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3112

**NEC INFORMATION SYSTEMS, INC.
WINCHESTER DISK DRIVE
MAINTENANCE GUIDE**

Model: D2257

**Customer Engineering Reprint
Product Maintenance Manual**

729-1503

PREFACE

The purpose of this manual is to provide the Wang-trained Customer Engineer (CE) with instructions to operate, troubleshoot and repair the D2257 Winchester Disk Drive.

First Edition (May 1984)

This edition is the first reprint of NEC Information Systems, Inc. maintenance guide for the D2257 Winchester Disk Drive. The material in this document may only be used for the purpose stated in the Preface. Updates and/or changes to this document will be published as Publication Update Bulletins (PUB's) or subsequent editions.

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This PUB contains procedures for installing a Dual Port Option in the Wang Model 2286V-2 (NEC D2257) fixed disk drive.

INSTRUCTIONS:

Remove and insert attached pages and/or microfiche as follows:

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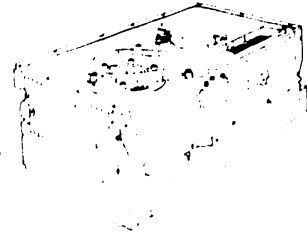
SYSTEM

OVER-

VIEW

Chapter 1

System Overview



The D2257 and D2247E disk drives are the newest models in the NEC D2200 series. They are compact, highly reliable, low-cost disk drives fully compatible with earlier D2200 models. They offer up to 167.7 megabytes (MB) of unformatted data storage on 8-inch platters. Actual storage capacity depends upon the model and formatting method used.

1.1 D22x7 SYSTEM DESIGN

Both models use fixed-disk, Winchester-type technology, which provides the most advanced method of storing and retrieving large amounts of data. Each 22x7 disk drive contains a number of 8-inch platters (see Table 1-1) sealed within a protective, air-tight enclosure. This enclosure protects the recording platters from atmospheric dust and dirt to improve operational reliability. A spindle, a drive motor, a rotary actuator assembly, and movable read/write heads are also contained within the enclosure.

Table 1-1 D22x7 Disk Drive Storage Capacity

MODEL	UNFORMATTED CAPACITY (MB)	NUMBER OF 8-INCH DISK PLATTERS	NUMBER OF MOVABLE R/W HEADS
D2257	167.7	5	8
D2247E	103.2	3	5

Both the D2257 and the D2247E are equipped with standard features which simplify installation and integration into an existing system. Installation in a rack or cabinet is easily accomplished with the mounting frame bracket that allows the drive to be installed in either a horizontal or vertical position.

System integration is simplified by signal line terminators and by Sector and Index signals in the B cable. Switch-selectable sector length and address mark detect functions configure the D22x7 drives for virtually any system.

NEC's large scale integrated circuits (LSIs) protect even the weakest signals from noise and insure high operational reliability. D22x7 drives require no scheduled maintenance and are adjustment-free. As a result, customer maintenance costs are low, while satisfaction is high.

Figure 1-1 shows the major components of the D22x7 series.

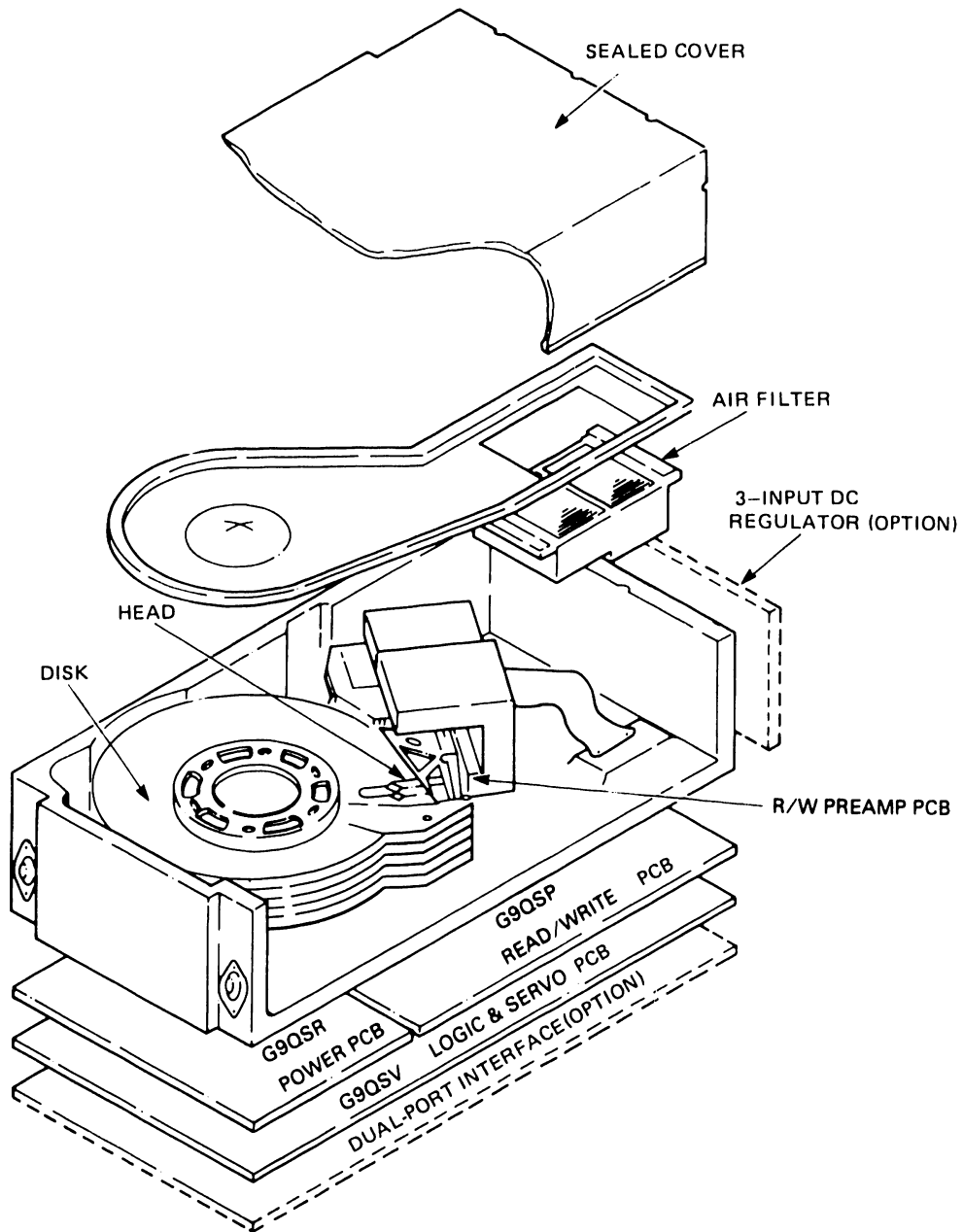


Figure 1-1 Major Components of the D22x7 Series Disk Drives

Figures 1-2 and 1-3 show the arrangement of recording platters and read/write heads within the D2257 and D2247E disk drives.

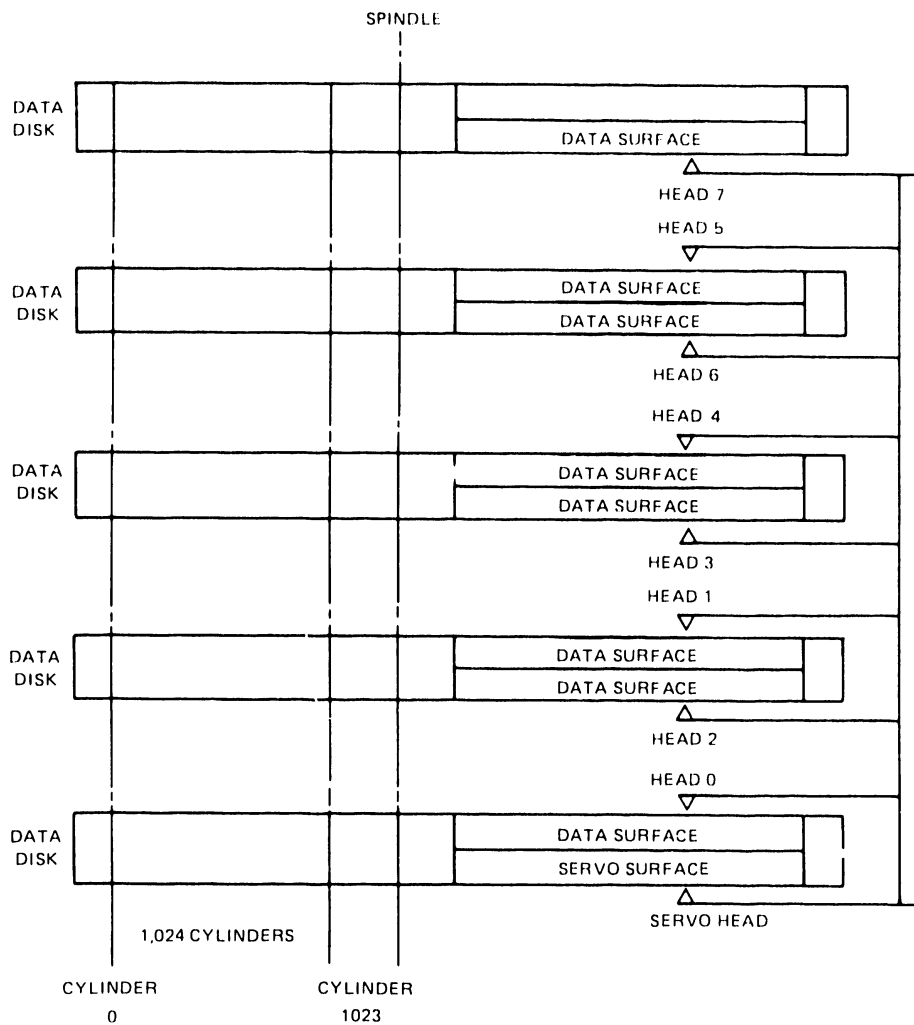


Figure 1-2 D2257 Disk Arrangement

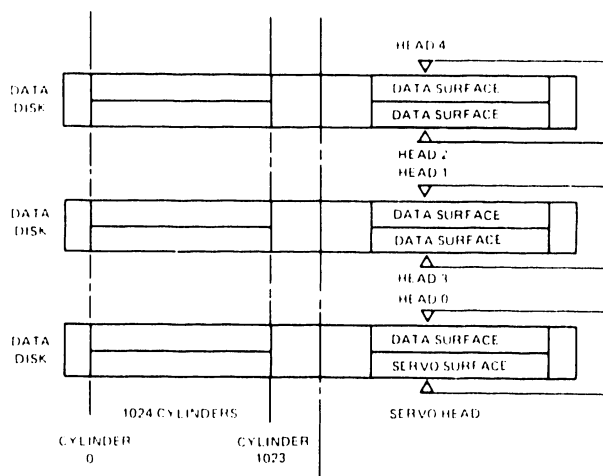


Figure 1-3 D2247E Disk Arrangement

The servo disk surface is shown in Figure 1-4.

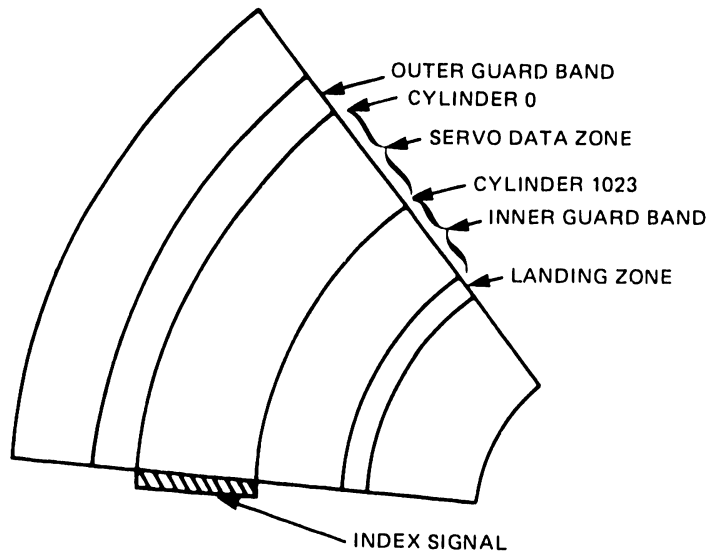


Figure 1-4 Servo Disk Surface

The Index signal is a six-bit pattern written along one radius of the servo surface. It identifies the beginning of a recording track. The index pattern repeats each time the radius intersects one of the recording tracks.

The servo data zone contains 1024 concentric recording tracks. Each recording track contains prerecorded positioning data, including clock and synchronization signals, that provides the necessary information to place and maintain the read/write heads on track.

The inner and outer guard bands bracket the servo data zone. They contain six-bit patterns that distinguish them from the servo data zone. These patterns recur every 320 bytes. Table 1-2 lists the bit patterns used on the servo surface.

Table 1-2 Servo Surface Bit Patterns

SIGNAL	BIT PATTERN
Index	0 1 1 0 1 0
Inner Guard Band	0 1 1 0 0 1
Outer Guard Band	0 1 1 1 0 0

The landing zone is a silicon-coated surface where the read/write heads rest when the recording disks are not spinning. During read, write, and seek operations the heads "float" approximately 20 microinches above the surface of the disk, supported by a cushion of air.

1.2 DISK CIRCUITRY

A block diagram of a D22x7 disk drive is shown in Figure 1-5. The functional components consist of the interface, the read/write circuits, the servo control, and the motor control circuits.

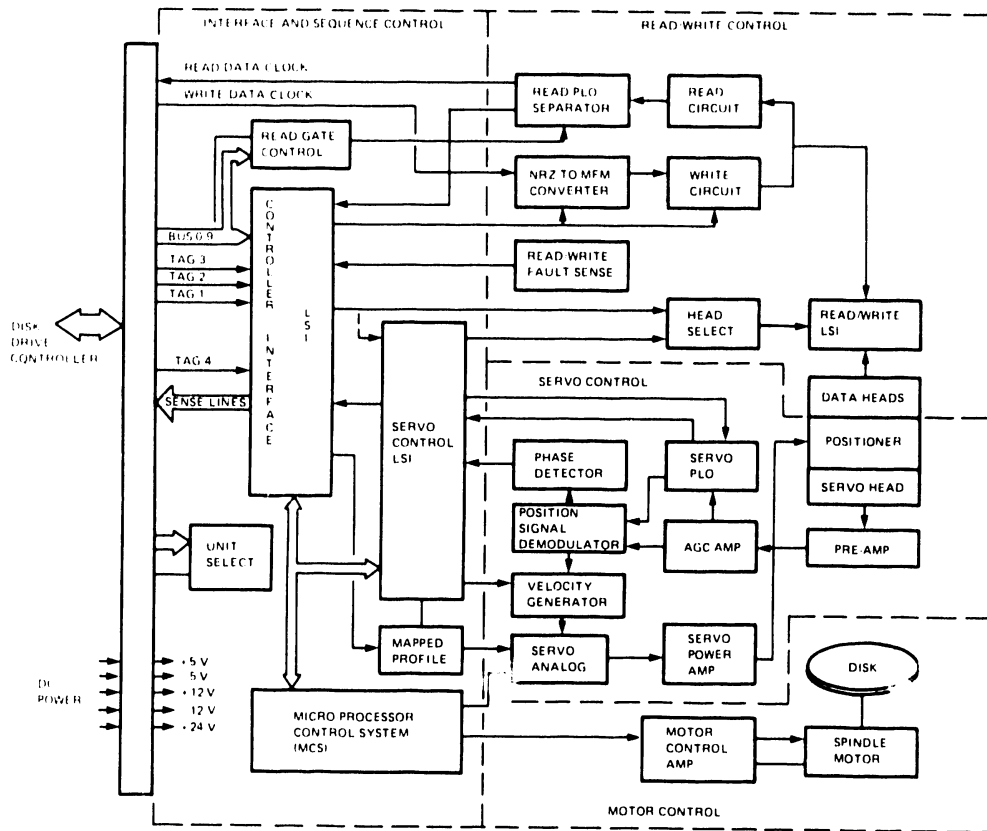


Figure 1-5 D22x7 Functional Block Diagram

The interface routes data, addresses, status information, and control signals between the disk drive and the controller.

The read/write circuits control the transfer of data from the disk (read operation), and to the disk (write operation). During a write operation, the circuits receive serial nonreturn-to-zero (NRZ) format data from the controller and convert the data to a modified frequency modulation (MFM) format. The MFM data is then written on the disk. During a read operation, the circuits read and amplify the data from the disk, convert it from MFM to NRZ format, and send the NRZ data serially to the controller.

The servo control reads the data prerecorded on the servo disk. The servo control uses this data to position and maintain the read/write heads on the correct cylinder.

The motor control circuits drive the spindle motor.

1.3 POWER REQUIREMENTS

D22x7 disk drives operate on externally supplied dc power. DC power requirements are listed in Table 1-3.

Table 1-3 DC Power Requirements

REQUIRED VOLTAGE	TOLERANCE	DAMAGE THRESHOLD	CURRENT	RIPPLE (PEAK TO PEAK)
+5.0 V	±0.25 V	±25%	4.0 A	100 mV
-5.0 V	±0.25 V	±25%	0.5 A	100 mV
+12.0 V	±0.60 V	±25%	0.6 A	100 mV
-12.0 V	±0.60 V	±25%	0.5 A	100 mV
+24.0 V	±2.40 V	±25%	2.7 A* 5.0 A**	240 mV

*2.7 A — average running current
**5.0 A — peak starting current (25 seconds maximum duration)

All power line voltages must be established within 500 milliseconds (ms) of power on. When power is turned on, voltages must be enabled in the following order: +5V, -5V, ±12V, +24V. When power is turned off, lines must be disabled in the reverse order: +24V, ±12V, -5V, +5V.

1.4 FEATURES

Shorter access times, high-speed data transfers, and mechanical reliability are required for efficient computer network operations. To meet these demands the NEC D22x7 disk drives offer the following features.

1.4.1 Enhanced Seek Time

Seek time is the time required to find requested data on the disk. Both D22x7 models have an average seek time of 20 milliseconds (ms), and a maximum seek time of 40 ms.

1.4.2 Rapid Data Transfer Rate

Both the D2257 and the D2247E offer a data transfer rate of approximately 1.2 MB per second.

1.4.3 Compact Mounting

The D22x7's compact size allows for either horizontal or vertical mounting in a limited space. The drive's lock mechanism is easily accessible even after the drive has been placed within a system cabinet.

D22x7 drives also feature an integrated cooling fan that reduces space and power requirements.

1.4.4 Simplified Maintenance

The air-tight, sealed disk/head assembly and the D22x7's simplified design produce a disk drive that requires no periodic maintenance. Servo circuits are maintenance-free and require no adjustment. Neither installation nor field service requires special tools. Motor electronics are placed outside the head/disk assembly and do not need "clean room" repair facilities.

An optional diagnostic panel is available for test and maintenance purposes (see Appendix C).

1.4.5 Design Reliability

D22x7 disk drives use lightweight, contact-type start/stop heads that eliminate damage to the heads and disk. A simplified rotary actuator, a directly coupled, brushless dc motor, and a closed-loop air circulation system are the system's major mechanical components. The control logic is microprocessor controlled and designed to minimize electronic components. This design strategy ensures high reliability and low cost.

1.4.6 Standard Interfaces

Both the D2257 and the D2247E use the same standard original equipment manufacturer interfaces for connection to a disk controller and to a power supply.

1.4.7 Safety

D22x7 models conform to Underwriter's Laboratories Safety Regulation UL478.

1.4.8 System Configuration Flexibility

One to sixteen D22x7 disk drives can be connected to a single controller in either a daisy-chain or radial system (see Figures 1-6 and 1-7).

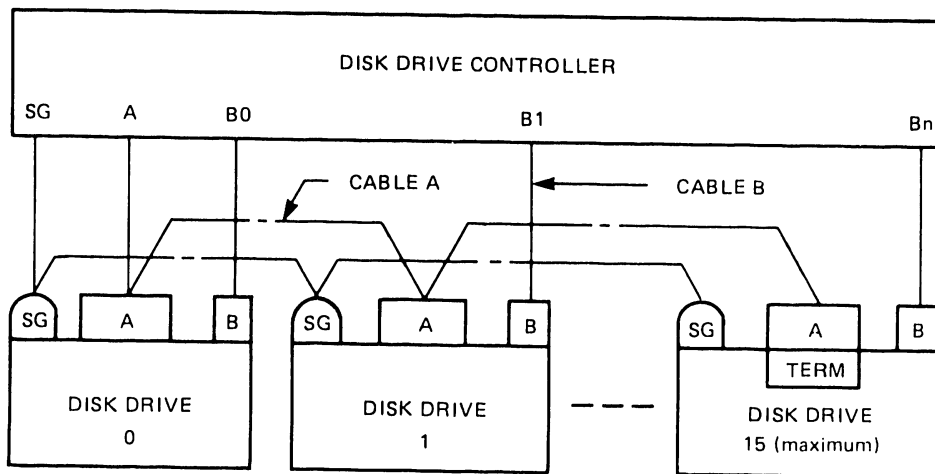


Figure 1-6 Daisy-Chain System Configuration

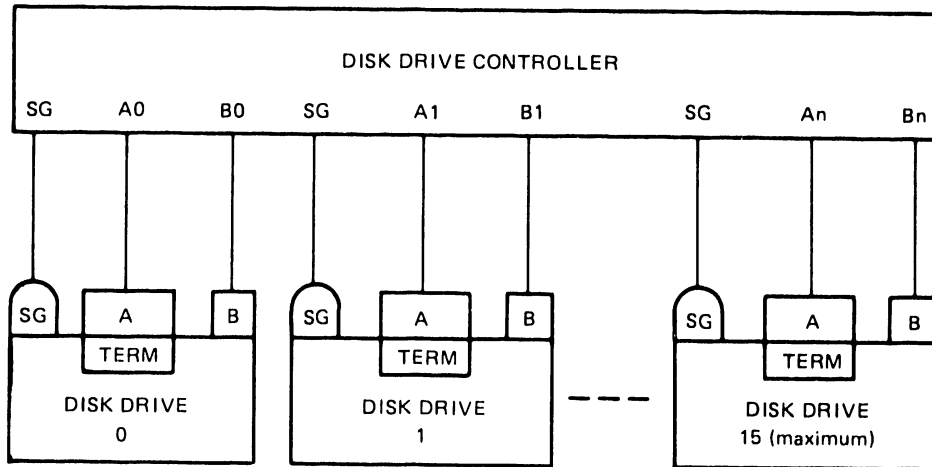


Figure 1-7 Radial System Configuration

1.5 RELATED DOCUMENT

For additional information on D22x7 disk drives, refer to the *D22x7 Series 8-Inch Winchester Disk Drive Product Description* (NEC document number 819-000080-7001).

1.6 SPECIFICATIONS

D22x7 specifications are listed in Appendix B.

1.7 OPTIONS

Table 1-4 lists available options for D22x7 disk drives.

Table 1-4 Available Options

OPTION	DESCRIPTION
3-Input DC Regulator Option	Supplies internal dc "power set" (+24V, +12V, +5V, -5V, -12V) by converting external dc input of +24V, +5V, and -12V.
Dual-Port Option	Enables a D22x7 drive to interface with two controllers.
DC Power Supply	Supplies internal dc "power set" (+24V, +12V, +5V, -5V, -12V) from ac input power. The unit provides power for two disk drives.
Diagnostic Panel	Maintenance tool for monitoring and testing disk drive operation.

CHAPTER

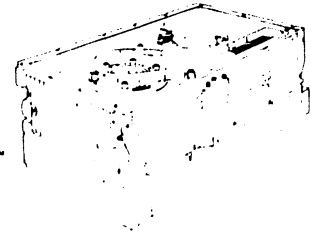
2

INSTALLATION

PROCEDURES

Chapter 2

Installation Procedures



This chapter provides the recommended procedures for installing a D22x7 disk drive. When preparing the installation site, refer to the environmental specifications listed in Appendix B.

2.1 UNPACKING/REPACKING

Before unpacking the disk drive, examine the shipping carton for damage. If damage has occurred, notify the carrier immediately. Do not open the carton until the carrier's representative is present.

If there is no damage to the shipping carton, use these procedures to unpack the disk drive. Failure to follow these procedures can void the product warranty.

1. Open the top of the shipping carton.
2. Remove the top packing cushion (see Figure 2-1).
3. Carefully remove the disk drive from the shipping carton.
4. Remove the plastic shipping bag from the disk drive.
5. Save all packing material for reshipping.
6. Check all items against the bill of material to insure that no items are missing.
7. Check all items for shipping damage.

To repack the disk drive, reverse these procedures.

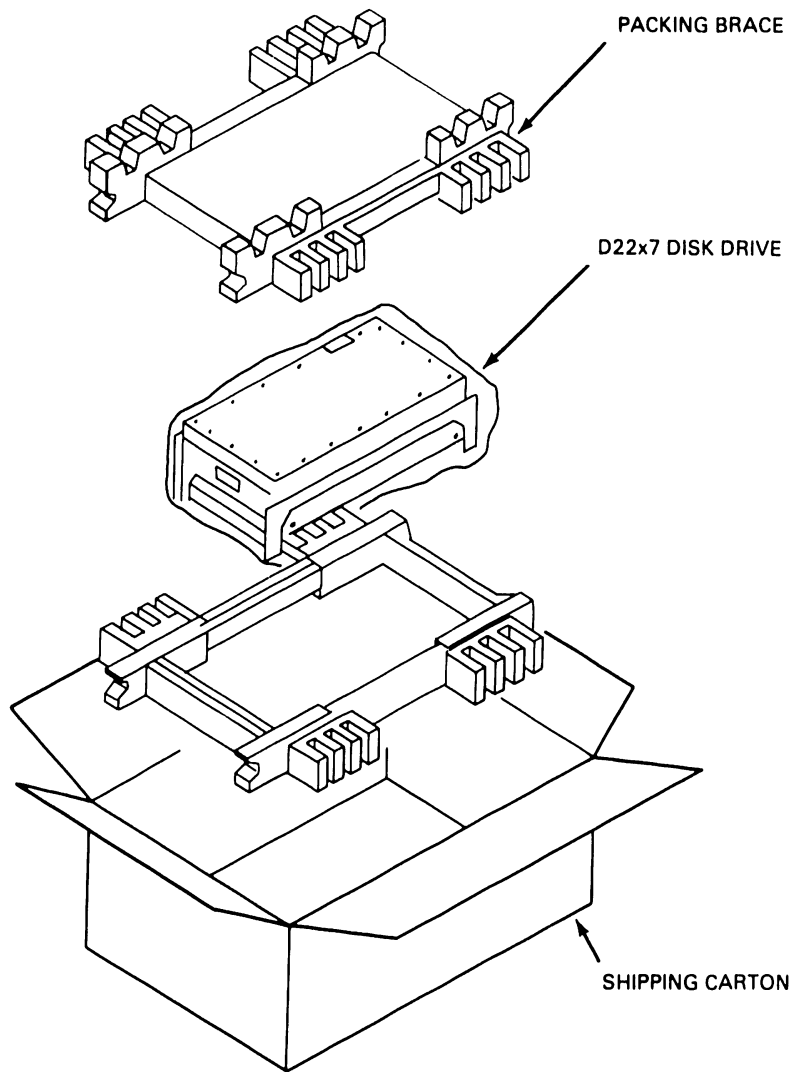


Figure 2-1 D22x7 Packaging

2.2 TERMINATING RESISTORS

Each D22x7 disk drive is shipped with four 56Ω terminating resistors installed on the G9QSV logic and servo printed circuit board (PCB) as shown in Figure 2-2.

If the D22x7 drive is connected to the controller in a radial configuration, leave these four resistors in place. If a daisy-chain configuration is used, remove these resistors from all except the last drive in the chain (see Figure 2-3).

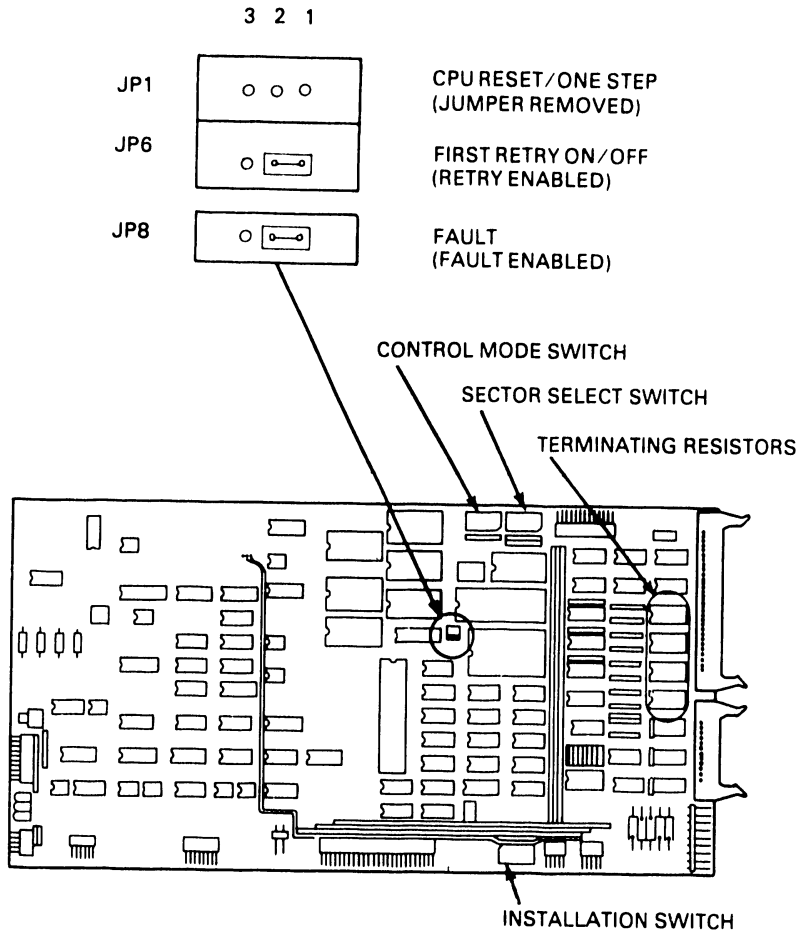


Figure 2-2 G9QSV Logic and Servo PCB

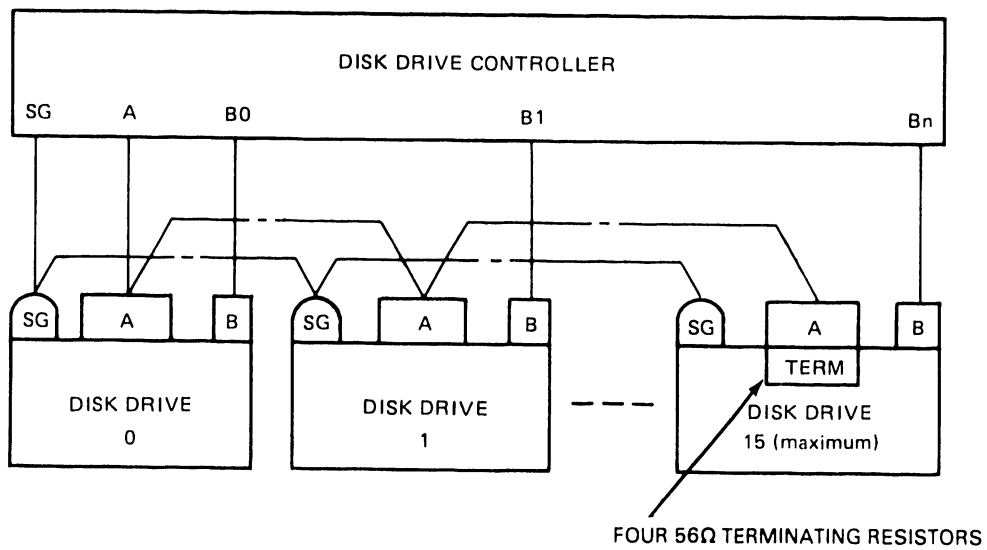


Figure 2-3 Daisy-Chain Terminating Resistors

2.3 JUMPER REQUIREMENTS

Three jumper settings must be verified before power is applied to the disk drive. The location of these three jumpers (JP1, JP6, and JP8) on the G9QSV PCB is shown in Figure 2-2. Insure that settings match those shown in Figure 2-2.

CAUTION

Do not alter these jumper settings. They are intended for factory adjustments only.

2.4 SWITCH SETTINGS

Three eight-segment, dual-inline-packaged (DIP) switch assemblies on the G9QSV logic and servo PCB configure the D22x7 to communicate with the controller and set the sector count. DIP switch assembly locations are shown in Figure 2-4.

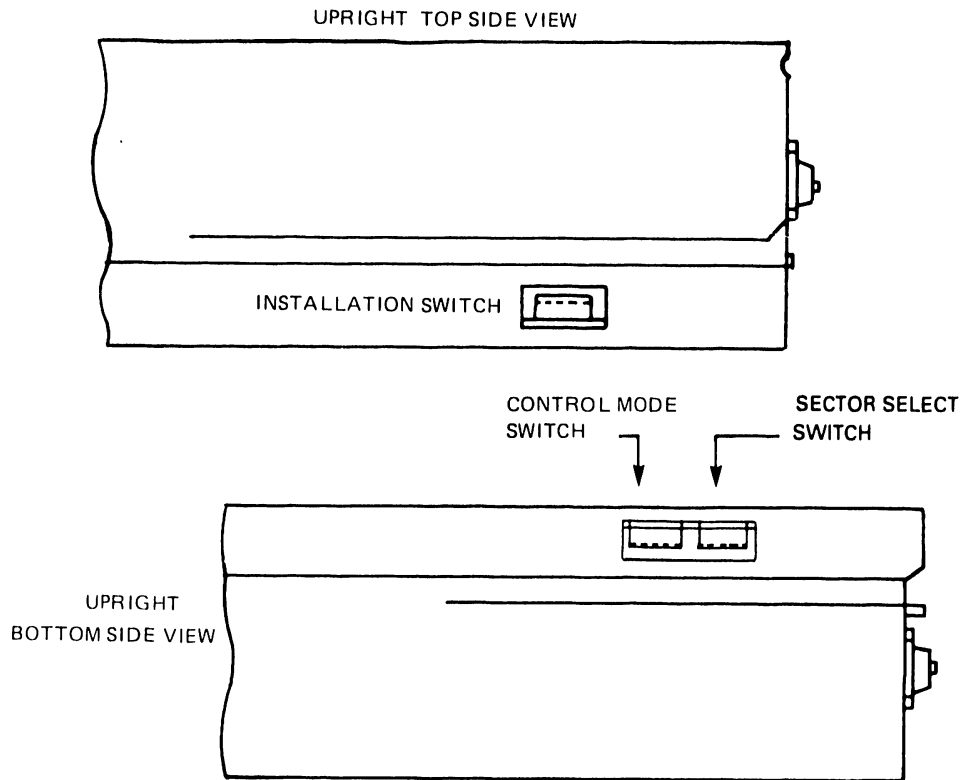


Figure 2-4 DIP Switch Locations on D22x7 Drives

2.4.1 Installation Switch Assembly

The installation switch assembly, shown in Figure 2-5, sets the device address and controls the power-on sequence.

Segments 1, 2, 3, and 4 assign the device address, a hexadecimal number from 0 to F.

Segment 5 determines which of the Unit Select bit lines are used to transmit the device address. For device addresses 0 to 3, set segment 5 to the 0 position; for addresses 4 to F, set segment 5 to the 1 position.

Segment 7 enables a 30-second delay in the start-up time of the spindle motor. This segment can be used in dual-drive configurations to insure that both drives do not overload the power supply by simultaneously activating their power-up sequence.

Segment 8 places the D22x7 in local or remote mode at power-on. Segment 6 of the installation switch assembly is not used.

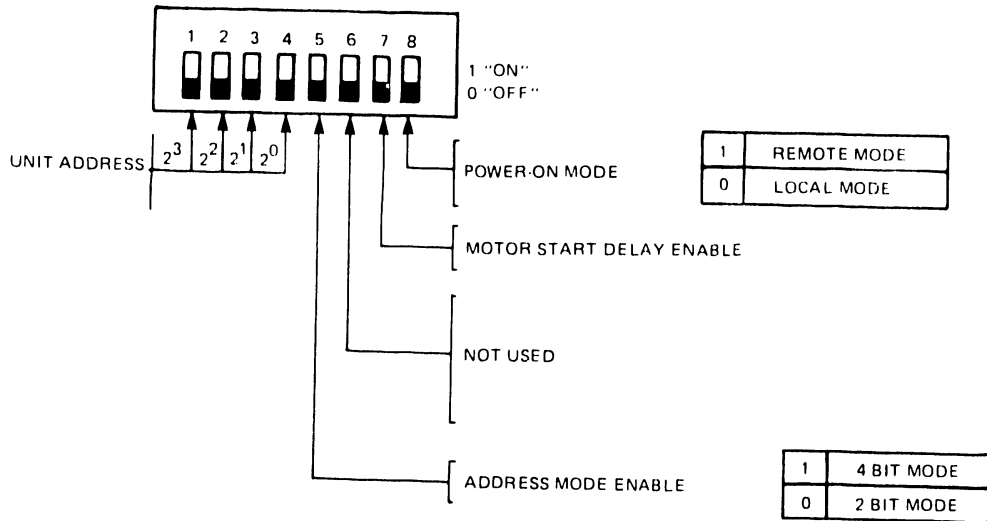


Figure 2-5 Installation DIP Switch

2.4.2 Control Mode Switch Assembly

The control mode switch assembly (shown in Figure 2-6) configures the D22x7 to communicate with the disk controller and enables certain optional drive features.

Segments 1, 2, and 3 are set according to the D22x7 model used.

Segment 4 enables the Address Mark function.

Segment 5 enables the Read Sector function. When segments 5 and 7 of the control mode switch assembly are set to 1, Tag 4 can be used in conjunction with bus bits 8 and 9 to request the current sector address. The D22x7 issues the address across the sense lines.

Segment 6 enables the Format Write Release Option used with some controllers.

Segment 7 enables the Tag 4 line.

Segment 8 enables the controller interface.

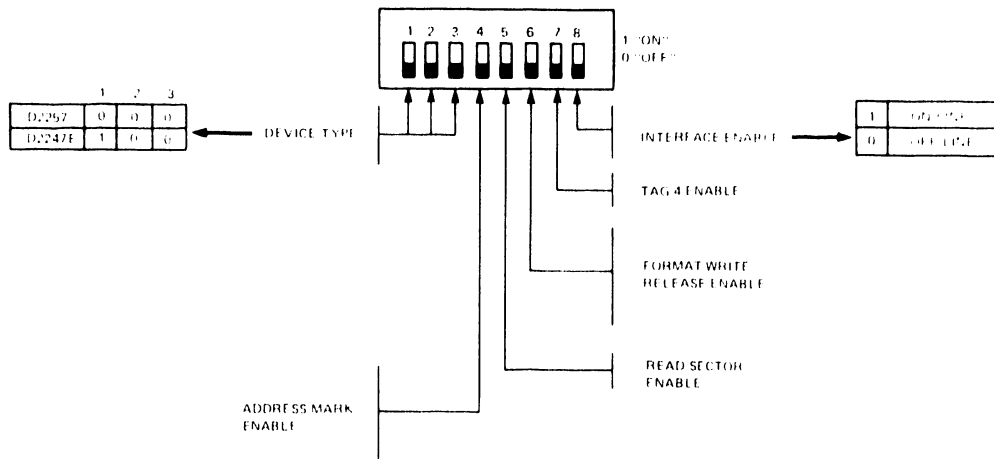


Figure 2-6 Control Mode DIP Switch

2.4.3 Sector Select Switch Assembly

The Sector Select switch sets the number of sectors per track. Any number of sectors from 1 to 128 can be chosen.

Segment 1 of this assembly determines the disposition of odd or remainder bytes. These are extra bytes that must be allocated when the available bytes per track are not evenly divisible by the number of sectors per track. With segment 1 in the 0 position, odd bytes are grouped together in an extra sector at the end of the track. With this segment in the 1 position, the last sector is reduced to account for odd bytes.

Figure 2-7 shows the allocation of 33 sectors using each of these disposition methods.

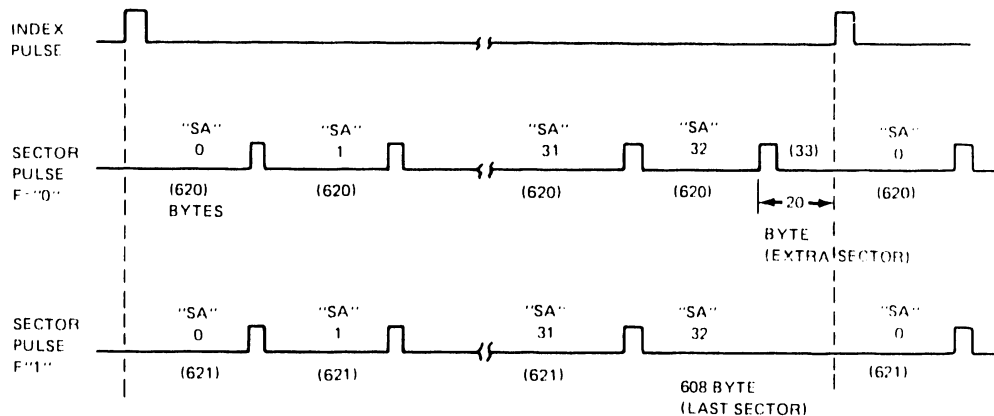
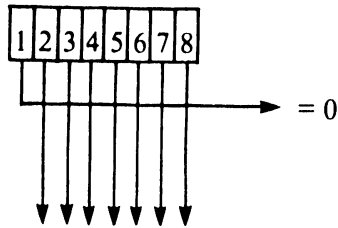


Figure 2-7 Sector Allocation

Tables 2-1 and 2-2 list Sector Select switch settings and the resulting sector allocations for D22x7 drives.

Table 2-1 Sector Selection List (Disposition Switch = 0)

SECTOR SWITCH SETTING

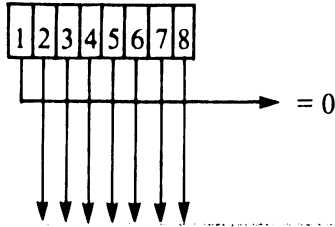


TRACK = 20,480 BYTES

$2^6 2^5 2^4 2^3 2^2 2^1 2^0$	SECTORS PER TRACK	BYTES PER SECTOR	EXTRA SECTOR BYTES
0 0 0 0 0 0 1	1	20480	0
0 0 0 0 0 1 0	2	10240	0
0 0 0 0 0 1 1	3	6826	2
0 0 0 0 1 0 0	4	5120	0
0 0 0 0 1 0 1	5	4096	0
0 0 0 0 1 1 0	6	3413	2
0 0 0 0 1 1 1	7	2925	5
0 0 0 1 0 0 0	8	2560	0
0 0 0 1 0 0 1	9	2275	5
0 0 0 1 0 1 0	10	2048	0
0 0 0 1 0 1 1	11	1861	9
0 0 0 1 1 0 0	12	1706	8
0 0 0 1 1 0 1	13	1575	5
0 0 0 1 1 1 0	14	1462	12
0 0 0 1 1 1 1	15	1365	5
0 0 1 0 0 0 0	16	1280	0
0 0 1 0 0 0 1	17	1204	12
0 0 1 0 0 1 0	18	1137	14
0 0 1 0 0 1 1	19	1077	17
0 0 1 0 1 0 0	20	1024	0
0 0 1 0 1 0 1	21	975	5
0 0 1 0 1 1 0	22	930	20
0 0 1 0 1 1 1	23	890	10
0 0 1 1 0 0 0	24	853	8
0 0 1 1 0 0 1	25	819	5
0 0 1 1 0 1 0	26	787	18
0 0 1 1 0 1 1	27	758	14
0 0 1 1 1 0 0	28	731	12
0 0 1 1 1 0 1	29	706	6
0 0 1 1 1 1 0	30	682	20

Table 2-1 Sector Selection List (Disposition Switch = 0) (cont'd)

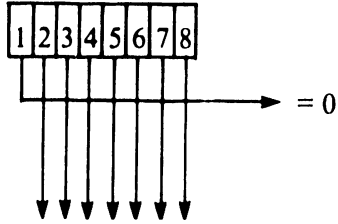
SECTOR SWITCH SETTING



		TRACK = 20,480 BYTES	
$2^6 2^5 2^4 2^3 2^2 2^1 2^0$	SECTORS PER TRACK	BYTES PER SECTOR	EXTRA SECTOR BYTES
0 0 1 1 1 1 1	31	660	20
0 1 0 0 0 0 0	32	640	0
0 1 0 0 0 0 1	33	620	20
0 1 0 0 0 1 0	34	602	12
0 1 0 0 0 1 1	35	585	5
0 1 0 0 1 0 0	36	568	32
0 1 0 0 1 0 1	37	553	19
0 1 0 0 1 1 0	38	538	36
0 1 0 0 1 1 1	39	525	5
0 1 0 1 0 0 0	40	512	0
0 1 0 1 0 0 1	41	499	21
0 1 0 1 0 1 0	42	487	26
0 1 0 1 0 1 1	43	476	12
0 1 0 1 1 0 0	44	465	20
0 1 0 1 1 0 1	45	455	5
0 1 0 1 1 1 0	46	445	10
0 1 0 1 1 1 1	47	435	35
0 1 1 0 0 0 0	48	426	32
0 1 1 0 0 0 1	49	417	47
0 1 1 0 0 1 0	50	409	30
0 1 1 0 0 1 1	51	401	29
0 1 1 0 1 0 0	52	393	44
0 1 1 0 1 0 1	53	386	22
0 1 1 0 1 1 0	54	379	14
0 1 1 0 1 1 1	55	372	20
0 1 1 1 0 0 0	56	365	40
0 1 1 1 0 0 1	57	359	17
0 1 1 1 0 1 0	58	353	6
0 1 1 1 0 1 1	59	347	7
0 1 1 1 1 0 0	60	341	20

Table 2-1 Sector Selection List (Disposition Switch = 0) (cont'd)

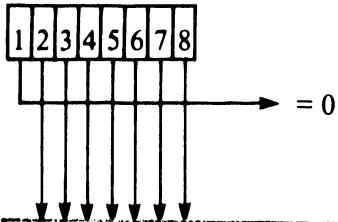
SECTOR SWITCH SETTING



		TRACK = 20,480 BYTES	
$2^6 2^5 2^4 2^3 2^2 2^1 2^0$	SECTORS PER TRACK	BYTES PER SECTOR	EXTRA SECTOR BYTES
0 1 1 1 1 0 1	61	335	45
0 1 1 1 1 1 0	62	330	20
0 1 1 1 1 1 1	63	325	5
1 0 0 0 0 0 0	64	320	0
1 0 0 0 0 0 1	65	315	5
1 0 0 0 0 1 0	66	310	20
1 0 0 0 0 1 1	67	305	45
1 0 0 0 1 0 0	68	301	12
1 0 0 0 1 0 1	69	296	56
1 0 0 0 1 1 0	70	292	40
1 0 0 0 1 1 1	71	288	32
1 0 0 1 0 0 0	72	284	32
1 0 0 1 0 0 1	73	280	40
1 0 0 1 0 1 0	74	276	56
1 0 0 1 0 1 1	75	273	5
1 0 0 1 1 0 0	76	269	36
1 0 0 1 1 0 1	77	265	75
1 0 0 1 1 1 0	78	262	44
1 0 0 1 1 1 1	79	259	19
1 0 1 0 0 0 0	80	256	0
1 0 1 0 0 0 1	81	252	68
1 0 1 0 0 1 0	82	249	62
1 0 1 0 0 1 1	83	246	62
1 0 1 0 1 0 0	84	243	68
1 0 1 0 1 0 1	85	240	80
1 0 1 0 1 1 0	86	238	12
1 0 1 0 1 1 1	87	235	35
1 0 1 1 0 0 0	88	232	64
1 0 1 1 0 0 1	89	230	10
1 0 1 1 0 1 0	90	227	50

Table 2-1 Sector Selection List (Disposition Switch = 0) (cont'd)

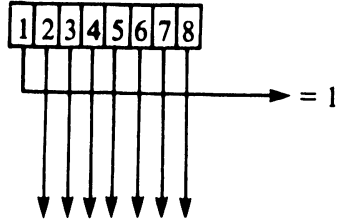
SECTOR SWITCH SETTING



		TRACK = 20,480 BYTES	
$2^6 2^5 2^4 2^3 2^2 2^1 2^0$	SECTORS PER TRACK	BYTES PER SECTOR	EXTRA SECTOR BYTES
1 0 1 1 0 1 1	91	225	5
1 0 1 1 1 0 0	92	222	56
1 0 1 1 1 0 1	93	220	20
1 0 1 1 1 1 0	94	217	82
1 0 1 1 1 1 1	95	215	55
1 1 0 0 0 0 0	96	213	32
1 1 0 0 0 0 1	97	211	13
1 1 0 0 0 1 0	98	208	96
1 1 0 0 0 1 1	99	206	86
1 1 0 0 1 0 0	100	204	80
1 1 0 0 1 0 1	101	202	78
1 1 0 0 1 1 0	102	200	80
1 1 0 0 1 1 1	103	198	86
1 1 0 1 0 0 0	104	196	96
1 1 0 1 0 0 1	105	195	5
1 1 0 1 0 1 0	106	193	22
1 1 0 1 0 1 1	107	191	43
1 1 0 1 1 0 0	108	189	68
1 1 0 1 1 0 1	109	187	97
1 1 0 1 1 1 0	110	186	20
1 1 0 1 1 1 1	111	184	56
1 1 1 0 0 0 0	112	182	96
1 1 1 0 0 0 1	113	181	27
1 1 1 0 0 1 0	114	179	74
1 1 1 0 0 1 1	115	179	10
1 1 1 0 1 0 0	116	176	64
1 1 1 0 1 0 1	117	175	5
1 1 1 0 1 1 0	118	173	66
1 1 1 0 1 1 1	119	172	12
1 1 1 1 0 0 0	120	170	80
1 1 1 1 0 0 1	121	169	31
1 1 1 1 0 1 0	122	167	106
1 1 1 1 0 1 1	123	166	62
1 1 1 1 1 0 0	124	165	20
1 1 1 1 1 0 1	125	163	105
1 1 1 1 1 1 0	126	162	68
1 1 1 1 1 1 1	127	161	33
0 0 0 0 0 0 0	128	160	0

Table 2-2 Sector Selection List (Disposition Switch = 1)

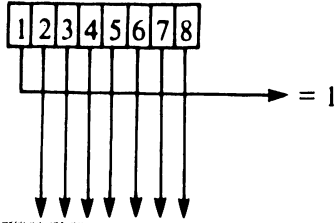
SECTOR SWITCH SETTING



		TRACK = 20,480 BYTES	
$2^6 2^5 2^4 2^3 2^2 2^1 2^0$	SECTORS PER TRACK	BYTES PER SECTOR	LAST SECTOR SHORTER
0000001	1	20480	0
0000010	2	10240	0
0000011	3	6827	-1
0000100	4	5120	0
0000101	5	4096	0
0000110	6	3414	-4
0000111	7	2926	-2
0001000	8	2560	0
0001001	9	2276	-4
0001010	10	2048	0
0001011	11	1862	-2
0001100	12	1707	-4
0001101	13	1576	-8
0001110	14	1463	-2
0001111	15	1366	-10
0010000	16	1280	0
0010001	17	1205	-5
0010010	18	1138	-4
0010011	19	1078	-2
0010100	20	1024	0
0010101	21	976	-16
0010110	22	931	-2
0010111	23	891	-13
0011000	24	854	-16
0011001	25	820	-20
0011010	26	788	-8
0011011	27	759	-13
0011100	28	732	-16
0011101	29	707	-23
0011110	30	683	-10

Table 2-2 Sector Selection List (Disposition Switch = 1) (cont'd)

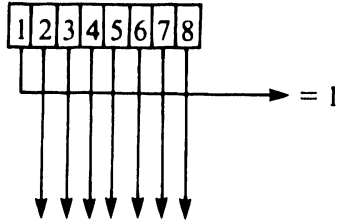
SECTOR SWITCH SETTING



		TRACK = 20,480 BYTES	
$2^6 2^5 2^4 2^3 2^2 2^1 2^0$	SECTORS PER TRACK	BYTES PER SECTOR	LAST SECTOR SHORTER
0 0 1 1 1 1 1	31	661	-11
0 1 0 0 0 0 0	32	640	0
0 1 0 0 0 0 1	33	621	-13
0 1 0 0 0 1 0	34	603	-22
0 1 0 0 0 1 1	35	586	-30
0 1 0 0 1 0 0	36	569	-4
0 1 0 0 1 0 1	37	554	-18
0 1 0 0 1 1 0	38	539	-2
0 1 0 0 1 1 1	39	526	-34
0 1 0 1 0 0 0	40	512	0
0 1 0 1 0 0 1	41	500	-20
0 1 0 1 0 1 0	42	488	-16
0 1 0 1 0 1 1	43	477	-31
0 1 0 1 1 0 0	44	466	-24
0 1 0 1 1 0 1	45	456	-40
0 1 0 1 1 1 0	46	446	-36
0 1 0 1 1 1 1	47	436	-12
0 1 1 0 0 0 0	48	427	-16
0 1 1 0 0 0 1	49	418	-2
0 1 1 0 0 1 0	50	410	-20
0 1 1 0 0 1 1	51	402	-16
0 1 1 0 1 0 0	52	394	-8
0 1 1 0 1 0 1	53	387	-31
0 1 1 0 1 1 0	54	380	-40
0 1 1 0 1 1 1	55	373	-35
0 1 1 1 0 0 0	56	366	-16
0 1 1 1 0 0 1	57	360	-40
0 1 1 1 0 1 0	58	354	-52
0 1 1 1 0 1 1	59	348	-52
0 1 1 1 1 0 0	60	342	-40

Table 2-2 Sector Selection List (Disposition Switch = 1) (cont'd)

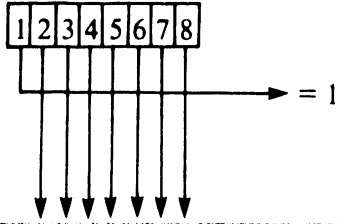
SECTOR SWITCH SETTING



		TRACK = 20,480 BYTES	
$2^6 2^5 2^4 2^3 2^2 2^1 2^0$	SECTORS PER TRACK	BYTES PER SECTOR	LAST SECTOR SHORTER
0 1 1 1 1 0 1	61	336	-16
0 1 1 1 1 1 0	62	331	-42
0 1 1 1 1 1 1	63	326	-58
1 0 0 0 0 0 0	64	320	0
1 0 0 0 0 0 1	65	316	-60
1 0 0 0 0 1 0	66	311	-46
1 0 0 0 0 1 1	67	306	-22
1 0 0 0 1 0 0	68	302	-56
1 0 0 0 1 0 1	69	297	-13
1 0 0 0 1 1 0	70	293	-30
1 0 0 0 1 1 1	71	289	-39
1 0 0 1 0 0 0	72	285	-40
1 0 0 1 0 0 1	73	281	-33
1 0 0 1 0 1 0	74	277	-18
1 0 0 1 0 1 1	75	274	-70
1 0 0 1 1 0 0	76	270	-40
1 0 0 1 1 0 1	77	266	-2
1 0 0 1 1 1 0	78	263	-34
1 0 0 1 1 1 1	79	260	-60
1 0 1 0 0 0 0	80	256	0
1 0 1 0 0 0 1	81	253	-13
1 0 1 0 0 1 0	82	250	-20
1 0 1 0 0 1 1	83	247	-21
1 0 1 0 1 0 0	84	244	-16
1 0 1 0 1 0 1	85	241	-5
1 0 1 0 1 1 0	86	239	-74
1 0 1 0 1 1 1	87	236	-52
1 0 1 1 0 0 0	88	233	-24
1 0 1 1 0 0 1	89	231	-79
1 0 1 1 0 1 0	90	228	-40

Table 2-2 Sector Selection List (Disposition Switch = 1) (cont'd)

SECTOR SWITCH SETTING



TRACK = 20,480 BYTES

$2^6 2^5 2^4 2^3 2^2 2^1 2^0$	SECTORS PER TRACK	BYTES PER SECTOR	LAST SECTOR SHORTER
1 0 1 1 0 1 1	91	226	-86
1 0 1 1 1 0 0	92	223	-36
1 0 1 1 1 0 1	93	221	-73
1 0 1 1 1 1 0	94	218	-12
1 0 1 1 1 1 1	95	216	-40
1 1 0 0 0 0 0	96	214	-64
1 1 0 0 0 0 1	97	212	-84
1 1 0 0 0 1 0	98	209	-2
1 1 0 0 0 1 1	99	207	-13
1 1 0 0 1 0 0	100	205	-20
1 1 0 0 1 0 1	101	203	-23
1 1 0 0 1 1 0	102	201	-22
1 1 0 0 1 1 1	103	199	-17
1 1 0 1 0 0 0	104	197	-8
1 1 0 1 0 0 1	105	196	-100
1 1 0 1 0 1 0	106	194	-84
1 1 0 1 0 1 1	107	192	-64
1 1 0 1 1 0 0	108	190	-40
1 1 0 1 1 0 1	109	188	-12
1 1 0 1 1 1 0	110	187	-90
1 1 0 1 1 1 1	111	185	-55
1 1 1 0 0 0 0	112	183	-16
1 1 1 0 0 0 1	113	182	-86
1 1 1 0 0 1 0	114	180	-40
1 1 1 0 0 1 1	115	179	-105
1 1 1 0 1 0 0	116	177	-52
1 1 1 0 1 0 1	117	176	-112
1 1 1 0 1 1 0	118	174	-52
1 1 1 0 1 1 1	119	173	-107
1 1 1 1 0 0 0	120	171	-40
1 1 1 1 0 0 1	121	170	-90
1 1 1 1 0 1 0	122	168	-16
1 1 1 1 0 1 1	123	167	-61
1 1 1 1 1 0 0	124	166	-104
1 1 1 1 1 0 1	125	164	-20
1 1 1 1 1 1 0	126	163	-58
1 1 1 1 1 1 1	127	162	-94
0 0 0 0 0 0 0	128	160	0

2.5 CABINET/RACK INSTALLATION

The mounting bracket (see Figure 2-8) shipped with the D22x7 secures the disk drive when it is installed in a cabinet or rack.

