/18/88	99/99/99
962962-001	S/W-GCR, ASSY, ECC GENERATOR	3	A	132	1.000	1.000	EA	B	Y	N	1.000	0	0	U6J	7/18/86	99/99/99
203046-150	IC-74LS42 DCDR BCD-DEC	3	C	133	2.000	1.000	EA	B	Y	N	2.000	0	0	U11P,2T	5/12/86	99/99/99
962967-001	S/W-GCR, ASSY,POLYNOMIAL STATE	3	A	134	1.000	1.000	EA	M	Y	N	1.000	0	0	U2P ECO#30797	8/18/88	99/99/99
203102-373	IC-74LS373 LATCH D OCT	3	G	135	2.000	1.000	EA	B	Y	N	2.000	0	0	U2R,5R	5/12/86	99/99/99
203046-148	IC-74LS138 DCDR 3-8 LINE	3	K	136	1.000	1.000	EA	B	Y	N	1.000	0	0	U5T	5/12/86	99/99/99
971165-001	ADHESIVE-MODIFIED CYANOACRYLA*	1	B	143	.001	1.000	EA	F	Y	N	.001	0	0	ECO#30287	1/22/88	99/99/99
208430-900	WIRE-30AWG,KYNAR ROLL,UL	3	E	144	.001	1.000	FT	F	Y	N	.001	0	0	ECO#30287	1/22/88	99/99/99
961707-001	STIFFENER-EDGE,PCB	1	B	146	1.000	1.000	EA	B	N	N	1.000	0	0		00/00/00	99/99/99
970518-001	BUS BAR-12 PIN,INSULATED	3	A	147	2.000	1.000	EA	B	N	N	2.000	0	0		00/00/00	99/99/99
213271-603	SCREW-PHP,ZINC,6-32X3/16	3	G	148	1.000	1.000	EA	F	Y	N	1.000	0	0		5/12/86	99/99/99
970460-001	NUT-SYNC,6-32,HEATSINK,.220MAX	3	D	149	1.000	1.000	EA	B	Y	N	1.000	0	0		00/00/00	99/99/99
209990-071	ADHESIVE-SUPERBONDER	3	C	151	0.000	1.000	EA	F	Y	N	0.000	0	0		11/22/85	99/99/99
964107-001	HEATSINK	3	A	152	1.000	1.000	EA	B	Y	N	1.000	0	0	XVR1	11/04/86	99/99/99
962957-001	S/W-GCR, ASSY, CRC GENERATOR	3	A	153	1.000	1.000	EA	B	Y	N	1.000	0	0	U3J	7/18/86	99/99/99
962972-001	S/W-GCR, ASSY,POLYNOMIAL STATE	3	A	154	1.000	1.000	EA	M	Y	N	1.000	0	0	U5P	7/18/86	99/99/99
209100-548	TUBING-TEFLON #17	3	B	156	.001	1.000	EA	F	Y	N	.001	0	0	ECO#30592	5/27/88	99/99/99
209998-060	LOCTITE TAK PAK	3	B	157	.001	1.000	EA	F	Y	N	.001	0	0	ECO#30134	3/01/88	99/99/99
971041-001	LABEL-BAR CODE,1.425LX.25W,9.*	3	B	158	1.000	1.000	EA	F	Y	N	1.000	0	0	ECO#30659	5/27/88	99/99/99