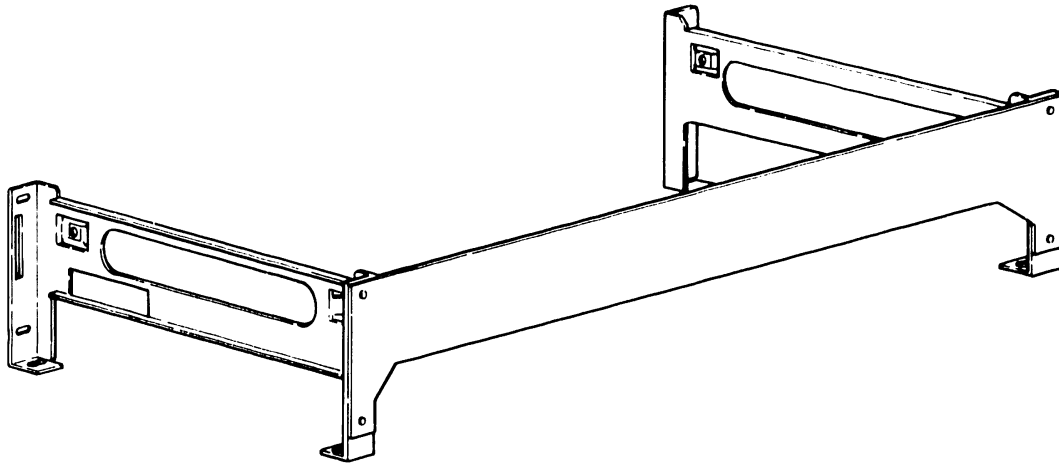


Figure 2-8 Mounting Bracket

The drive can be installed in either a horizontal or vertical position as shown in Figure 2-9. Figure 2-9 also shows the required ventilation for each mounting position. An air flow of 1.1 cubic yards per minute (1.1 yd³/min) is required on a 0.4-inch surface.

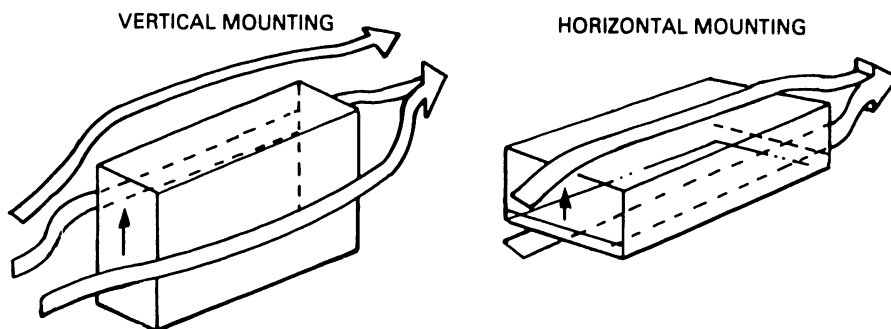


Figure 2-9 Vertical and Horizontal Installation

When installing the disk drive, first verify that the mounting holes in the rack or cabinet align with the holes in the mounting bracket. Refer to Appendix B for information on unit dimensions.

2.6 CABLE CONNECTIONS

This section describes the different connectors for the interface signal cables (cables A and B), for the system ground cable, and for the power cable.

2.6.1 Interface Cables

Interface cables A and B are connected to the G9QSV PCB as shown in Figure 2-10.

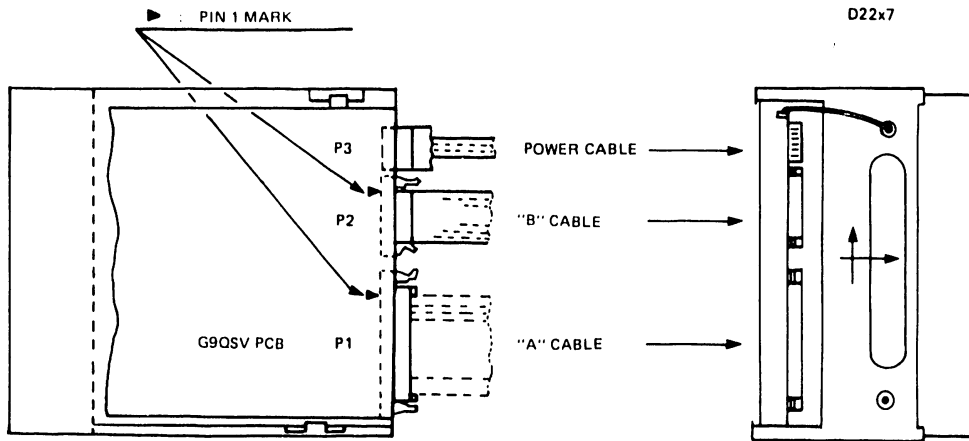


Figure 2-10 Interface Cable Connections

Cable B should not exceed 49.2 ft (15 m) in length. Cable A should not exceed 98.4 ft (30 m) in length. In a daisy chain configuration, the total length of cable A (from the first to the last drive) should not exceed 98.4 ft (see Figure 2-11).

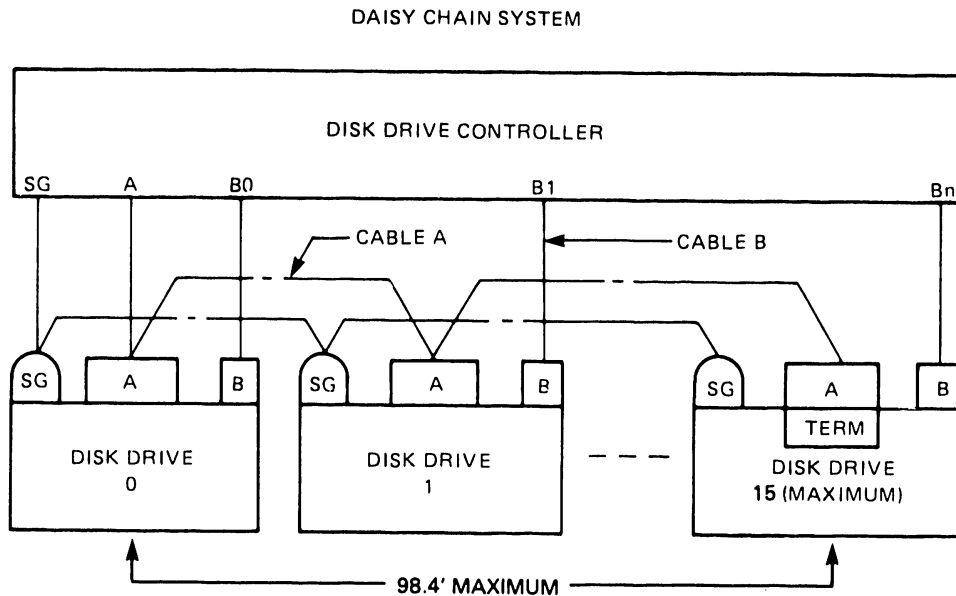


Figure 2-11 Daisy-Chain Cabling

2.6.2 System Ground Cable

Connect a system ground cable to the Signal Ground terminal at the rear of the disk drive (see Figure 2-12).

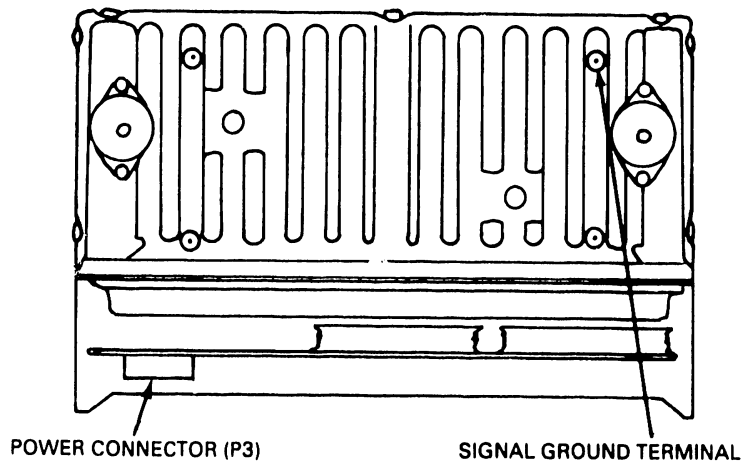


Figure 2-12 Signal Ground and Power Connections

2.6.3 Power Cable

Connect the power cable to connector P3 at the rear of the disk drive (see Figure 2-12).

2.7 LOCK CONTROL ASSEMBLY

When the disk drive is shipped, the spindle and actuator positioner are secured with a lock device to prevent movement. This device must be released prior to operating the drive. To unlock the spindle and actuator, slide the lock control lever (see Figure 2-13) to the FREE position.

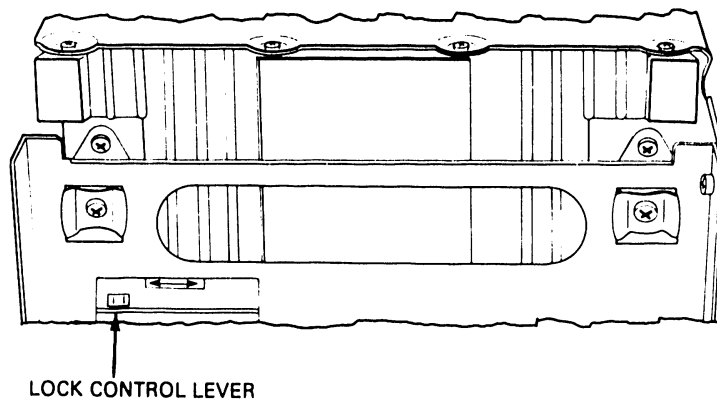


Figure 2-13 Lock Control Assembly

CHAPTER

3

PREVENTIVE MAINTENANCE & TROUBLESHOOTING

Chapter 3

Preventive Maintenance and Troubleshooting



This chapter outlines maintenance and troubleshooting procedures for the D22x7 disk drive. It describes preventive maintenance, test operations and test points, and associated waveforms. Refer to Appendix C for information on how to use the optional diagnostic panel.

3.1 GENERAL MAINTENANCE RULES

Always observe the following general rules when replacing parts or servicing the disk drive.

- Turn off the disk drive and disconnect all ac power to the drive power supply before performing any maintenance procedure on the drive.
- Never remove or install any PCB, or disconnect any connector, plug, or wire while power is on.
- When removing any connector, grasp it firmly by its sides and pull it out. Do not remove any connector by pulling on the wire bundle.
- Do not remove any parts that are not specified in the replacement procedures.
- Package PCBs in an electrostatic-free envelope when they are transported.

3.2 MAINTENANCE TOOLS

Standard maintenance procedures require the following common hand tools.

- No. 1 Phillips screwdriver
- No. 2 Phillips screwdriver
- Small straight-tip screwdriver

The following instruments are also required.

- High impedance voltmeter
- Oscilloscope (Tektronics 465 or equivalent)

A rotor handler (NEC part number 134-233280) and a diagnostic panel (NEC part number 134-200267) are recommended.

3.3 PREVENTIVE MAINTENANCE

Preventive maintenance is limited to periodic dusting of the surface of the drive. No lubrication or further cleaning is required or recommended. D22x7 disk drives contain no parts that require scheduled adjustment or replacement.

NOTE

The air filter in the sealed head/disk assembly cannot be replaced or cleaned.

As part of a periodic preventive maintenance routine, run system-specific (software) diagnostic programs or use the diagnostic panel to run offline test procedures (see Appendix C).

3.4 TROUBLESHOOTING

If a fault occurs, attempt to isolate the fault to the host, to the host controller, to the disk drive, or to another connecting component. For faults isolated to the disk drive, use the troubleshooting procedures outlined in the following flowcharts. These procedures localize the fault to a specific drive component.

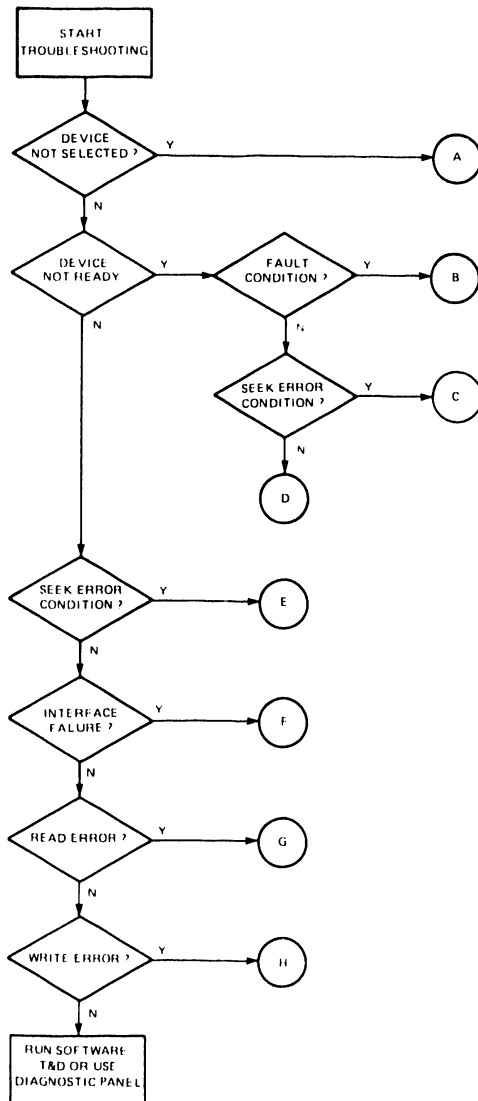


Figure 3-1 Troubleshooting Flowcharts

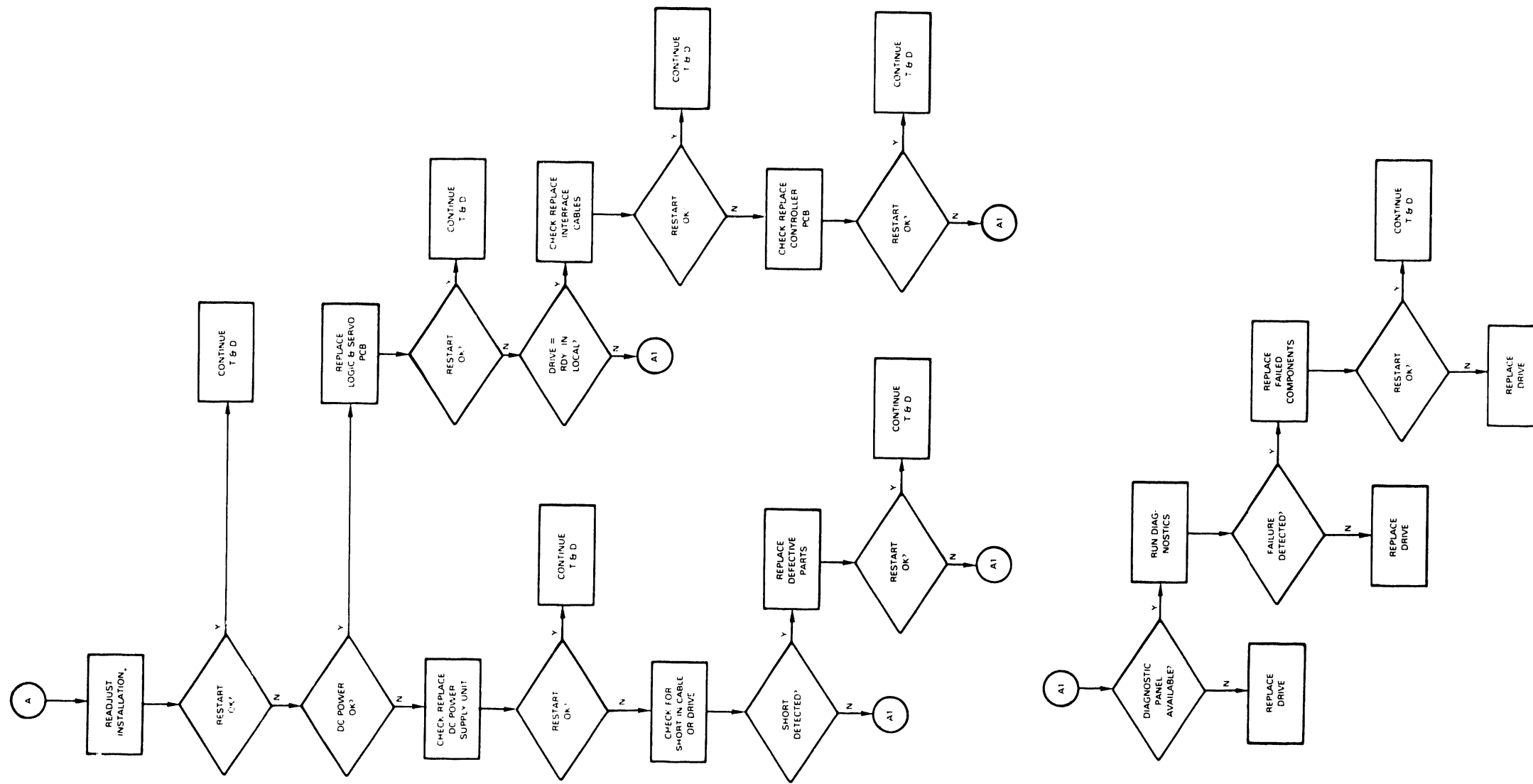


Figure 3-1 Troubleshooting Flowcharts (cont'd)

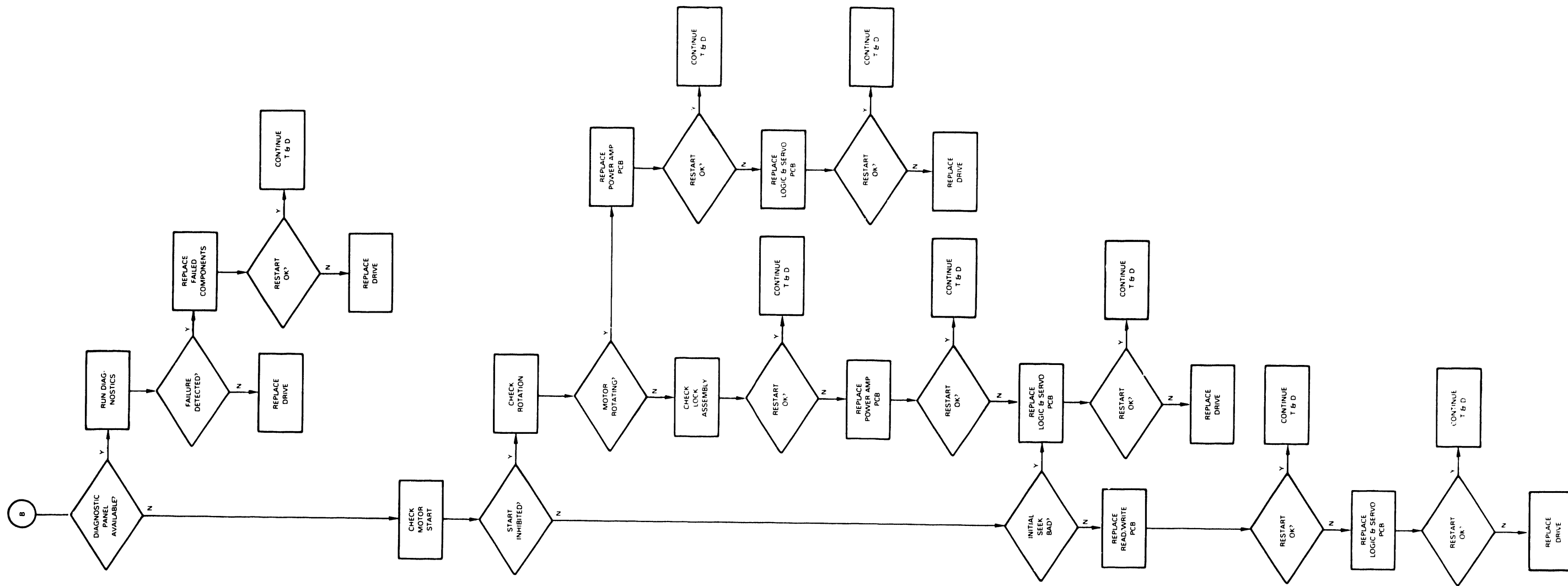


Figure 3-1 Troubleshooting Flowcharts (cont'd)

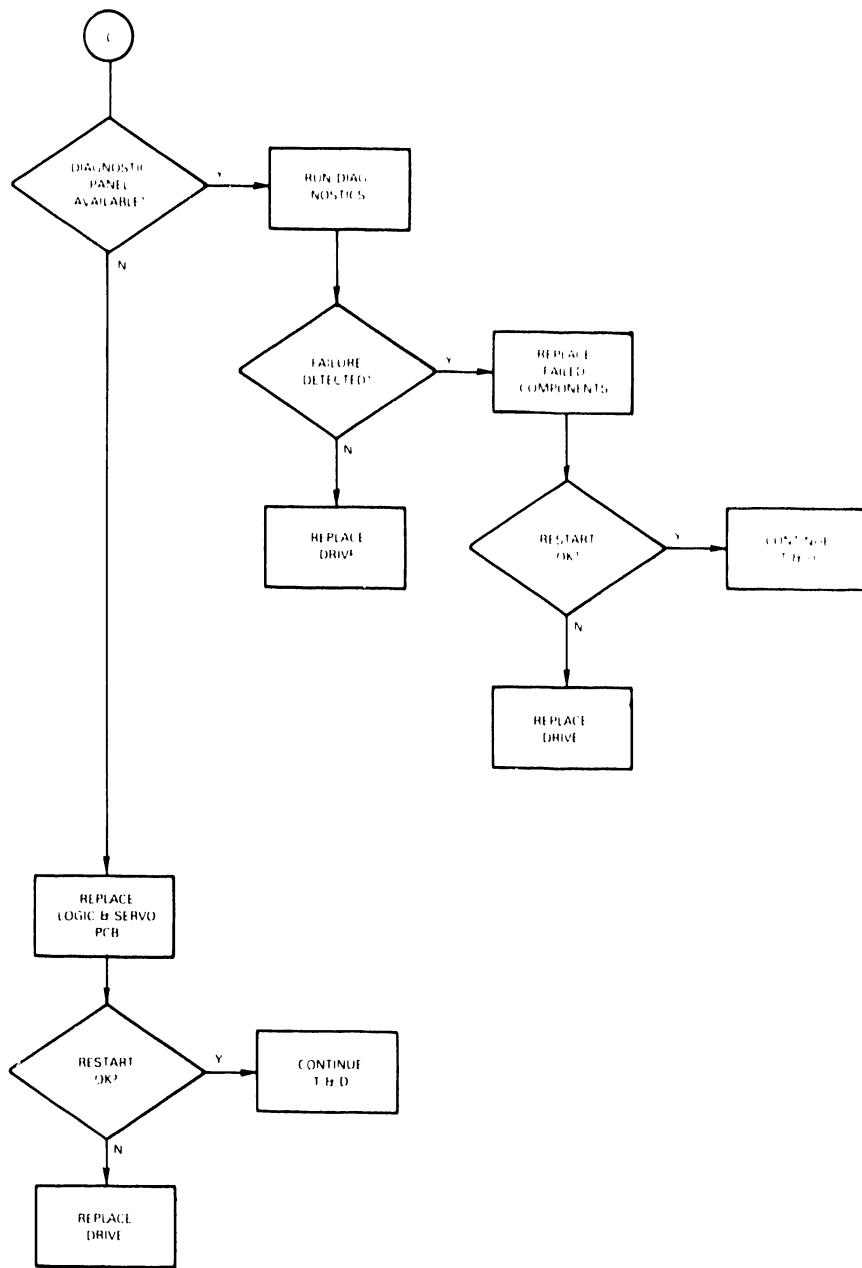


Figure 3-1 Troubleshooting Flowcharts (cont'd)

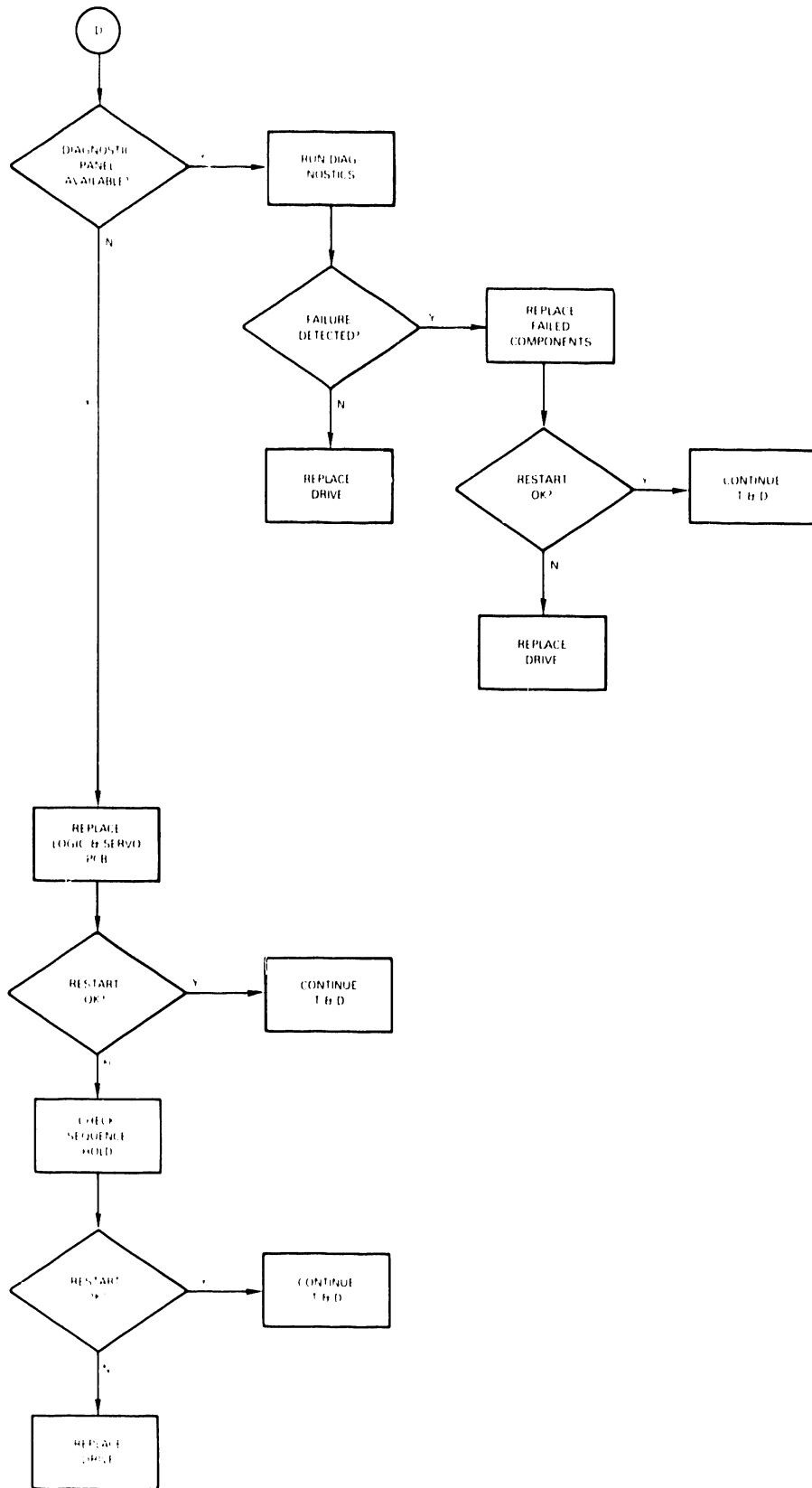


Figure 3-1 Troubleshooting Flowcharts (cont'd)

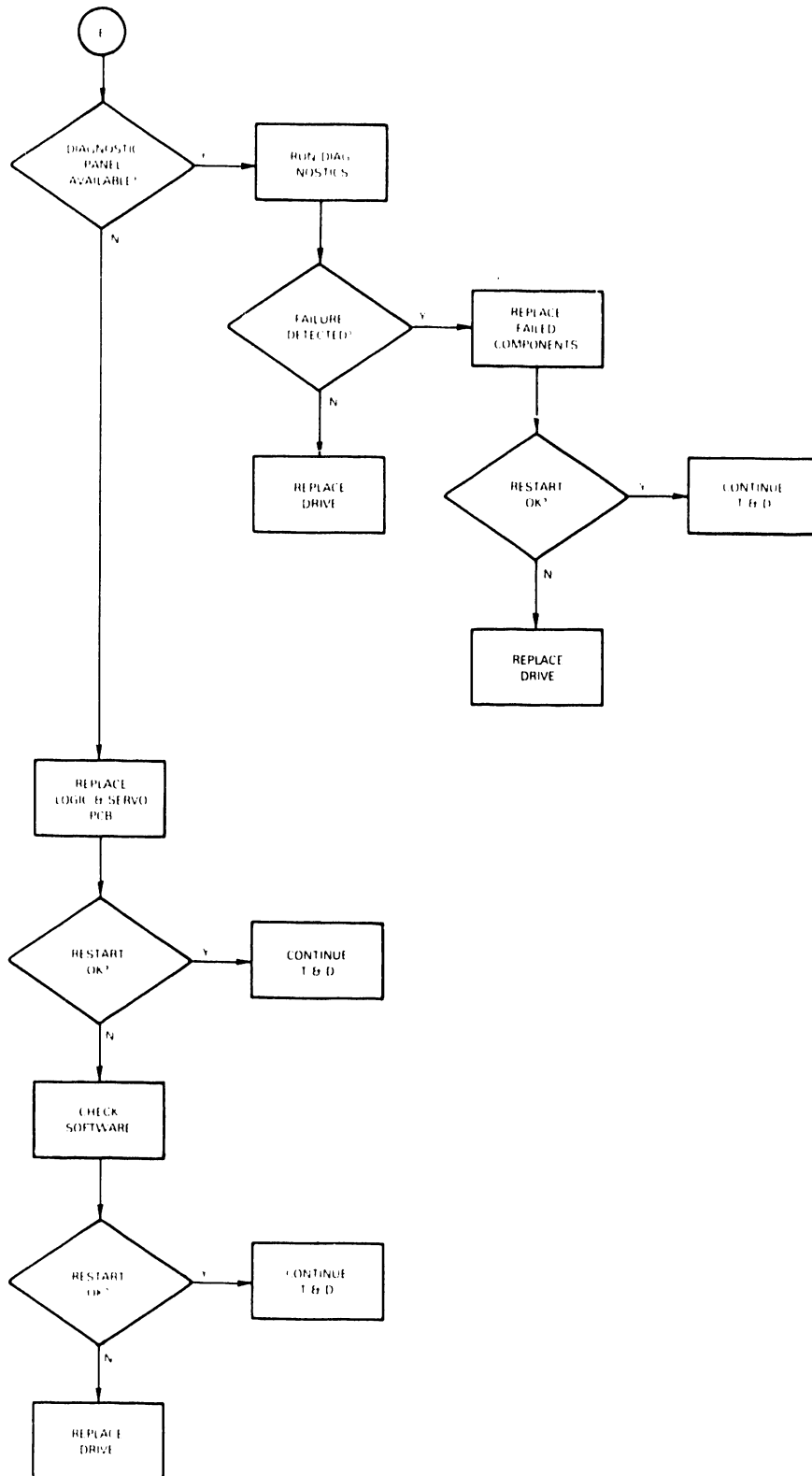


Figure 3-1 Troubleshooting Flowcharts (cont'd)

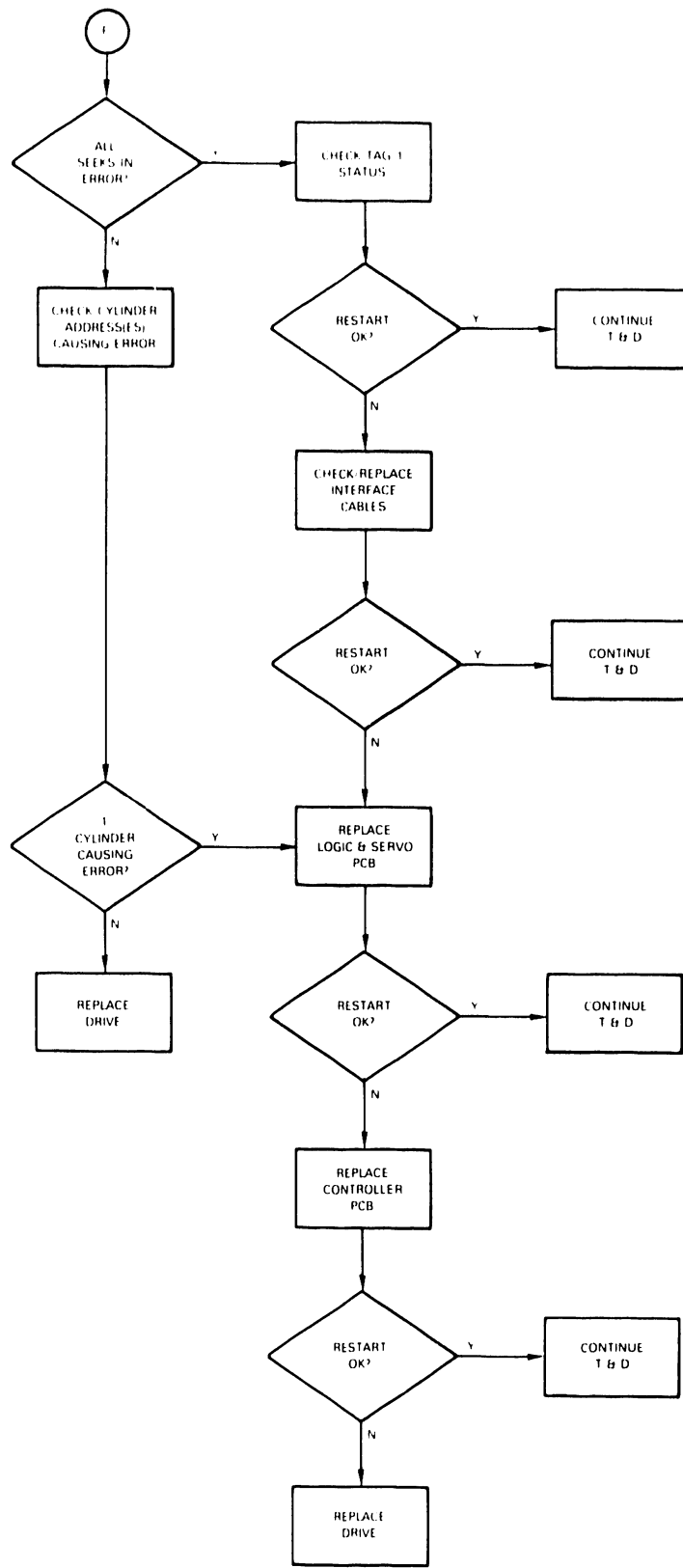


Figure 3-1 Troubleshooting Flowcharts (cont'd)

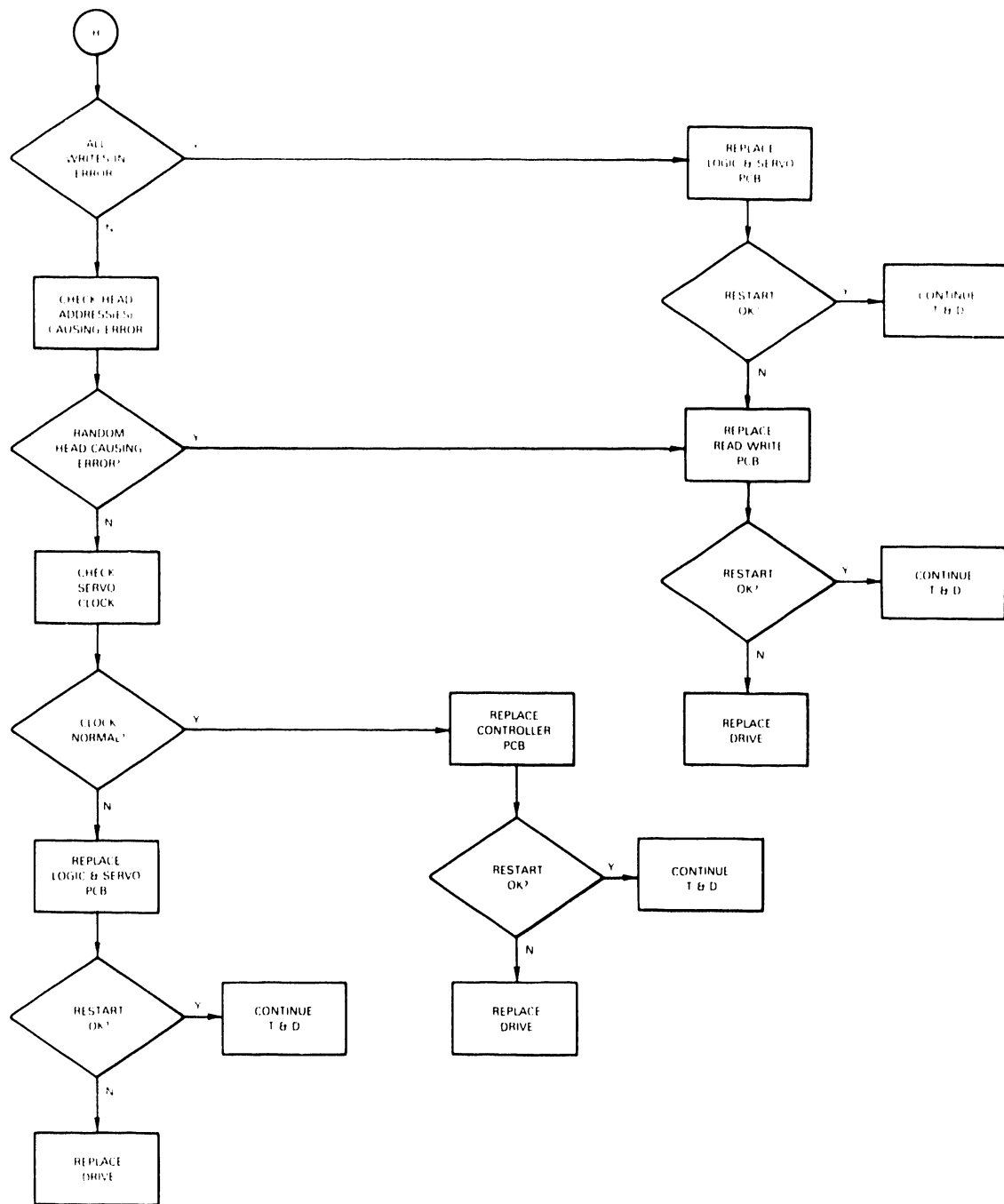


Figure 3-1 Troubleshooting Flowcharts (cont'd)

3.5 SERVO SYSTEM SIGNALS

Test point locations on the G9QSV logic and servo PCB are shown in Figure 3-2. Figures 3-3 and 3-4 show how to access these test points from the exterior of the D22x7 drive. Table 3-1 lists the signal output and signal level from each test point.

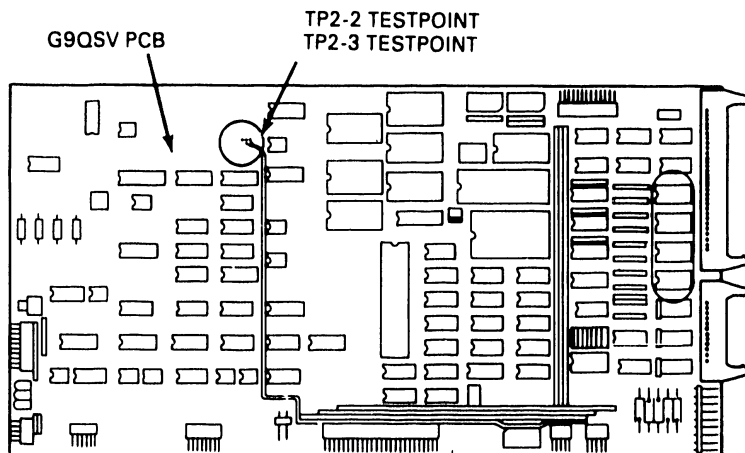


Figure 3-2 G9QSV Test Point Locations

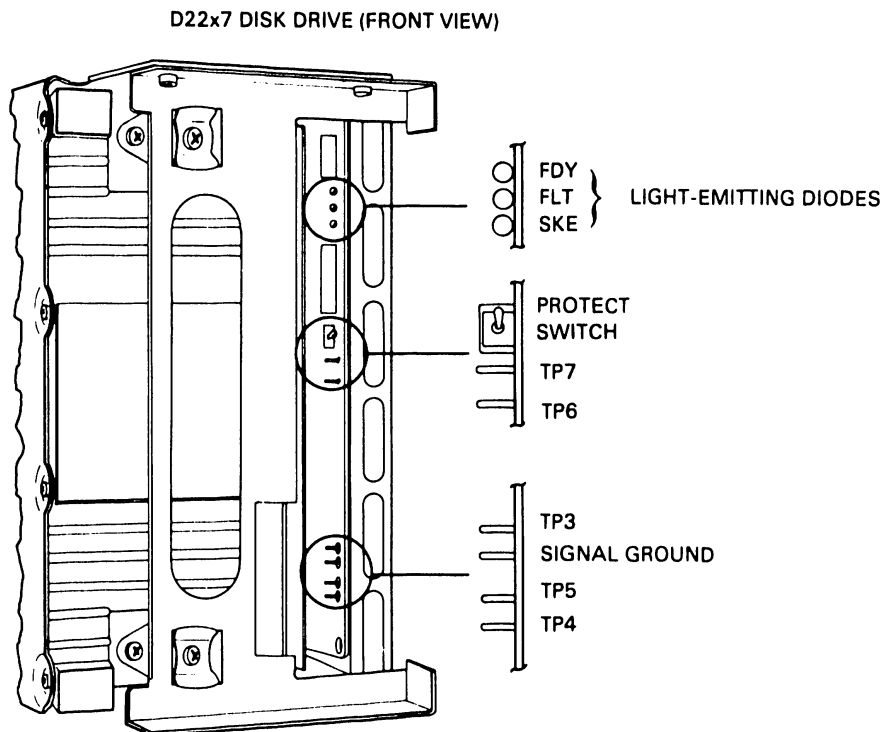


Figure 3-3 Test Points — Front View

D22x7 DISK DRIVE (SIDE VIEW)

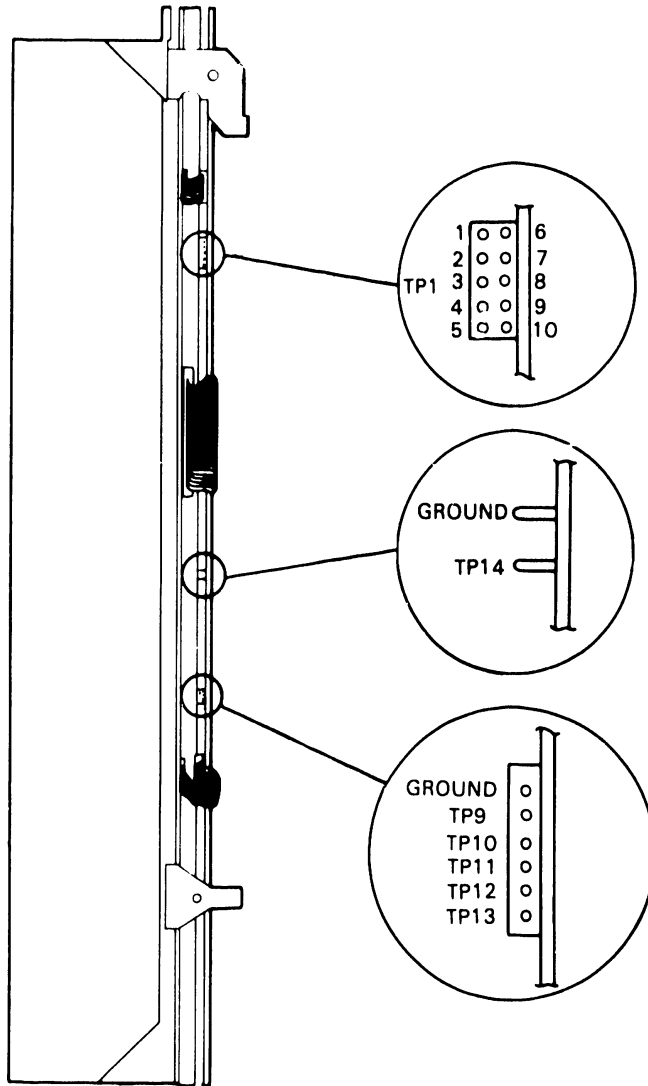


Figure 3-4 Test Points — Side View

Table 3-1 Test Point Signal Outputs

TEST POINT	SIGNAL	LEVEL
TP-2	Tripulse input (positive polarity)	20-90 mVpp
TP2-3	Tripulse input (negative polarity)	20-90 mVpp
TP3	Automatic gain control (AGC) standard voltage	1.4 V (approx)
TP4	AGC control voltage	6.0 V (approx)
TP5	Dipulse output (AGC output)	6.0 Vpp (approx)
TP6	Q position signal	0 to ± 6.0 V
TP7	N position signal	0 to ± 6.0 V
TP8	Servo window signal (NW1)	TTL levels
TP9	Speed set signal	0 to +8.0 V
TP10	Speed signal	0 to ± 8.0 V
TP11	Rectified speed signal	0 to -8.0 V
TP12	Noise injunction terminal	0 to 2.0 Vpp
TP13	Selected position signal	0 to ± 6.0 V
TP14	Servo current (0.5 V corresponds to 1.0A)	0 to 1.5 Vpp

Normal servo system signals match the specifications and waveforms listed in Table 3-2.

Table 3-2 G9QSV Servo Signals

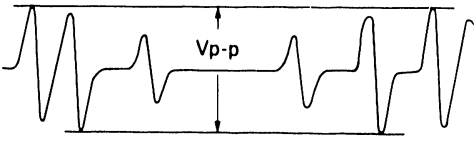
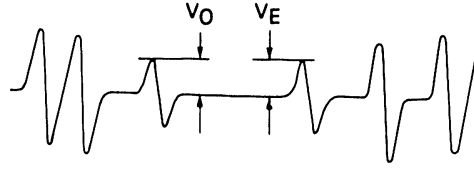
FUNCTION	TEST POINT	COMMENTS
Tripulse input amplitude	TP2-2, TP2-3	 <p data-bbox="852 724 1323 787">40mV_{pp} ≤ V_{pp} ≤ 180mV_{pp} at Cylinder 000 and Cylinder 1023</p>
AGC output amplitude	TP5	 <p data-bbox="852 1197 1323 1239">V_O, V_E = About 1.6 V_{O-p}</p>
AGC standard voltage	TP3	DC about 1.4V

Table 3-2 G9QSV Servo Signals (cont'd)

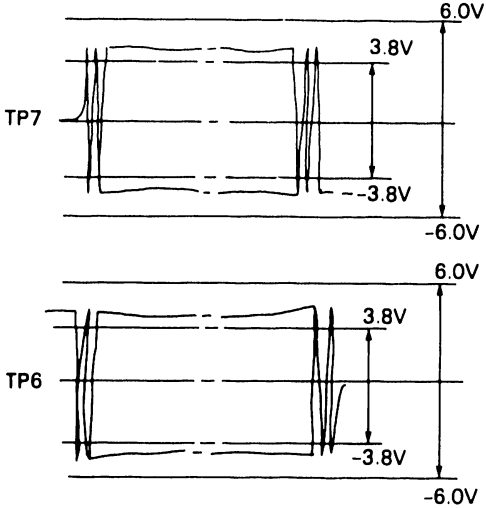
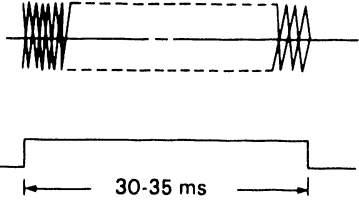
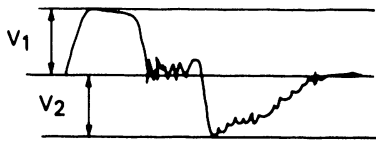
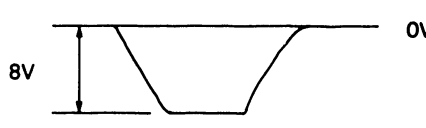
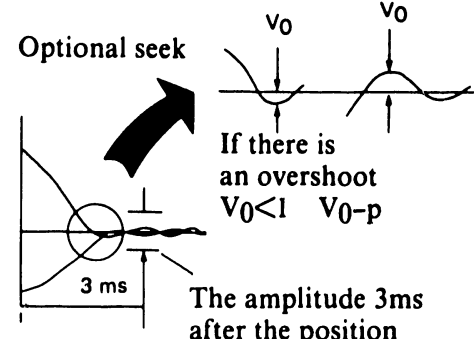
FUNCTION	TEST POINT	COMMENTS
Position signal amplitude	TP6, TP7 TP1-4 of G9QSV is the trigger.	<p>000 ⇌ 1023 Cylinder Repeat Seek</p>  <p>The figure shows two waveforms. The top waveform is labeled TP7 and the bottom is labeled TP6. Both waveforms show a signal that is mostly flat with a sharp, narrow pulse. The pulse amplitude is 3.8V, and the signal range is from -6.0V to 6.0V.</p>
Seek time	TP1-3 TP1-5	<p>000 ⇌ 1023 Cylinder Repeat Seek</p>  <p>The figure shows two diagrams. The top diagram shows a signal with a dashed box around a specific pulse. The bottom diagram shows a pulse with a horizontal arrow below it indicating a duration of 30-35 ms.</p> <p>*The settling time is not included.</p>

Table 3-2 G9QSV Servo Signals (cont'd)

FUNCTION	TEST POINT	COMMENTS
<p>Current waveform</p>	<p>TP14</p> <p>The trigger is TP1-4 and TP1-3 of G9QSV.</p>	<p>000 ⇌ 1023 Cylinder Repeat Seek</p>  <p>$V_1 + 0.8 - 1.2 \text{ V}$ $V_2 < 1.3 \text{ V}$</p> <p>(The polarity changes according to the seek direction.)</p>
<p>Speed profile follows</p>	<p>TP10, TP11</p> <p>The trigger is TP1-4 and TP1-3 of G9QSV.</p>	<p>000 ⇌ 1023 Cylinder Repeat Seek</p>  <p>The speed set signal (TP10) is inverted and made to overlap the speed signal (TP11).</p>
<p>Position transient response</p>	<p>TP13</p> <p>The trigger is TP1-5 of G9QSV.</p>	<p>Optional seek</p>  <p>If there is an overshoot $V_0 < 1 V_{0-p}$</p> <p>The amplitude 3ms after the position mode is set shall be less than $0.5V_{0p}$.</p>

3.6 SEEK OPERATIONS TESTING

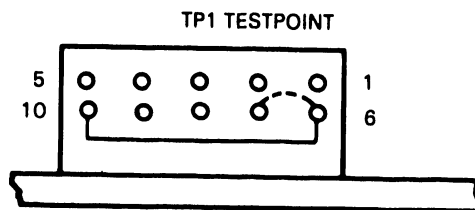
A repeat seek or a one-cylinder seek operation can be initiated by connecting strapping wire to TP1.

3.6.1 Repeat Seek Operation

A repeat seek operation seeks from the low cylinder (cylinder 000) to the high cylinder (cylinder 1023), and then from the high cylinder back to the low cylinder. To perform a repeat seek operation, connect wires to TP1 as shown in Figure 3-5.

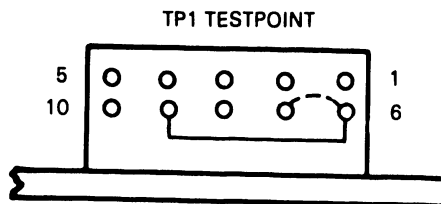
3.6.2 One-Cylinder Seek Operation

A one-cylinder seek operation seeks from cylinder 000, to cylinder 001, to cylinder 002, and continues to the high cylinder. From the high cylinder, the unit seeks to cylinder 1022, to cylinder 1021, and continues back to the low cylinder. To perform a one-cylinder seek operation, connect wires to TP1 as shown in Figure 3-6.



IF PINS 6 AND 7 ARE CONNECTED, THE SEEK INTERVAL TIME IS 100 MILLISECONDS.

Figure 3-5 Repeat Seek Using TP1



IF PINS 6 AND 7 ARE CONNECTED, THE SEEK INTERVAL TIME IS 1.5 SECONDS.

Figure 3-6 One-Cylinder Seek Using TP1

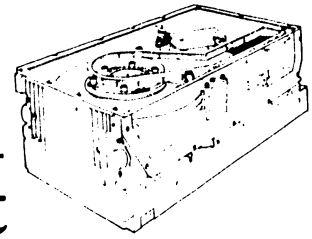
CHAPTER

4

REMOVAL AND REPLACEMENT PROCEDURES

Chapter 4

Removal and Replacement Procedures



This chapter provides procedures for removing and replacing D22x7 components and assemblies. Field-replaceable items are listed in Table 4-1.

Table 4-1 D22x7 Field Replaceable Components

COMPONENT/ASSEMBLY	NEC PART NUMBER
G9QSV Logic and Servo PCB	134-832956
G9QSR Power Amplifier PCB	134-832952
G9QSP Read/Write PCB	134-832950
Earth Pad Assembly	134-232861
Motor Stator Assembly	806-942281-003

4.1 G9QSV (LOGIC AND SERVO) PCB REMOVAL

Follow these steps to remove the G9QSV logic and servo PCB.

1. Turn off the D22x7.
2. Disconnect the dc power supply.
3. Loosen the two screws that secure the board cover to the drive unit (see Figure 4-1).

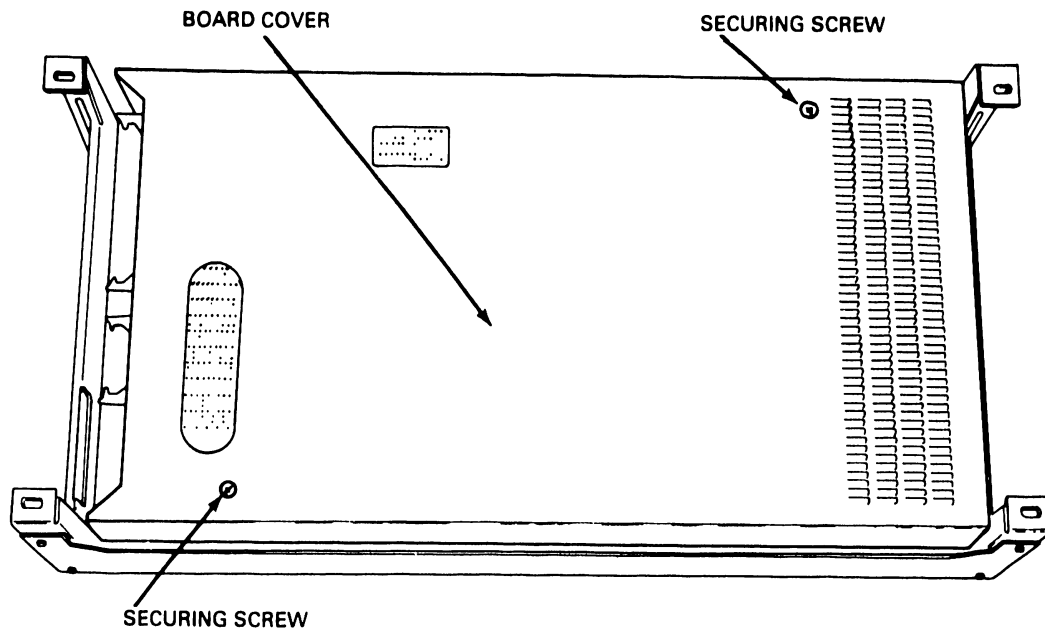


Figure 4-1 D22x7 Board Cover

4. Lift the board cover straight up to remove it.
5. Disconnect cable connectors J55, J54, J53, and J41 (see Figure 4-2).

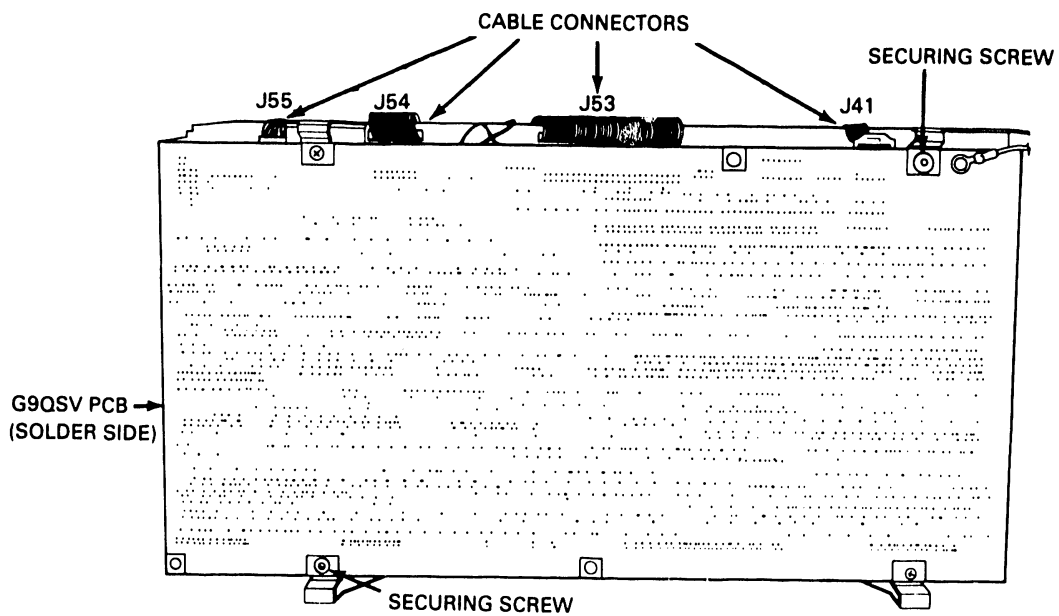


Figure 4-2 G9QSV Cable Connectors

6. Remove the two screws that fasten the G9QSV to the drive unit (see Figure 4-2).
7. Lift the G9QSV PCB straight up to remove it.

When installing a new G9QSV PCB, be sure that the DIP switch, jumper, and terminating resistor configurations on the replacement board match those on the old board.

4.2 G9QSP (READ/WRITE) PCB REMOVAL

Follow these steps to remove the G9QSP read/write PCB.

1. Turn off the D22x7.
2. Disconnect the dc power supply.
3. Remove the G9QSV PCB (see Section 4.1).
4. Remove the four screws that secure the larger air separator (air separator A) to the drive unit (see Figure 4-3).

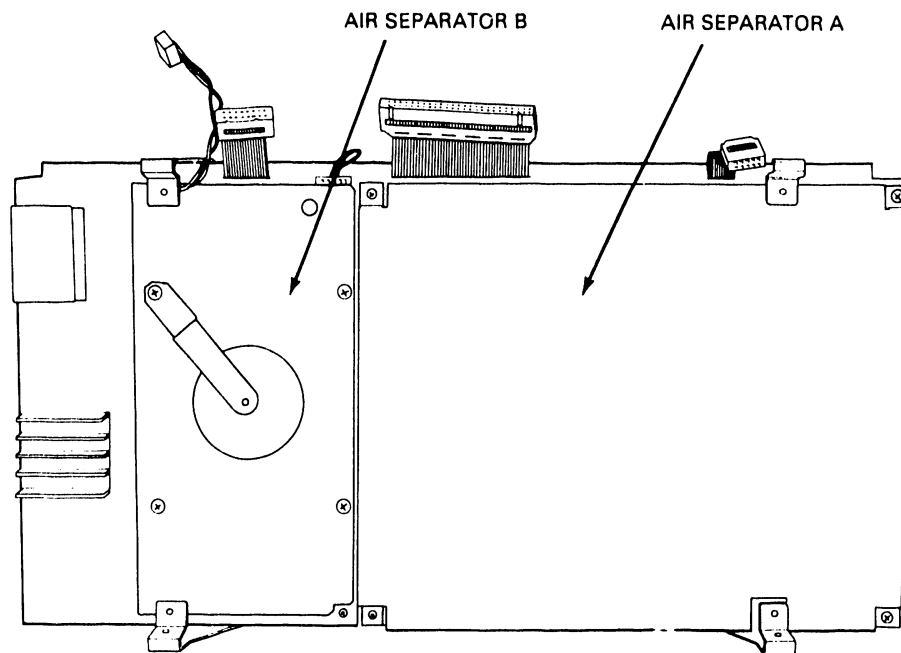


Figure 4-3 D22x7 Air Separators

5. Lift air separator A straight up to remove it.
6. Disconnect cable connectors J31 and J32 (see Figure 4-4).
7. Lift the G9QSP PCB slightly and slide it away from the earth pad assembly to remove it (see Figure 4-4).

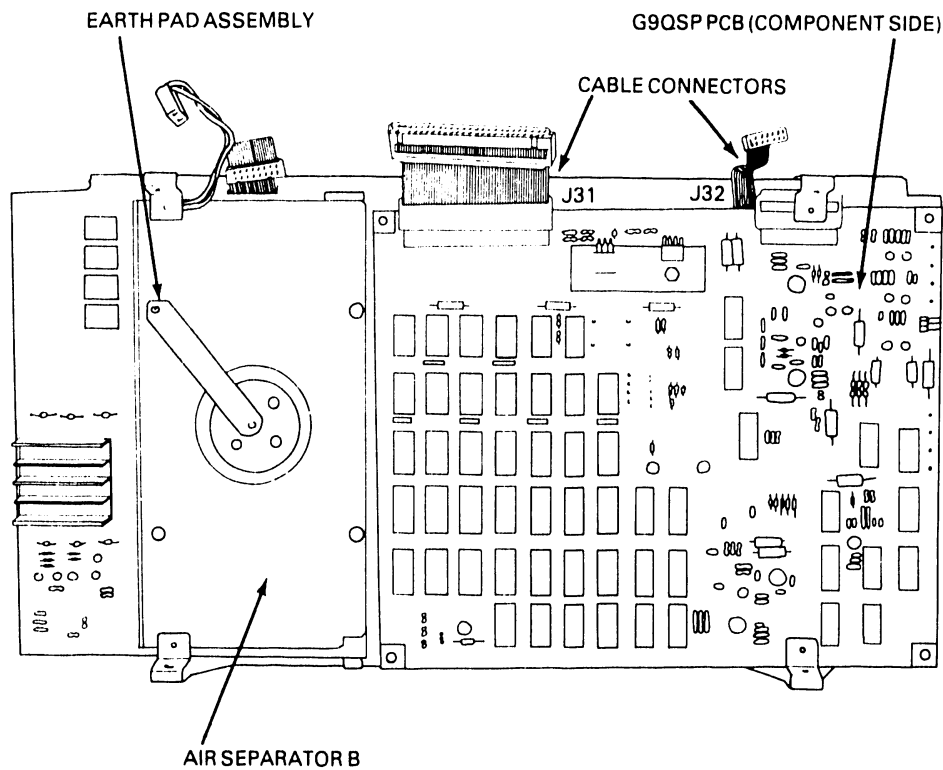


Figure 4-4 G9QSP Cable Connectors

4.3 EARTH PAD ASSEMBLY REMOVAL

Follow these steps to remove the earth pad assembly.

1. Turn off the D22x7.
2. Disconnect the dc power supply.
3. Remove the G9QSV PCB (see Section 4.1).
4. Remove the screw that attaches the earth pad assembly to the smaller air separator (air separator B — see Figure 4-4).
5. Lift the earth pad assembly straight up to remove it.

4.4 G9QSR (POWER AMPLIFIER) PCB REMOVAL

Follow these steps to remove the G9QSR power amplifier PCB.

1. Turn off the D22x7.
2. Disconnect the dc power supply.
3. Remove the G9QSV PCB (see Section 4.1).
4. Remove the earth pad assembly (see Section 4.3).
5. Remove the three screws that secure air separator B to the drive unit (see Figure 4-4).
6. Lift air separator B and slide it to the side to remove it.
7. Disconnect cable connectors J22, J23, J24, and J44 (see Figure 4-5).

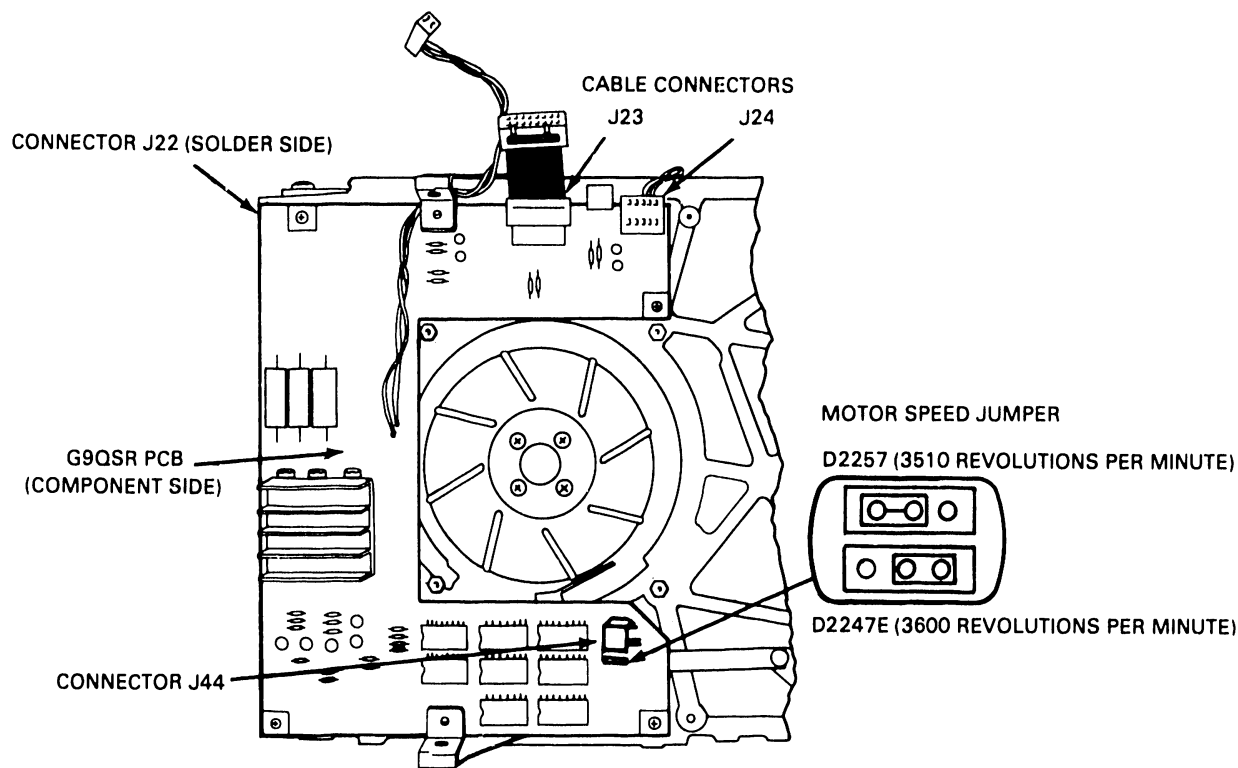


Figure 4-5 G9QSR Cable Connectors

8. Remove the three screws that attach the G9QSR PCB to the drive unit (see Figure 4-5).
9. Lift the G9QSR PCB slightly and slide it to the side to remove it.

When installing a new G9QSR PCB, be sure that the motor speed jumper (see Figure 4-5) is correctly set. Figure 4-5 shows the correct settings for D2247E and D2257 disk drives.

4.5 MOTOR STATOR ASSEMBLY REMOVAL

Follow these steps to remove the motor stator assembly.

1. Turn off the D22x7.
2. Disconnect the dc power supply.
3. Remove the G9QSV PCB (see Section 4.1).
4. Remove the earth pad assembly (see Section 4.3).
5. Remove the G9QSR PCB (see Section 4.4).
6. Loosen the four screws that secure the fan (see Figure 4-6) and remove the fan by lifting it straight up.

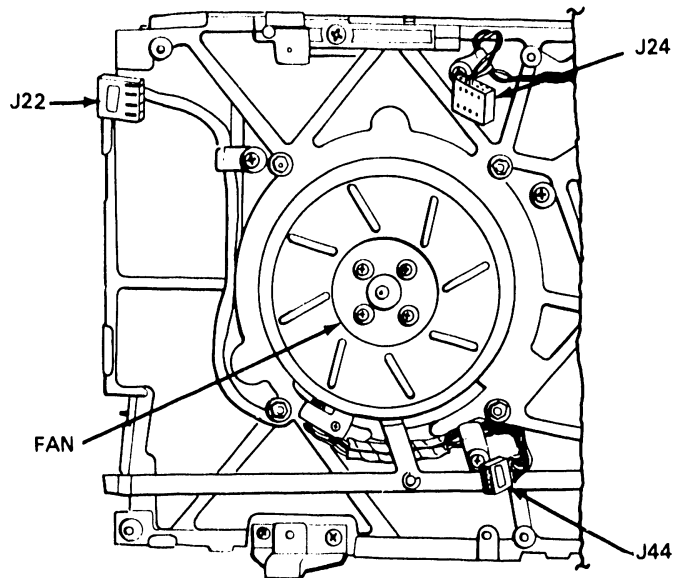


Figure 4-6 D22x7 Fan

7. Remove the rotor using the special rotor handling tool (see Figure 4-7).
8. Loosen the three screws that secure the claw stopper (see Figure 4-7) and remove the claw stopper.
9. Loosen the three screws that secure the motor shield and remove it.
10. Slide the motor stator assembly carefully along the spindle to remove it.

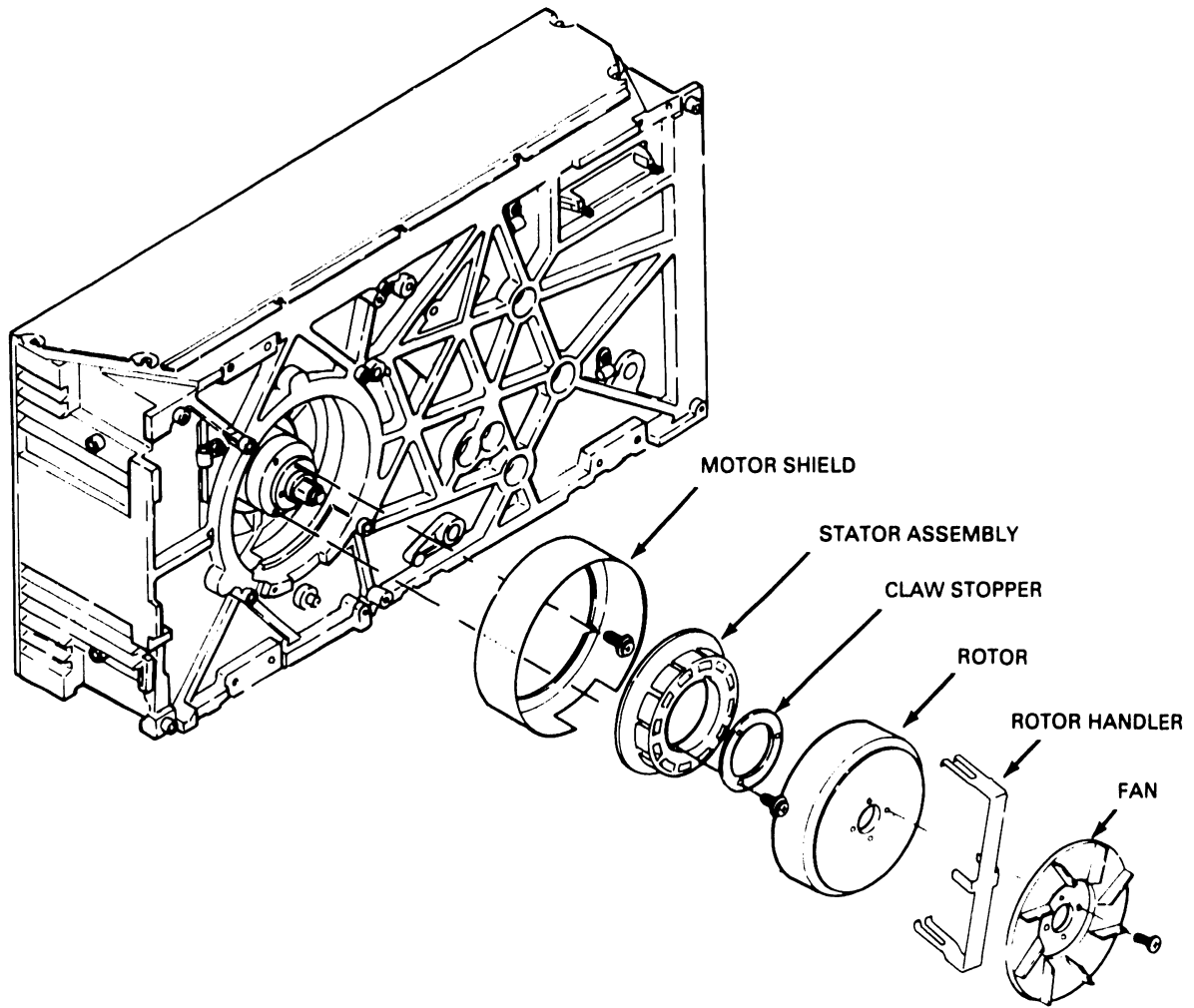


Figure 4-7 D22x7 Stator Assembly

CHAPTER

5

ILLUSTRATED

PARTS

BREAKDOWN

Chapter 5

Illustrated Parts Breakdown

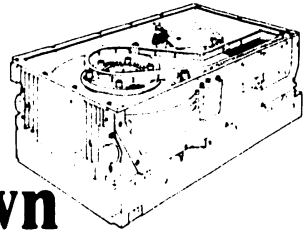


Figure 5-1 shows the D22x7 standard assembly. Figure 5-2 shows the sealed head/disk enclosure along with its external parts. Items are described in the accompanying tables.

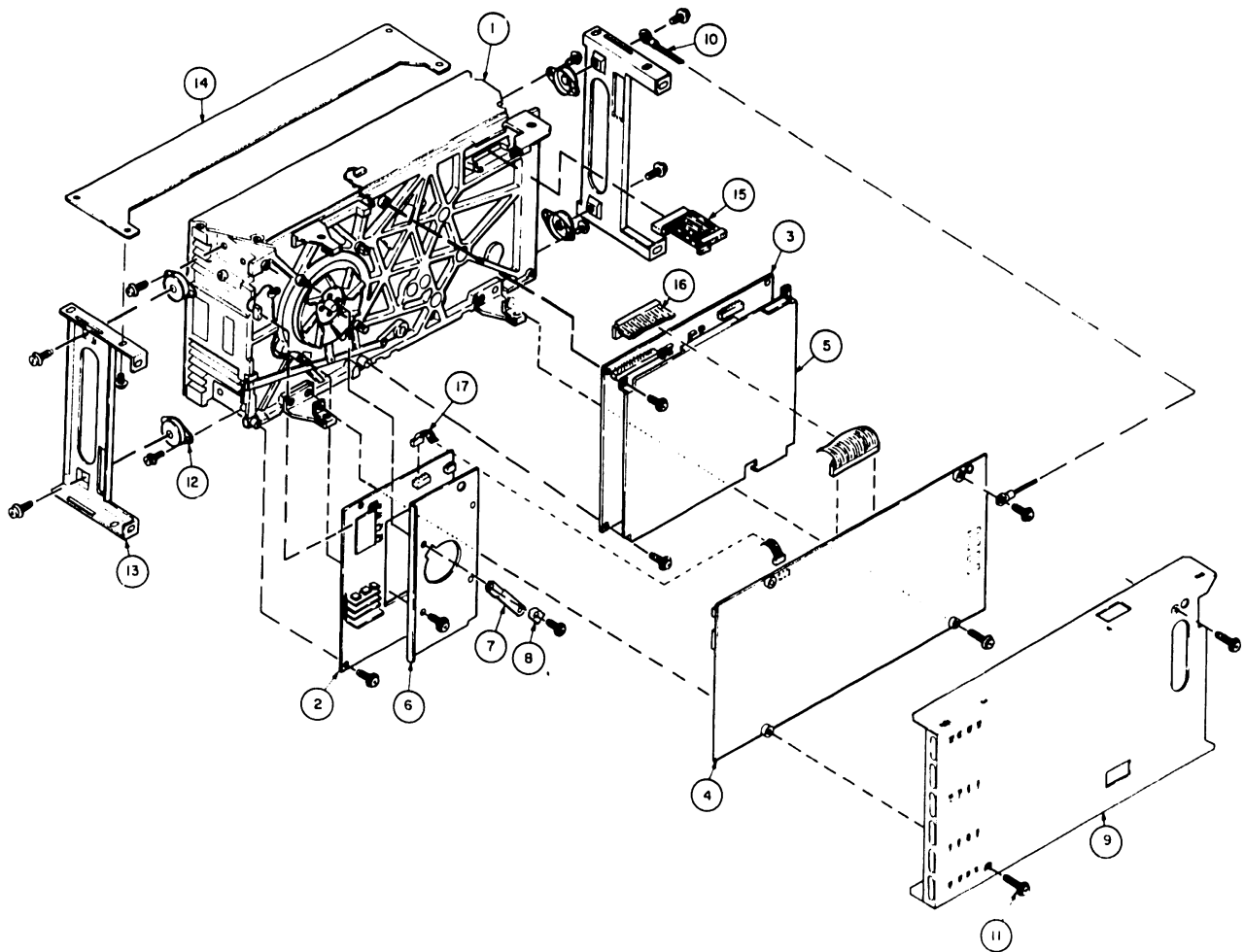


Figure 5-1 D22x7 Standard Assembly

Table 5-1 D22x7 Standard Assembly

ITEM	DESCRIPTION	PART NUMBER	QUANTITY	
			D2247E	D2257
1	047 Head/Disk Enclosure	134-200339-402	1	
1	057 Head/Disk Enclosure	134-200339-502		1
2	G9QSR PCB	134-832952	1	1
3	G9QSP PCB	134-832950	1	1
4	G9QSV PCB	134-832956	1	1
5	Air Separator (A)	134-247626	1	1
6	Air Separator (B)	134-248945	1	1
7	Earth Pad Assembly	134-232861	1	1
8	Spring Clamp	134-247779	1	1
9	Board Cover	134-249448	1	1
10	Grounding Cable	134-232933-0	1	1
11	Screw	805-300003-008	2	2
12	Cushion (Rubber)	806-937115	4	4
13	Bracket Frame	134-249453	2	2
14	Bracket Plate	134-247929	1	1
15	Head/Disk Enclosure Cable Assembly	134-232842	1	1
16	G9QSP PCB Cable Assembly	134-233527	1	1
17	G9QSR PCB Cable Assembly	134-233528	1	1

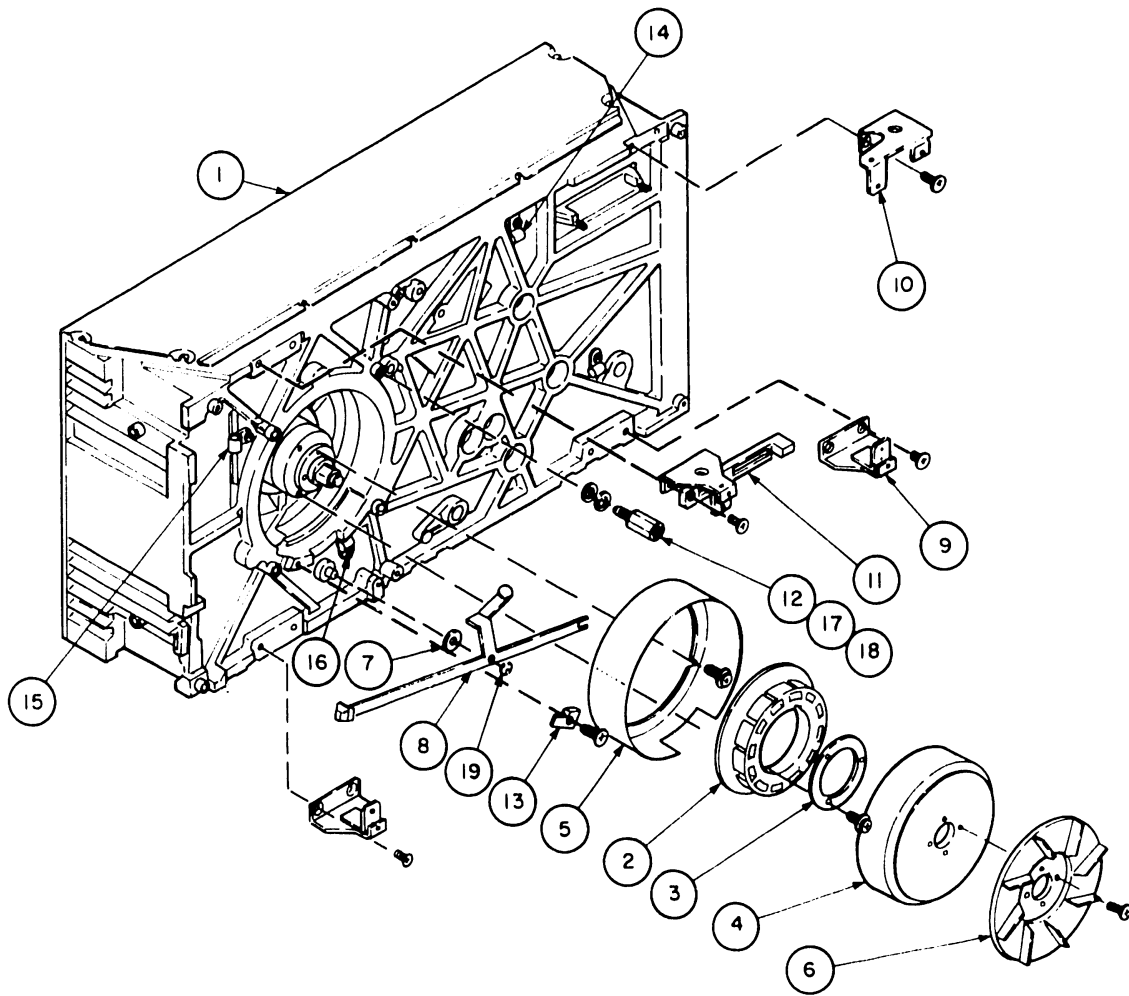


Figure 5-2 D22x7 Head/Disk Enclosure (External Parts)

Table 5-2 Head/Disk Enclosure External Parts

ITEM	DESCRIPTION	PART NUMBER	QUANTITY	
			D2247E	D2257
1	047 Head/Disk Enclosure	134-200339-402	1	
1	057 Head/Disk Enclosure	134-200339-502		1
2	Stator Assembly	806-942281-003	1	1
3	Claw Stopper	134-247662	1	1
4	Rotor	806-942281-002	1	1
5	Motor Shield	134-247782	1	1
6	Fan	134-247663	1	1
7	Pivot Spacer	134-247674	1	1
8	Stopper Link Assembly	134-233039	1	1
9	PCB Support A	134-233510	3	3
10	PCB Support B	134-249452	1	1
11	PCB Guide	134-248516	1	1
12	Stud	134-247621	4	4
13	Cable Clamp	134-248222	1	1
14	Nylon Clip HK-2N	803-070031-002	3	3
15	Nylon Clip HK-3N	803-070031-003	1	1
16	Nylon Clip HK-4N	803-070031-004	1	1
17	Washer	805-604204	4	4
18	Washer	806-931079-004	4	4
19	E-Ring	803-010001-030	1	1

APPENDIX
A
SCHE-
MATIC
DIAGRAMS

THE SCHEMATICS, WHEN AVAILABLE, ARE ON THE LAST FICHE IN THIS SET.

APPENDIX

B

SPECIFICATIONS

Appendix B

Specifications

Table B-1 Operating Specifications

FEATURE	SPECIFICATION
General	
Start Time	Less than 35 seconds
Stop Time	Less than 25 seconds
Recording Mode	MFM
Interface Mode	NRZ
Head Positioning	Closed servo rotary actuator
Track Following	Modified-dipulse pattern
Basic Power Requirements	
Voltage and Current	+5 Vdc, 4.0 A -5 Vdc, 0.5 A +12 Vdc, 0.6 A -12 Vdc, 0.5 A +24 Vdc, 2.7 A (average) 5.0 A (peak)
Power Dissipation	100 W (average) 150 W (peak)
Heat Generation	86 BTU/hour

Table B-1 Operating Specifications (cont'd)

FEATURE	SPECIFICATION
Environmental	
Temperature (Ambient) Operating Nonoperating Storage*	41° to 104° F (5° to 40° C) 14° to 140° F (-10° to 60° C) -40° to 158° F (-40° to 70° C)
Temperature (Gradient/maximum) Operating Nonoperating Storage	18°F per hour (10°C per hour) 27°F per hour (15°C per hour) 45°F per hour (25°C per hour)
Relative Humidity (No Condensation) Operating Nonoperating Storage	20% to 80% relative humidity 10% to 90% relative humidity 5% to 95% relative humidity
Vibration Operating Nonoperating Storage	0.2G 0.5G 1.5G
Shock Operating Nonoperating Storage	2G (20 ms) 5G (10 ms) 15G (30 ms)
Altitude (Maximum) Operating Nonoperating Storage	10,000 feet (3,048 meters) 40,000 feet (12,192 meters) 40,000 feet (12,192 meters)
*Storage-unopened, as shipped from factory	

Table B-2 Design Specifications

FEATURE	MODEL	
	D2257	D2247E
Unformatted Storage Capacity		
Per Unit (MB)	167.7	103.2
Per Cylinder (bytes)	163,840	100,800
Per Track (bytes)	20,480	20,480
General		
Recording Disks	5	3
Data Heads	8	5
Servo Heads	1	1
Cylinders	1,024	1,024
Track Density (tracks/inch)	960	960
Bit Density (bits/inch)	9,420	8,670
Data Transfer Rate (MB/second)	1.19	1.20
Spindle Rotation (RPM)	3,510	3,600
Average Latency Time (ms)	8.55	8.33
One Cylinder Seek Time (ms)	5	5
Average Seek Time (ms)	20.0	20.0
Maximum Seek Time (ms)	40.0	40.0
Sectors per Track	Switch Selectable	
Reliability		
Mean Time-Between-Failures (MTBF)	12,000 hours	
Mean Time-to-Repair (MTTR)	less than one hour	
Service Life	approximately 5 years	

Table B-3 Physical Dimensions

DIMENSIONS	BASIC UNIT	STANDARD ASSEMBLY*
Width	8.54 in. (217 mm)	8.89 in. (226 mm)
Height	5.47 in. (139 mm)	5.62 in. (143 mm)
Depth	16.53 in. (420 mm)	18.50 in. (470 mm)
Weight	30.46 lbs. (13.8 kg)	32.45 lbs. (14.7 kg)

*The standard assembly includes a frame bracket.

Table B-4 Interface Cable Descriptions

SPECIFICATION	CABLE A	CABLE B
TYPE	Flat cable, 30 twisted pairs	Flat cable, 9 twisted pairs with ground plane and drain wire
IMPEDANCE	100 $\Omega \pm 10 \Omega$	130 $\Omega \pm 15 \Omega$
WIRE	28 AWG, 7 strands	28 AWG, 7 strands
PROPAGATION DELAY TIME	5.6 ns/meter (nominal)	5.5 ns/meter (nominal)
MAXIMUM CABLE LENGTH	98.4 ft. (30 m)	49.2 ft. (15 m)
VOLTAGE RATING	300 V (RMS)	300 V (RMS)
PART NUMBER	Spectra Strip SS-455-248-60	3 M 3476-26

Table B-5 Power Cable Descriptions

CABLE	DESIGNATION	NEC PART NUMBER	WIRE SIZE
DC Cable	0X7 DC Cable	134-233535-GRP-0	AWG 18
AC Cable	DKU000-HAC1	134-232903-GRP-0	AWG 18

Table B-6 Option Cable Descriptions

CABLE	DESIGNATION	NEC PART NUMBER	WIRE SIZE
3-DC Option Cable	DKU000-H3P7	806-942333-200-0	
Operator Panel Cable			AWG 22-32

Table B-7 Interface Connector Descriptions

CABLE	CABLE CONNECTOR ASSEMBLY	G9QSV PCB CONNECTOR ASSEMBLY
A	60-pin connector 3 M, #3334-6000 (or equivalent)	60-pin vertical adapter TPD, #R60L NEC, #802-710100-560 (or equivalent)
B	26-pin connector 3 M, #3399-3000 (or equivalent)	26-pin vertical adapter TPD, #R26L (or equivalent)

Table B-8 DC Power Cable Connector Descriptions

CONNECTOR	NEC PART NUMBER	VENDOR/PART NUMBER
Disk Side Housing	806-927329-009-0	AMP Ltd./87159-9
Disk Side Contact	806-927329-571-0	AMP Ltd./87027-1
Power Supply Side Housing	802-710113-009-0	AMP Ltd./1-480706-0
Power Supply Side Contact	802-710114-002-0	AMP Ltd./350705-1

Table B-9 AC Power Cable Connector Descriptions

CONNECTOR	NEC PART NUMBER	VENDOR/PART NUMBER
Distributor Side Housing	802-710113-503-0	AMP Ltd./350766-1
Distributor Side Contact	802-710114-002-0	AMP Ltd./350705-1
Power Side Housing	802-710113-503-0	AMP Ltd./350766-1
Power Side Contact	802-710114-102-0	AMP Ltd./350550-1

Table B-10 3-DC Option Cable Connector Descriptions

CONNECTOR	NEC PART NUMBER	VENDOR/PART NUMBER
Disk Side Housing	806-927329-009-0	AMP Ltd./87159-9
Disk Side Contact	806-927329-571-0	AMP Ltd./87027-1
Power Supply Side Housing		AMP Ltd./1-480270-0
Power Supply Side Contact		AMP Ltd./60617-4

Table B-11 Operator Panel Cable Connector Descriptions

CONNECTOR	VENDOR	PART NUMBER
Disk Side Housing	Berg	65043-032
Disk Side Contact	Berg	47744 (for AWG 28, 30, 32)
	Berg	47745 (for AWG 22, 24, 26)

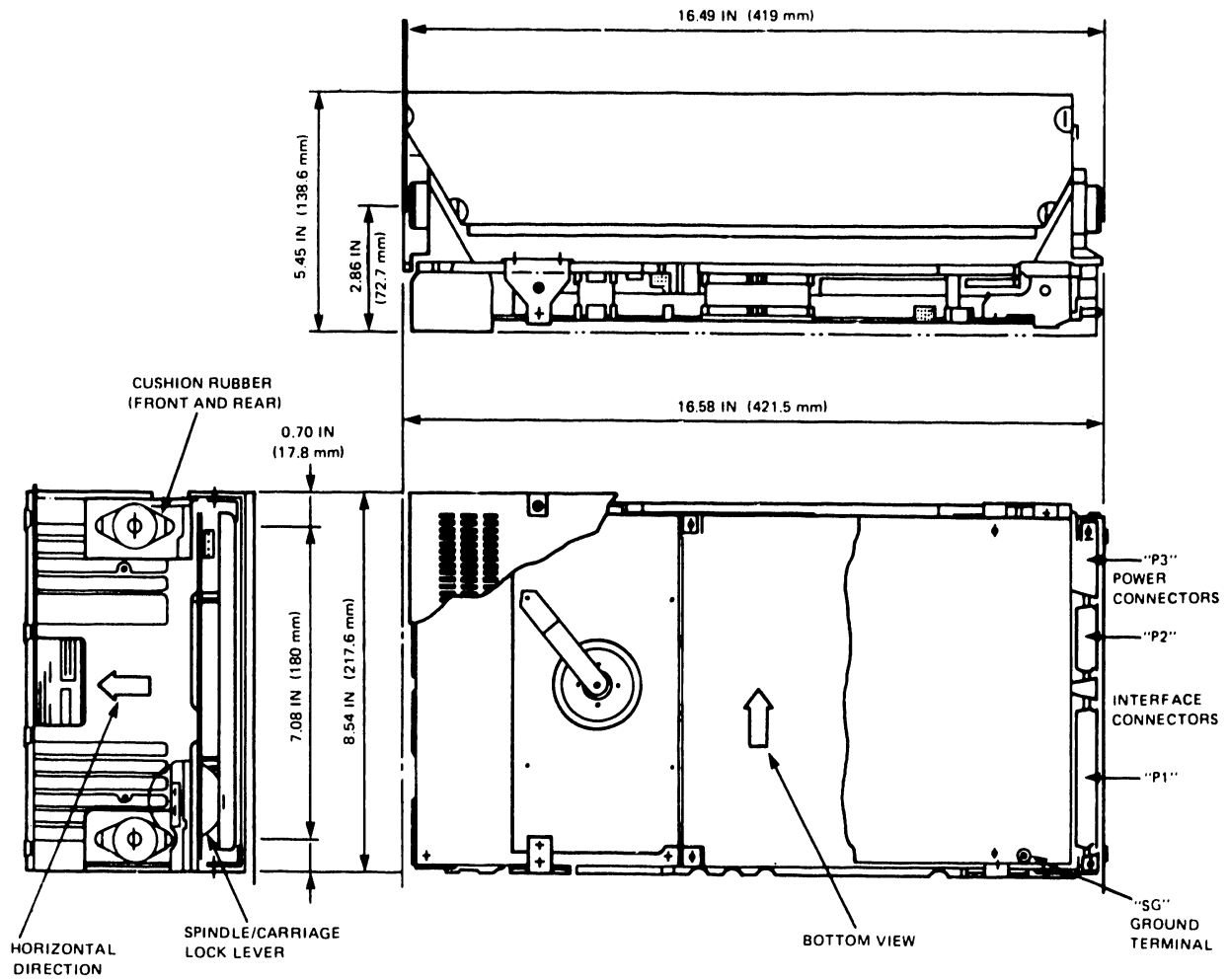


Figure B-1 D22x7 Basic Assembly Dimensions

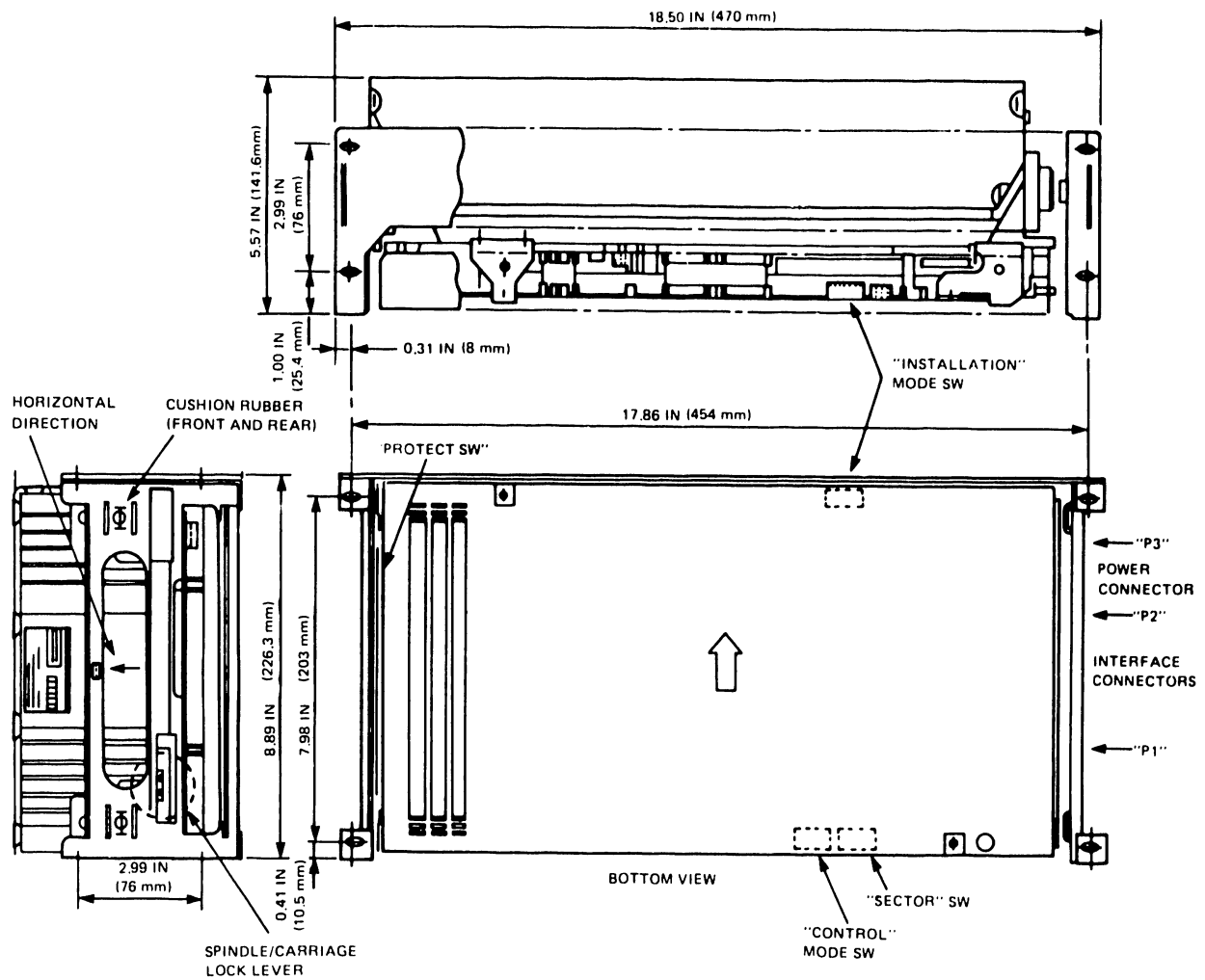


Figure B-2 D22x7 Standard Assembly Dimensions

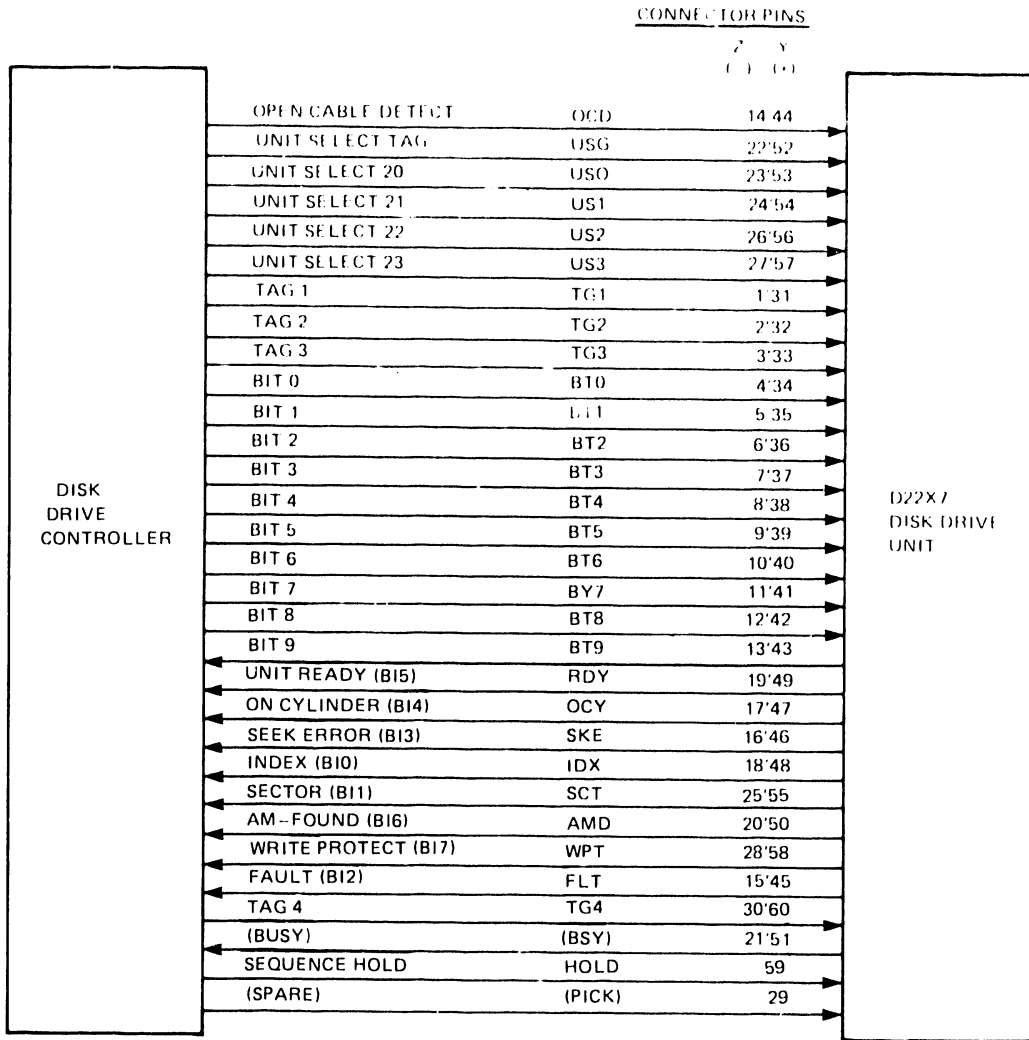


Figure B-3 Cable A Signals

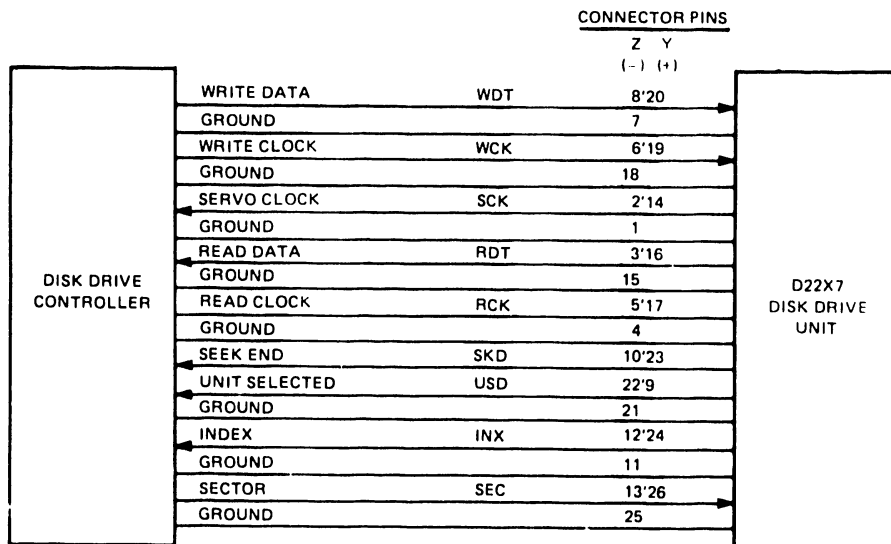


Figure B-4 Cable B Signals

APPENDIX

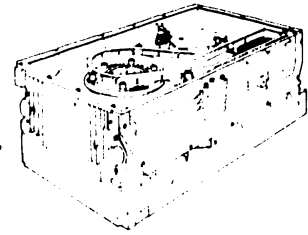
C

DKU0000-HLOG

DIAGNOSTIC PANEL

Appendix C

DKU000-HLOG Diagnostic Panel



The DKU000-HLOG Diagnostic Panel tests D22x7 disk drives. When the disk drive is offline, the panel simulates an interface controller and functions as a drive exerciser. When the disk drive is online, the panel functions as a status monitor. All errors detected by the panel are encoded and logged in its internal memory and retained for more than 100 hours after power has been turned off.

C.1 CONTROL PANEL

The diagnostic panel is shown in Figure C-1. The panel contains a 25-key keypad, five LED status indicators, a six-digit liquid crystal display (LCD) window, and two summary charts. A mounting spring on each end attaches the panel to the disk drive as shown in Figure C-2.

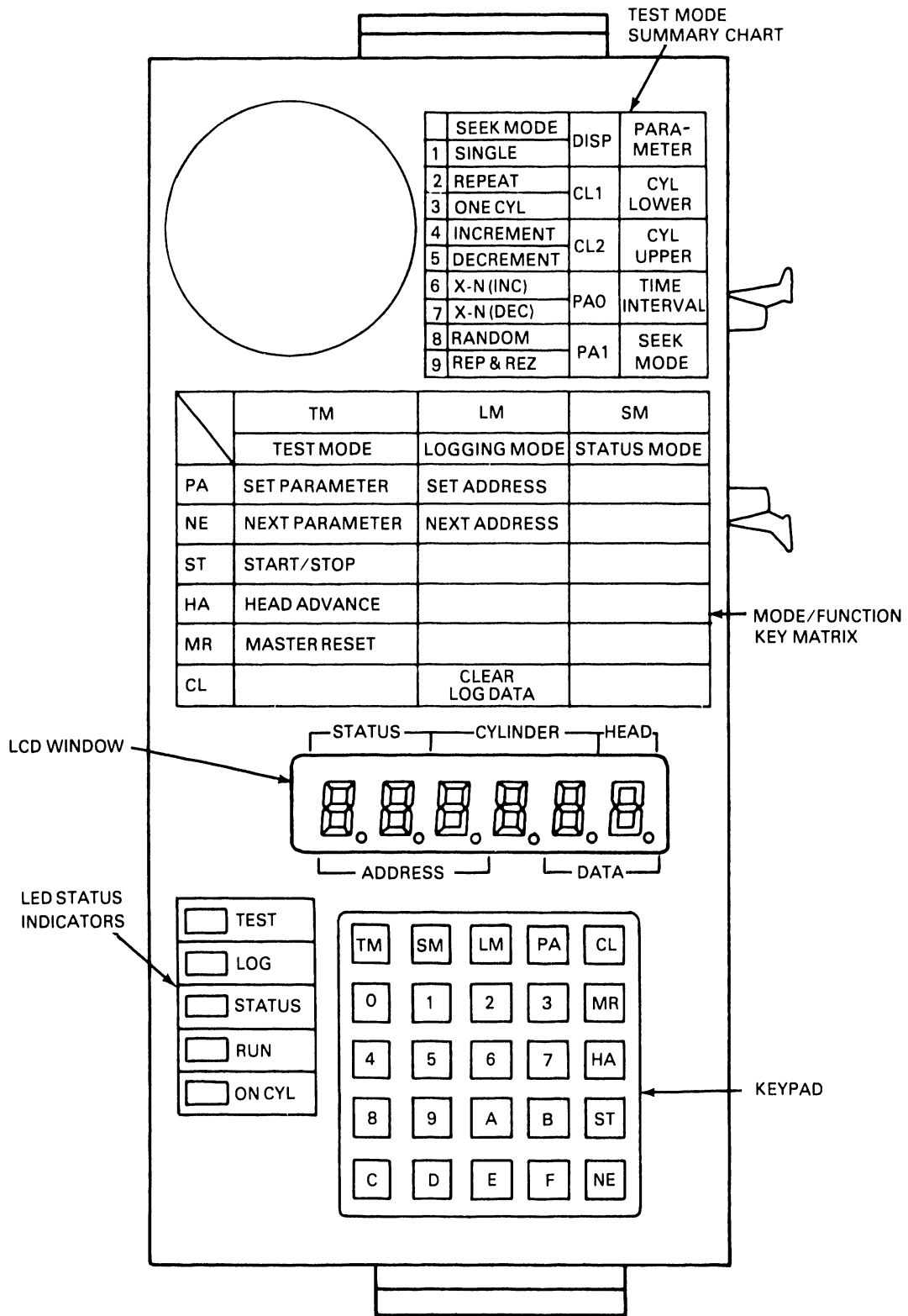


Figure C-1 Diagnostic Panel

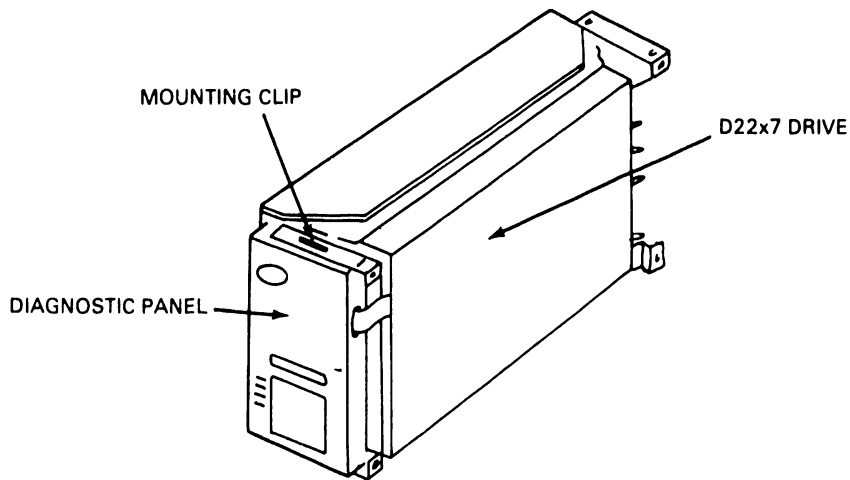


Figure C-2 Attaching the Diagnostic Panel to the Drive

A 0.4 Farad capacitor provides nonvolatile memory for the logging function. The diagnostic panel is connected to the disk drive by an interface cable as shown in Figure C-3.

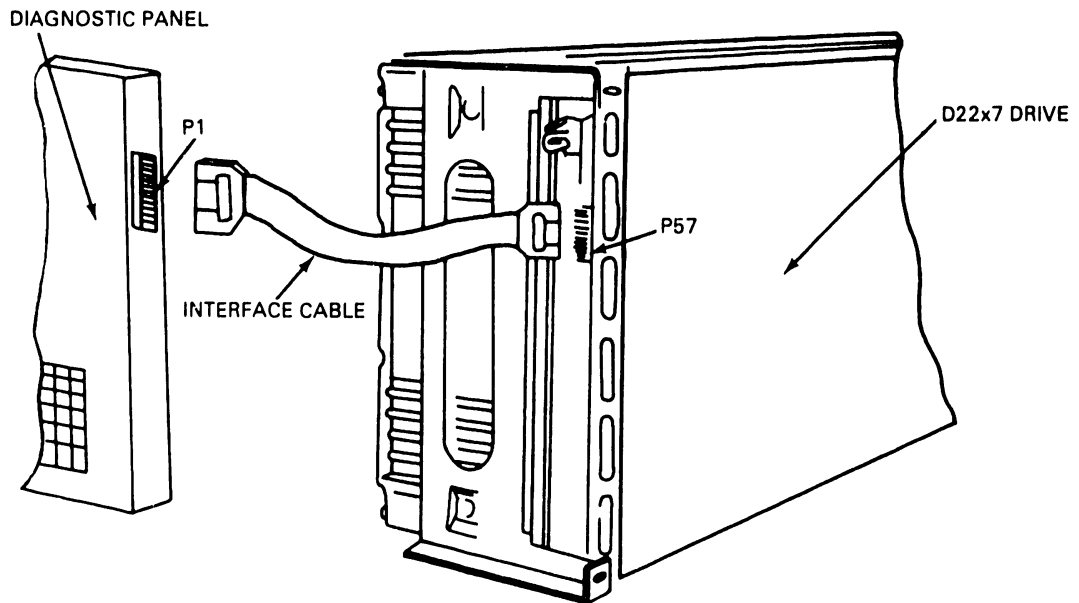


Figure C-3 Diagnostic Panel Cable and Connector

C.1.1 Keypad

The keypad contains 25 keys. Sixteen of these keys, representing hexadecimal digits 0 to F, are used to enter exercise parameters when Test mode is selected.

Three keys select the operational mode of the diagnostic panel. The functions of these keys are listed in Table C-1.

Table C-1 Mode Selection Keys

KEY	MODE SELECTED	DESCRIPTION
TM	Test Mode	Test mode places the disk drive offline. The diagnostic panel simulates an interface controller, and exercises the drive.
SM	Status Mode	Status mode monitors the online operation of the drive. The LCD window displays the current drive status, as well as the current head and cylinder address.
LM	Log Read Mode	Log Read mode provides a record of status or error information. Errors are logged sequentially and by type.

The six remaining keys enable specific diagnostic panel functions as listed in Table C-2.

Table C-2 Diagnostic Panel Functions

KEY	FUNCTION	MODE	DESCRIPTION
PA	Parameter Input	TM	Enables entry of seek test parameters from the panel keypad. See Section C.3.1.1.
		LM	Enables entry of sequential record address from the keypad. See Section C.4.2.
CL	Clear	LM	Clears the logging area. See Section C.4.3
MR	Master Reset	TM	Performs a return-to-zero (RTZ) operation. See Section C.3.1.

Table C-2 Diagnostic Panel Functions (cont'd)

KEY	FUNCTION	MODE	DESCRIPTION
HA	Head Advance	TM	Increases the head address by one each time the key is pressed. See Section C.3.1.
ST	Start/Stop	TM	Starts or stops the selected operation.
NE	Next Parameter	TM	Enters the parameter value selected by the PA key and brings up the next parameter. See Section C.3.1.1.
		LM	Initiates and advances search routine through error logs. See Sections C.4.1 and C.4.2.

C.1.2 LED Status Indicators

Three LEDs, labelled TEST, LOG, and STATUS, indicate the operational mode of the diagnostic panel. Two additional LEDs, labelled RUN and ON CYL, indicate the operational mode of the disk drive.

C.1.3 LCD Display Window

The six-digit LCD window displays status or error information. Depending upon the selected operational mode, the following information is displayed:

- cylinder address
- head address
- drive status
- error count.

C.1.4 Diagnostic Panel Summary Charts

Two charts, a Mode/Function Key Matrix and a Test Mode Summary, are included on the diagnostic panel. The Mode/Function Key Matrix lists the function performed by each of the six function keys in the three operational modes. The Test Mode Summary lists the nine seek operations and four parameters used in Test mode.

C.2 STATUS MODE

In Status mode, the diagnostic panel displays the current status of the disk drive. When an error occurs, data is logged in the diagnostic panel's internal memory and simultaneously displayed in the six-digit LCD window. Subsequent errors are logged in memory. The panel display, however, remains unchanged. Status information is formatted as shown in Figure C-4.

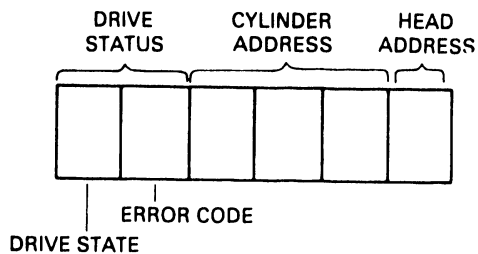


Figure C-4 Status Mode Display Format

C.2.1 Starting Status Mode

Pressing the SM key starts Status mode. When Status mode is selected, the STATUS and ON CYL LEDs light. The data window displays the drive status, consisting of the operational state of the disk drive and an associated error code, the current cylinder address, and the current head address.

C.2.1.1 DRIVE STATUS

The two-digit drive status display lists the operational state of the disk drive along with an encoded error report. Table C-3 lists the drive state displays and the corresponding state of operation.

Table C-3 Disk Drive Operational States

LCD DISPLAY	OPERATIONAL STATE
1	Power On/Initialization Sequence
2	Stop State
3	Start Delay
4	Motor Start (90% RPM attained)
5	Motor Speed Increase (97% RPM attained)
6	Full Motor Speed
7	Phase-Locked Oscillator
8	Recalibrate Out
9	Recalibrate In
A	Ready (On Cylinder)
B	Heads Out
C	Interface Check
D	Heads In
E	Fault (Not Ready)
F	Fault (Ready)

Table C-4 lists all drive status reports, along with suggested troubleshooting procedures.

Table C-4 Drive Status Reports

DISPLAY		ERROR CONDITION	SUGGESTED PROCEDURES
DRIVE STATE	ERROR CODE		
1	1	Voltage Fault	Check source voltage.
1	2	Read-only-memory (ROM) fault	Replace G9QSV PCB.
1	4	Fault latch	Replace G9QSV PCB.
2	1	Voltage fault	Check source voltage.
3	1	Voltage fault	Check source voltage.
4	1	Voltage fault	Check source voltage.
4	3	Insufficient motor speed	Check motor rotation. Replace G9QSR PCB.
4	4	No motor rotation	Check lock control lever. Replace G9QSR PCB.
5	1	Voltage fault	Check source voltage.
5	2	Insufficient motor speed	Check source voltage. Check cable connector. Replace G9QSR PCB. Replace G9QSV PCB. Replace the unit.
5	3	Excessive motor speed	See Fault 52.
6	1	Voltage fault	Check source voltage.
6	3	Excessive motor speed	See Fault 52.
7	1	Voltage fault	Check source voltage.
7	2	Motor speed loss	Restart motor. If Fault 43 or 44 occurs, replace G9QSR PCB. Replace G9QSV PCB. Replace unit.
7	4	Loss of index	Check the tripulse output. If tripulse is available, replace G9QSV PCB. Replace unit. If tripulse is not available, replace G9QSR PCB. Replace unit.

Table C-4 Drive Status Reports (cont'd)

DISPLAY		ERROR CONDITION	SUGGESTED PROCEDURES
DRIVE STATE	ERROR CODE		
7	5	Inner guard band (IGB) not found	Replace G9QSV PCB. Replace unit.
8	1	Voltage fault	Check source voltage.
8	2	Motor speed loss	See Fault 72.
8	4	Loss of index	See Fault 74.
8	5	Outer guard band (OGB) not found	Check lock control lever. Verify current flow in the voice coil. Replace G9QSV PCB. Replace unit.
8	6	No N linearity found	Replace G9QSV PCB. Replace unit.
8	7	No half track found	Replace G9QSV PCB.
8	8	No Q linearity found	Replace G9QSV PCB.
8	9	No zero difference found	Replace G9QSV PCB.
8	A	Target velocity not obtained	Replace G9QSV PCB.
8	B	Servo circuit fault	See Fault 8A.
8	C	Over-shoot check	See Fault 8A.
8	D	Over-shoot check (time out)	See Fault 8A.
9	1	Voltage fault	Check source voltage.
9	2	Motor speed loss	See Fault 72.
9	4	Loss of index	See Fault 74.
9	5	Only OGB detected	Replace G9QSV PCB. Replace unit.
9	9	No N linearity found	See Fault 86.
9	A	Target velocity not obtained	See Fault 8A.
9	C	Over-shoot check	See Fault 8A.
9	D	Over-shoot check (time out)	See Fault 8A.

Table C-4 Drive Status Reports (cont'd)

DISPLAY		ERROR CONDITION	SUGGESTED PROCEDURES
DRIVE STATE	ERROR CODE		
A	1	Voltage fault	Check the source voltage.
A	2	Motor speed loss	See Fault 72.
A	3	Excessive motor speed	See Fault 52.
A	4	Loss of index	Check the tripulse or cylinder concerned. If index signal found, replace G9QSV PCB. If index signal missing, replace unit.
A	C	R/W positioner off track	Replace G9QSV PCB. Replace unit.
B	1	Voltage fault	Check the source voltage.
B	4	Loss of index	See Fault A4.
B	9	No zero difference found	Replace G9QSV PCB.
B	A	Target velocity not obtained	See Fault 8A.
B	C	Over-shoot check	See Fault 8A.
B	D	Over-shoot check (time out)	See Fault 8A.
B	E	OGB detected during seek	See Fault 8A.
B	F	IGB detected during seek	See Fault 8A.
C	1	More than 1024 cylinders detected	
C	2	Tag 1 received when not on cylinder	
C	3	Tag 1 received when not ready	
D	1	Voltage fault	Check the source voltage.
D	4	Loss of index	See Fault A4.
D	9	No zero difference found	Replace G9QSV PCB.
D	A	Target velocity not obtained	See Fault 8A.

Table C-4 Drive Status Reports (cont'd)

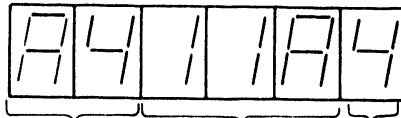
DISPLAY DRIVE STATE	ERROR CODE	ERROR CONDITION	SUGGESTED PROCEDURES
D	C	Over-shoot check	See Fault 8A.
D	D	Over-shoot check (time out)	See Fault 8A.
D	E	OGB detected during seek	See Fault 8A.
D	F	IGB detected during seek	See Fault 8A.
E	1	Seek error	
E	2	Excessive seek velocity	
E	3	Seek velocity too low	
E	4	PLO fault	
E	5	R/W positioner off track	See Fault AC.
E	6	Offset command error	
E	7	Faulty RTZ operation	
F	1	Write protect violation	Check for defective interface.
F	2	Write gate while not ready	Check for defective interface. Replace G9QSV PCB. Replace unit.
F	3	Write clock fault	Replace G9QSV PCB. Replace unit.
F	4	Write head off track	Replace G9QSV PCB.
F	5	Abnormal write operation	Replace G9QSP PCB. Replace G9QSV PCB. Replace unit.
F	6	Abnormal read operation	See Fault F5.

C.2.1.2 CYLINDER AND HEAD ADDRESSES

When the diagnostic panel is in Status mode, the current cylinder address is displayed in three digit hexadecimal notation. The current head address is displayed as a single digit.

C.2.2 Using Status Mode

Status mode displays the current status of the disk drive. If an error occurs, the corresponding drive status report is displayed. Simultaneously, the displayed data is logged in the diagnostic panel's internal memory. The presence of a non-zero digit in the right position of the drive status display, or the presence of a "00" code in the drive status display indicates an error condition (see Figure C-5).



THE SAMPLE DISPLAY INDICATES THAT THE INDEX SIGNAL WAS NOT DETECTED AT CYLINDER 11A_H, HEAD 4.

Figure C-5 Status Mode Error Display Format

The panel's internal memory records subsequent errors as they occur. The LCD display, however, remains unchanged until the SM key is pressed. Pressing the SM key displays the latest drive status report.

C.2.3 Ending Status Mode

Pressing the TM or LM key ends Status mode.

C.3 TEST MODE

In Test mode, the diagnostic panel places the disk drive offline; that is, the interface between the drive and the drive controller is disabled. The diagnostic panel simulates the drive controller, and enables nine different seek operations to test the drive.

C.3.1 Starting Test Mode

Select Test mode by pressing the TM key and then pressing the 9 key. Pressing the 9 key acts as a safety device that prevents the disk drive moving from an online to an offline condition when the TM key is accidentally pressed.

After Test mode is selected, press the MR key to perform a return-to-zero (RTZ) operation. This operation moves the read/write heads to Cylinder 000.

Press the HA key to select the desired read/write head. The head address appears in the rightmost character position of the LCD display. The address is incremented by one each time the HA key is pressed.

C.3.1.1 INPUT PARAMETERS

After the read/write head is selected, three parameters (low cylinder address, high cylinder address, and interval timing) are set. Press the PA key to begin setting parameters for seek operations. The resulting LCD display is shown in Figure C-6.

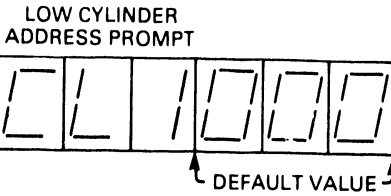


Figure C-6 Low Cylinder Parameter Display

The low cylinder address (CL1) default value (Cylinder 000) appears in the address field as shown. To set a new low cylinder address, enter three hexadecimal digits from the numeric keypad. Press the NE key to accept the default value or to accept the new value as entered from the keypad.

When the NE key is pressed, the LCD display appears as shown in Figure C-7.

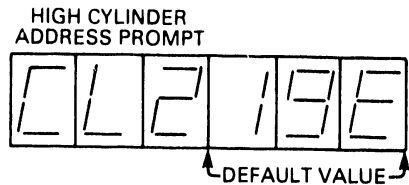


Figure C-7 High Cylinder Parameter Display

The high cylinder address (CL2) default value (Cylinder 19E) occupies the address field. To set a new high cylinder address, enter three hexadecimal digits from the keypad. The high cylinder address must be greater than the low cylinder address. Press the NE key to accept the default value or to accept the new value as entered from the keypad.

After pressing the NE key, the LCD display appears as shown in Figure C-8.

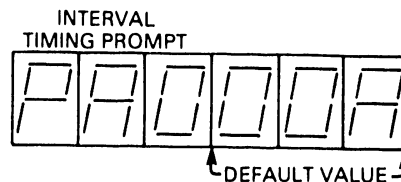


Figure C-8 Interval Timing Parameter Display

The interval timing default value, expressed in milliseconds, is recorded in the address field. To set a new interval timing, enter three hexadecimal digits from the keypad. Press the NE key to accept the default value or to accept the new value as entered from the keypad.

C.3.1.2 SEEK MODES

After the interval timing value is entered and the NE key pressed, the following display appears.

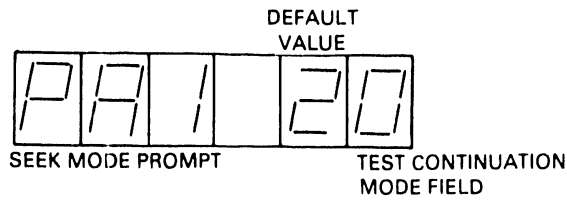


Figure C-9 Seek Mode Display

The seek mode digit selects one of the nine seek operations listed on the Test Mode Summary chart. The test continuation digit determines the conditions under which a seek test is halted. When a zero is displayed, seek operations are halted if an error occurs. When any other digit is displayed, seek operations continue to completion.

The seek mode default value is recorded in the address field. To set a new seek mode and test continuation condition, enter two digits from the keypad. Press the NE key to accept the default value or to accept the new value as entered from the keyboard.

Table C-5 summarizes the nine seek modes that can be selected.

Table C-5 Seek Modes

MODE NUMBER	SEEK MODE	DESCRIPTION
1	Single Seek	Seeks to destination cylinder (CL2) and stops. To repeat, press the MR key and wait until the read/write heads return to cylinder 000. Then press the ST key.
2	Repeat Seek	Seeks directly from the low cylinder address to the high cylinder address, and then from the high cylinder to the low cylinder. The cycle is repeated.
3	One Cylinder	Seeks one cylinder at a time from the low cylinder (CL1) to the high cylinder (CL2), and then from the high cylinder to the low cylinder. The cycle repeats. For example, with CL1 equal to 000 and CL2 equal to 100, seeks to 001, to 002, to ..., to 100. Then seeks to 099, to 098, to ..., to 000.
4	Increment Seek	Seeks one cylinder at a time from the low cylinder (CL1) to the high cylinder (CL2), and then returns directly to the low cylinder to repeat the cycle. For example, with CL1 equal to 000 and CL2 equal to 100, seeks to 001, to 002, to ..., to 100. Returns to CL1 and repeats.

Table C-5 Seek Modes (cont'd)

MODE NUMBER	SEEK MODE	DESCRIPTION
5	Decrement Seek	Seeks one cylinder at a time from the high cylinder (CL2) to the low cylinder (CL1), and then returns directly to the high cylinder to repeat the cycle. For example, with CL1 equal to 000 and CL2 equal to 100, seeks to 099, to 098, to ..., to 000. Returns to CL2 and repeats.
6	X + N (INC)	Seeks incrementally from the low cylinder (CL1) to the high cylinder (CL2), and then returns directly to CL1 to repeat the cycle. For example, with CL1 equal to 000 and CL2 equal to 100, seeks to 001 and returns to CL1; seeks to 002 and returns to CL1; seeks to ... and returns to CL1; seeks to 100. Returns to CL1 and repeats cycle.
7	X - N (DEC)	Seeks decrementally from the high cylinder (CL2) to the low cylinder (CL1), and then returns directly to CL2 to repeat the cycle. For example, with CL1 equal to 000 and CL2 equal to 100, seeks to 099 and returns to CL2; seeks to 098 and returns to CL2; seeks to ... and returns to CL2; seeks to 000. Returns to CL2 and repeats cycle.
8	Random	Seeks randomly within the parameters set by the low and high cylinder addresses.
9	Repeat and RTZ	Seeks to high cylinder (CL2), returns to cylinder 000, and repeats cycle.

C.3.2 Using Test Mode

When all parameters are set, press the ST key to enter Test mode. The RUN LED lights and the selected seek operation is performed. If an error occurs while a seek test is running, the diagnostic panel displays the status of the drive just as it does in Status mode (see Section C.2).

C.3.3 Ending Test Mode

Seek operations are halted before completion by a seek error (depending on the status of the test continuation condition), or by pressing the ST key. When seek operations stop, the RUN LED goes out. The panel remains in the Test mode. To end Test mode press the SM or LM key.

C.4 LOG READ MODE

The diagnostic panel stores specific information on each error that occurs during either Status or Test mode. Information is logged into a dedicated 640-byte memory that consists of two sections. The first section (memory addresses 000_H through 0FF_H) records the number of times a specific error occurs. The second section (memory addresses 100_H through 27F_H) provides a sequential log of drive operations. The Log Read mode provides access to both of these memory areas.

C.4.1 Error/Count Log

Press the LM key to start the Log Read mode. The LOG and the ON CYL LEDs light. When using the Error/Count Log, the LCD display is formatted as shown in Figure C-10.

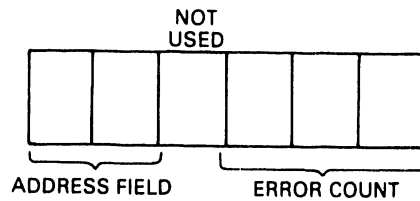


Figure C-10 Error/Count Log Display Format

When the LM key is pressed, the three-digit address field displays memory location 000 and the two-digit data field displays the total number of recorded errors.

Subsequent entries in the Error/Count Log are displayed by pressing the NE key. In most instances, pressing the NE key results in the following LCD display.

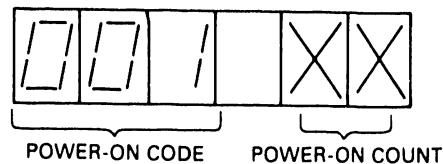


Figure C-11 Error/Count Log Power-On Count

The address field displays memory location 001 signifying power-on. The data field displays the power-on count.

Pressing the NE key again initiates a search through the Error/Count Log. When an error is detected, a drive status report (listed in Table C-3) is displayed in the address field. The number of times the error occurred is displayed in the data field. A sample LCD display is shown in Figure C-12.

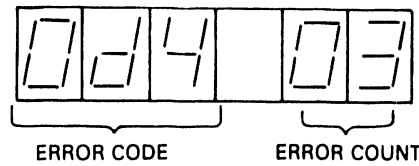


Figure C-12 Error/Count Log Error Display Format

The above display indicates that the d4 error (loss of Index signal) occurred three times.

Each time the NE key is pressed, the display advances to the next error. When all errors have been displayed, or if no errors have occurred, the display returns to the 000 memory address and the total count of logged errors.

C.4.2 Sequential Operations Log

Memory addresses 100 through 27F are assigned to the Sequential Operations Log. This log records errors and power-on and power-off operations. To access the Sequential Operations Log press the LM key to start Log Read mode, and then press the PA key.

Use the numeric keypad to initiate a search through the Sequential Operations Log. To examine the entire log, enter 100 from the keypad. Any other memory address from 101 through 27F can be entered. When the address has been entered, press the NE key to display the contents of the address location. The LCD display format is shown in Figure C-13.

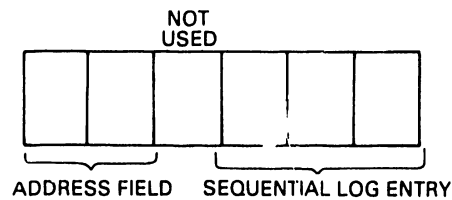


Figure C-13 Sequential Operations Log Display Format

Each time the NE key is subsequently pressed, the address field is incremented by one and the contents of that memory location are displayed in the data field. Figure C-14 shows sequential log entries.

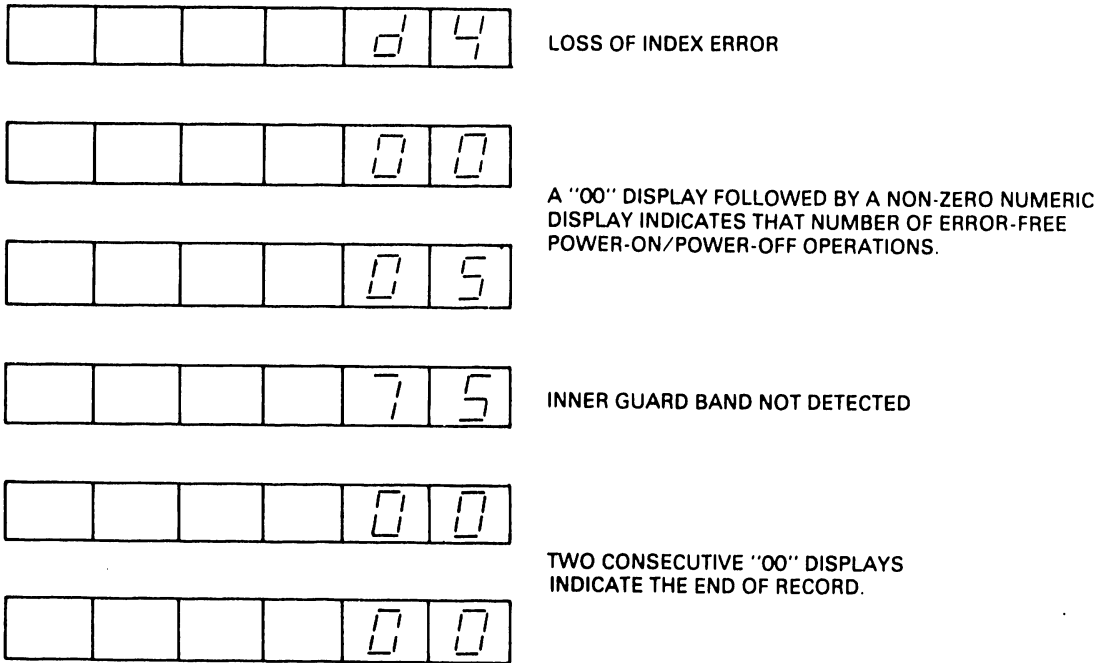


Figure C-14 Sequential Operations Log Entries

C.4.3 Ending Log Read Mode

Press the CL key to clear both the error/count log and the sequential log. Press the LM or SM key to end Log Read mode.

APPENDIX

D

DKU000-H3P7

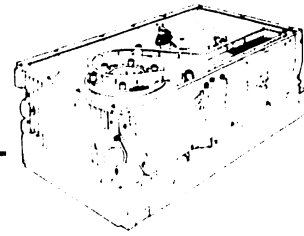
3-INPUT DC

REGULATOR

OPTION

Appendix D

DKU000-H3P7 3-Input DC Regulator Option



This appendix assumes familiarity with the operation of the 3-Input DC Regulator option. It describes only the regulator's electrical input requirements and its physical dimensions.

D.1 GENERAL DESCRIPTION

The 3-Input DC Regulator requires an input set of three dc voltages: +24V, +5V, and -12V. From this input set, the regulator supplies the power set of dc voltages required by the D22x7 disk drive: +24V, +12V, +5V, -5V, and -12V.

The regulator contains an input connector, a signal ground terminal, voltage converters, and an output cable that connects to the D22x7 disk drive. The 3-Input DC Regulator is mounted within the D22x7 and does not affect its exterior dimensions.

Figure D-1 diagrams the 3-Input DC Regulator and Figure D-2 shows its physical dimensions.

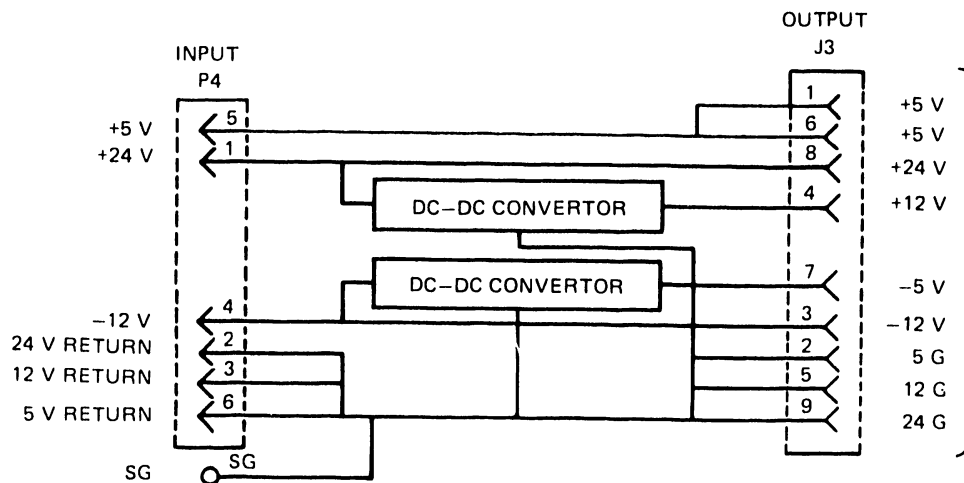


Figure D-1 Block Diagram: 3-Input DC Regulator

D.2 INTERFACE REQUIREMENTS

The following three sections describe specific interface requirements.

D.2.1 DC Power Connector (P4)

A six-pin AMP connector (No. 1-380999-0) is used for power input. Figure D-3 shows this connector, and Table D-1 lists its pin functions.

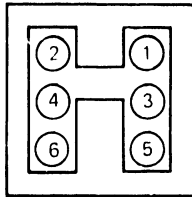


Figure D-2 P4 Connector

Table D-1 P4 Pin Assignments

PIN NUMBER	FUNCTION
1	+24 V dc
2	24 V return
3	12 V return
4	-12 V dc
5	+5 V dc
6	5 V return

The recommended mating connector for P4 is described below.

- Cable side housing— AMP P/N 1-480270-0
- Receptacle contact— AMP P/N 60617-4
AMP P/N 60619-4
- Cable wire — No. 18 AWG standard wire

D.2.2 Signal Ground Terminal

The signal grounding wire is connected to the SG terminal. The recommended mating connector for the SG terminal is described below.

- Cable side housing— AMP Plasti-Grip Terminal
- Receptacle contact— AMP P/N 170782-1
- Cable wire — No. 18 AWG standard wire

D.2.3 DC Power Input Requirement

Table D-2 lists dc input requirements.

Table D-2 DC Power Requirements

VOLTAGE (VOLTS-DC)	TOLERANCE (+VOLTS-DC)	CURRENT (AMPERES-DC)	RIPPLE (MILLIVOLTS P-P)
+5.0	0.25	4.0	100
-12.0	0.60	1.0	100
+24.0	2.40	3.0 average 5.5 peak	240

D.3 INSTALLING THE 3-INPUT DC POWER REGULATOR

Figure D-4 shows how to install the regulator.

D.4 ELECTRICAL SPECIFICATIONS

Table D-3 lists the electrical specifications of the 3-Input DC Regulator.

Table D-3 Electrical Specifications

Input Voltage	+5V	+24V	-12V		
Input Regulation	±5%	±10%	±5%		
Output Voltage	+5V (through)	+24V (through)	-12V (through)	+12V	-5V
Output Current	5 Amax	5 Amax	1 Amax	0.6 Amax	1.2 Amax
Load Regulation +12V: 0.2A < I _o < 0.6A -5V: 0.3A < I _o < 1.2A	—	—	—	±3%	±3%
Total Variation	—	—	—	±5%	±5%
Ripple	—	—	—	100 mVP-P	
Protection	—	—	—	Short-circuit protection	
Ambient Temperature 5°C to 50°C					

D.5 PHYSICAL DIMENSIONS

Figure D-3 shows the dimensions of the 3-Input DC Regulator Option.

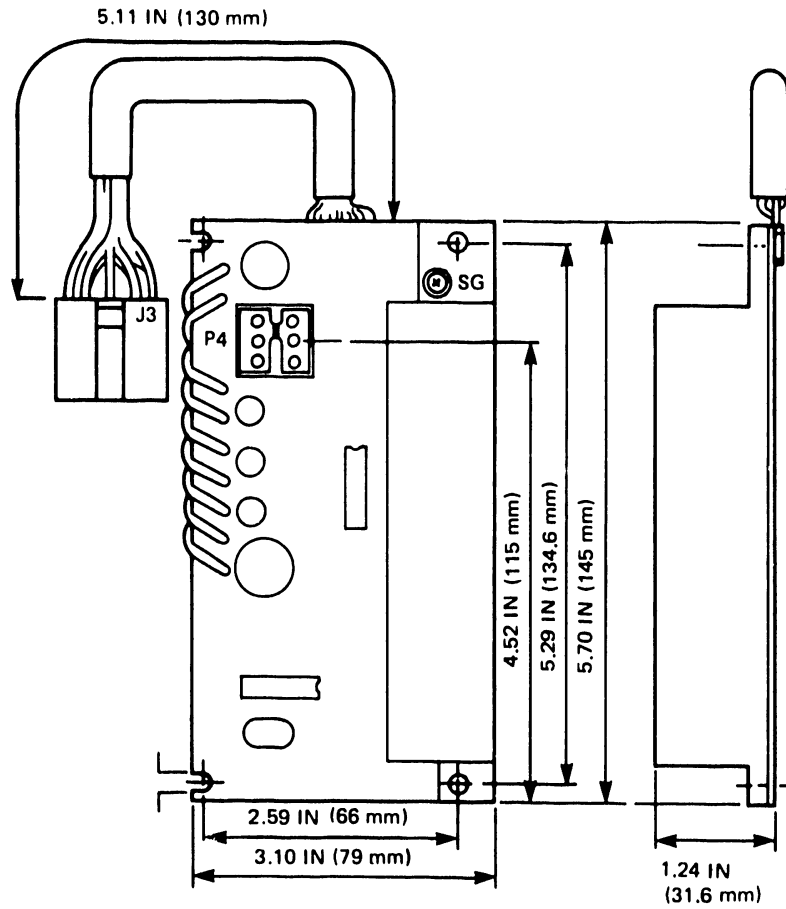


Figure D-3 3-Input DC Regulator Dimensions

Figure D-4 shows how to mount the 3-Input DC Regulator on a D22x7 disk drive.

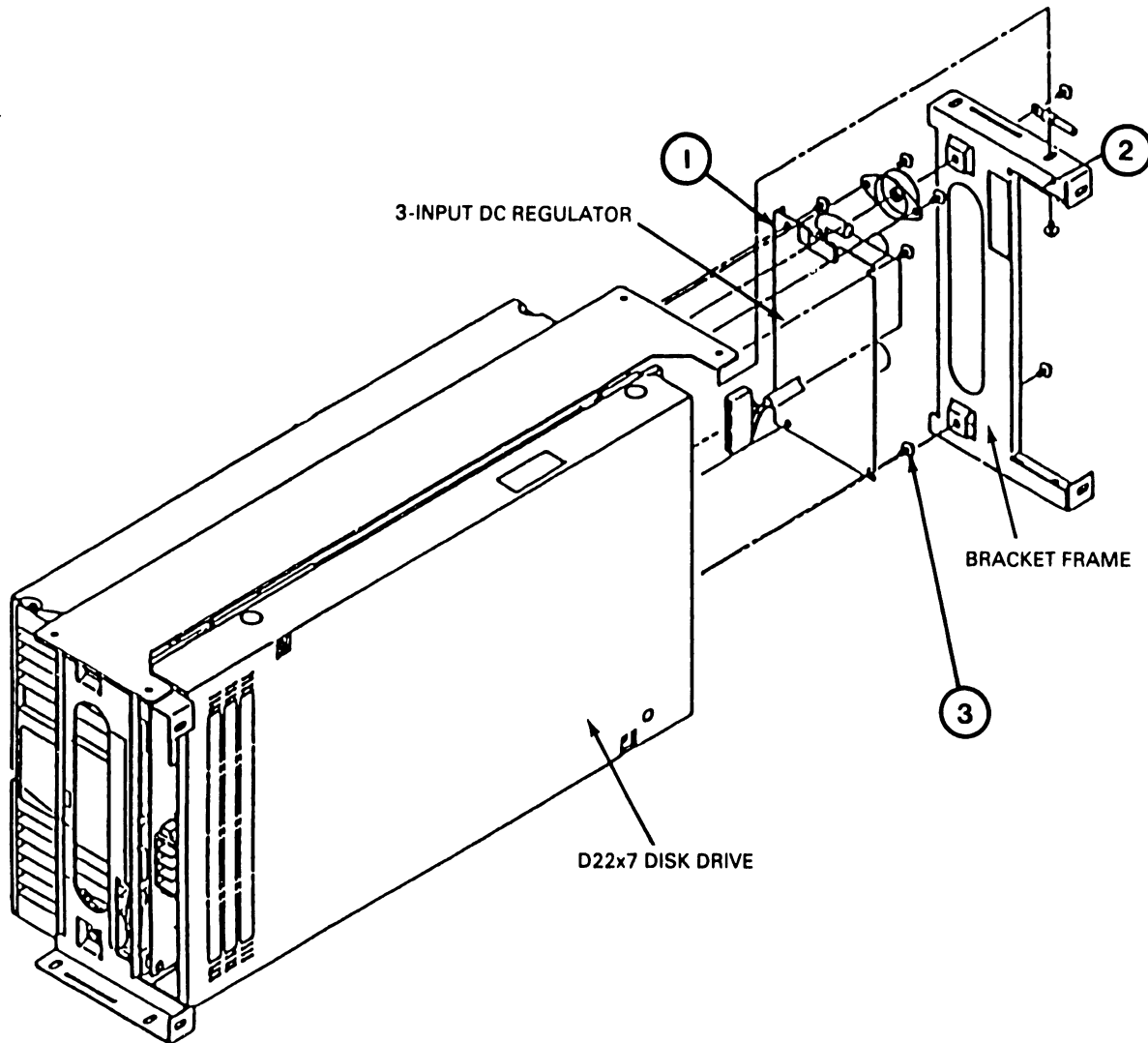


Figure D-4 3-Input DC Regulator Mounting.

Table D-4 DKU000-H3P7 3-Input DC Regulator Parts

ITEM	DESCRIPTION	PART NUMBER	QUANTITY
1	DKU000-H3P7 Regulator	806-942333-200	1
2*	Edging	806-935002-016-0	5 cm
3*	Screw	805-300004-010-0	4

*Items 2 and 3 are shipped with Item 1.

APPENDIX

E

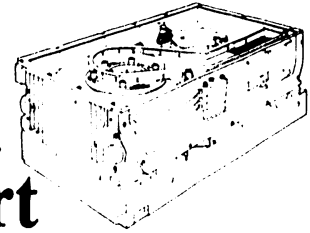
DKU-HDP2

DUAL PORT

INTERFACE OPTION

Appendix E

DKU000-HDP2 Dual-Port Interface Option



This appendix assumes familiarity with the operation of the Dual-Port Interface, and describes only certain of its features.

E.1 GENERAL DESCRIPTION

The Dual-Port Interface allows access to one drive by two controllers. In allowing dual access, the interface functions as a switch that routes the necessary control and data signals to and from the correct controller.

The electrical specifications of the Dual-Port Interface (including line receivers and transmitters, cables and cable connectors, signal definitions, and pin assignments) are the same as those of a standard D22x7. The only difference is that D22x7 disk drives equipped with this option have two identical interfaces providing communications channels with two controllers.

These two identical interfaces are designated port A and port B. Communication links into and from port A are designated route 0; communication links into and from port B are designated route 1. Each port is physically connected to its controller by an A and a B cable.

Figure E-1 shows a dual-port cabling diagram.

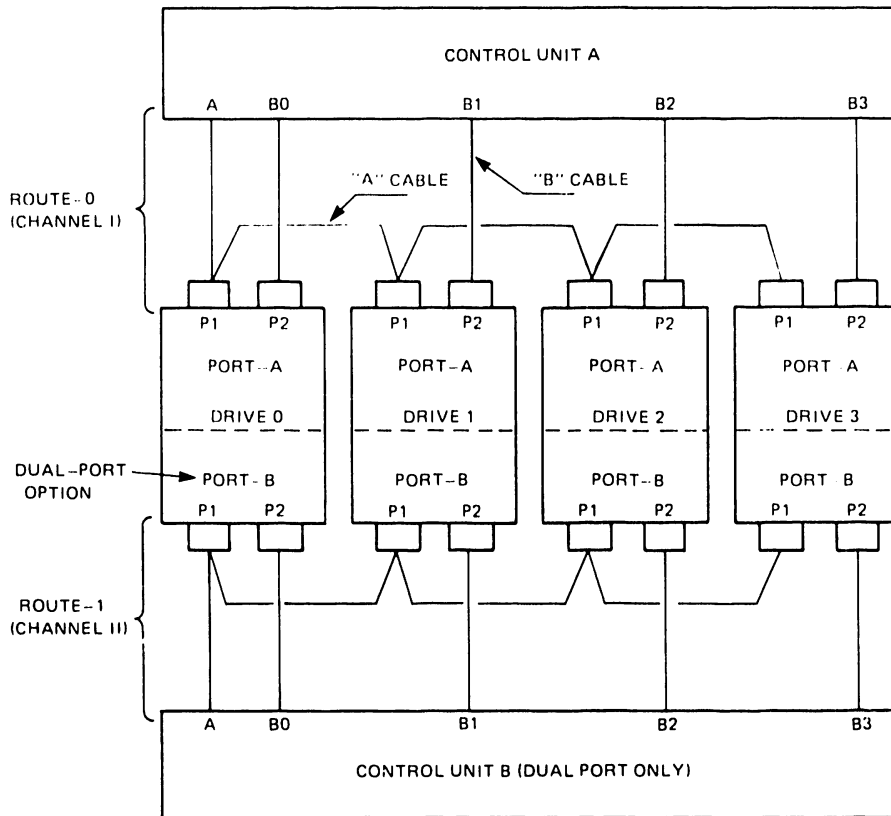


Figure E-1 Dual-Port System Cabling

E.2 SWITCHES AND INDICATORS

Three switches and four LED indicators located on the interface G9TXW PCB control its functions and provide status information. These switches and indicators are shown in Figure E-2.

E.2.1 Port A (Route 0) Switches and Indicators

- Toggle Switch In the "E" (Enable) position, this switch establishes a communications channel (route 0) between the disk drive and a drive controller.
In the "D" (Disable) position, no communications channel is established between the disk drive and the drive controller.
- RSV (LED) When lit, indicates that the D22x7 is priority-selected by the route 0 controller.
- SEL (LED) When lit, indicates that the D22x7 is selected by the route 0 controller.

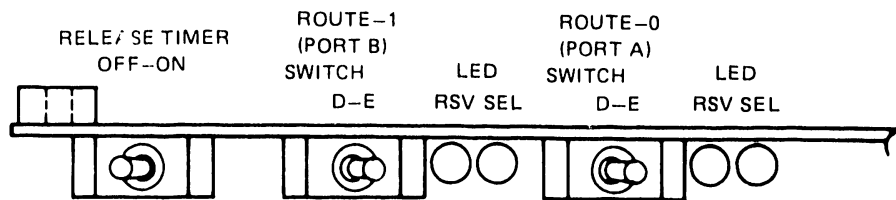


Figure E-2 Dual-Port Control Switches and Indicators

E.2.2 Port B (Route 1) Switches and Indicators

- **Toggle Switch** In the “E” (Enable) position, this switch establishes a communications channel (route 1) between the disk drive and a drive controller.

In the “D” (Disable) position, no communications channel is established between the disk drive and the drive controller.
- **RSV (LED)** When lit, indicates that the D22x7 is priority-selected by the route 1 controller.
- **SEL (LED)** When lit, indicates that the D22x7 is selected by the route 1 controller.

E.2.3 Release Timer: ON/OFF Switch

This switch controls the release timer, a device that allows alternate controller access to the drive. With this switch in the OFF position, a drive remains selected until specifically released by the controller (see Section E.5.1).

With this switch in the ON position, the release timer automatically manages controller access. Each controller is allowed approximately 500 milliseconds of disk time. After that period, the communications channel is disabled and drive access is granted to the other controller.

E.3 DRIVE SELECTION

Drive selection is controlled by the G9TXW PCB on the Dual-Port Interface. When no controller has the drive reserved, the drive is available and can be selected or reserved by either controller. The interface recognizes and engages with the first controller to complete a drive selection. The drive is reserved by the selecting controller, and remains reserved until a Release signal, a release timer function, or a dc power-down occurs.

If the drive is already reserved or selected, a Busy signal is issued on cable A of the controller attempting the select. This Busy signal is issued within 600 ns of the selection attempt and remains until the drive is no longer reserved or selected.

E.4 INTERFACE

The dual-port read/write cable (cable B) is identical to the standard D22x7 cable B. The dual-port control cable (cable A), however, provides one additional status line. This line, Busy, issues a status response to a controller attempting to select a reserved or selected drive.

E.5 STATUS COMMANDS

The Dual-Port Interface provides two additional status commands.

E.5.1 Release Command

This command (bus bit 9 and Tag 3) is transmitted to the drive from the controller. It releases controller reserve and priority select, freeing the drive for use by the other controller.

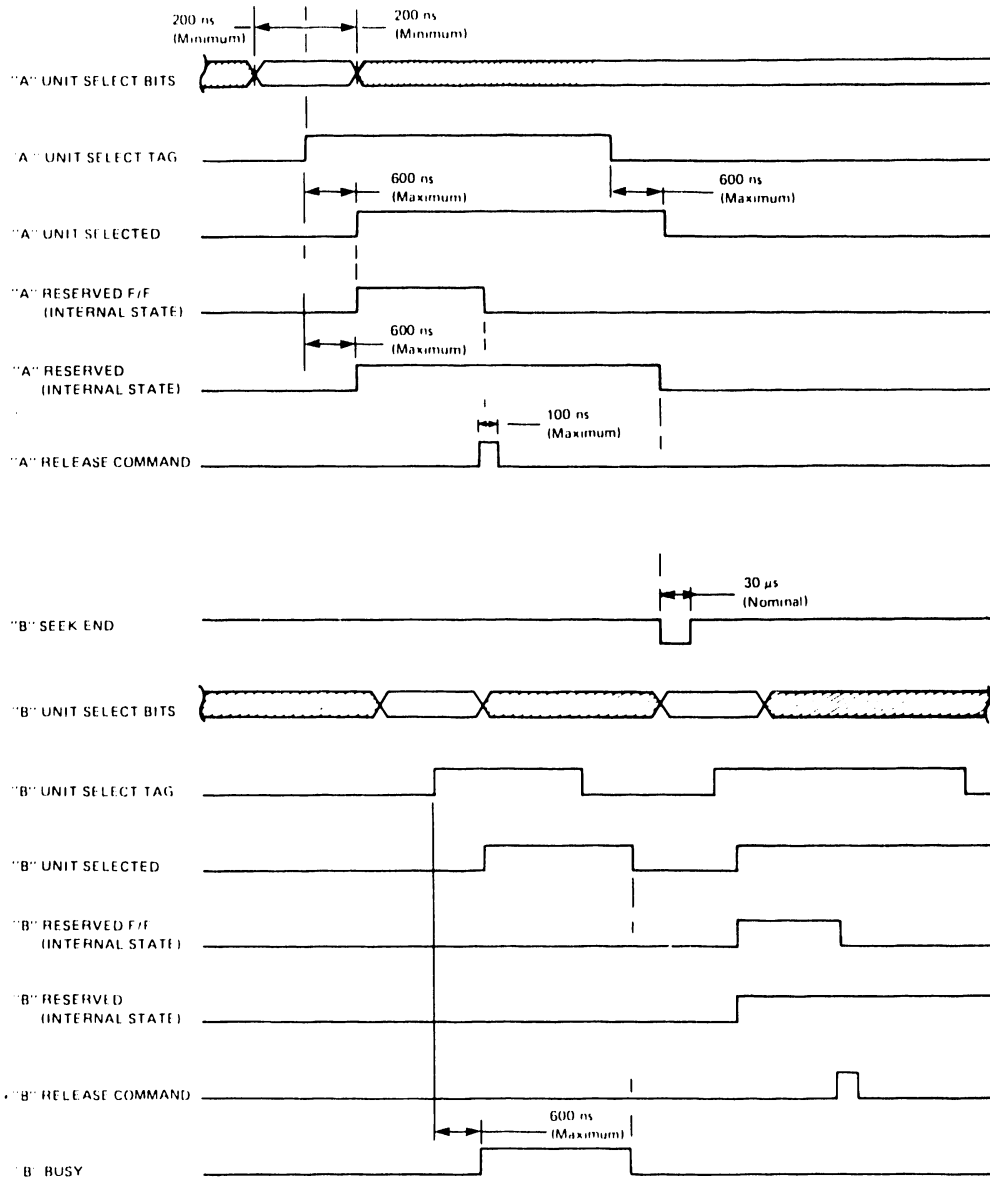


Figure E-3 Unit Select Timing for Dual-Port Option

E.5.2 Priority Select

The Priority Select signal (bus bit 9, Unit Select lines, and Unit Select Tag) is issued by a controller. This signal forces the drive to become unconditionally selected and absolutely reserved by the controller issuing the Priority Select signal. While this signal is active, the second controller is denied access to the drive. A Priority Select signal is not disabled by the release timer function.

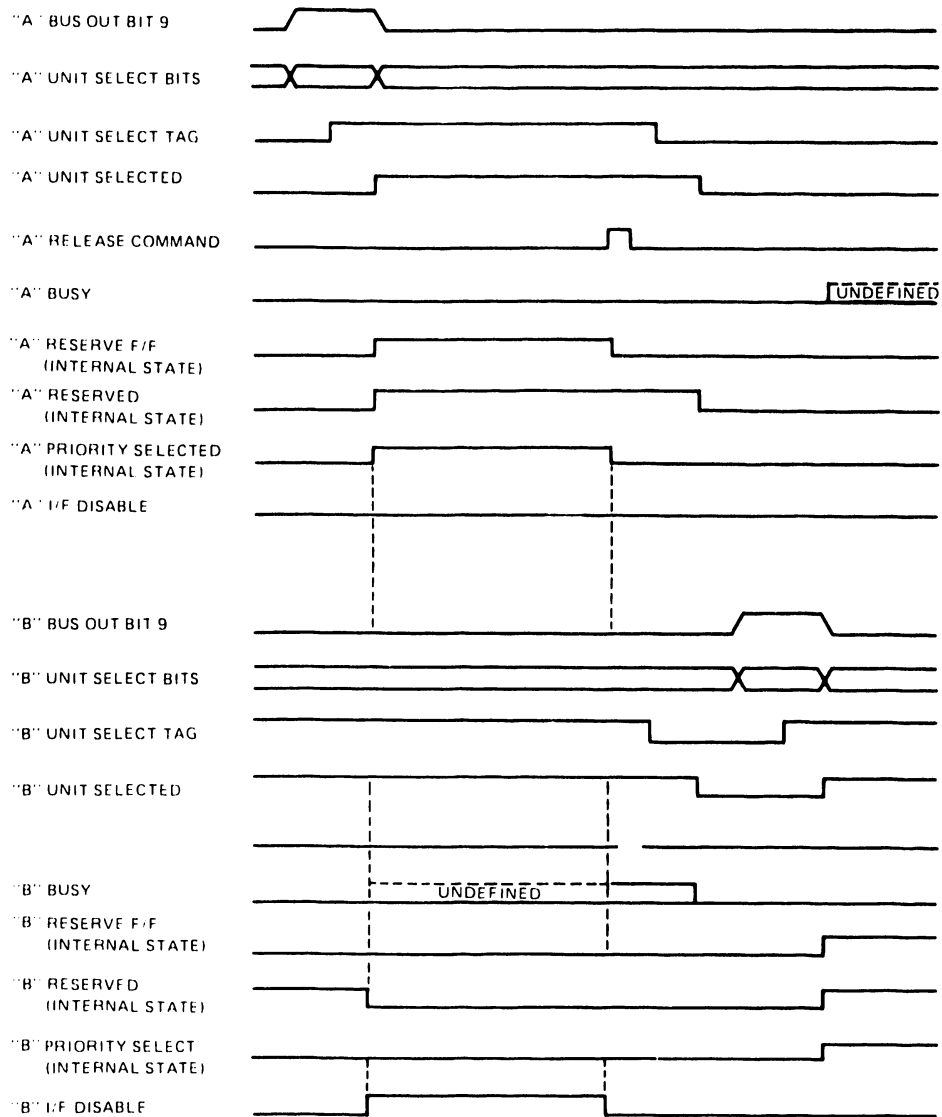


Figure E-4 Sample Priority Select Timing

E.6 INSTALLING THE DUAL PORT OPTION

This section contains procedures for installing a dual port option in the Wang Models 2268V-2 (NEC D2257) fixed disk drive. This option provides two identical interfaces designated Port A and Port B which allow access to the drive by two CPUs. The dual port circuitry functions as a switch to route necessary control and data signals to the proper CPU. A status response (Busy) signal is provided which prevents the drive from being accessed simultaneously by the two CPUs.

E.6.1 Upgrade Kit Components

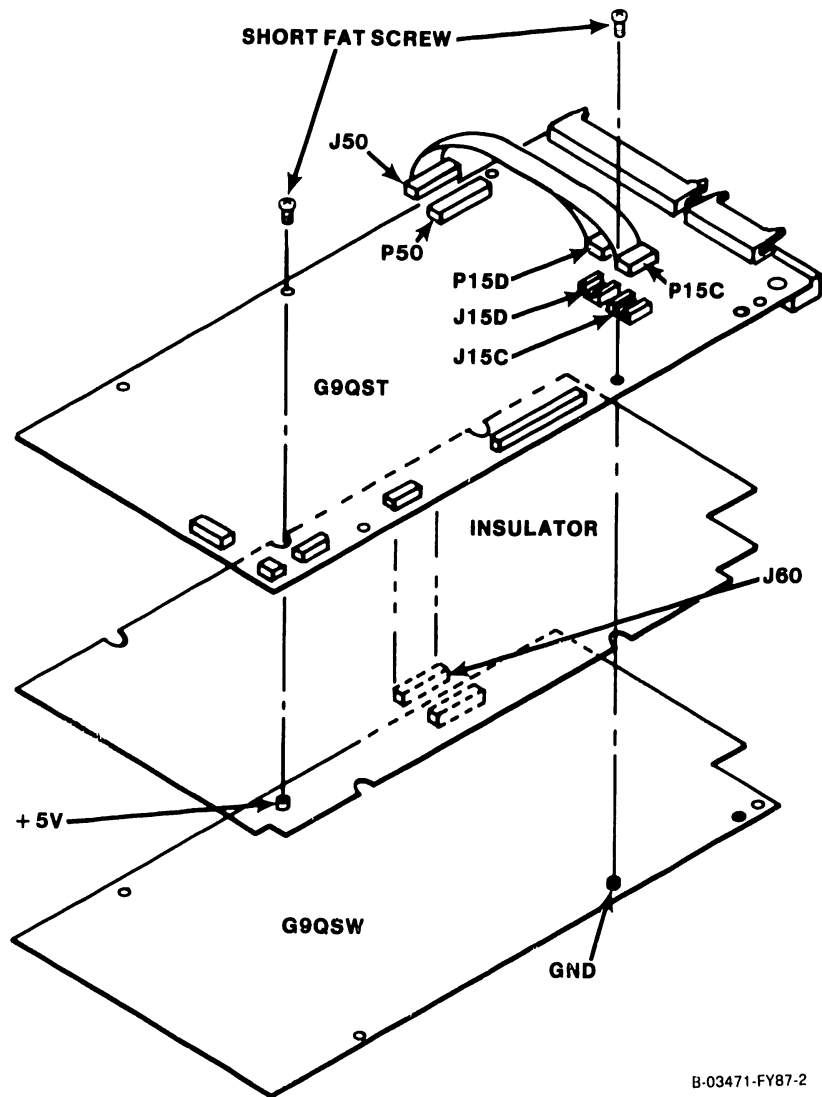
The following parts are included with each NEC upgrade kit:

<u>Quantity</u>	<u>Description</u>	<u>Wang Part Number</u>
1	NEC Dual Port Option kit (Includes G9TXW dual port board, insulator, J50-J60 cable, collar, four screws, and option label)	725-0192
1	NEC installation manual	

E.6.2 Installation Procedure

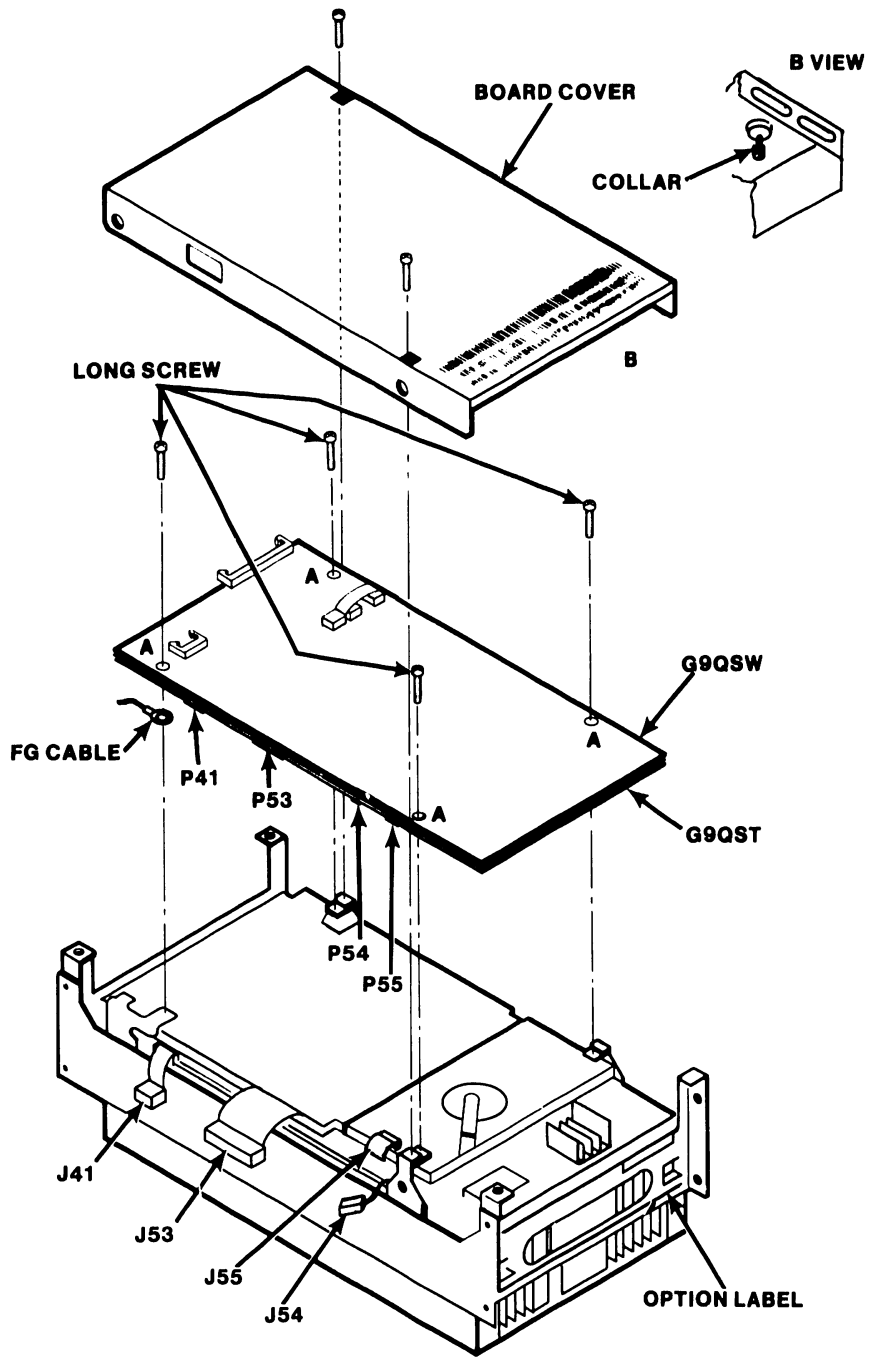
1. Remove two screws securing Logic and Servo board cover and remove cover.
2. Disconnect cables at J41, J53, J54 and J55 on Logic and Servo board.
3. Remove two screws securing Logic and Servo board (G9QST) to drive and remove board.
4. Assemble G9QST board together with Dual Port Option board (G9TXW) with insulator placed between boards (see Figure E-5).
5. Secure assembly with two screws (large diameter) from kit inserted from G9QST side of assembly. Note that screws insert in holes labeled +5V and GND on Dual Port Option board.
6. Find J50-J60 cable in kit and connect between boards (see Figure E-7).
7. Connect cable from 15A on Dual Port Option board to J15D on G9QST board.
8. Connect cable from 15B on Dual Port Option board to J15C on G9QST board.
9. Mount board assembly to drive with two screws (long) from kit. Insert screws in holes labeled 'A' in Figure E-6.
10. Move jumper on MODE switch (see Figure E-7) to CDC (2-3) position.

11. Set ROUTE-0 (PORT A) switch (SW1) on Dual Option board to 'E' (Enable) position.
12. Set ROUTE-1 (PORT B) switch (SW2) to 'E' (Enable) position.
13. Set RELEASE TIMER switch (SW3) to OFF position.
14. On Unit Address Selector switch bank for PORT B (location 13 on Dual Port Option board shown in Figure E-7) set all switches to '0' position. Proper settings are shown on diagram on board cover.
15. Remove terminators on Dual Port board.
16. Remove mounting brackets on each end of drive and install new brackets from kit.
17. Reinstall board cover using remaining two long screws and new collars (see Figure E-6) from kit.
18. Find option label in kit and place on drive in position indicated in Figure E-6.



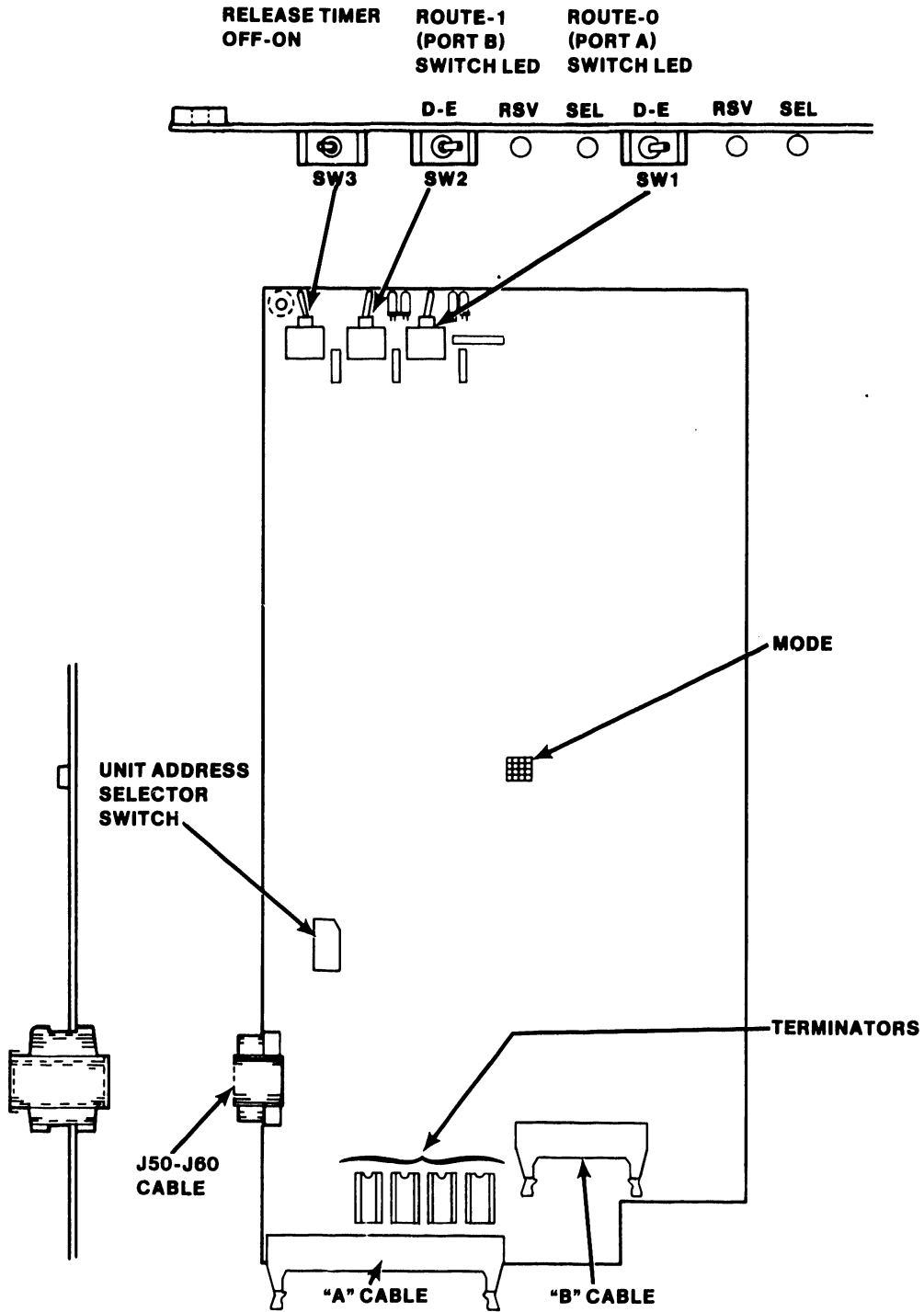
B-03471-FY87-2

Figure E-5 Assembly of Logic and Servo and Dual Port Option Boards



B-03471-FY87-3

Figure E-6 Mounting boards to drive.



B-03471-FY87-1

Figure E-7 Dual Port Option Board

CROSS REFERENCED LISTING

This page contains a brief cross referenced listing of NEC spares with their equivalent Wang part numbers on the Winchester Disk Drive Model D2257.

D2257 (167.7 MB WINCHESTER) SPARES LISTING
SORTED BY WLI #

WLI #	NEC Part Number	NEC Spare Number	Description
726-8111	134-232951	134-232951	Earth Pad Assy
726-8121	134-233100	134-832950	Read/Write PWA (G9QSP)
726-8122	134-233102	134-832952	Power Amp PWA (G9QSR)
726-8123	134-233106	134-832956	Logic & Servo PWA (G9QSV)
726-8124	134-200339-502	134-237667-057	057 DE Assy

D2257 (167.7 MB WINCHESTER) SPARES LISTING
SORTED BY NEC PART #

NEC Part Number	WLI #	NEC Spare Number	Description
134-200339-502	726-8124	134-237667-057	057 DE Assy
134-232951	726-8111	134-232951	Earth Pad Assy
134-233100	726-8121	134-832950	Read/Write PWA (G9QSP)
134-233102	726-8122	134-832952	Power Amp PWA (G9QSR)
134-233106	726-8123	134-832956	Logic & Servo PWA (G9QSV)

Abbreviations

A	Ampere
ac	alternating current
AM	Address Mark
AWG	American Wire Gauge
CA	Cylinder Address
CRC	Cyclic Redundancy Check
dc	direct current
DE	Disk Enclosure
DIP	Dual-inline-packaged
DKC	Disk Controller
DKU	Disk Unit
ECC	Error Correction Code
EOR	End of Record
GND	Ground
HA	Head Address
HEX	Hexadecimal
IGB	Inner Guard Band
I/O	Input/Output
LED	Light emitting diode
m	meter
MB	Megabyte
MFM	Modified Frequency Modulation
MHz	Megahertz
mm	Millimeter
ms	Millisecond
mV	Millivolt
MTBF	Mean Time Between Failures
MTTR	Mean Time to Repair
NRZ	Non-Return-to-Zero
ns	Nanosecond
OGB	Outer Guard Band
PCB	Printed Circuit Board
PLO	Phase Locked Oscillator
RMS	Root-Mean-Square
ROM	Read only memory
RPM	Revolutions per Minute
R/W	Read/Write
SA	Sector Address
TTL	Transistor/Transistor Logic
V	Volt
μ s	microsecond

APPENDIX
A
SCHE-
MATIC
DIAGRAMS

Appendix A

Schematic Diagrams



This Appendix includes the logic diagrams and schematics for each PCB in the D22x7 disk drive. It also includes drawings illustrating the interface and cable connections between PCBs and the signal pin assignments for each connector.

A.1 SIGNAL TRACING SCHEME

The signal tracing scheme provides the ability to easily trace a signal from source to destination within the D22x7 logic. Each individual drawing contains, in its lower right-hand corner, a page number, an identifier, and a drawing number as shown in Figure A-1.

Figure A-1 also shows the horizontal/vertical coordinates that are used to locate and identify a signal upon a specific page.

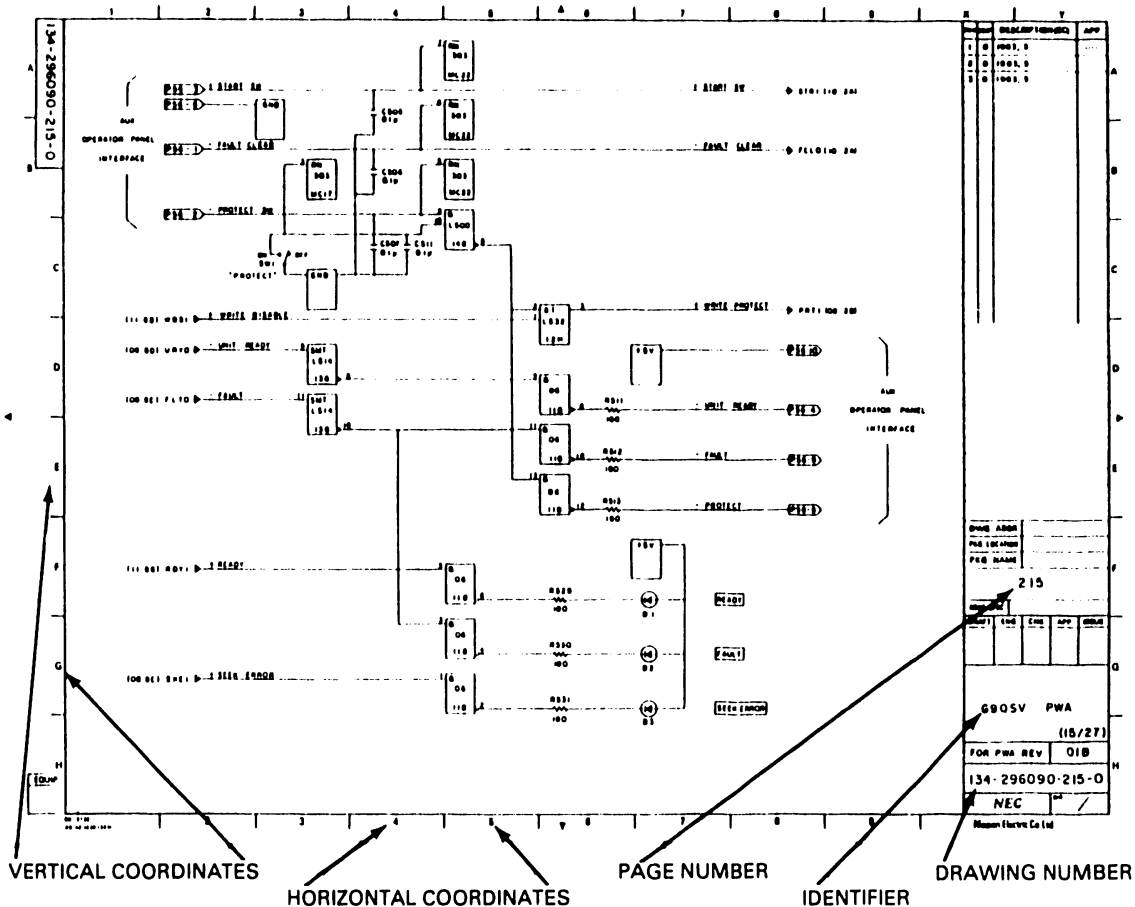


Figure A-1 Schematic Format

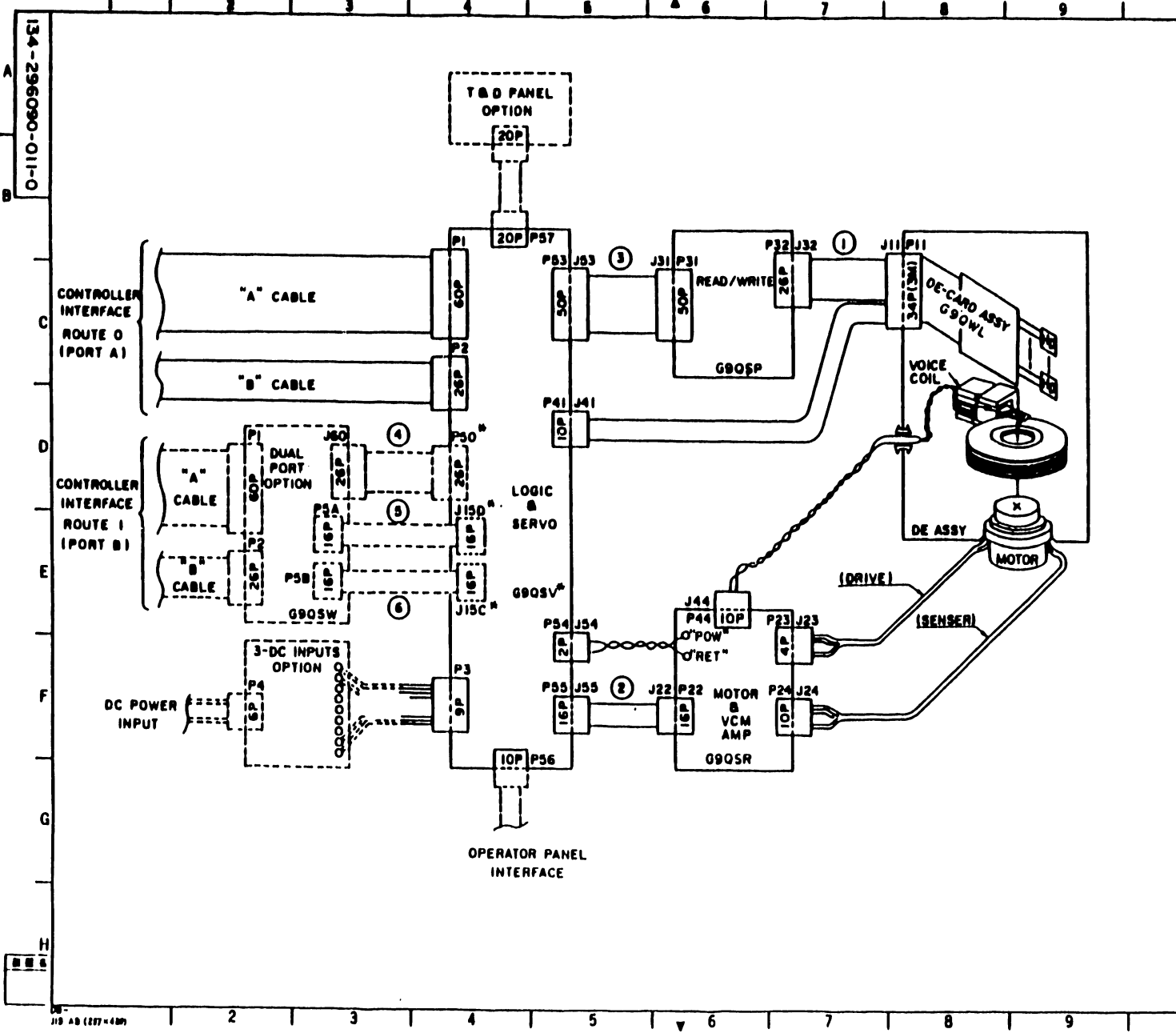
A.2 DRAWINGS

Table A-1 lists the drawings contained in this Appendix along with their drawing numbers.

Table A-1 Schematic Drawings

DIAGRAM	DRAWING NUMBER
I/O Connectors	134-296090-021
Interface and Power Connectors	134-296090-022
Head/Disk Assembly Internal Cabling Diagram	134-296090-011
Internal Cabling Diagram	134-296090-012
Route 0 (Port A) Interface	134-296090-051
Route 1 (Port B) Interface	134-296090-052
G9TXW PCB Schematic	134-296090-101/111
G9QSV PCB Schematic	134-296090-201/227
G9QSP PCB Schematic	134-296090-301/309
G9QSR PCB Schematic	134-296090-401/403
Head/Disk Assembly and Motor Circuit Diagram	134-296090-501
G9QWL PCB Schematic	134-296090-601

A-3



REV	NO	DATE	BY																
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图号																			
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PKG																			
011																			
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图号																			
图名																			
TITLE																			
DKUOX7-HBSC INTERNAL CABLING DIAGRAM																			
DWG NO																			
134-296090-011-0																			
NEC			1/1																

Hygon Electric Company Ltd

134-296090-051-0

"A" CABLE INTERFACE

PIN NO	FUNCTION	NAME	JUMP LOCATION
1	YSOT81Z	TAG 1	203-2A
2	YSOT81V		203-2A
3	YSOT82Z	TAG 2	203-2B
4	YSOT82V		203-2B
5	YSOT83Z	TAG 3	203-2C
6	YSOT83V		203-2C
7	YSOB10Z	BUS OUT BIT 0	202-2H
8	YSOB10V		202-2H
9	YSOB11Z	BUS OUT BIT 1	202-2H
10	YSOB11V		202-2H
11	YSOB12Z	BUS OUT BIT 2	202-2H
12	YSOB12V		202-2H
13	YSOB13Z	BUS OUT BIT 3	202-2F
14	YSOB13V		202-2F
15	YSOB14Z	BUS OUT BIT 4	202-2F
16	YSOB14V		202-2F
17	YSOB15Z	BUS OUT BIT 5	202-2E
18	YSOB15V		202-2E
19	YSOB16Z	BUS OUT BIT 6	202-2D
20	YSOB16V		202-2D
21	YSOB17Z	BUS OUT BIT 7	202-2D
22	YSOB17V		202-2D
23	YSOB18Z	BUS OUT BIT 8	202-2C
24	YSOB18V		202-2C
25	YSOB19Z	BUS OUT BIT 9	202-2C
26	YSOB19V		202-2C
27	YSOOC0Z	OPEN CABLE DETECT	202-2D
28	YSOOC0V		202-2D
29	YSOB12Z	BUS IN BIT 2 (FAULT)	205-8E
30	YSOB12V		205-8E

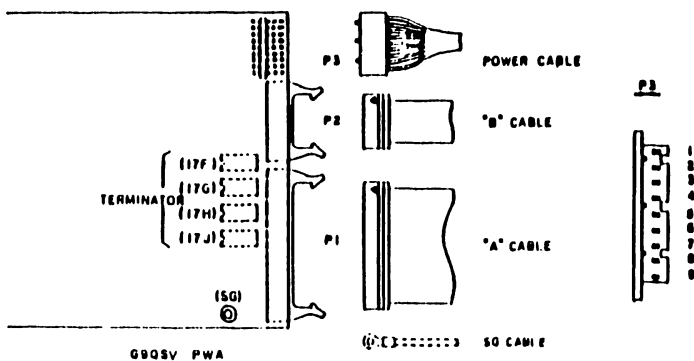
PIN NO.	FUNCTION	NAME	JUMP LOCATION
18	YSOB13Z	BUS IN BIT 3 (SEEN ERROR)	205-8D
19	YSOB13V		205-8D
17	YSOB14Z	BUS IN BIT 4 (ON CYLINDER)	205-8D
18	YSOB14V		205-8C
19	YSOB10Z	BUS IN BIT 0 (INDEX)	205-8F
20	YSOB10V		205-8F
19	YSOB12Z	BUS IN BIT 2 (UNIT READY)	205-8C
20	YSOB12V		205-8B
20	YSOB16Z	BUS IN BIT 6 (ADDRESS MARK FOUND)	205-8B
21	YSOB16V		206-8B
21	YSOB17Z	BUSY	206-8A
22	YSOB17V		206-8A
22	YSOUS1Z	UNIT SELECT 1A0	201-2F
23	YSOUS1V		201-2E
23	YSOUS2Z	UNIT SELECT 2 ⁰	201-2E
24	YSOUS2V		201-2D
24	YSOUS1Z	UNIT SELECT 2 ¹	201-2D
25	YSOUS1V		201-2C
25	YSOB11Z	BUS IN BIT 1 (SECTOR)	205-8F
26	YSOB11V		205-8E
26	YSOUS2Z	UNIT SELECT 2 ²	201-2C
27	YSOUS2V		201-2B
27	YSOUS3Z	UNIT SELECT 2 ³	201-2B
28	YSOUS3V		201-2A
28	YSOB17Z	BUS IN BIT 7 (WRITE PROTECT)	205-8B
29	YSOB17V		205-8A
29	YKSPCK0Z	POWER SEQUENCE PICK	203-2F
30	YKSHLD0Z	POWER SEQUENCE HOLD	203-2F
30	YSOT84Z	TAG 4	203-2D
31	YSOT84V		203-2D

"B" CABLE INTERFACE

PIN NO.	FUNCTION	NAME	JUMP LOCATION
1	X000	GROUND	206-8B
14	YSOSCKY	SERVO CLOCK	206-8B
2	YSOSCKZ		206-8B
18	X000	GROUND	206-8B
3	YSORDTZ	READ DATA	206-8C
18	YSORDTV		206-8C
4	X000	GROUND	206-8B
17	YSORCKY	READ CLOCK	206-8D
8	YSORCKZ		206-8C
18	X000	GROUND	206-8B
6	YSOWCKZ	WRITE CLOCK	202-2B
19	YSOWCKY		202-2A
7	X000	GROUND	206-8B
20	YSOWDTY	WRITE DATA	202-2A
8	YSOWDTZ		202-2A
21	X000	GROUND	206-8B
8	YSOUSDY	UNIT SELECTED	206-8D
22	YSOUSDZ		206-8D
10	YSOSK0Z	SEEK END	206-8E
23	YSOSKDY		206-8E
11	X000	GROUND	206-8B
24	YSOINKY	INDEX	206-8E
12	YSOINKZ		206-8F
25	X000	GROUND	206-8B
13	YSOSECZ	SECTOR	206-8F
26	YSOSECY		206-8F

POWER INTERFACE

PIN NO.	VOLTAGE	JUMP LOCATION
1	0V	218-2A
2	+5V	218-2A
3	+5V	218-2A
4	-5V	218-2B
5	-12V	218-2D
6	0V	218-2C
7	+12V	218-2C
8	+24V	218-2E
9	+24V RETURN	218-2E



REV	DESCRIPTION (RC)	APP
1	0 1983. 1. 18	

DWG ADDR	
PKG LOCATION	
PKG NAME	051
NEXT SPEC	
DRAFT	ENG
CHK	APP
ISSUE	

ROUTE 0 (PORT A)
INTERFACE

134-296090-051-0

NEC 1/1

134-296090-052-0

"A" CABLE INTERFACE

PIN NO.	FUNCTION	NAME	JUMP LOCATION
1	Y8101Z	TAG 1	103-2A
31	Y8101Y	TAG 1	103-2A
2	Y8102Z	TAG 2	103-2B
32	Y8102Y	TAG 2	103-2B
3	Y8103Z	TAG 3	103-2C
33	Y8103Y	TAG 3	103-2C
4	Y8102Z	BUS OUT BIT 0	102-2H
34	Y8101Y	BUS OUT BIT 0	102-2H
5	Y8101Z	BUS OUT BIT 1	102-2H
35	Y8101Y	BUS OUT BIT 1	102-2H
6	Y8102Z	BUS OUT BIT 2	102-2H
36	Y8102Y	BUS OUT BIT 2	102-2H
7	Y8103Z	BUS OUT BIT 3	102-2F
37	Y8103Y	BUS OUT BIT 3	102-2F
8	Y8104Z	BUS OUT BIT 4	102-2F
38	Y8104Y	BUS OUT BIT 4	102-2F
9	Y8105Z	BUS OUT BIT 5	102-2E
39	Y8105Y	BUS OUT BIT 5	102-2E
10	Y8106Z	BUS OUT BIT 6	102-2D
40	Y8106Y	BUS OUT BIT 6	102-2D
11	Y8107Z	BUS OUT BIT 7	102-2D
41	Y8107Y	BUS OUT BIT 7	102-2D
12	Y8108Z	BUS OUT BIT 8	102-2C
42	Y8108Y	BUS OUT BIT 8	102-2C
13	Y8109Z	BUS OUT BIT 9	102-2C
43	Y8109Y	BUS OUT BIT 9	102-2C
14	Y8100Z	OPEN CABLE DETECT	101-2D
44	Y8100Y	OPEN CABLE DETECT	101-2D
15	Y8101Z	BUS IN BIT 2	104-8E
45	Y8101Y	(FAULT)	104-8E

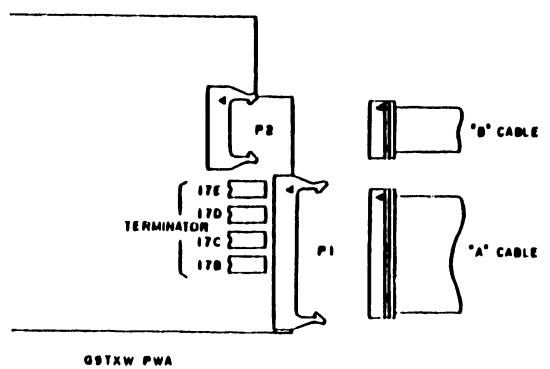
PIN NO.	FUNCTION	NAME	JUMP LOCATION
16	Y8101Z	BUS IN BIT 3	104-8D
46	Y8101Y	(SEEK ERROR)	104-8D
17	Y8102Z	BUS IN BIT 4	104-8D
47	Y8102Y	(ON CYLINDER)	104-8C
18	Y8101Z	BUS IN BIT 0	104-8F
48	Y8101Y	(INDEX)	104-8F
19	Y8101Z	BUS IN BIT 6	104-8C
49	Y8101Y	(UNIT READY)	104-8C
20	Y8101Z	BUS IN BIT 6	104-8B
50	Y8101Y	(ADDRESS MARK FOUND)	104-8B
21	Y8105Y	BUSY	105-8B
51	Y8105Y	BUSY	105-8A
22	Y8105Z	UNIT SELECT TAG	101-2F
52	Y8105Y	UNIT SELECT TAG	101-2E
23	Y8105Z	UNIT SELECT 2 ⁰	101-2E
53	Y8105Y	UNIT SELECT 2 ⁰	101-2D
24	Y8105Z	UNIT SELECT 2 ¹	101-2D
54	Y8105Y	UNIT SELECT 2 ¹	101-2C
25	Y8105Z	BUS IN BIT 1	104-8F
55	Y8105Y	(SECTOR)	104-8E
26	Y8105Z	UNIT SELECT 2 ²	101-2C
56	Y8105Y	UNIT SELECT 2 ²	101-2B
27	Y8105Z	UNIT SELECT 2 ³	101-2B
57	Y8105Y	UNIT SELECT 2 ³	101-2A
28	Y8101Z	BUS IN BIT 7	104-8B
58	Y8101Y	(WRITE PROTECT)	104-8A
29	Y8105Z	POWER SEQUENCE PICK	103-2F
59	Y8105Y	POWER SEQUENCE HOLD	103-2F
30	Y8104Z	TAG 4	103-2D
60	Y8104Y	TAG 4	103-2D

"B" CABLE INTERFACE

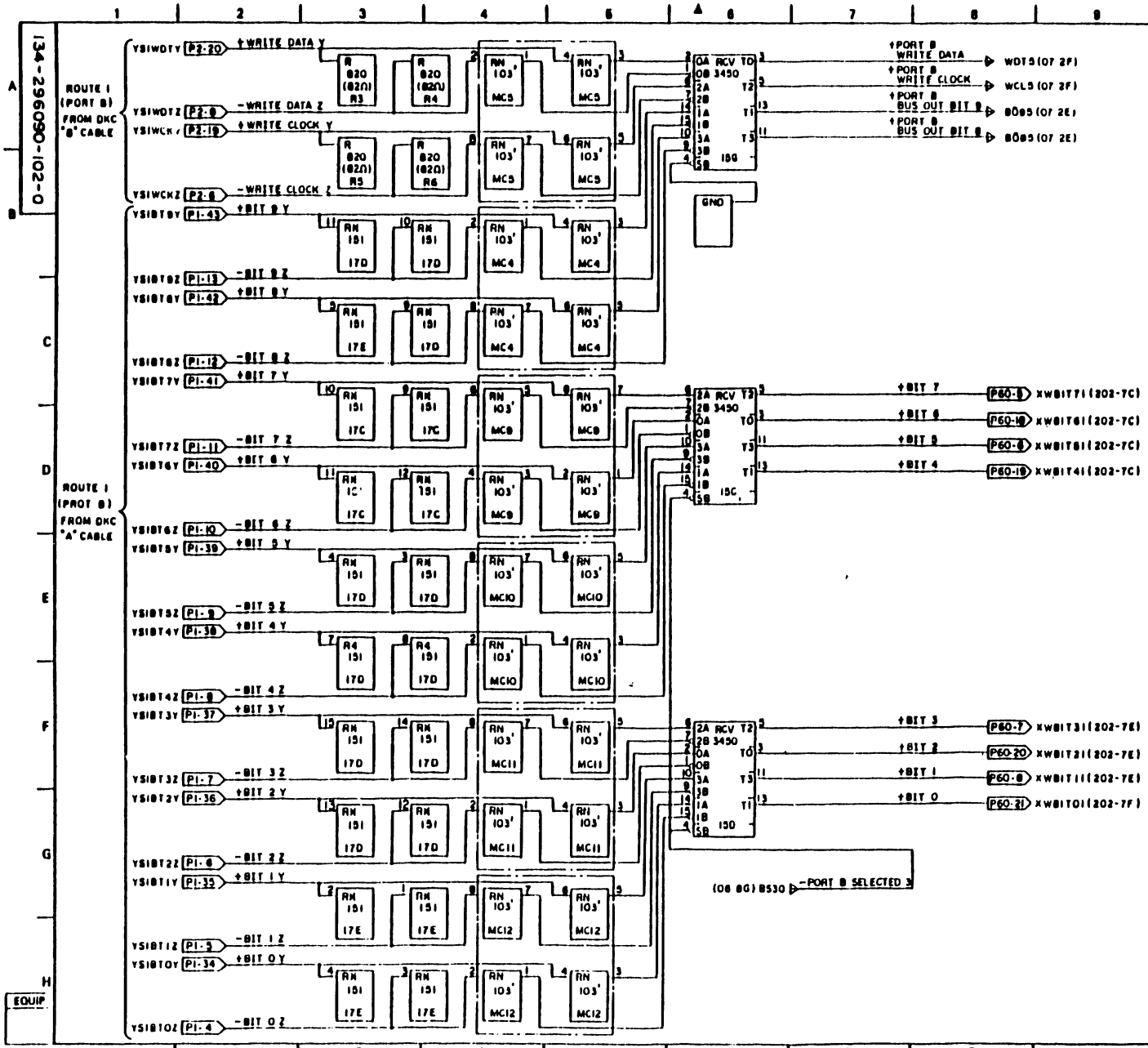
PIN NO.	FUNCTION	NAME	JUMP LOCATION
1	X000	GROUND	105-8B
14	Y81SCKY	SERVO CLOCK	105-8B
2	Y81SCKZ	SERVO CLOCK	105-8B
15	X000	GROUND	105-8C
3	Y81RDTZ	READ DATA	105-8C
16	Y81RDTY	READ DATA	105-8C
4	X000	GROUND	105-8D
17	Y81RCKY	READ CLOCK	105-8D
5	Y81RCKZ	READ CLOCK	105-8C
18	X000	GROUND	105-8D
6	Y81WCKZ	WRITE CLOCK	102-2B
19	Y81WCKY	WRITE CLOCK	102-2A
7	X000	GROUND	105-8D
20	Y81WDTY	WRITE DATA	102-2A
8	Y81WDTZ	WRITE DATA	102-2A
21	X000	GROUND	105-8D
9	Y81USDY	UNIT SELECTED	105-8D
22	Y81USDZ	UNIT SELECTED	105-8D
10	Y81SKDZ	SEEK END	105-8E
23	Y81SKDY	SEEK END	105-8E
11	X000	GROUND	105-8D
24	Y81INXY	INDEX	105-8E
12	Y81INXZ	INDEX	105-8F
25	X000	GROUND	105-8H
13	Y81SE CZ	SECTOR	105-8F
26	Y81SE CY	SECTOR	105-8F

REV	DESCRIPTION(S)	APP
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DWG ADDR	
PKG LOCATION	
PKG NAME	
052	
REV SPEC	
DRAFT	ENG
CHK	APP
ISSUE	
ROUTE 1 (PORT B) INTERFACE	
134-296090-052-0	
NEC	1/1



A-6



REV	DATE	DESCRIPTION(S)	APP
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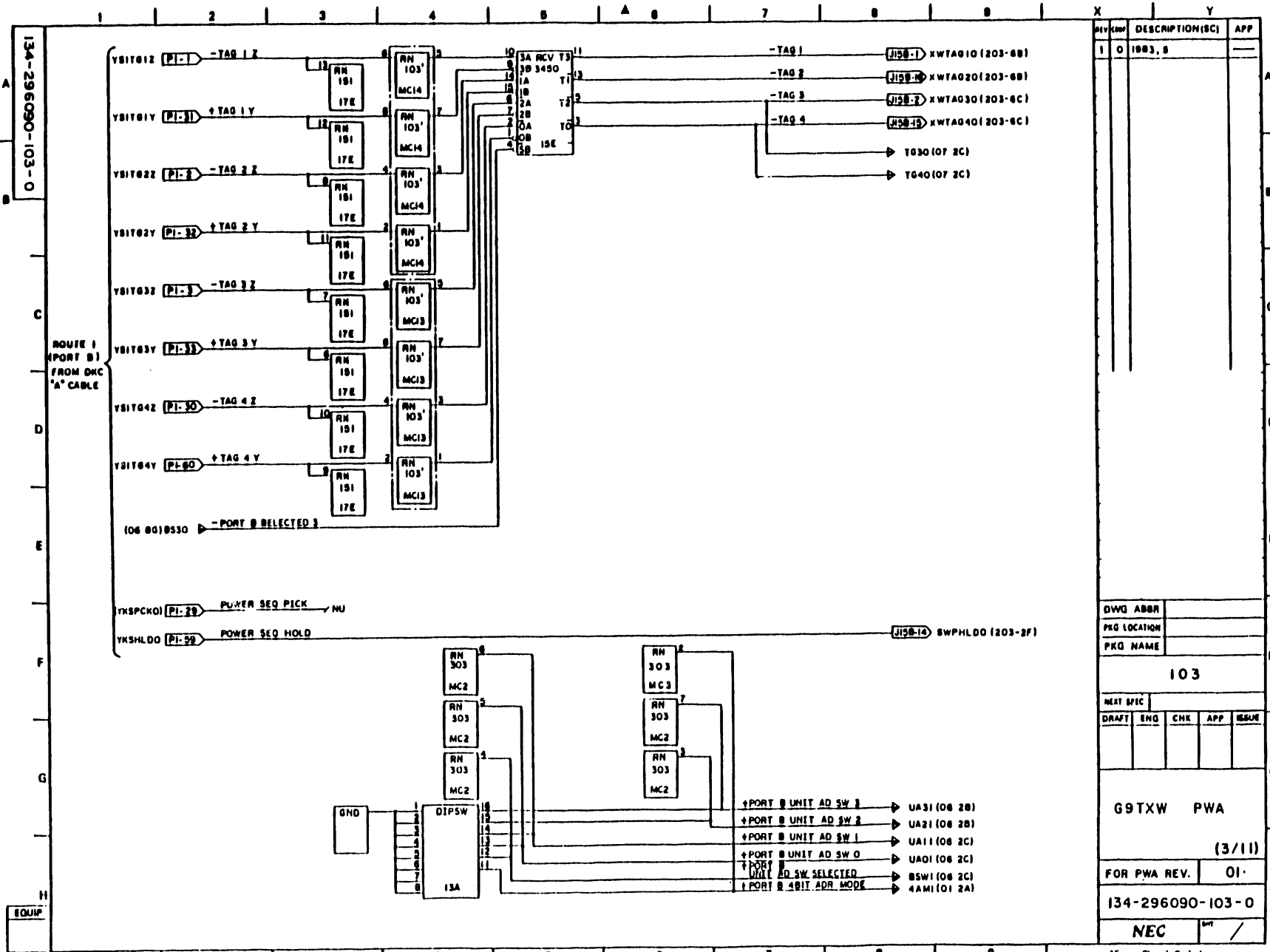
DWG ABBR	
PKG LOCATION	
PKG NAME	
102	
MAT SPEC	
DRAFT	ENG
CHK	APP
ISSUE	
G9TXW PWA	
(2/11)	
FOR PWA REV.	01
134-296090-102-0	
NEC	/

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98 42 1200-0001

A-9



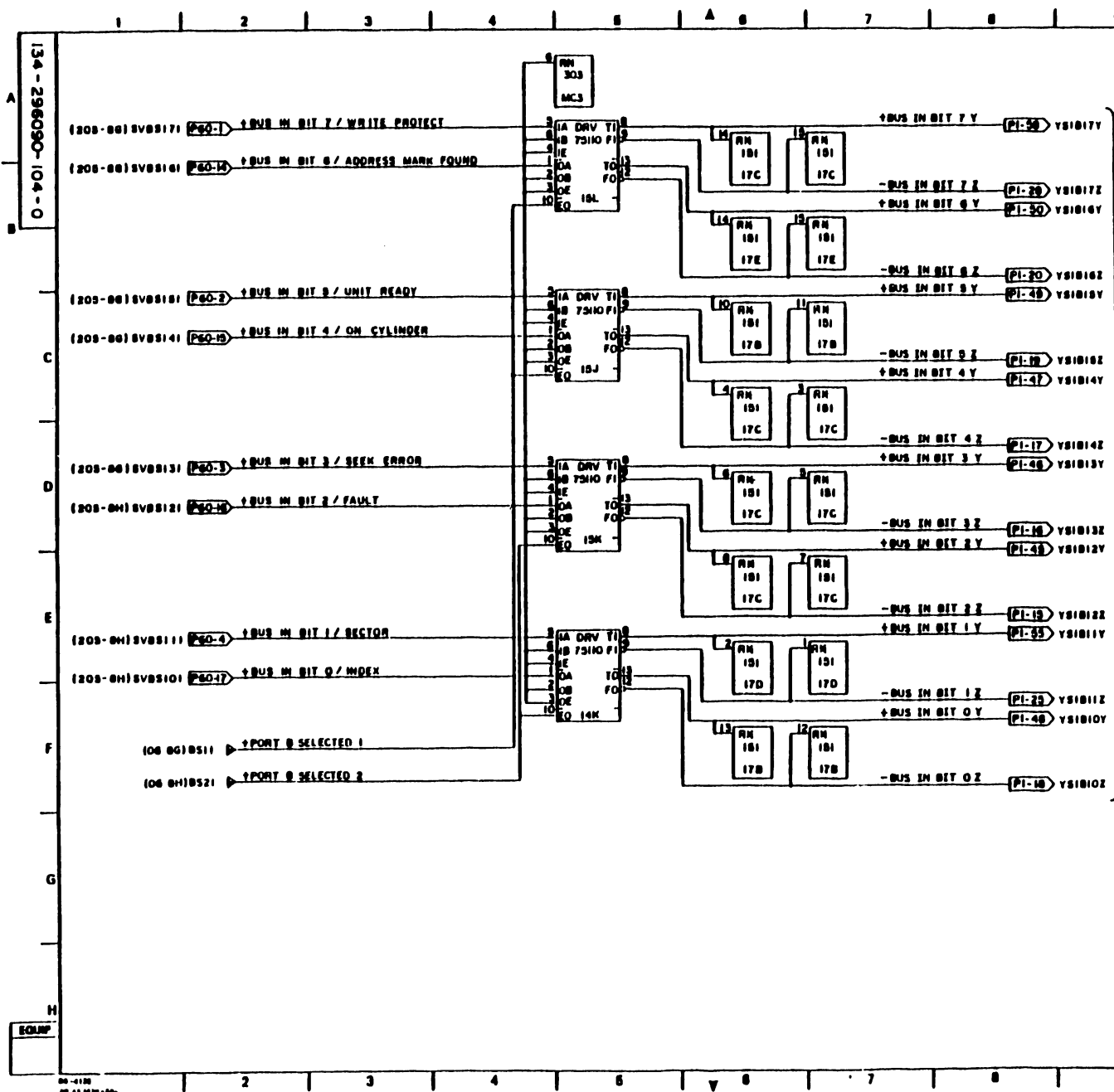
REV	DATE	DESCRIPTION (SC)	APP
1	Q	1003, S	

DWG ABBR				
PRG LOCATION				
PRG NAME				
103				
NEXT SPEC				
DRAFT	ENG	CHK	APP	ISSUE
G9TXW PWA				
(3/11)				
FOR PWA REV.	01			
134-296090-103-0				
NEC				

Nippon Electric Co. Ltd

90 4122
JAN 62 (100-1004)

A-10

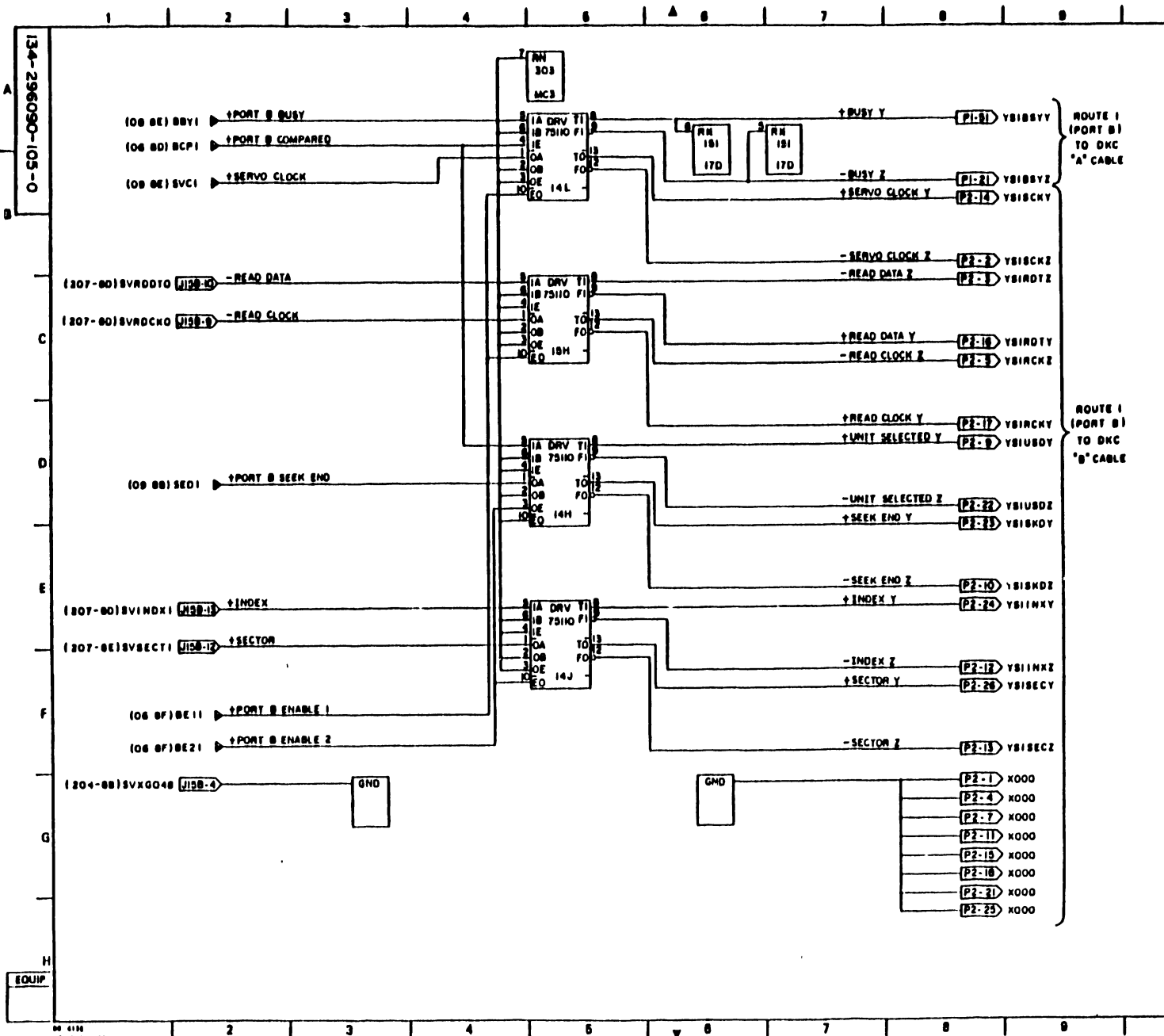


REV	DESCRIPTION (ISC)	APP
1 0	1983.5	

DWG ABBR	
PKG LOCATION	
PKG NAME	
104	
NEXT SPEC	
DRAFT	ENG
CHK	APP
ISSUE	
G9TXW PWA	
(4/11)	
FOR PWA REV.	01
134-296090-104-0	
NEC	DW /

Nippon Electric Co Ltd

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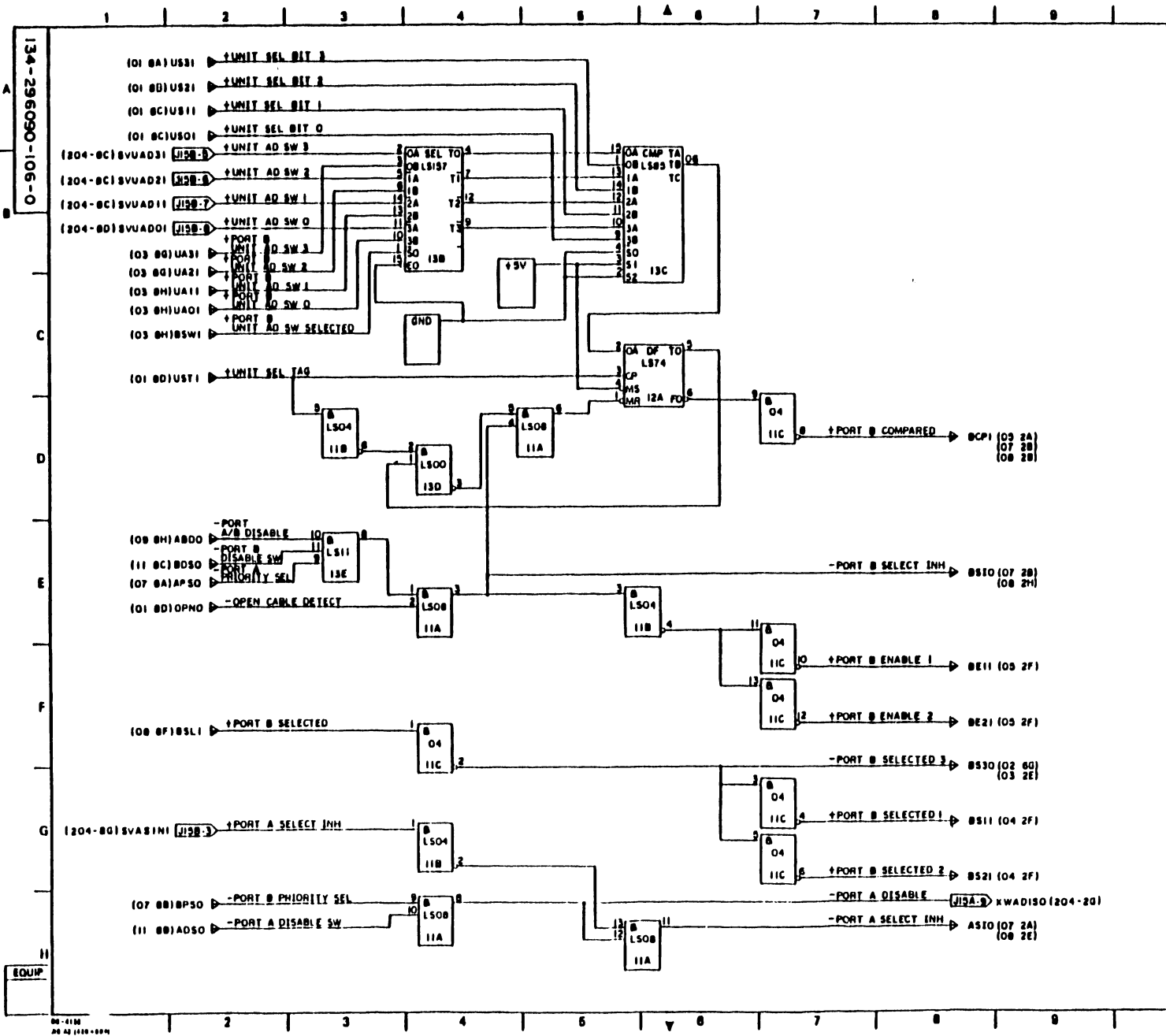


REV	DESCRIPTION (DC)	APP
1	0 1003, B	

DWG ABBR	
PKG LOCATION	
PKG NAME	
105	
NEXT SPEC	
DRAFT	ENG
CHK	APP
ISSUE	
G9TXW PWA	
(5/11)	
FOR PWA REV.	01
134-296090-105-0	
NEC	

Appon Electric Co Ltd

NO 4110
21 42 1100-1100



REV	DESCRIPTION (SC)	APP
1	0 1983.8	

DWG ABBR	
PKG LOCATION	
PKG NAME	
106	
NEXT SPEC	
DRAW	ENG
CHK	APP
ISSUE	
G9TXW PWA	
(6/11)	
FOR PWA REV.	01
134-296090-106-0	
NEC	

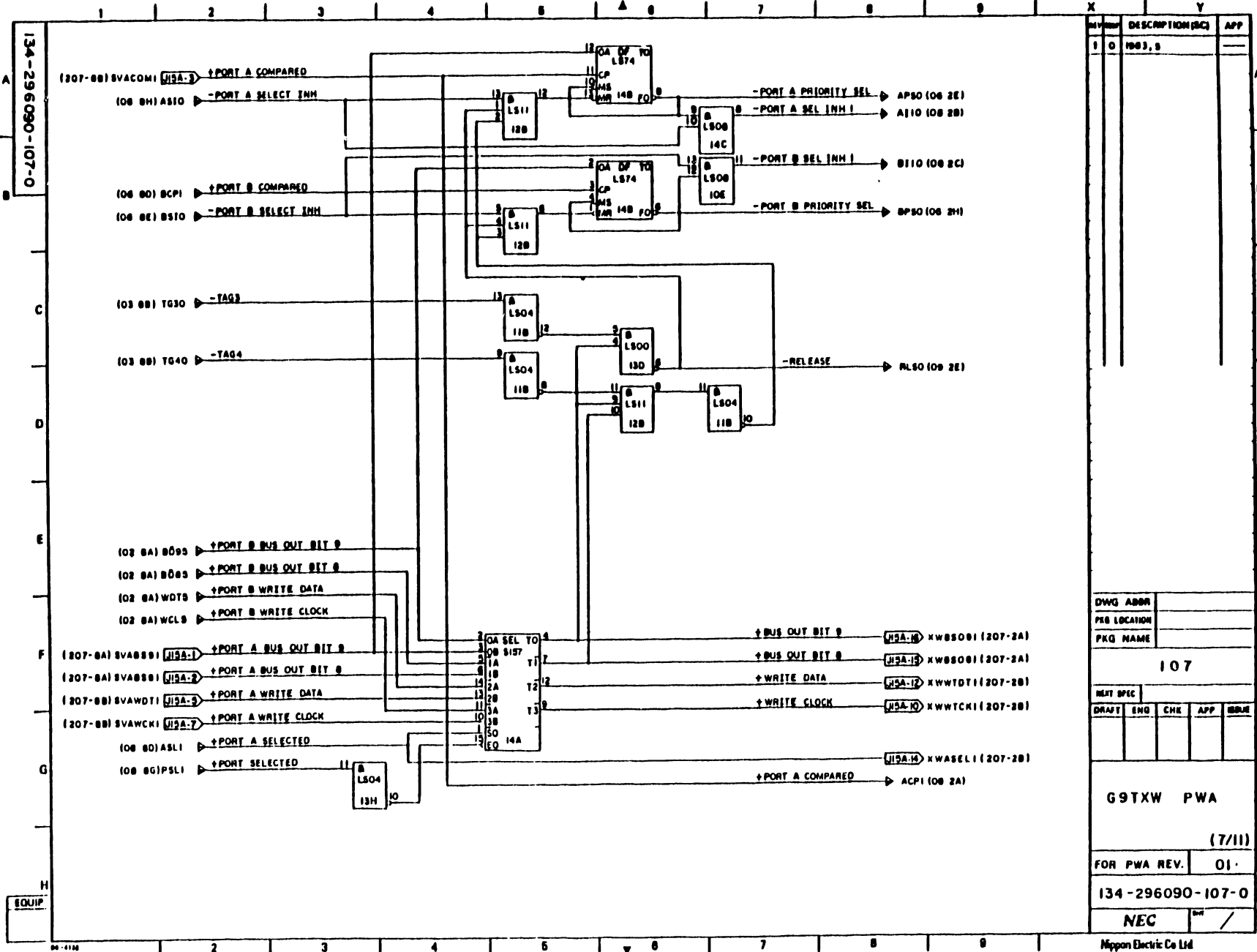
Nippon Electric Co Ltd

EQUIP

00-418
28 42 110-1004

134-296090-107-0

A-13

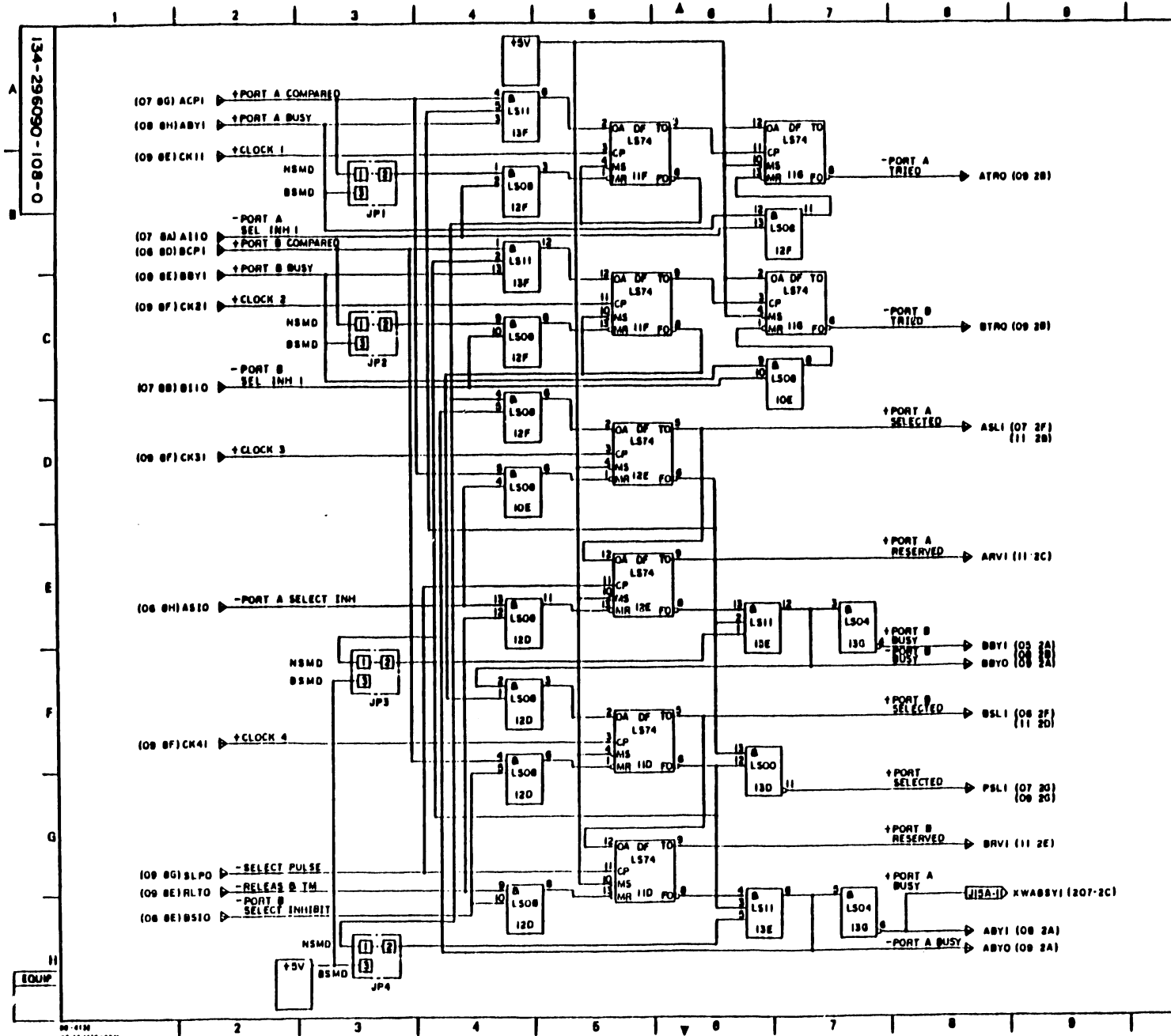


REV	DESCRIPTION (REV)	APP
1	0	

DWG ADDR	
PKG LOCATION	
PKG NAME	
107	
NEXT SPEC	
DRAFT	ENG
CHK	APP
ISSUE	
G9TXW PWA	
(7/11)	
FOR PWA REV.	01
134-296090-107-0	
NEC	

Nippon Electric Co Ltd

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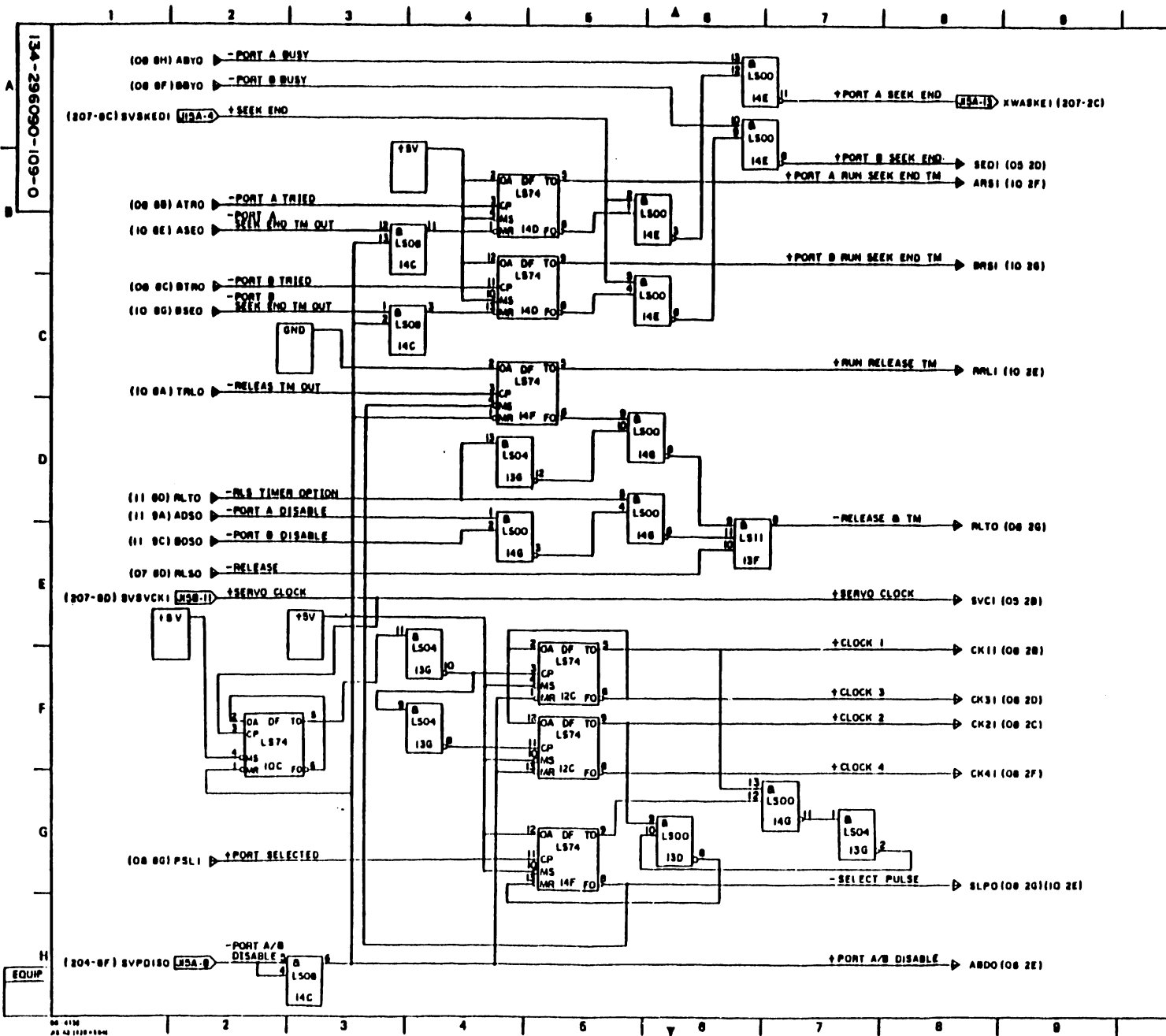
REV	DESCRIPTION(S)	APP
1	Q 1003, S	

DWG ABBR	
PLS LOCATION	
PKG NAME	108
NEXT SPEC	
DRAFT	ENG
CHK	APP
RESU	

G9TXW PWA	
(8/11)	
FOR PWA REV.	01
134-296090-108-0	
NEC	

Nippon Electric Co Ltd

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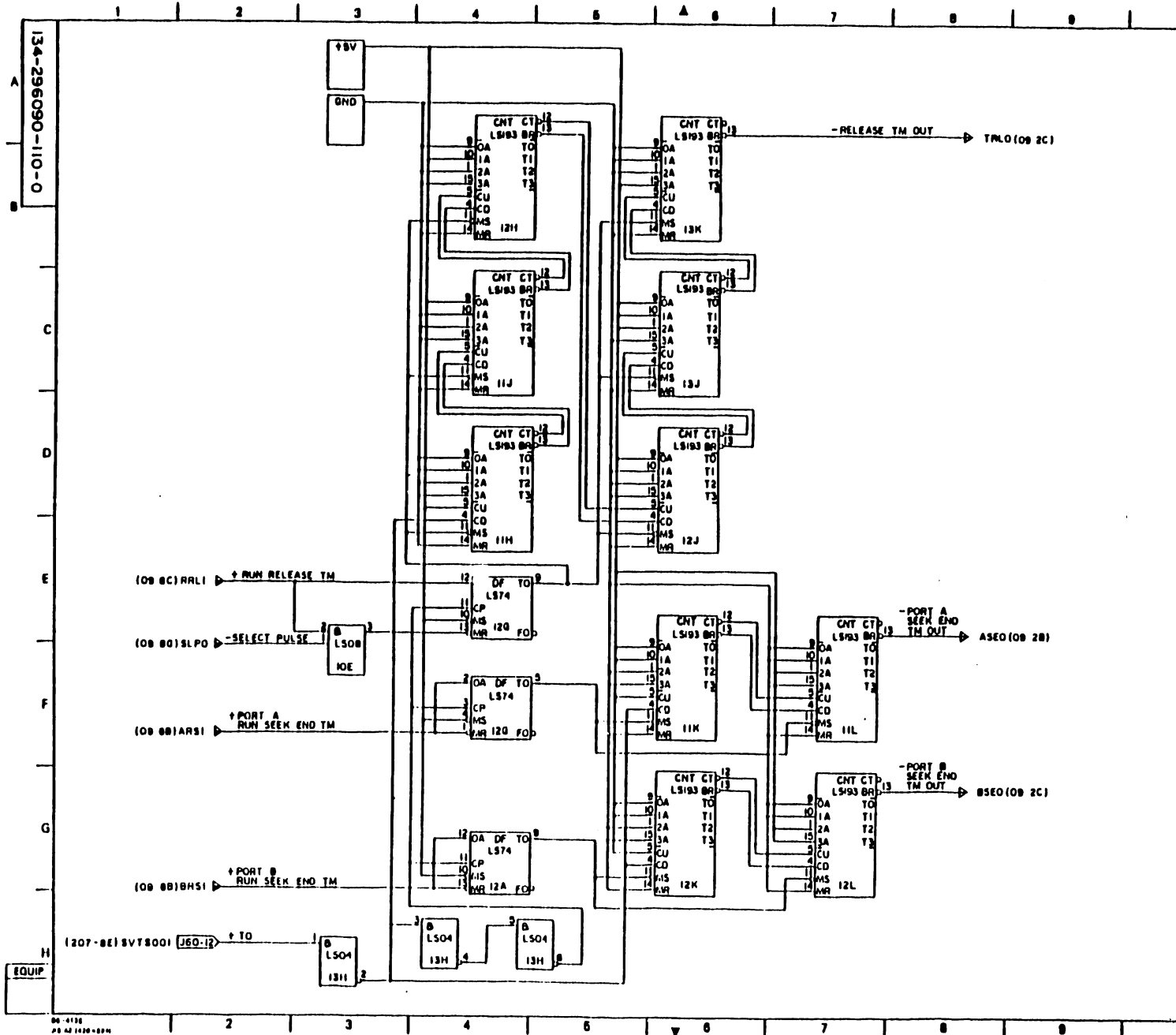


REV	DATE	DESCRIPTION (RC)	APP
1	0	1003, S	

DWG ABBR	
FIG LOCATION	
PKG NAME	
109	
NEXT SPEC	
DRAFT	ENG
CHK	APP
ISSUE	
G9TXW PWA	
(9/11)	
FOR PWA REV.	01
134-296090-109-0	
NEC	

Nippon Electric Co Ltd

00 4136
00 42 1000-1000

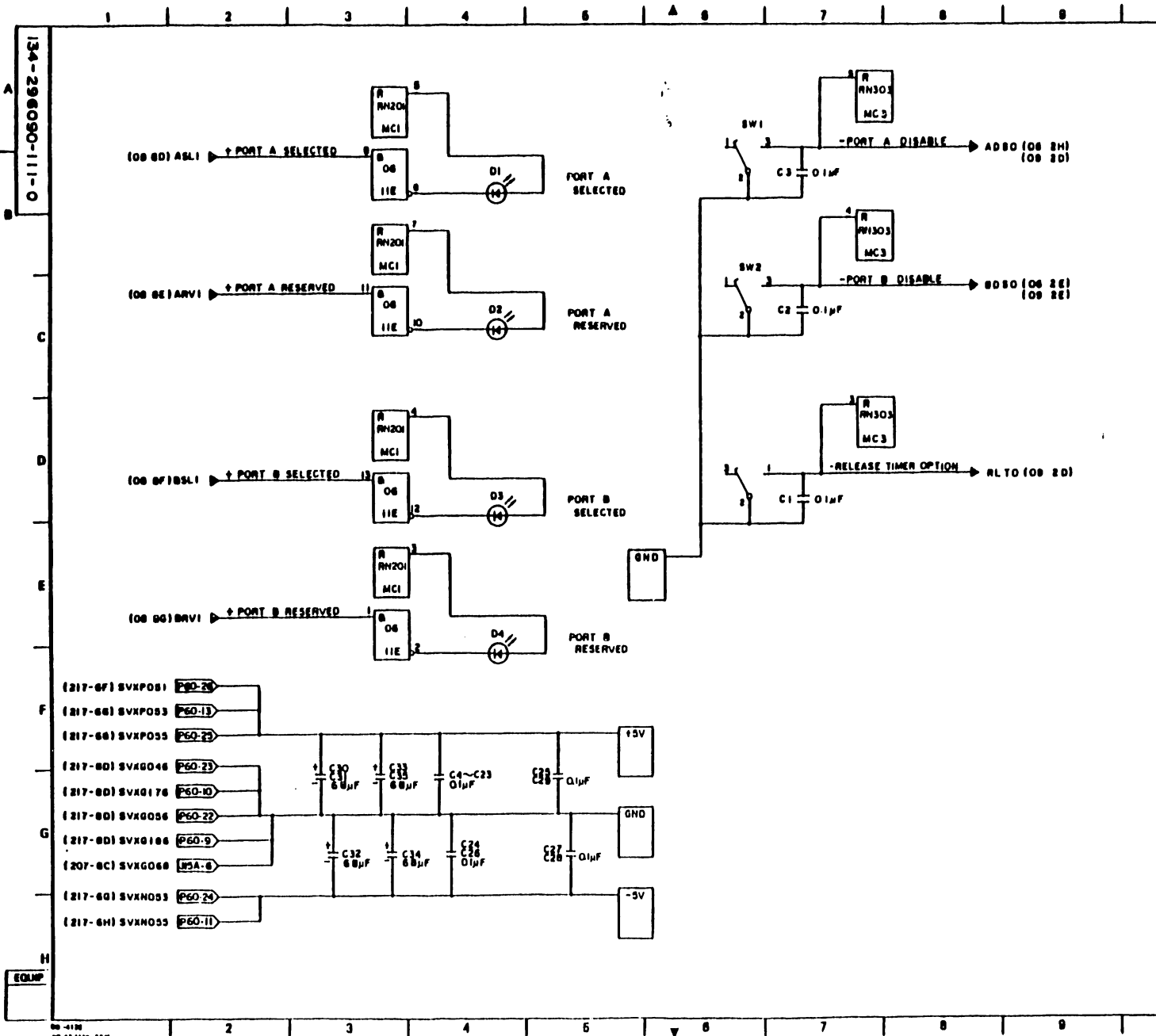


REV	DESCRIPTION (SC)	APP
1	0	1983, S

DWG ADDR	
PKG LOCATION	
PKG NAME	
110	
NEXT PIC	
DRAFT	ENG
CHK	APP
ISSUE	
G9TXW PWA	
(10/11)	
FOR PWA REV.	01
134-296090-110-0	
INEC	

Nippon Electric Co Ltd

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REV	DESCRIPTION (BC)	APP
1	Q 1983, 8	

DWG ABBR	
PKG LOCATION	
PKG NAME	

1 1 1

NEXT SPEC	
DRAFT	END
CHK	APP
ISSUE	

G9TXW PWA

(11/11)

FOR PWA REV. 01-

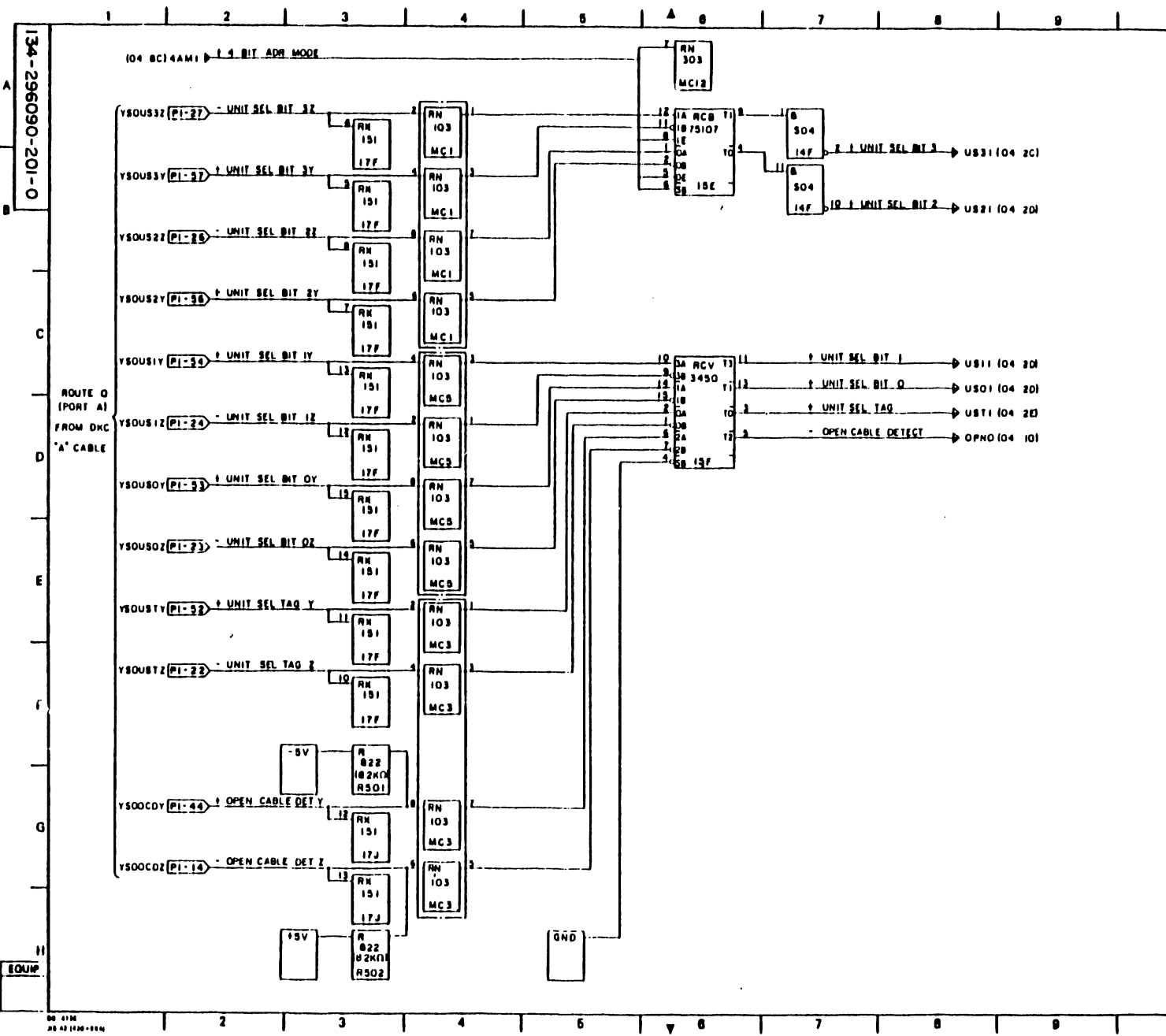
134-296090-111-0

NEC

Niopan Electric Co Ltd

134-296090-201-0

A-18

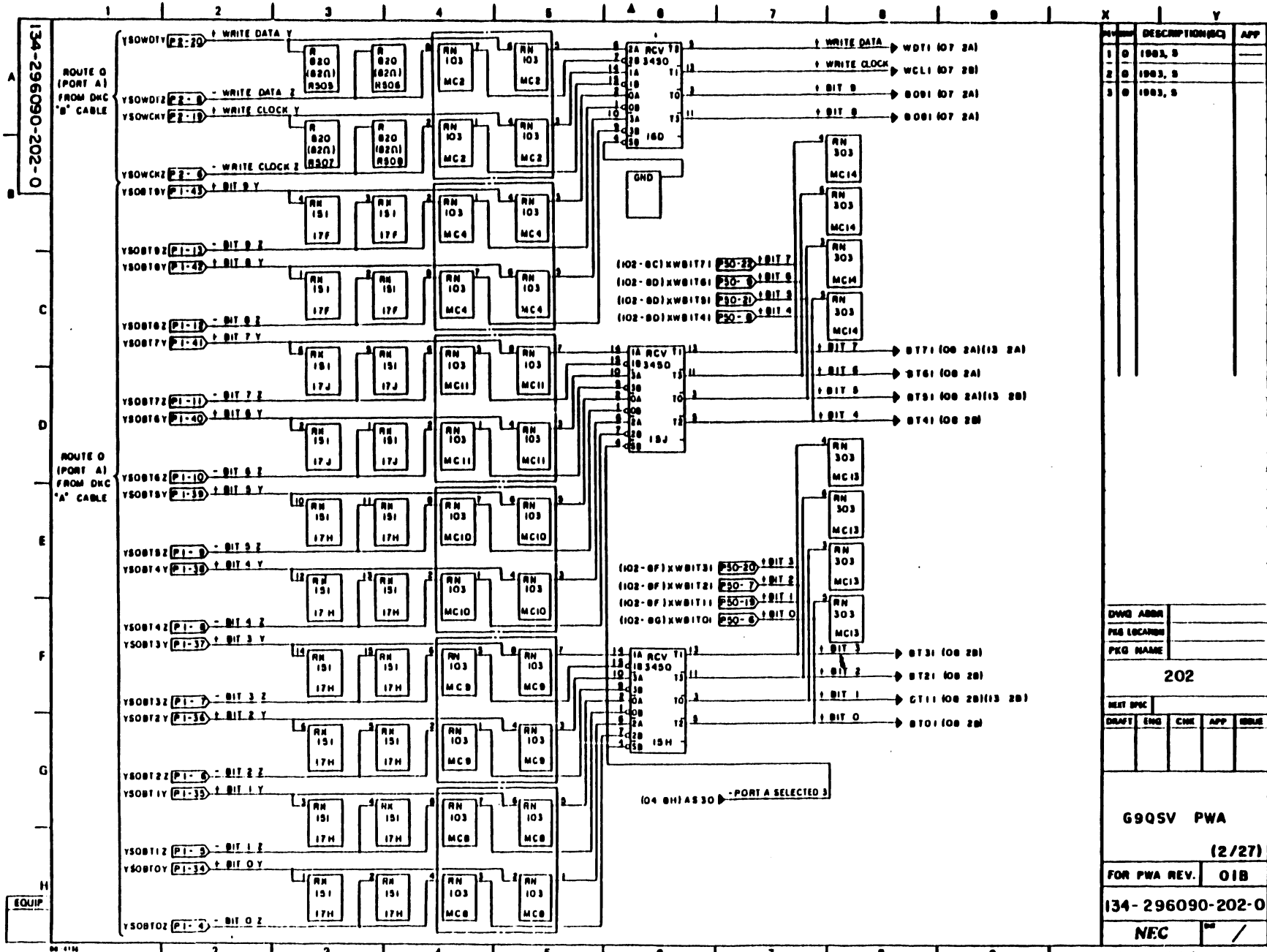


REV	DESCRIPTION (SC)	APP
1	0 1003, S	
2	0 1003, S	
3	0 1003, S	

DWG ABBR	
PKG LOCATION	
PKG NAME	
201	
NEXT SPEC	
DRAWN	ENG
CHK	APP
ISSUE	
G9QSV PWA	
(1/27)	
FOR PWA REV.	OIB
134-296090-201-0	
NEC	

Nippon Electric Co Ltd

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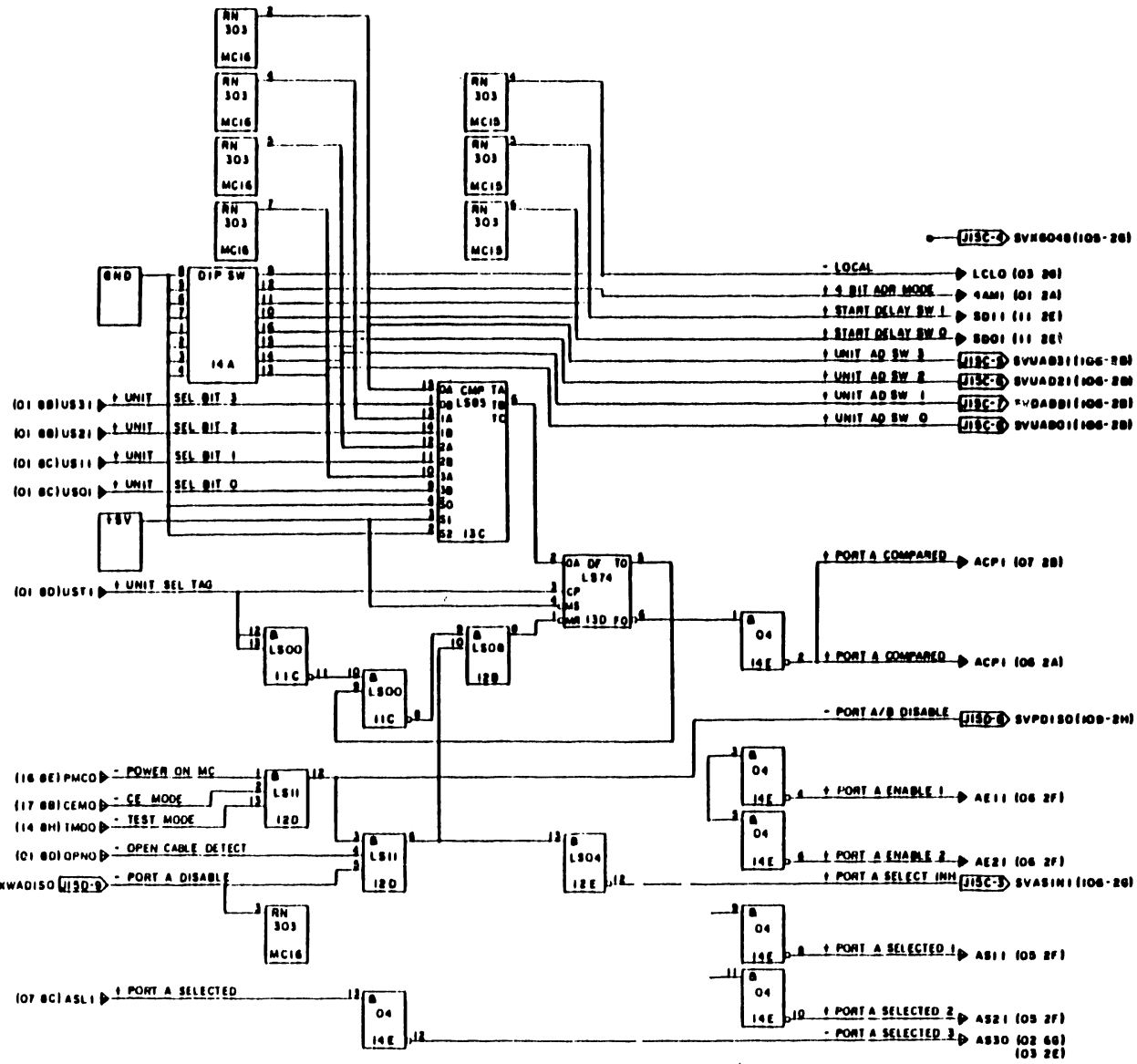
REV	DESCRIPTION (RC)	APP
1	0 1983, 9	
2	0 1983, 9	
3	0 1983, 9	

DWG ADDR	
FIG LOCARD	
PKG NAME	
202	
NEXT DPC	
DRAFT	ENG CKE APP ISSUE
G9QSV PWA	
(2/27)	
FOR PWA REV.	OIB
134-296090-202-0	
NFC	/

98 1126
20 04 1010-1000

Nippon Electric Co Ltd

134-296090-204-0



REV	DESCRIPTION (REV)	APP
1	1003, 3	
2	1003, 3	
3	1003, 3	

SWG ABR	
PWG (CARD)	
PLG NAME	

204

REV SPEC				
DRAWN	ENG	CHK	APP	DATE

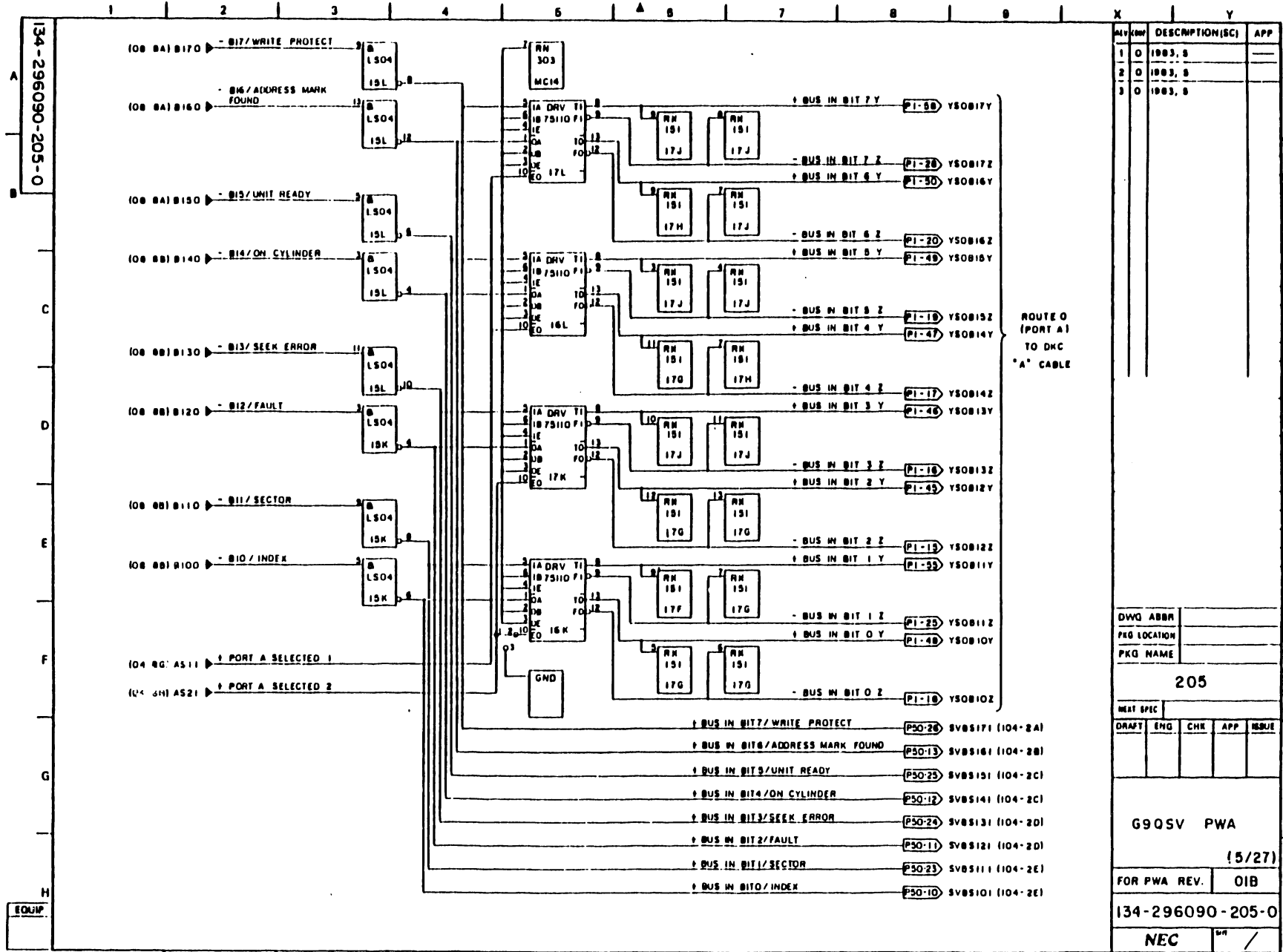
G90SV PWA
(4/27)

FOR PWA REV.	OIB
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134-296090-204-0

NEC

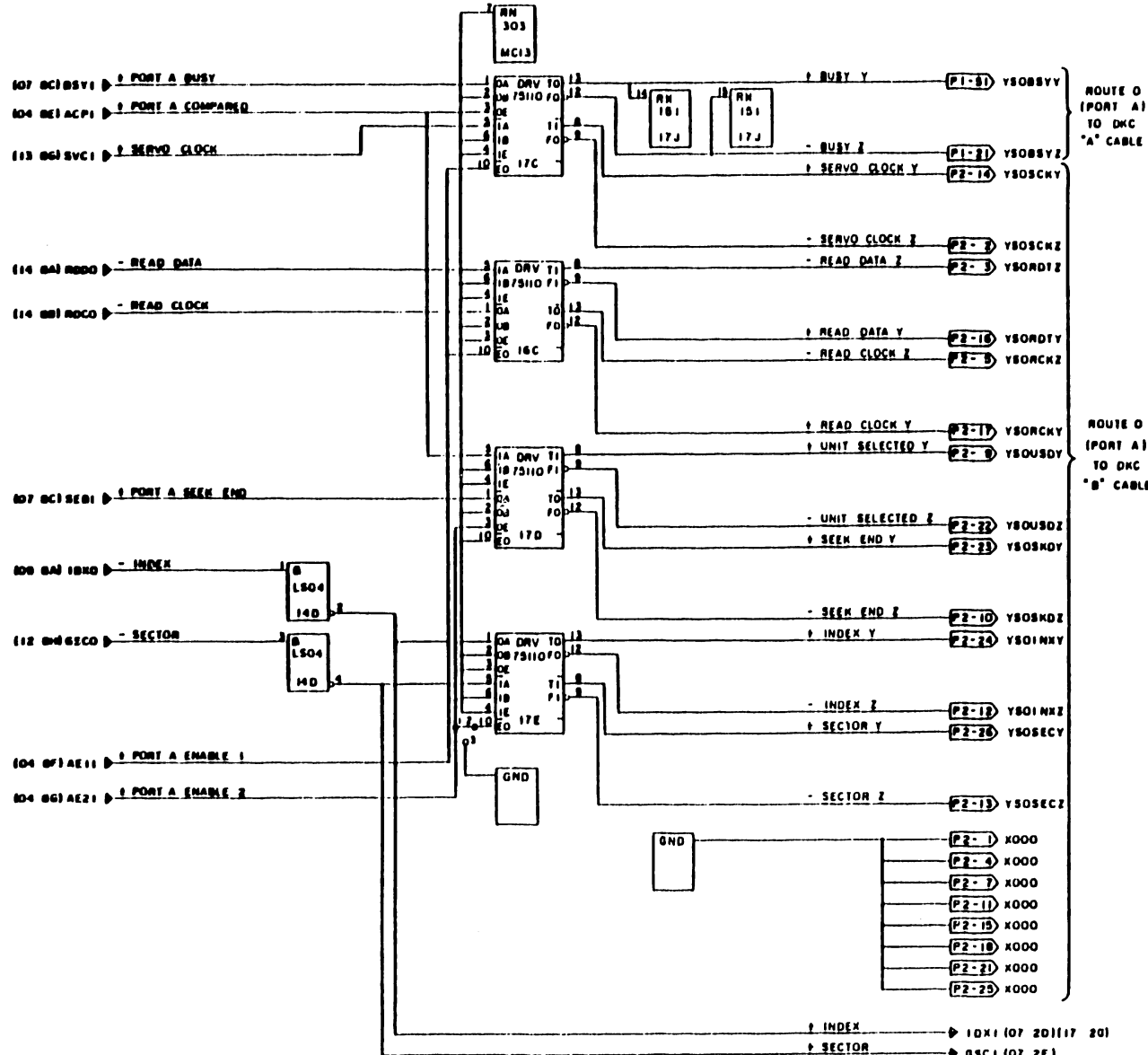
A-21



REV	DESCRIPTION(ISC)	APP
1	0 1983, 5	
2	0 1983, 5	
3	0 1983, 5	

DWG ABBR			
PKG LOCATION			
PKG NAME			
205			
NEXT SPEC			
DRAFT	ENG	CHK	APP
G9QSV PWA			
(5/27)			
FOR PWA REV.		OIB	
134-296090-205-0			
NEC		/	

134-296090-206-0



REV	DESCRIPTION (SC)	APP
1	O 1983, 5	
2	O 1983, 5	
3	O 1983, 5	

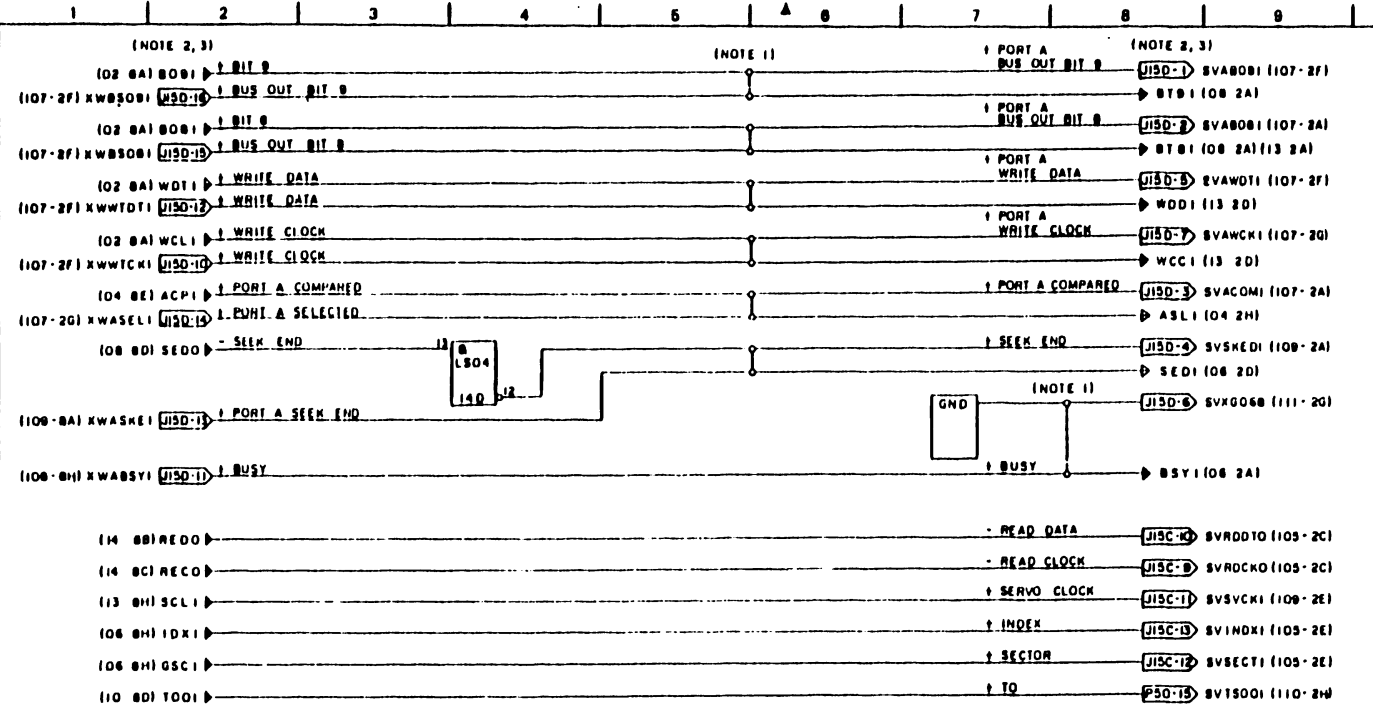
DWG ADDR	
PKG LOCATION	
PKG NAME	
206	
NEXT SPEC	
DRAFT	ENG
CHK	APP
ISSUE	
G9QSV PWA	
(6/27)	
FOR PWA REV.	OIB
134-296090-206-0	
NEC	SW /

Nacon Electric Co Ltd

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REV. 04/80
PWA 48 (Rev. 5-80)

134-296090-207-0



REV	DESCRIPTION (SC)	APP
1	0 1003, B	
2	0 1003, B	
3	0 1003, B	

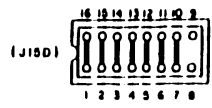
DWG ABBR	
PKG LOCATION	
PKG NAME	

207

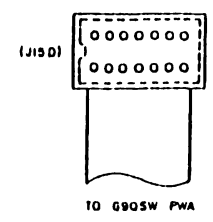
NEXT SPEC				
DRAFT	ENG	CHK	APP	ISSUE

G9QSV PWA	
(7/27)	
FOR PWA REV.	OIB
134-296090-207-0	
NEC	PH /

NOTE 1 G9QSV PWA



NOTE 2 G9QSV PWA WITH DUAL PORT OPTION

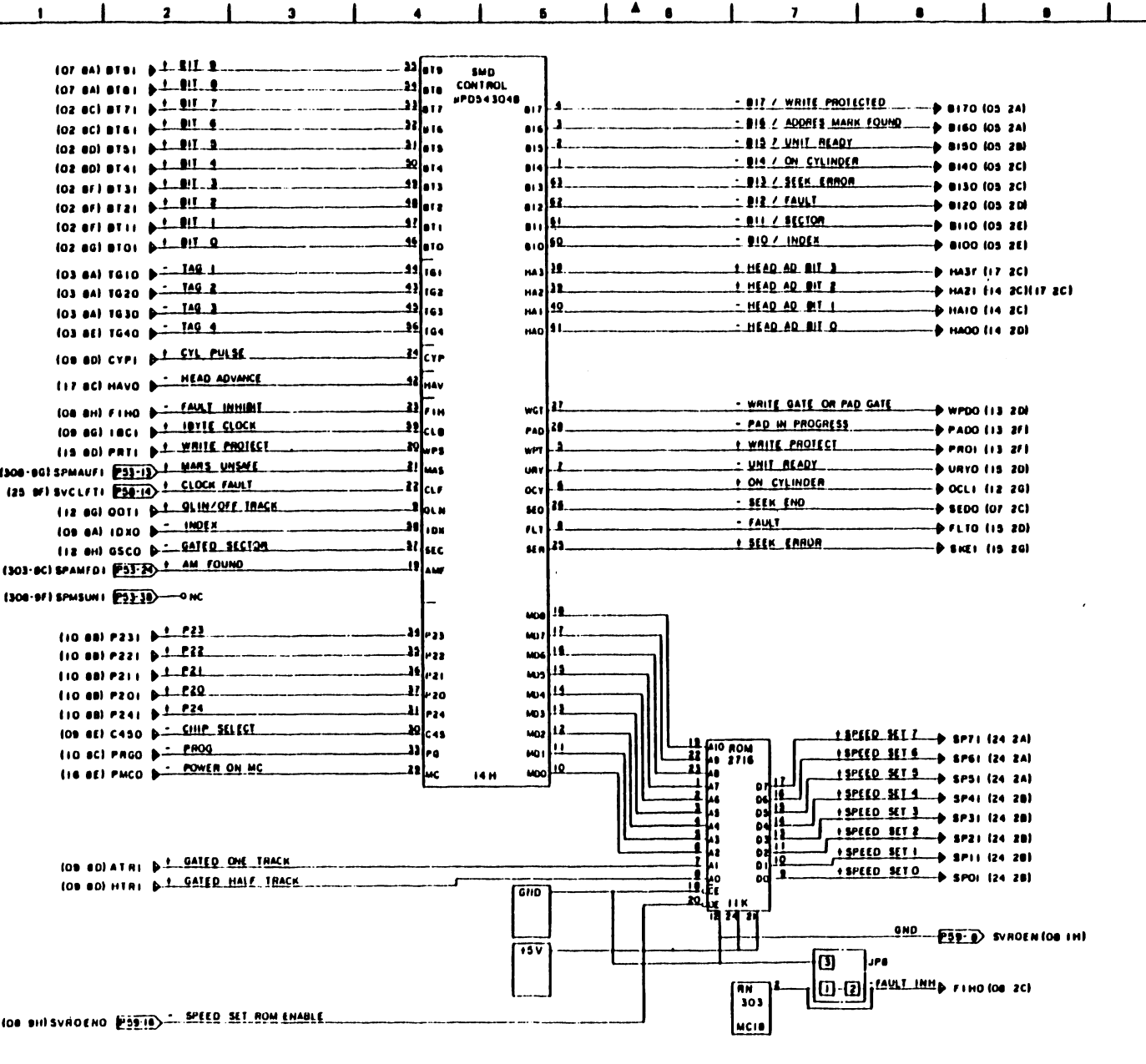


A-24

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134-296090-208-0

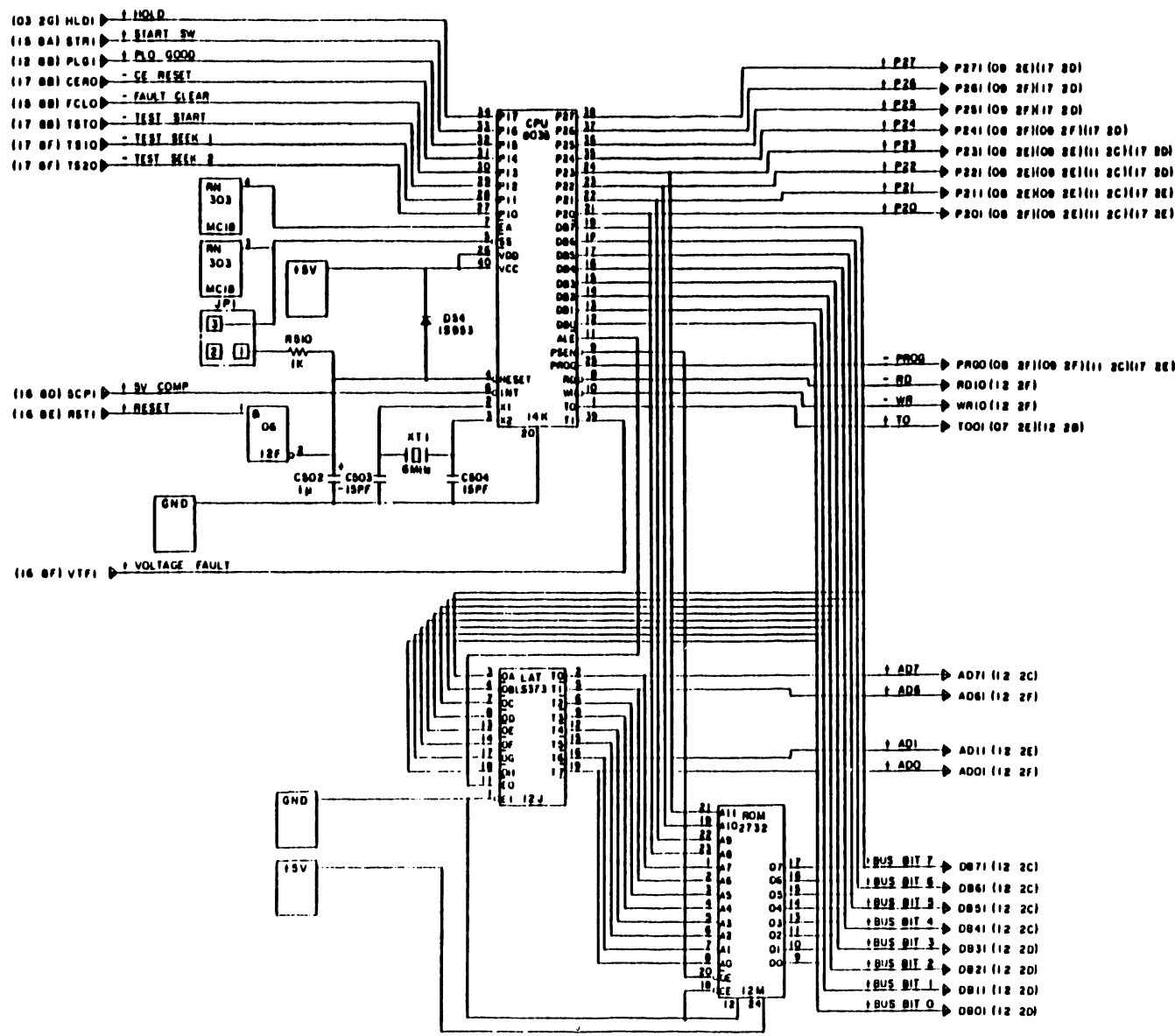
A-25



REV	DESCRIPTION (RC)	APP
1	0 1983, 5	
2	0 1983, 5	
3	0 1983, 5	

DWG ADDR	
P/S LOCATION	
PRG NAME	
208	
NEXT SPC	
DRAFT	ENG
CHK	APP
DATE	
G90SV PWA	
(8/27)	
FOR PWA REV.	OIB
134-296090-208-0	
NEC	/

134-296090-210-0



REV	DATE	DESCRIPTION(S)	APP
1	0	1003, 9	
2	0	1003, 9	
3	0	1003, 9	

DWG ABBR	
PKG LOCATION	
PKG NAME	210

NEXT SPEC				
DRAFT	ENG	CHK	APP	ISSUE

G9QSV PWA	
(10/27)	
FOR PWA REV.	OIB
134-296090-210-0	
NEC	/

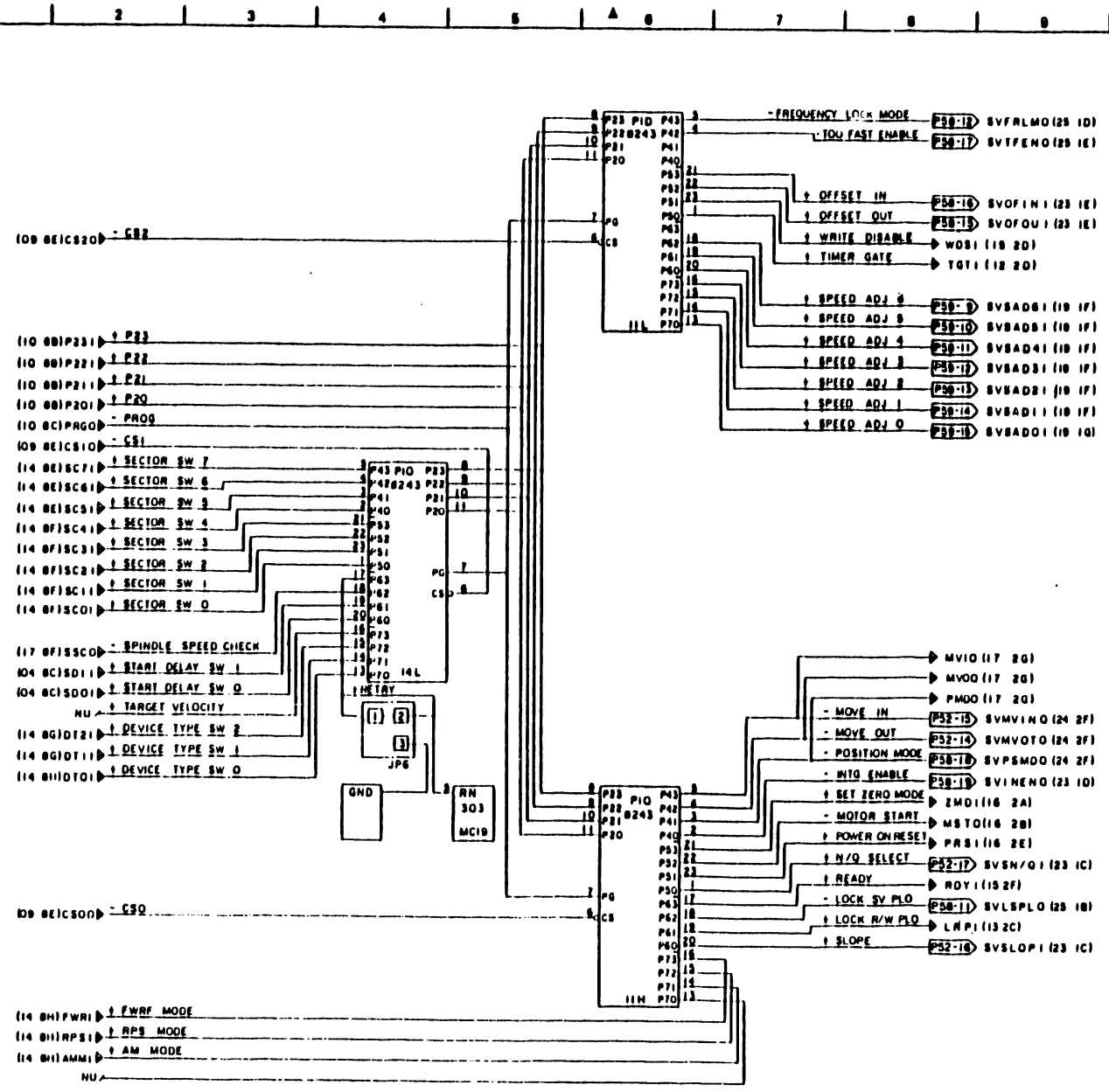
Nippon Electric Co Ltd

A-27

04 4110
05 42 (10-100)

134-296090-211-0

A-28



REV	DESCRIPTION(S)	APP
1	0 1003, S	
2	0 1003, S	
3	0 1003, S	

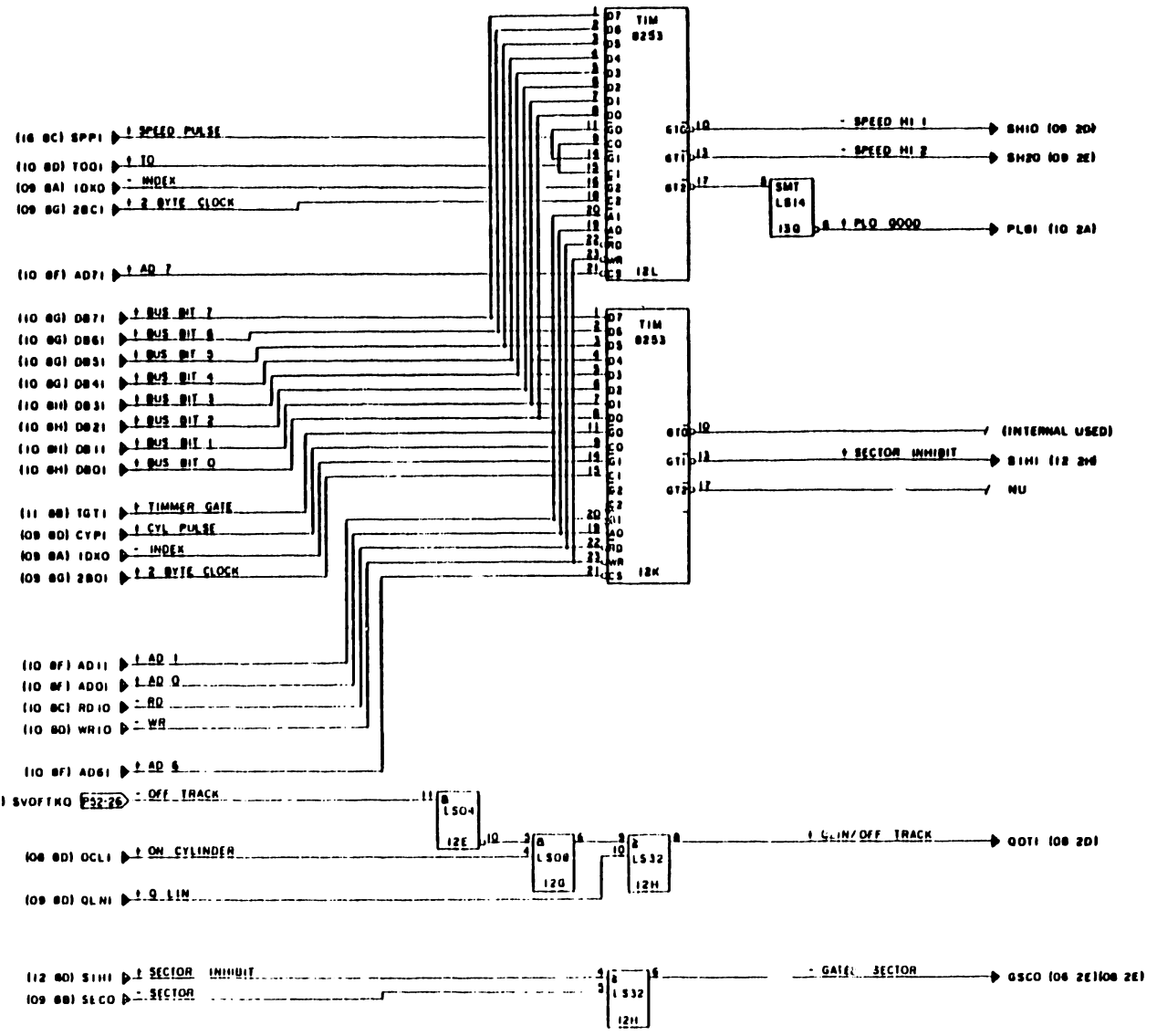
DWG ABBR	
FIG LOCATION	
PKG NAME	
211	
NEXT SPEC	
DRAWN	ENG
CHK	APP
ISSUE	
G9QSV PWA	
(11/27)	
FOR PWA REV.	01B
134-296090-211-0	
NEC	SW /

NEPCON Electric Co Ltd

1 2 3 4 5 6 7 8 9 X Y

134-296090-212-0

A
B
C
D
E
F
G
H
EQUIP



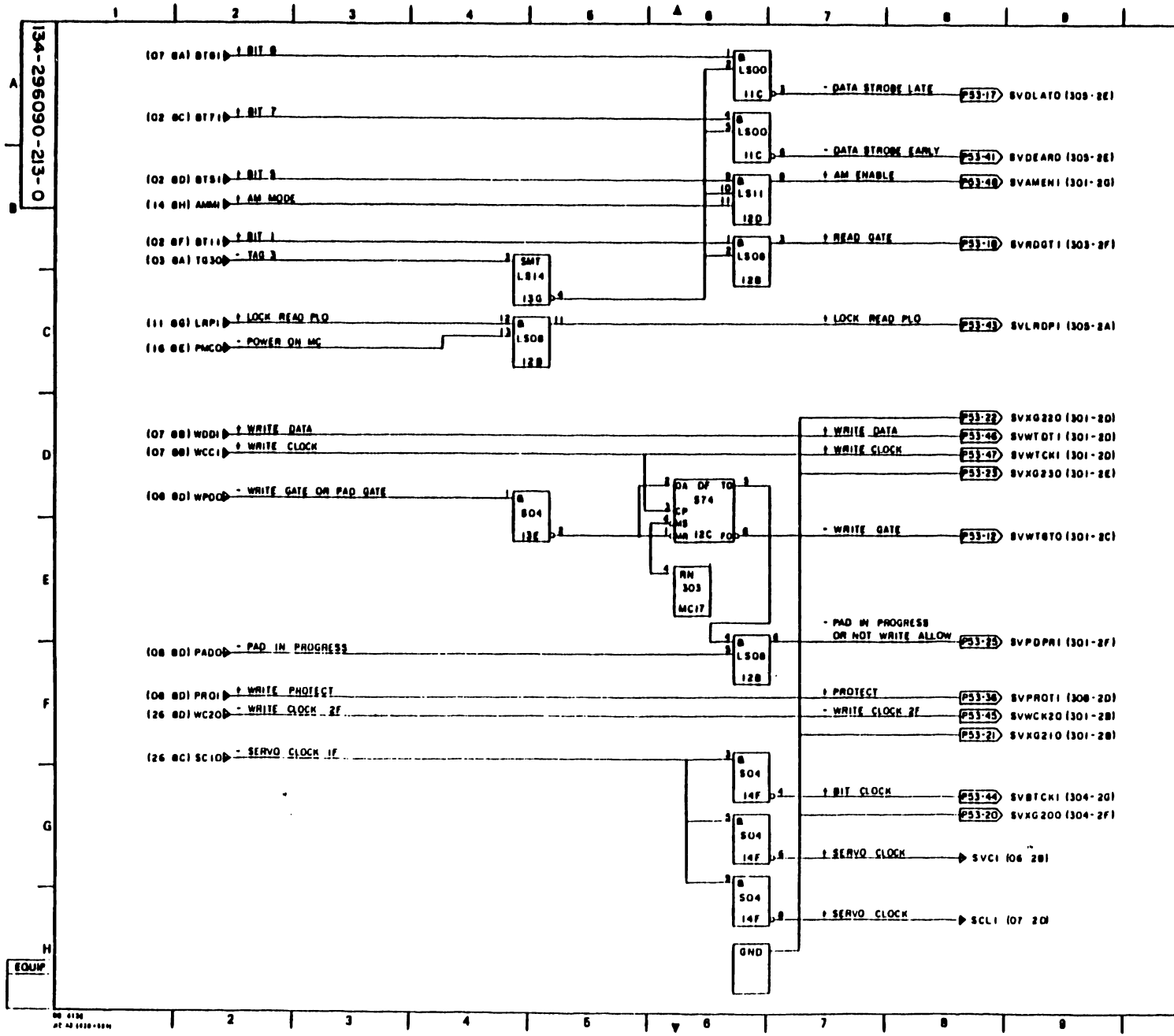
REV	DESCRIPTION(S)	APP
1	0 1983, 9	
2	0 1983, 9	
3	0 1983, 9	

DRWG ADDR				
PLG LOCARDN				
PLG NAME				
212				
REV	SPK			
DRWT	ENR	CNK	APP	EDR
G9QSV PWA				
(12/27)				
FOR PWA REV.				OIB
134-296090-212-0				
NEC				/

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134-296090-213-0

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REV	DESCRIPTION(ISC)	APP
1	0 1003, 8	
2	0 1003, 8	
3	0 1003, 8	

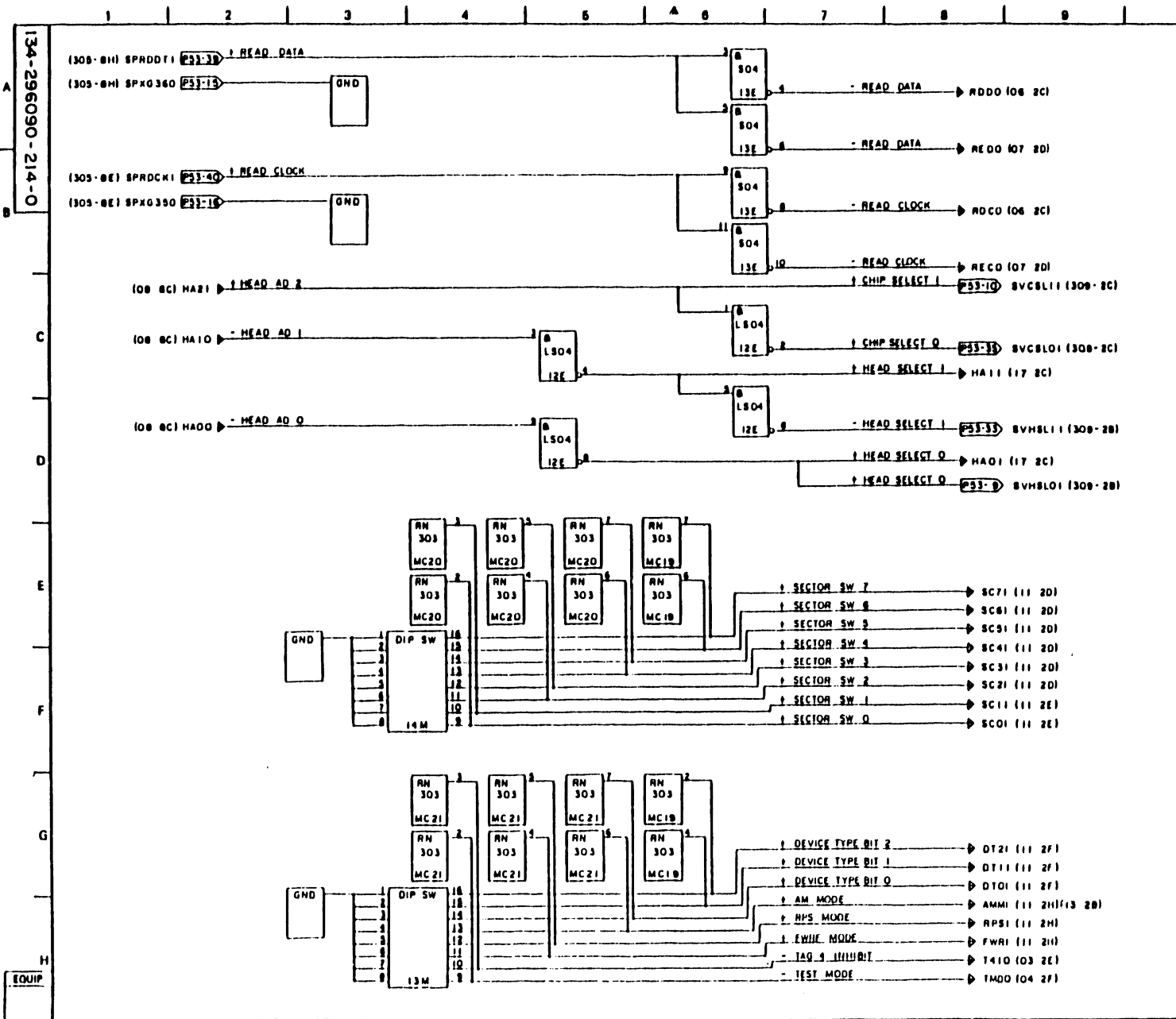
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↑ WRITE CLOCK	P53-46	SVWDT01 (301-20)
↑ WRITE CLOCK	P53-47	SVWTK1 (301-20)
↑ WRITE CLOCK	P53-23	SVXG230 (301-2E)
- WRITE GATE	P53-12	SVWGT01 (301-2C)
- PAD IN PROGRESS OR NOT WRITE ALLOW	P53-25	SVPOPRI (301-2F)
↑ PROJECT	P53-36	SVPROT1 (300-2D)
- WRITE CLOCK 2F	P53-45	SVWCK20 (301-2B)
- WRITE CLOCK 2F	P53-21	SVXG210 (301-2B)

DWG ABBR		
PKG LOCATION		
PKG NAME		
213		
NEXT SPEC		
DRAFT	ENG	CHK
APP	ISSUE	

G9QSV PWA	
(13/27)	
FOR PWA REV.	01B
134-296090-213-0	
NEC	SWT /

Nippon Electric Co Ltd

134-296090-214-0

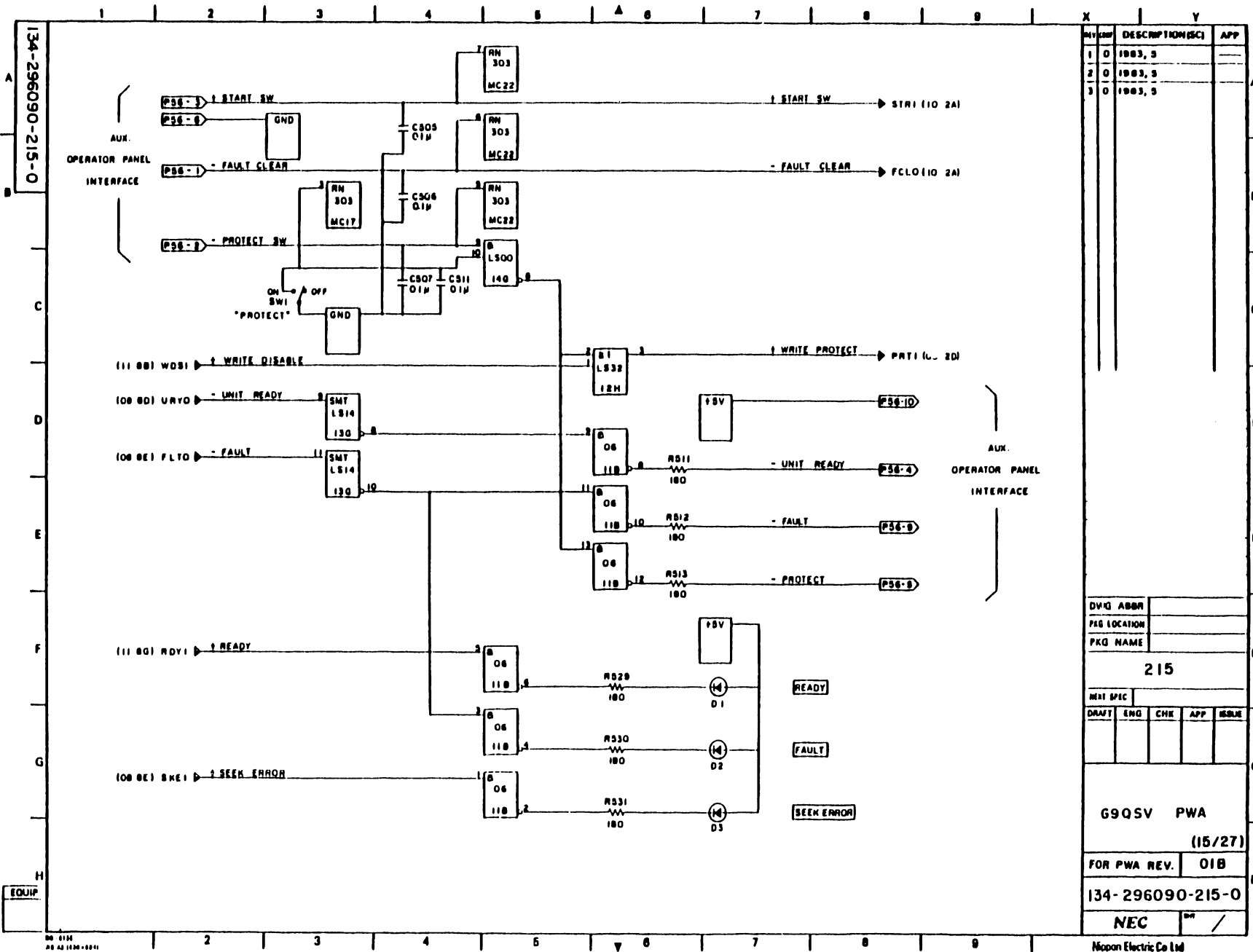


REV	DATE	DESCRIPTION(S)	APP
1	0	1883, 5	
2	0	1883, 5	
3	0	1883, 5	

DWG ABBR	
PKG LOCATION	
PKG NAME	
214	
MRT SPEC	
DRAFT	ENG
CHK	APP
ISSUE	
G9QSV PWA	
(14/27)	
FOR PWA REV.	OIB
134-296090-214-0	
NEC	DW /

A-31

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REV	DESCRIPTION(S)	APP
1	0 1983, 5	
2	0 1983, 5	
3	0 1983, 5	

DWG ABBR	
PKG LOCATION	
PKG NAME	
215	
REV	DATE
DRAW	ENG
CHK	APP
ISSUE	
G9QSV PWA	
(15/27)	
FOR PWA REV.	OIB
134-296090-215-0	
NEC	/

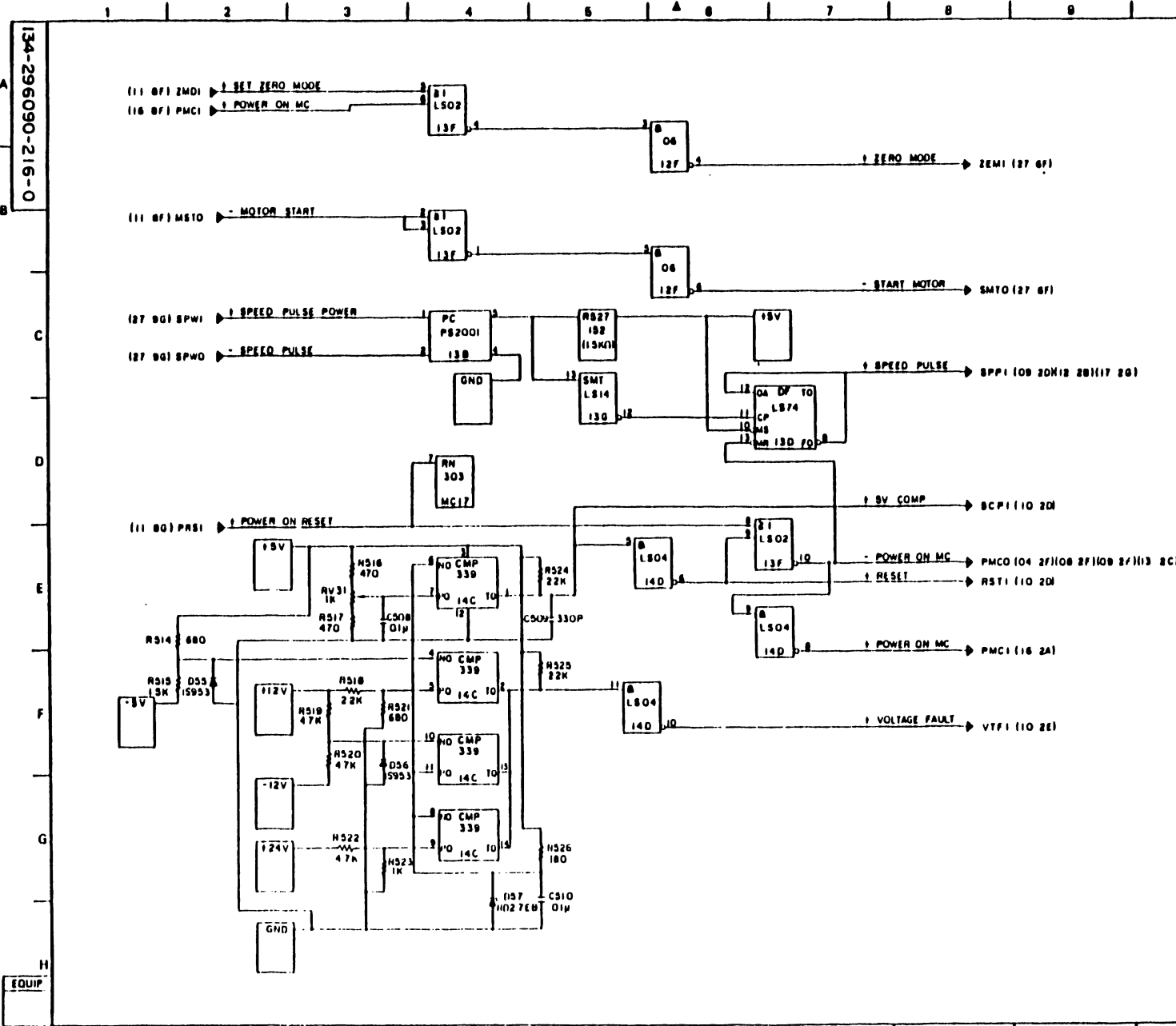
Moon Electric Co Ltd

REV	NO	DESCRIPTION (ISC)	APP
1	0	1983, 9	
2	0	1983, 9	
3	0	1983, 9	

REV	NO	DESCRIPTION (ISC)	APP
1	0	1983, 9	
2	0	1983, 9	
3	0	1983, 9	

DWG ABBR		
PRG LOCATION		
PRG NAME		
216		
NEXT SPEC		
DRAFT	ENG	CHK
APP	ISSUE	

G9QSV PWA	
(16/27)	
FOR PWA REV.	O1B
134-296090-216-0	
NEC	

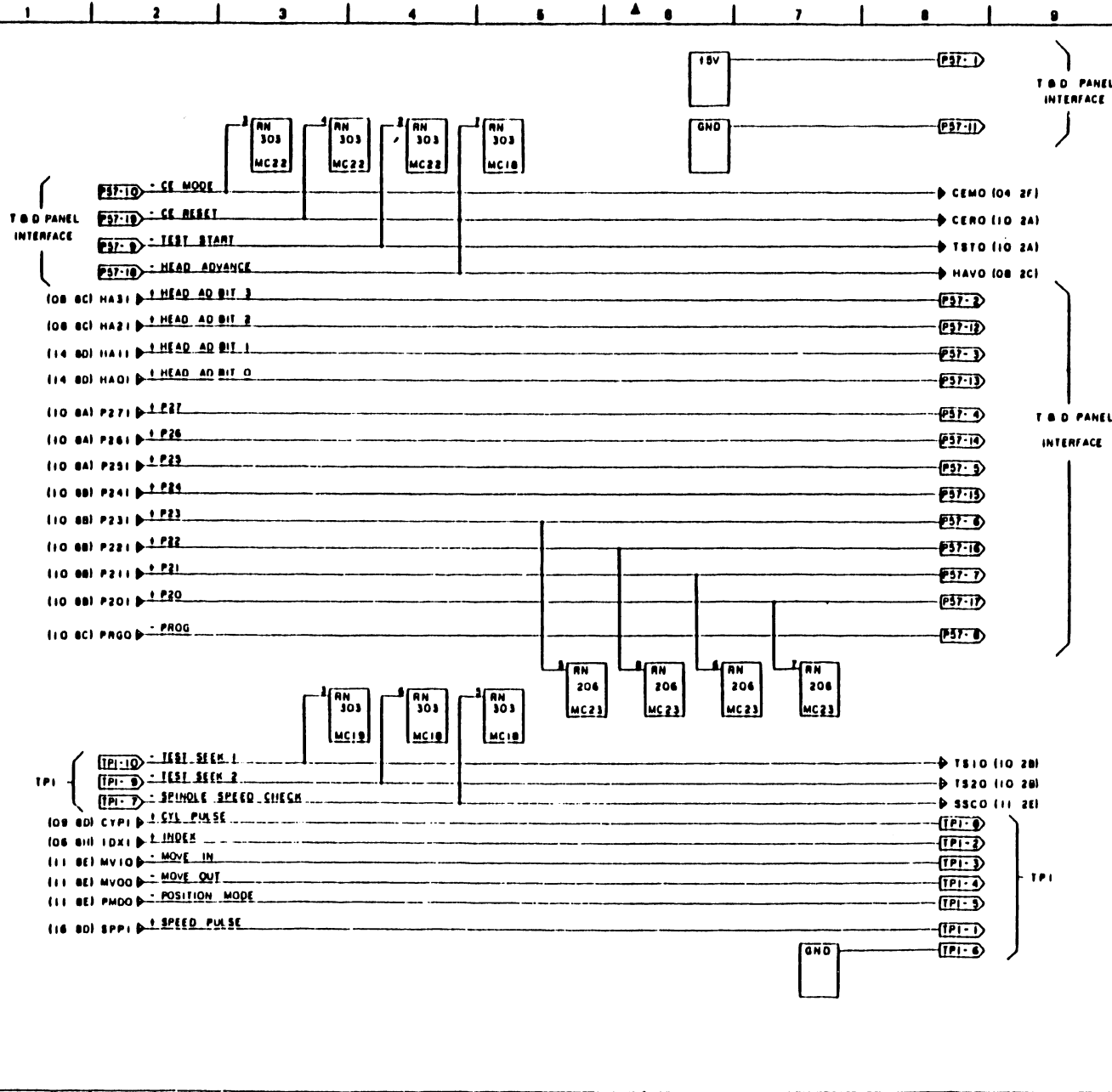


134-296090-216-0

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134-296090-217-0

A-34

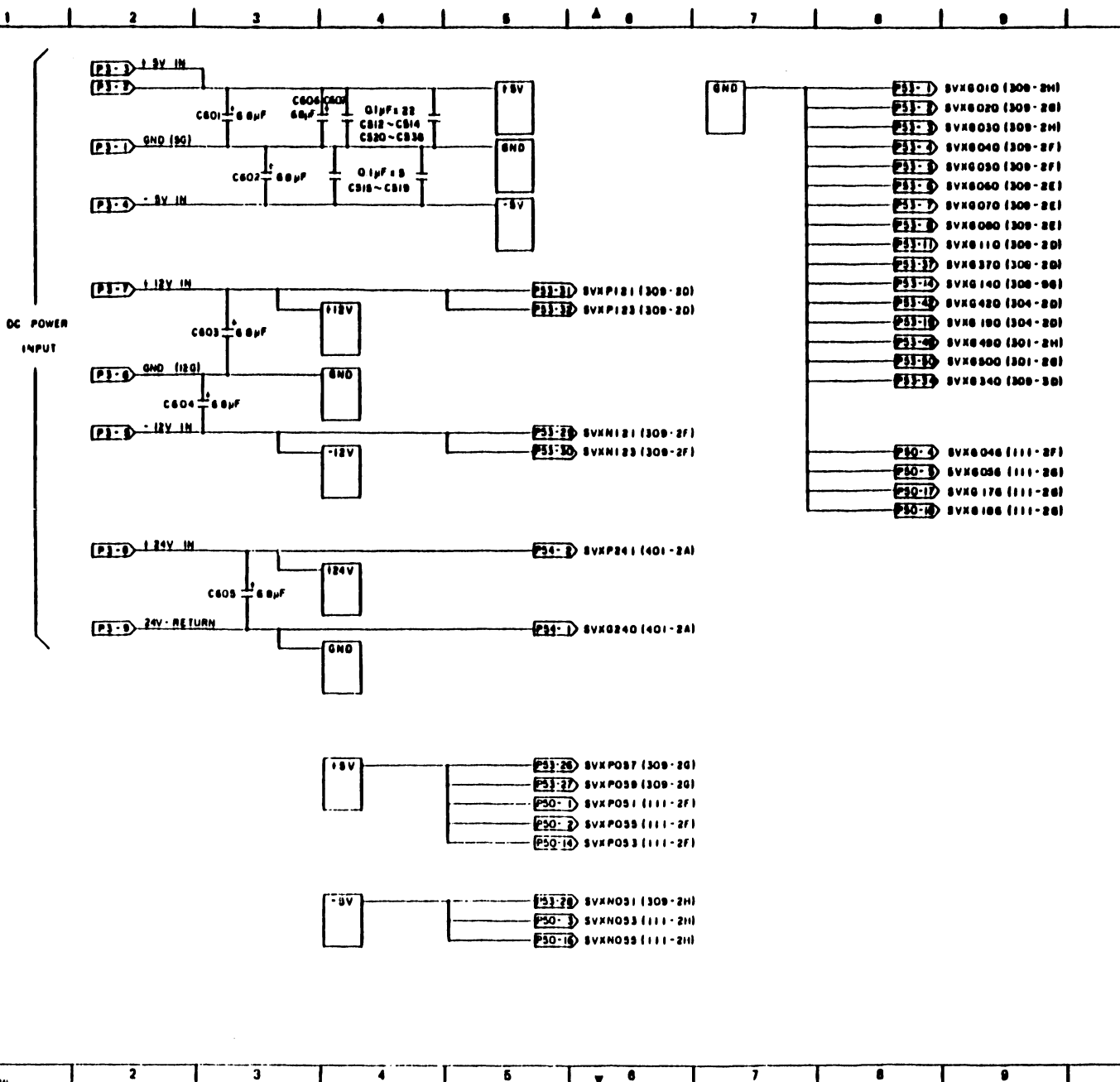


REV	LOW	DESCRIPTION(S)	APP
1	0	1983, 8	
2	0	1983, 9	
3	0	1983, 9	

DWG ABBR			
PKG LOCATION			
PKG NAME		217	
NEXT SPEC			
DRAFT	ENG	CHK	APP
			ISSUE
G9QSV PWA			
(17/27)			
FOR PWA REV.		OIB	
134-296090-217-0			
NEC		/	

Nacon Electric Co Ltd

134-296090-218-0



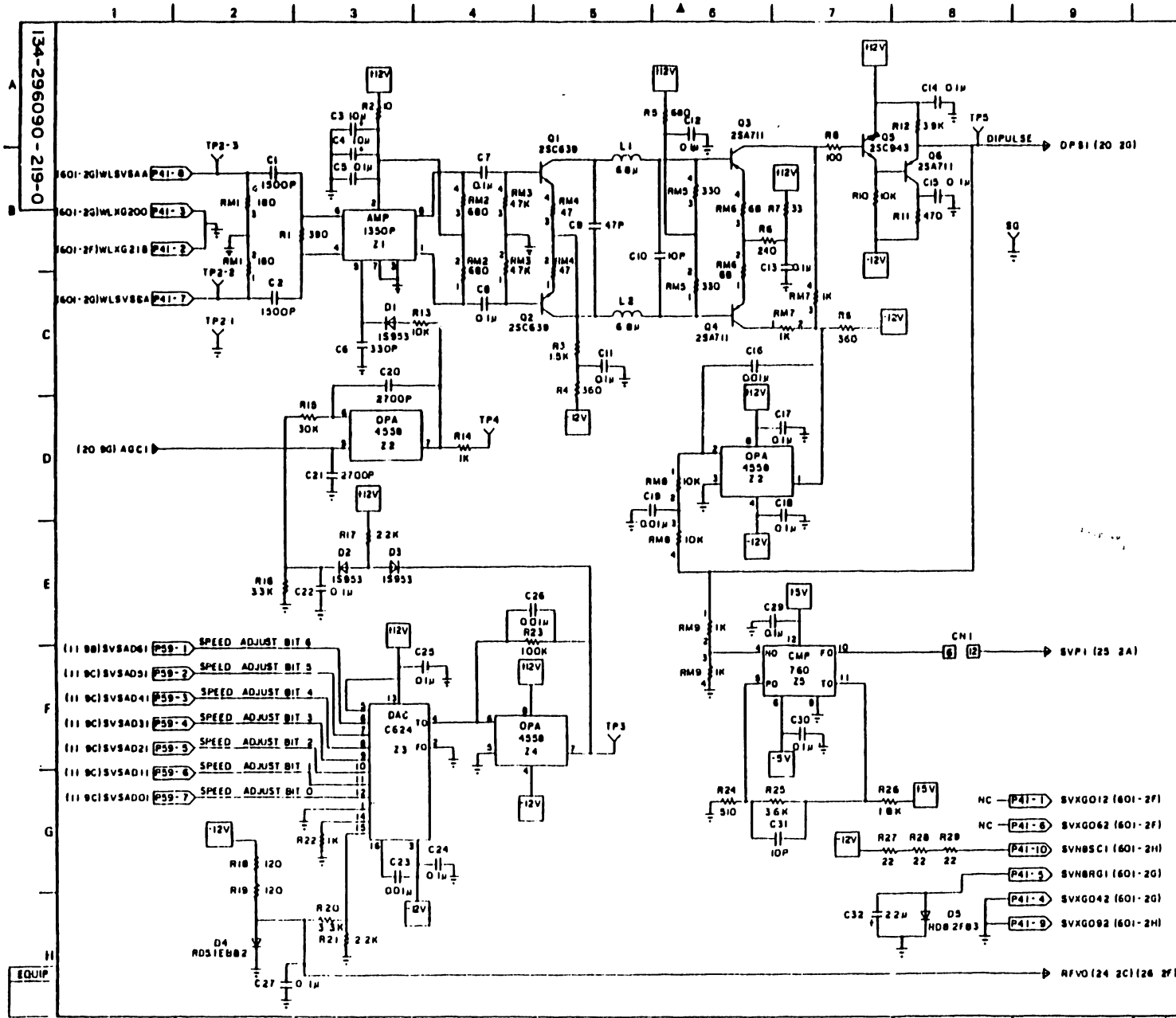
NO.	DESCRIPTION (REV)	APP.
1	0 1003, 0	
2	0 1003, 0	
3	0 1003, 0	

DCWG ADDR	
PKG LOCARD	
PKG NAME	
218	
NEXT SPEC	
DRAFT	ENG
CHE	APP
ORL	
G9QSV PWA	
(18/27)	
FOR PWA REV.	018
134-296090-218-0	
NEC	/

Nippon Electric Co Ltd

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REV	DATE	DESCRIPTION (SC)	APP
1	0	1983, 5	
2	0	1983, 5	
3	0	1983, 5	

DWG ABBR	
PKG LOCATION	
PKG NAME	

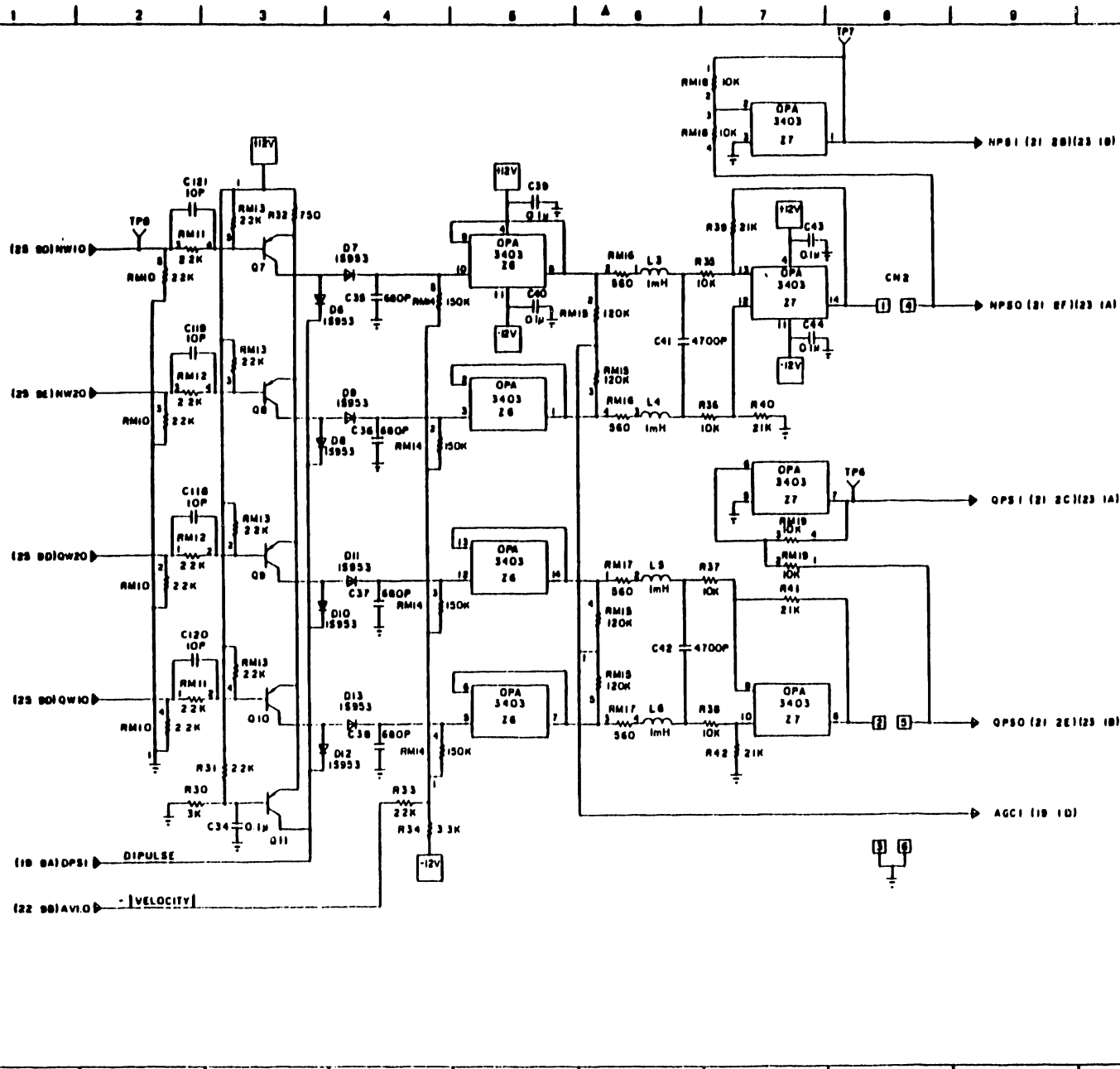
219				
NEXT SPEC				
DRAFT	ENG	CHK	APP	ISSUE

G9QSV PWA	
(19/27)	
FOR PWA REV.	OIB
134-296090-219-0	
NEC	

Nippon Electric Co Ltd

134-296090-220-0

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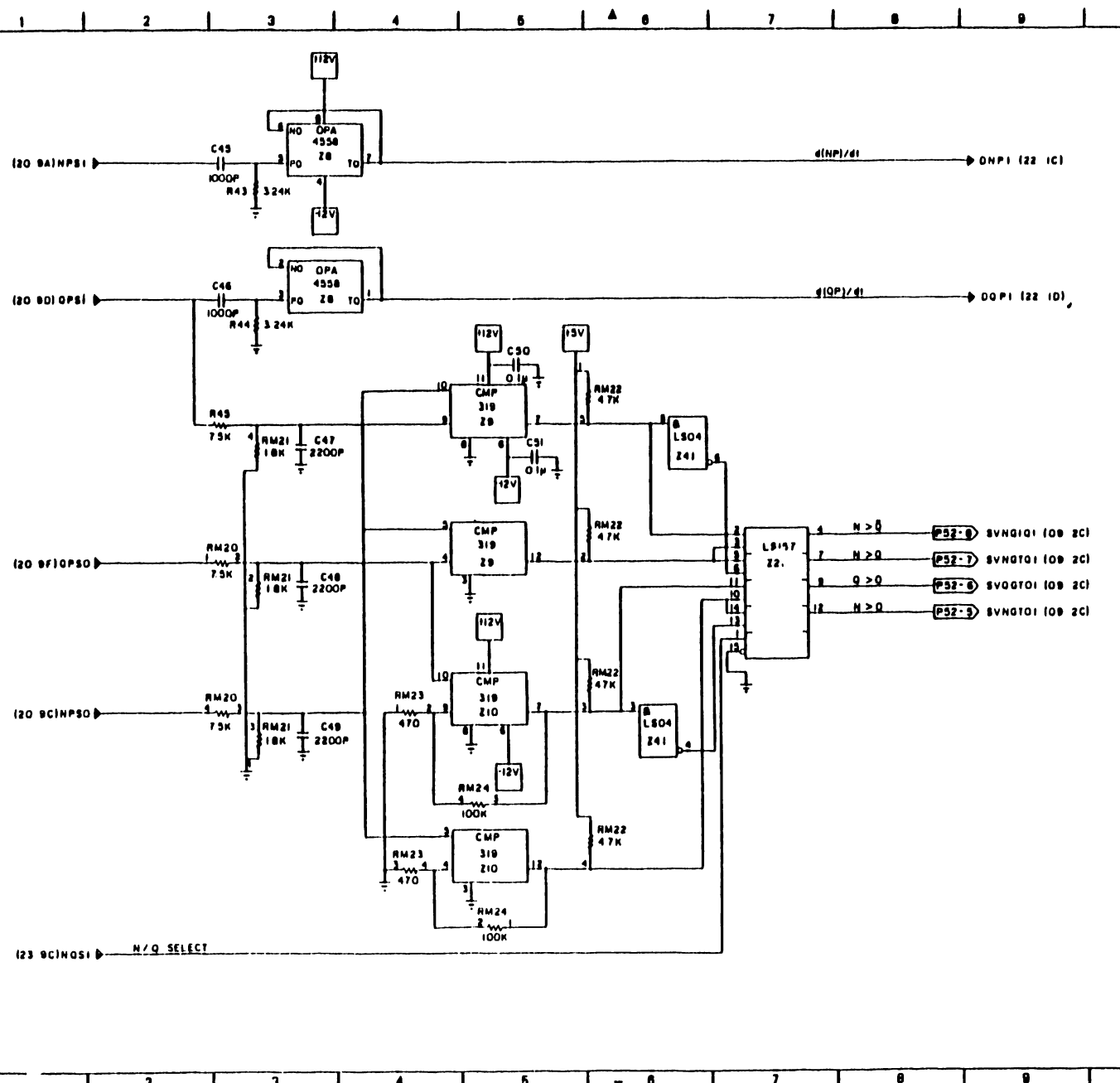
REV	DATE	DESCRIPTION (SC)	APP
1		D 1983, 8	
2		O 1983, 8	
3		O 1983, 8	

DWG ABBR	
PKG LOCATION	
PKG NAME	
220	
WKT SPEC	
DRAFT	ENG
CHK	APP
	ISSUE
G9QSV PWA	
(20/27)	
FOR PWA REV.	O1B
134-296090-220-0	
NEC	INT /

Nippon Electric Co Ltd

134-296090-221-0

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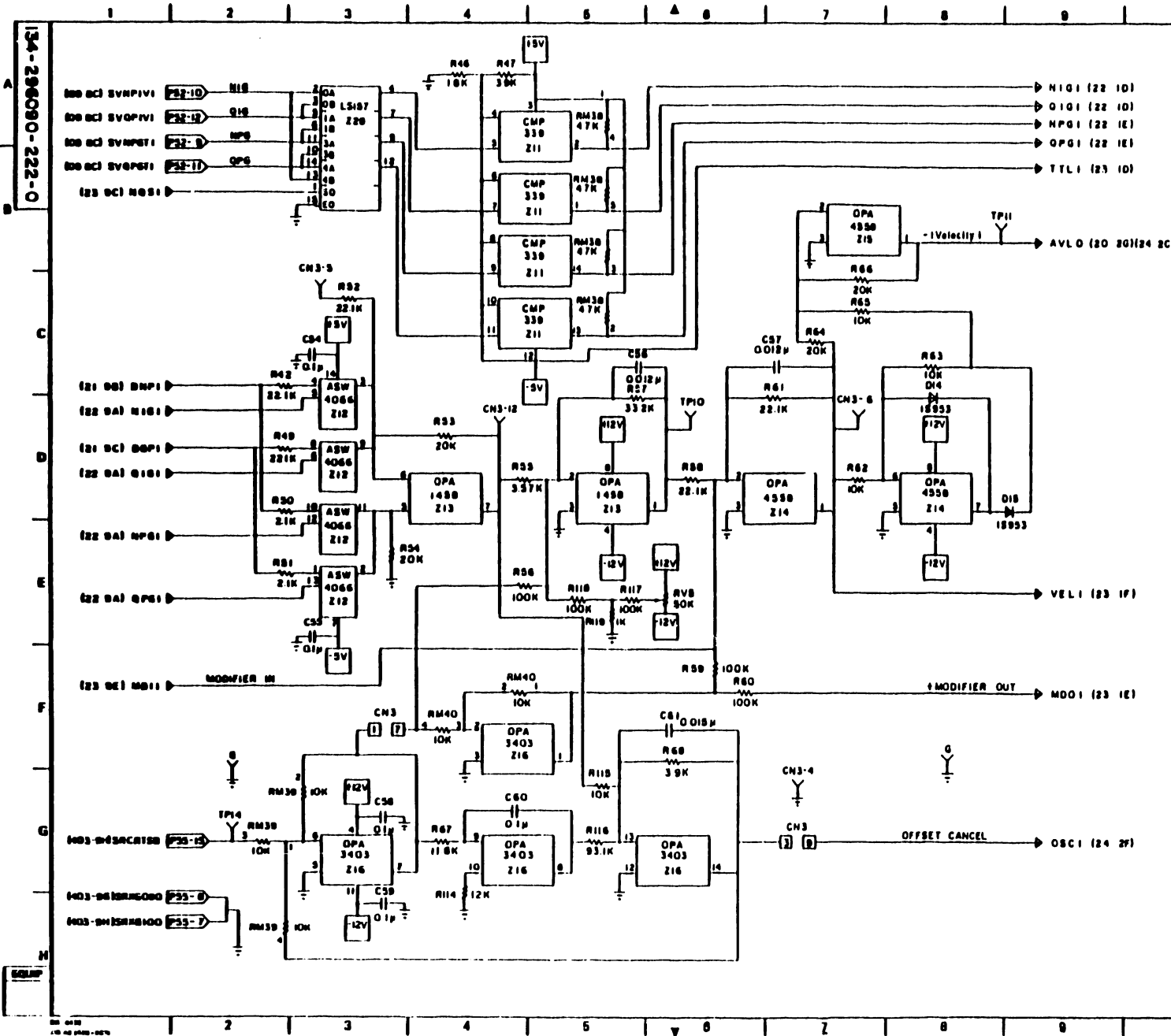


REV	DATE	DESCRIPTION(S)	APP
1	0	1983, 5	
2	0	1983, 5	
3	0	1983, 5	

DWG ABBR	
PKG LOCATION	
PKG NAME	221
REV	
DATE	
DRAWN	
ENG	
CHK	
APP	
ISSUE	
G9QSV PWA	
(21/27)	
FOR PWA REV.	01B
134-296090-221-0	
NEC	

Phoenix Electric Co Ltd

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REV/NO	DESCRIPTION(ISC)	APP
1 0	1983, 3	
2 0	1983, 3	
3 0	1983, 5	

DWG ABBR	
PKG LOCATION	
PKG NAME	

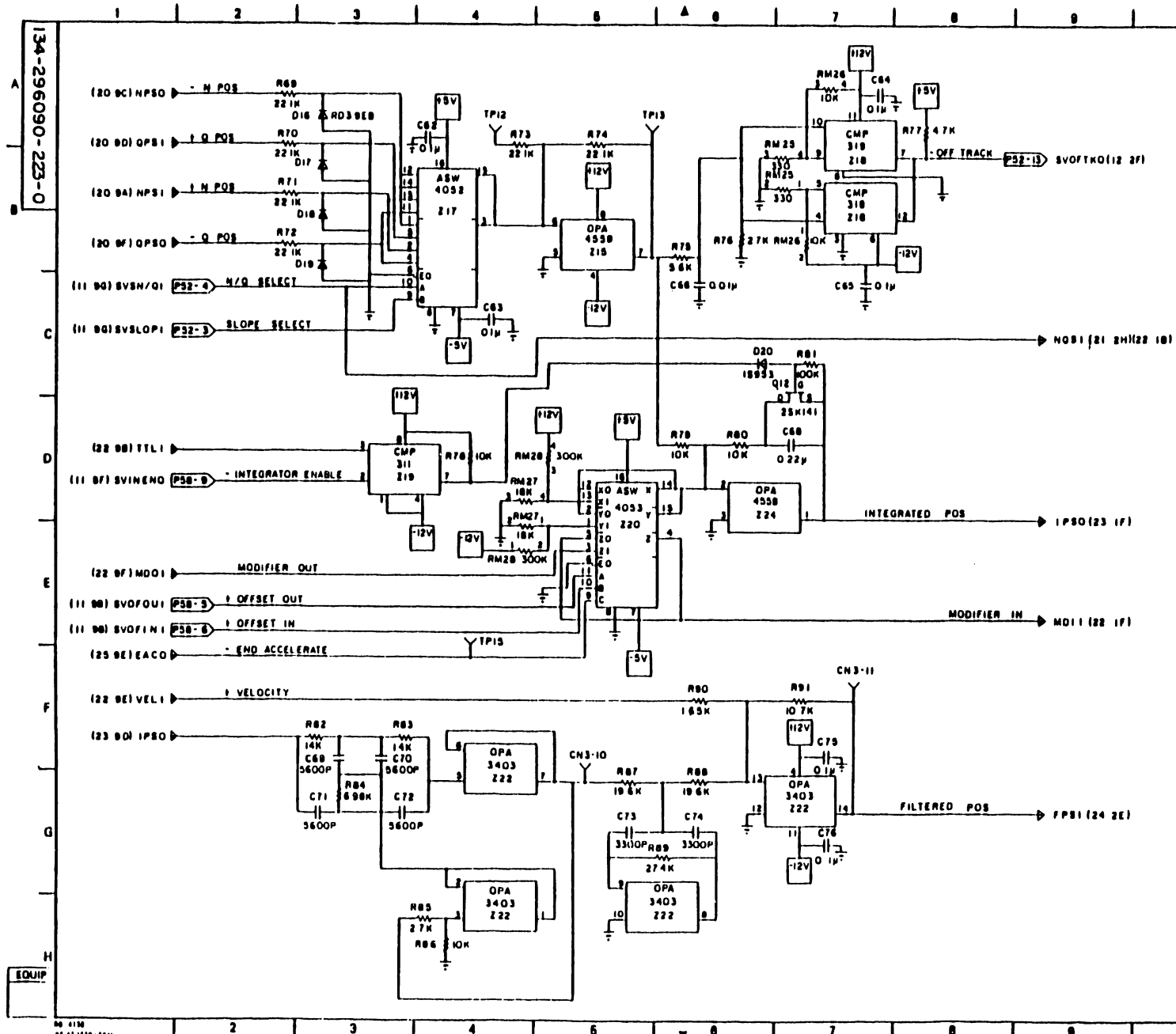
222

NEXT SPEC				
DRAFT	ENG	CHK	APP	ISSUE

G9QSV PWA	
(22/27)	
FOR PWA REV.	OIB
134-296090-222-0	
NEC	

Nippon Electric Co Ltd

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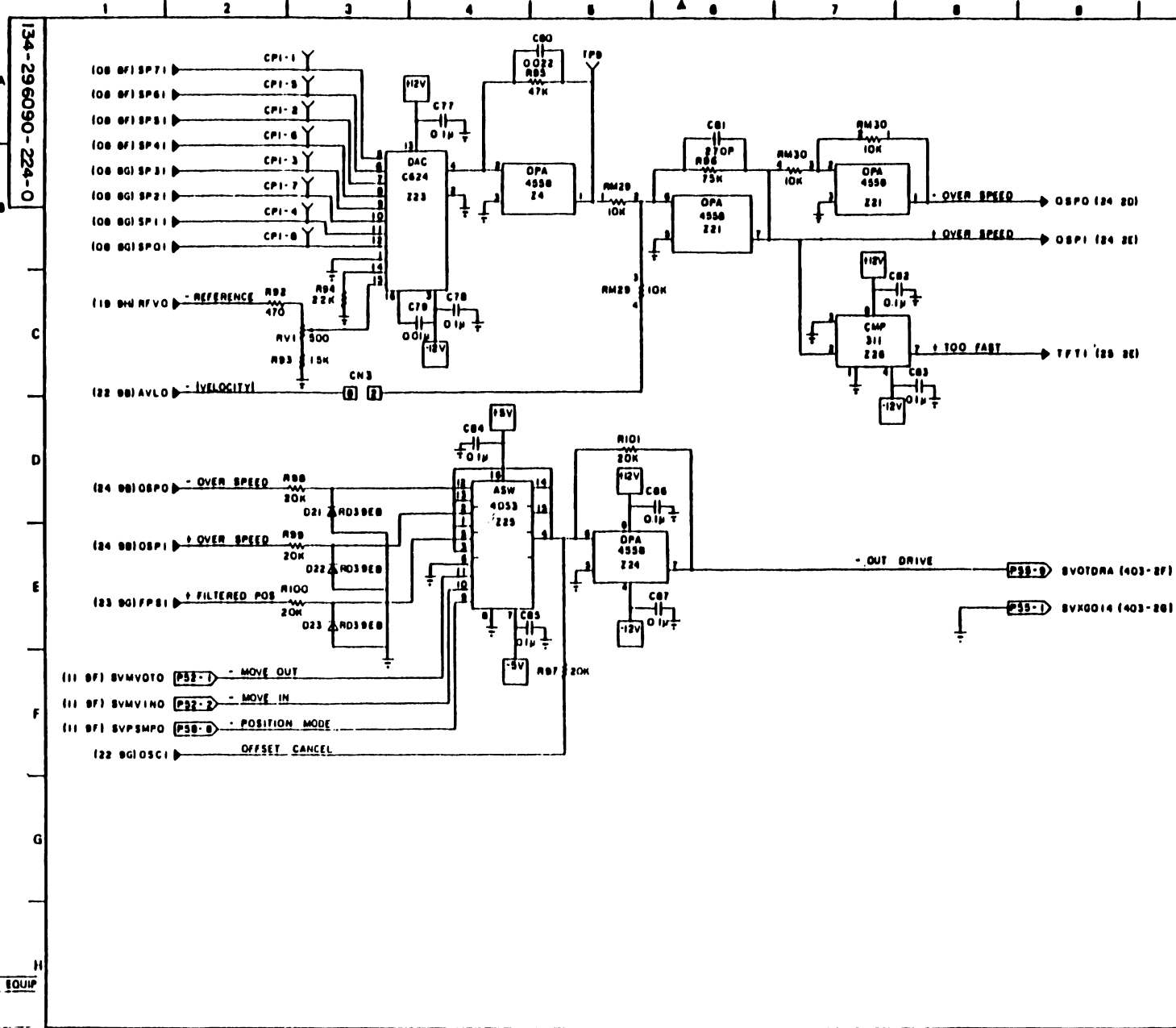


REV	DESCRIPTION (SC)	APP
1	0 1983, 8	
2	0 1983, 9	
3	0 1983, 5	

DWG ABBR	
FIG LOCATION	
PKG NAME	
223	
REV SPEC	
DRAWN	ENG
CHK	APP
ISSUE	
G9QSV PWA	
(23/27)	
FOR PWA REV.	018
134-296090-223-0	
NEC	SH /

Nacon Electric Co Ltd

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REV	COMP	DESCRIPTION (SC)	APP
1	O	1983, S	
2	O	1983, S	
3	O	1983, S	

DWG ADDR	
PKG LOCATION	
PKG NAME	

224

MATERIAL				
DRAWN	ENG	CHE	APP	DATE

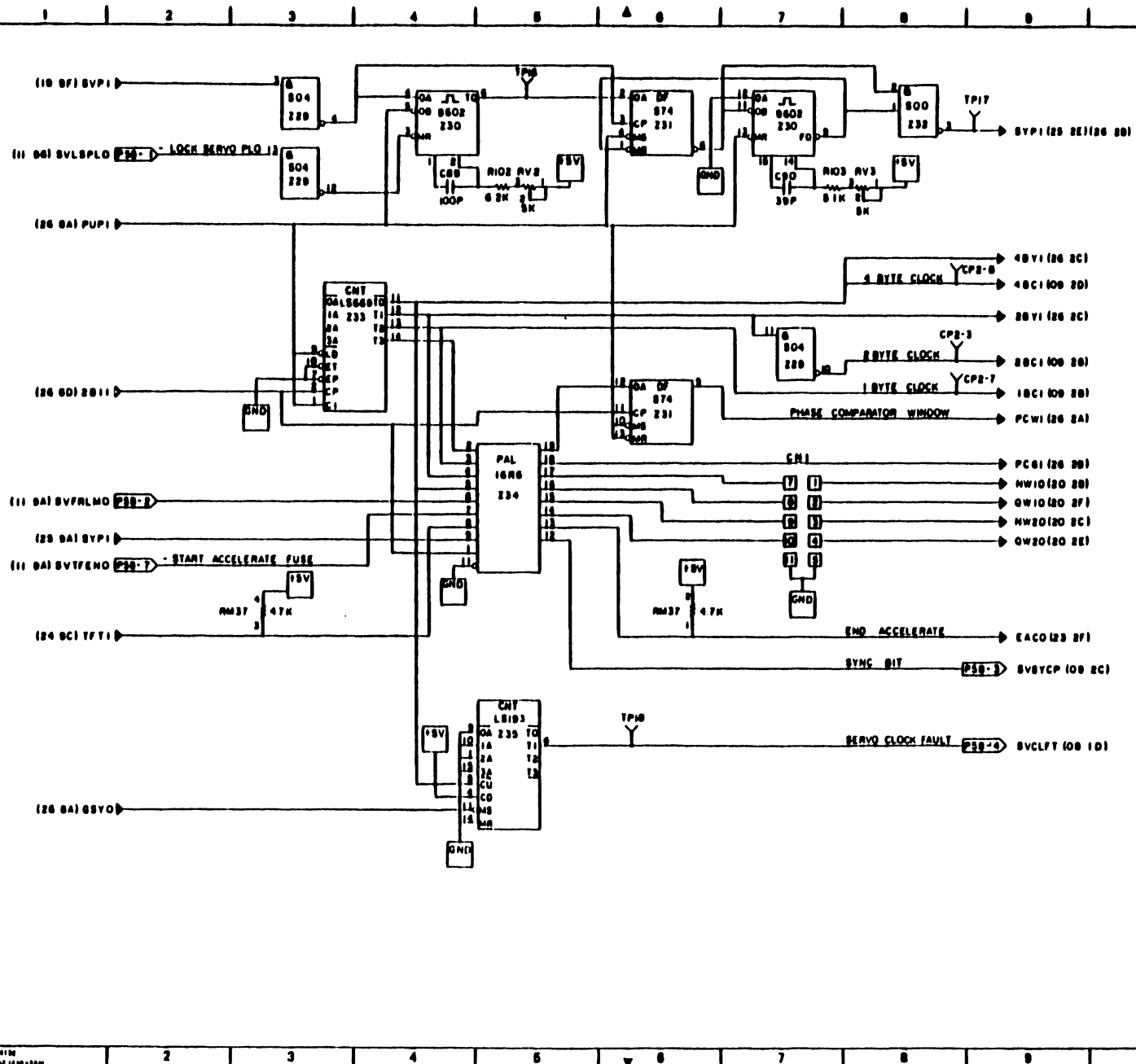
G9QSV	PWA
(24/27)	
FOR PWA REV.	01B
134-296090-224-0	
NEC	/.

Nippon Electric Co Ltd

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134-296090-225-0



REV	DESCRIPTION (SC)	APP
1	0 1983, 8	
2	0 1983, 8	
3	0 1983, 8	

DWG ABBR	
PRG LOCATION	
PRG NAME	

225

MKT SPEC				
DRAW	ENG	CHE	APP	ISSUE

G90SV PWA
(25/27)

FOR PWA REV. 01B

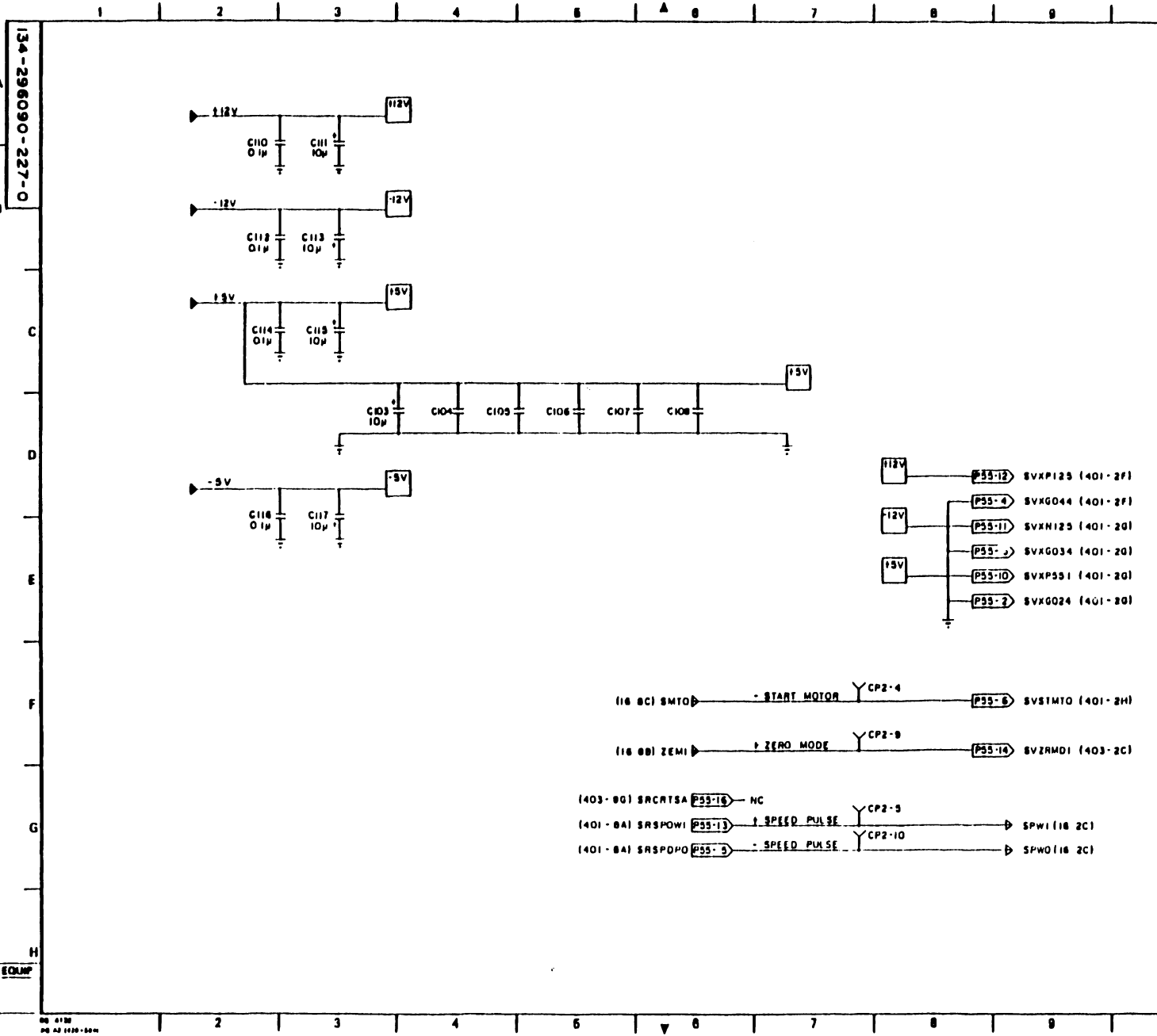
134-296090-225-0

NEC

Minim Electric Co Ltd

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REV	DESCRIPTION (SC)	APP
1	0 1983, 5	
2	0 1983, 5	
3	0 1983, 5	

- +12V → P55-12 → SVXP125 (401-2F)
- 12V → P55-4 → SVXG044 (401-2F)
- 12V → P55-11 → SVXM125 (401-20)
- +5V → P55-2 → SVXG034 (401-20)
- +5V → P55-10 → SVXP551 (401-20)
- +5V → P55-2 → SVXG024 (401-20)

DWG ABBR	
PKG LOCATION	
PKG NAME	

227

NEXT SPEC				
DRAFT	ENG	CHK	APP	ISSUE

G9QSV PWA

(27/27)

FOR PWA REV. OIB

134-296090-227-0

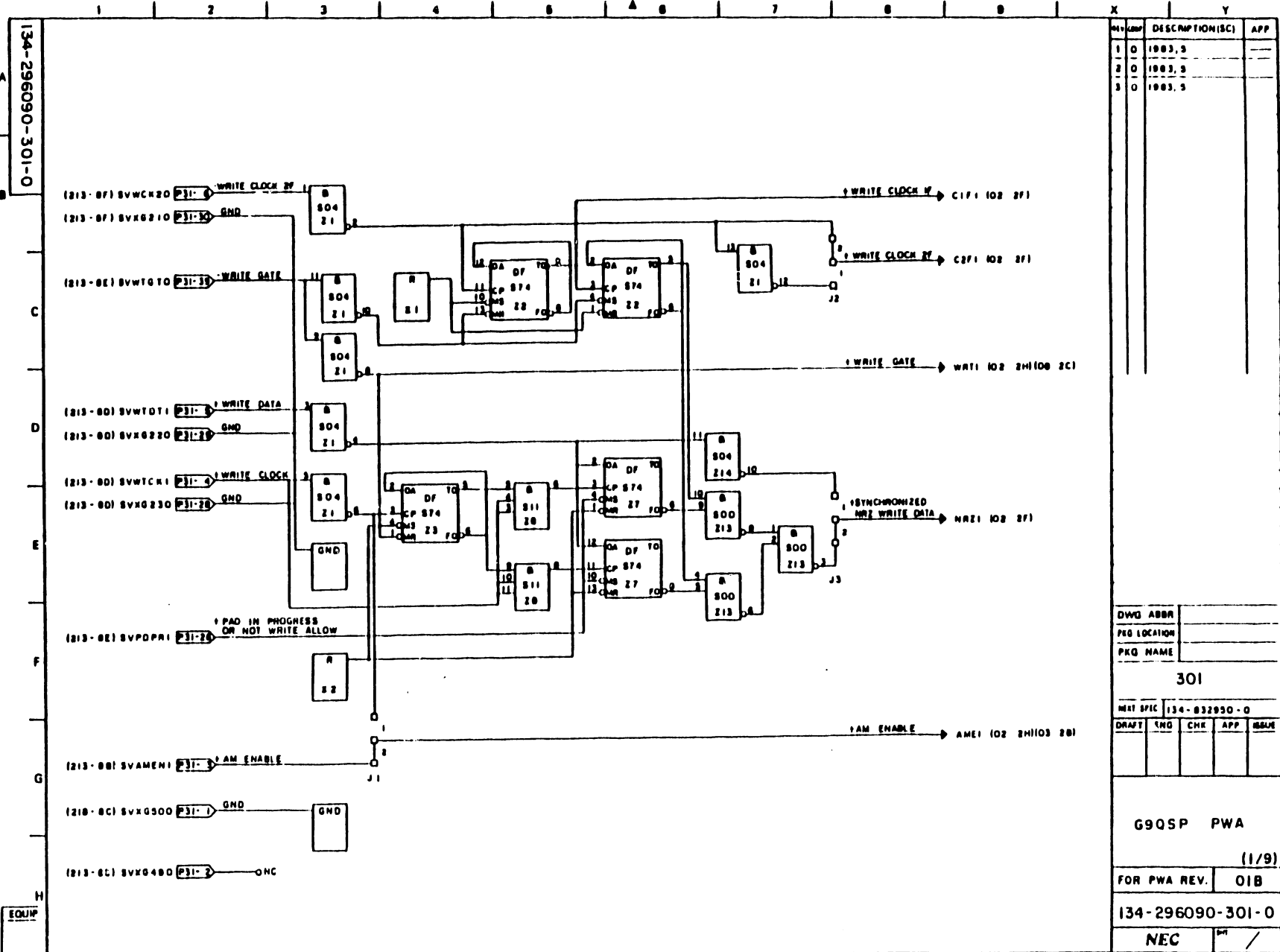
NEC

DN /

Necon Electric Co Ltd

PG 4130
PG 42 1120-1044

A-45

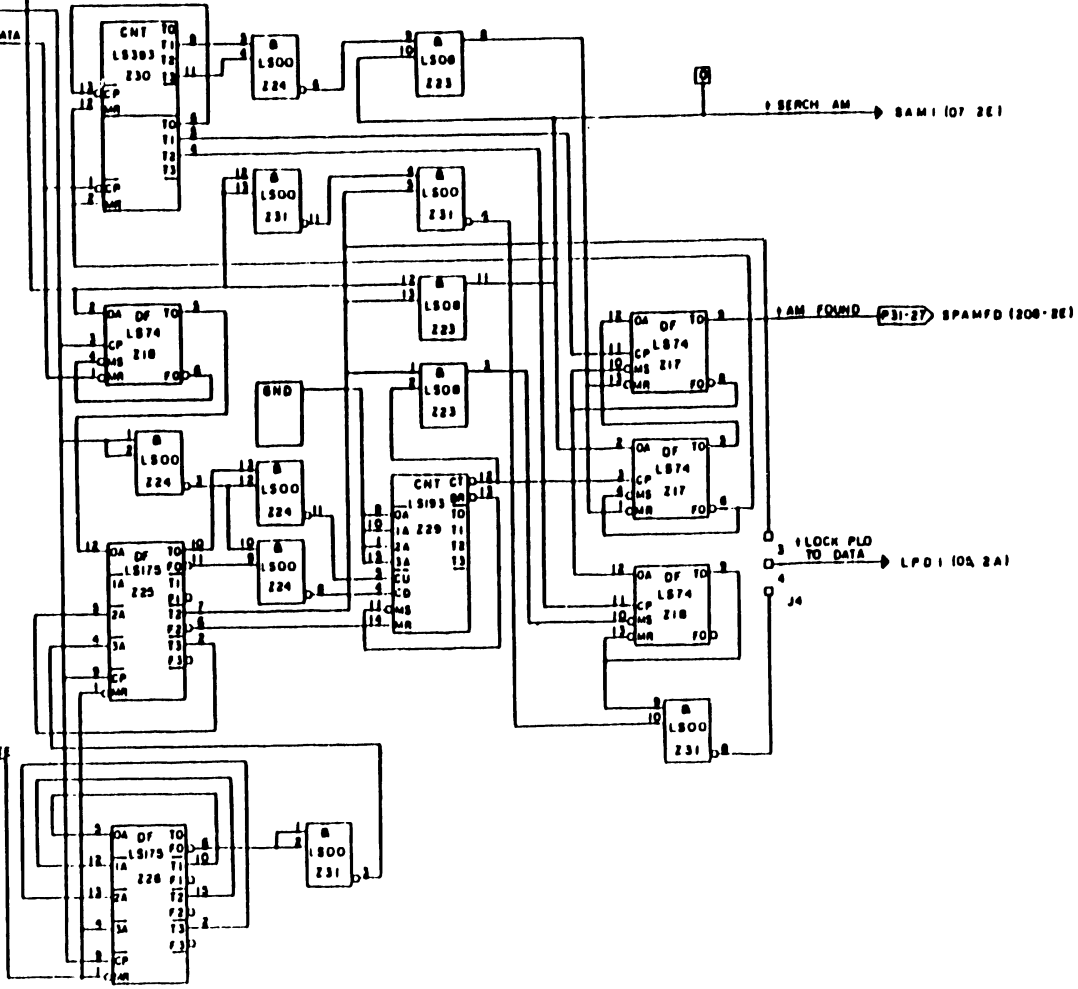


REV	DATE	DESCRIPTION(S)	APP
1	0	1983.3	
2	0	1983.3	
3	0	1983.3	

DWD ABBR		
PKG LOCATION		
PKG NAME		
301		
NEXT SPEC		134-832930-0
DRAFT	END	CHE
APP	ISSUE	
G9QSP PWA		
(1/9)		
FOR PWA REV.		OIB
134-296090-301-0		
NEC		/

134-296090-303-0

101-001 AME1 → JAM ENABLE
 104-001 B1C0 → INT CLOCK
 104-001 RD10 → RAW READ DATA



1213-001 SVR0G10 P31-33 → READ DATA

REV	DATE	DESCRIPTION (SC)	APP
1	0	1983.5	
2	0	1983.5	
3	0	1983.5	

DWG ABBR			
PRJ LOCATION			
PRJ NAME			
303			
NEXT SPEC			
DRAFT	ENG	CHK	APP
G9QSP PWA			
(3/9)			
FOR PWA REV.		OIB	
134-296090-303-0			
NEC		SHT /	

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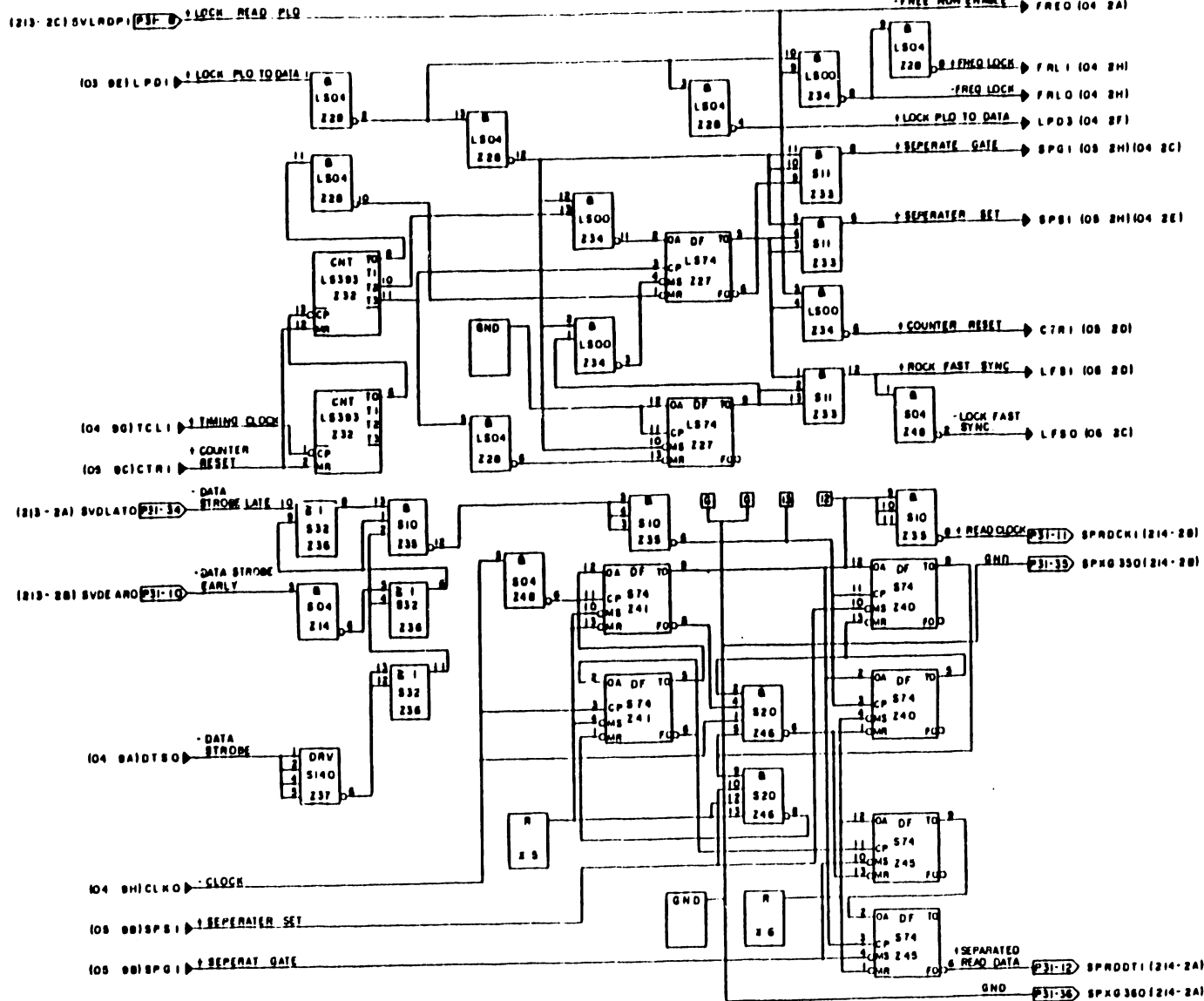
A-47

SCHEM.

NO. 5130
 00 01 1410-0001

134-296090-305-0

A-49



REV	DATE	DESCRIPTION (BC)	APP
1	0	1983, 5	
2	0	1983, 5	
3	0	1983, 5	

REV	DATE	DESCRIPTION (BC)	APP
1	0	1983, 5	
2	0	1983, 5	
3	0	1983, 5	

REV	DATE	DESCRIPTION (BC)	APP
1	0	1983, 5	
2	0	1983, 5	
3	0	1983, 5	

DWG ABBN	
PAG LOCATION	
PKG NAME	

305

NEXT SPEC				
DRAW	ENG	CHK	APP	ISSUE

G9QSP PWA
(5/9)

FOR PWA REV. 01B

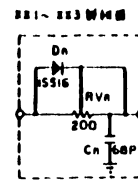
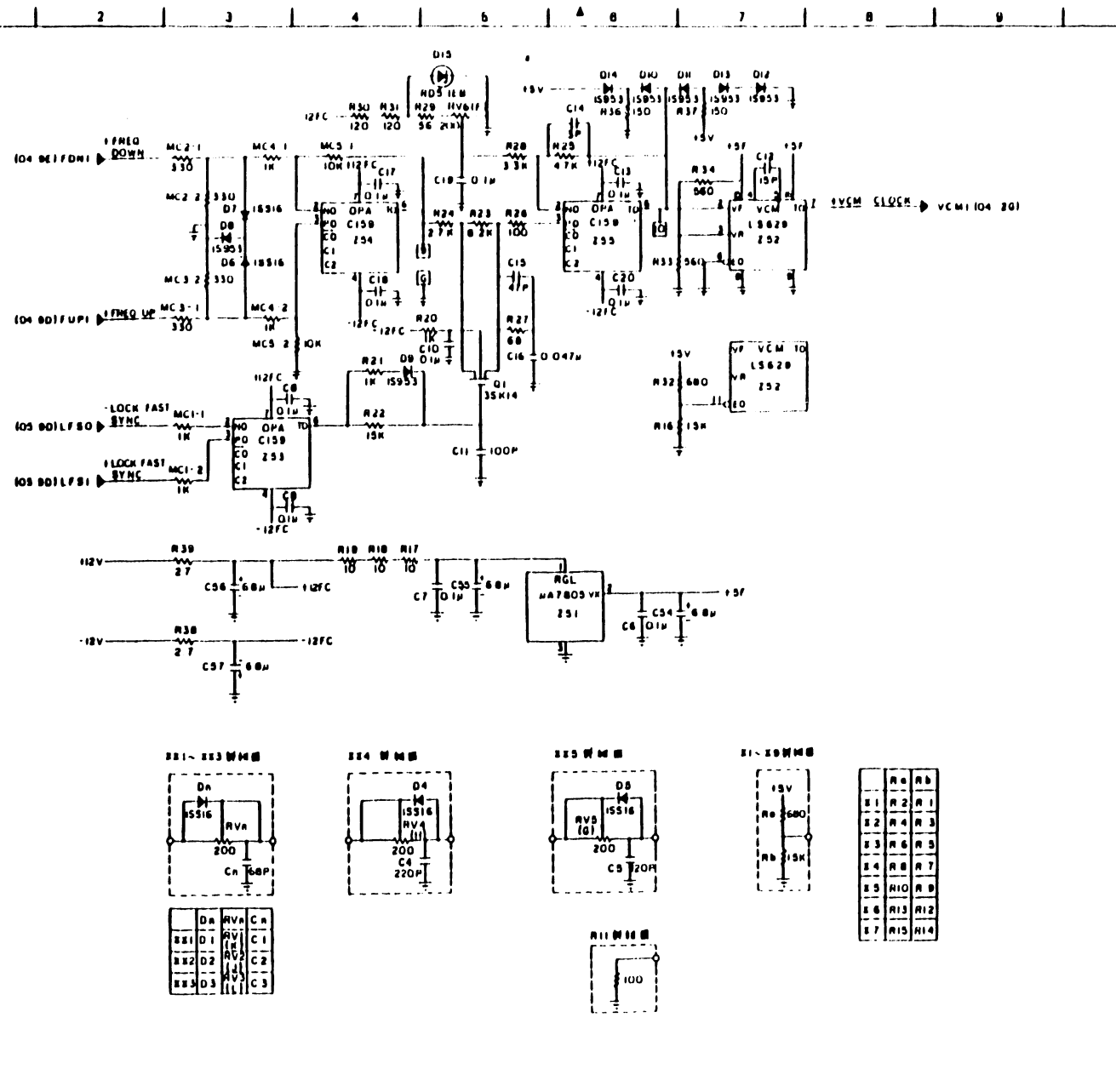
134-296090-305-0

NEC

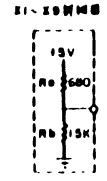
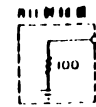
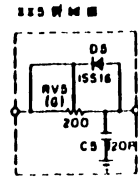
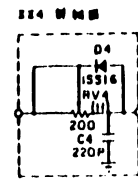
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134-296090-306-0

A-50



	D4	RV4	C4
221	D1	RV1	C1
222	D2	RV2	C2
223	D3	RV3	C3



	R6	R7
21	R2	R1
22	R4	R3
23	R6	R5
24	R8	R7
25	R10	R9
26	R13	R12
27	R15	R14

REV	DATE	DESCRIPTION (SC)	APP
1	0	1983, 5	
2	0	1983, 8	
3	0	1983, 5	

DWG ABBR
PKG LOCATION
PKG NAME

306

NEXT SPEC

DRAWN	ENG	CHK	APP	ISSUE

G9QSP PWA

(6/9)

FOR PWA REV. 01B

134-296090-306-0

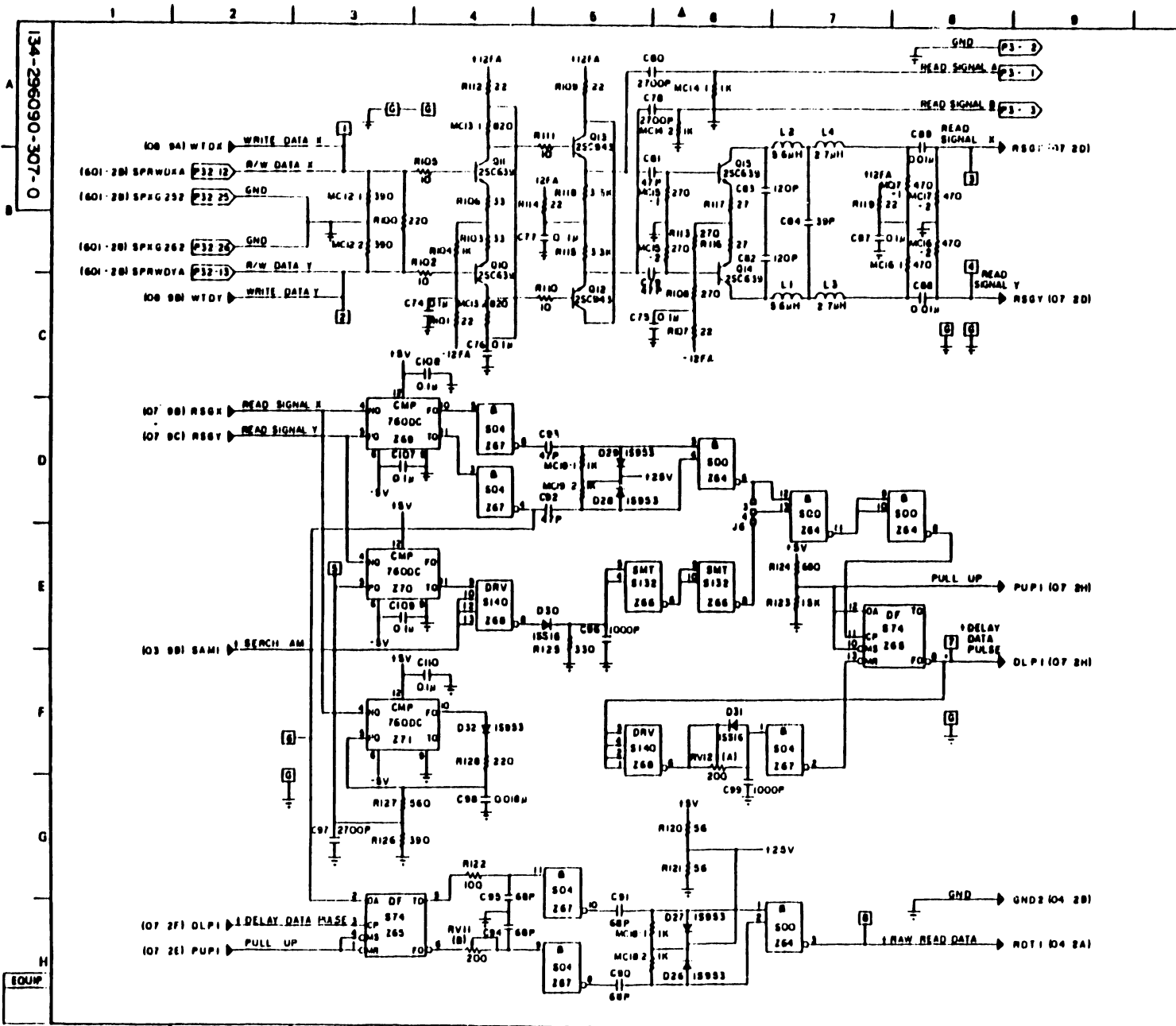
NEC

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Noncon Electric Co Ltd

NO. 0132
REV. 01 04/83

A-51

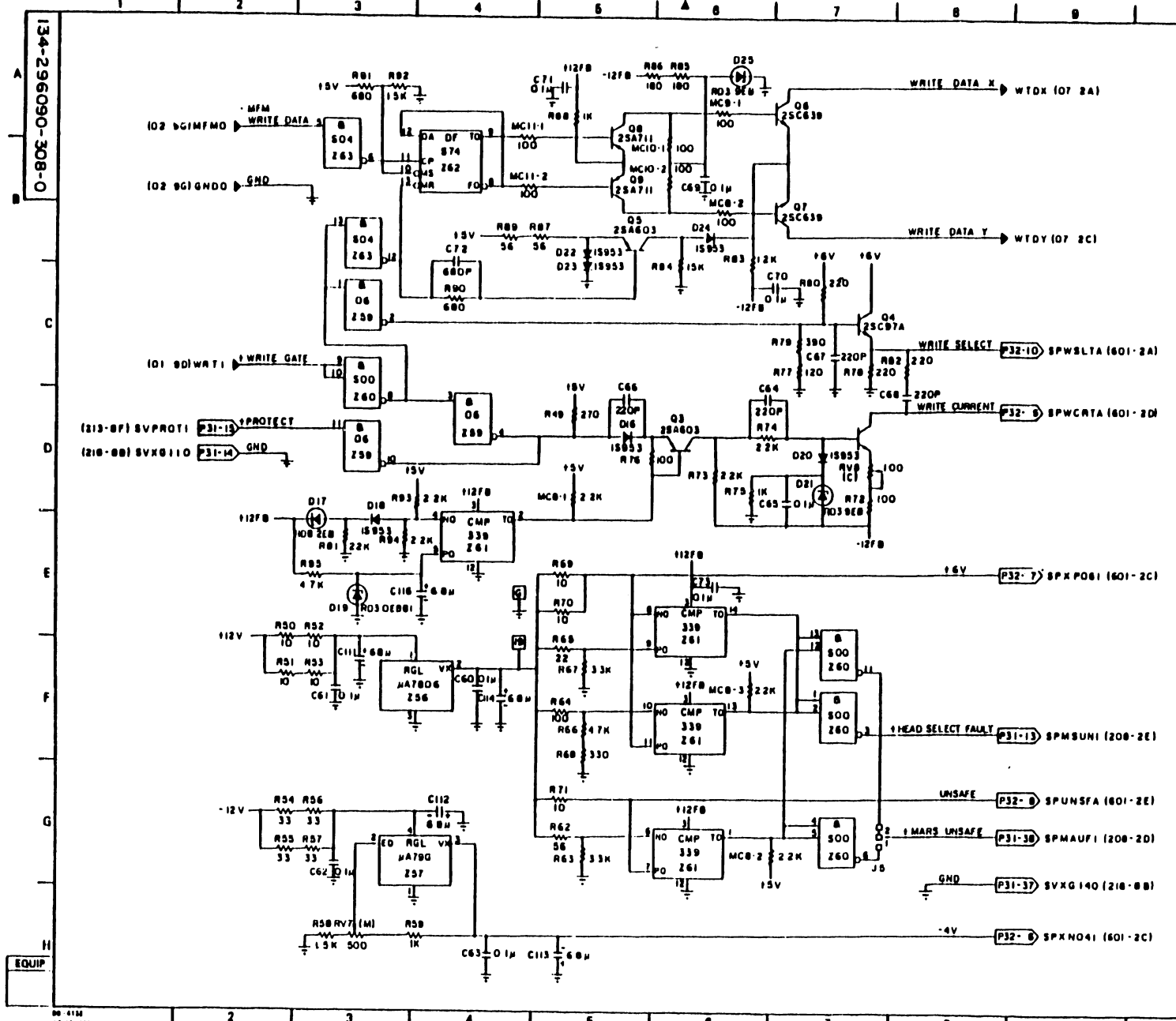


REV	DATE	DESCRIPTION (S/C)	APP
1	0	1003, S	
2	0	1003, S	
3	0	1003, S	

DWG ADDR	
PUB LOCATION	
PKG NAME	
307	
NEXT SPEC	
DRAWN	ING
CHK	APP
ISSUE	
G90SP PWA	
(7/9)	
FOR PWA REV. 01B	
134-296090-307-0	
NEC	

Nippon Electric Co Ltd

A-52

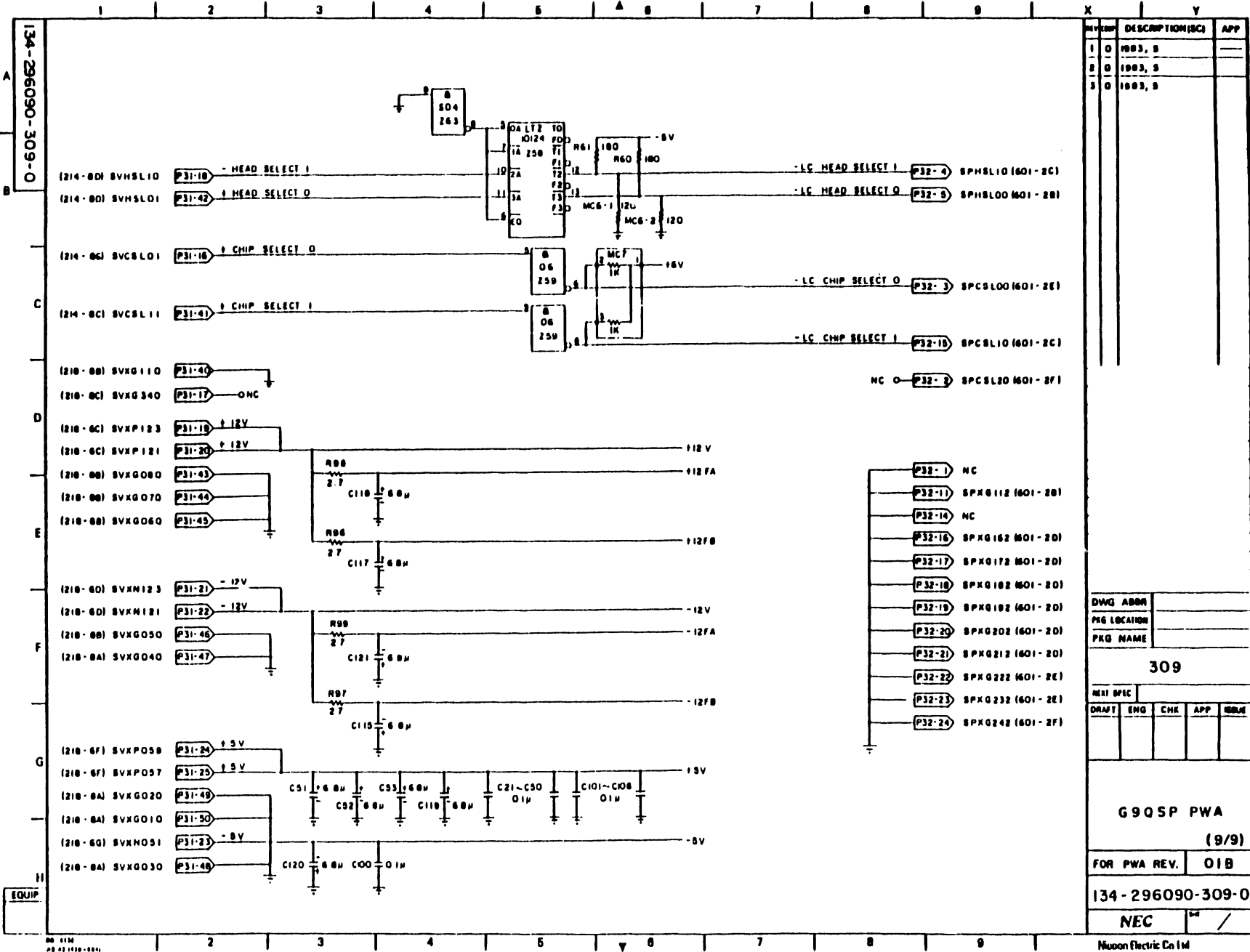


REV	DESCRIPTION (ISC)	APP
1	0 1983, 5	
2	0 1983, 5	
3	0 1983, 5	

DWG ABBR	
FIG LOCATION	
PKG NAME	
308	
MAT SPEC	
DRAFT	ENG
CHK	APP
ISSUE	
G9QSP PWA	
(8/9)	
FOR PWA REV.	OIB
134-296090-308-0	
NEC	

Mocon Electric Co Ltd

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REV	DESCRIPTION(SIC)	APP
1	0 1983, 5	
2	0 1983, 5	
3	0 1983, 5	

- P32-1 NC
- P32-11 SPKG 112 (601-20)
- P32-14 NC
- P32-16 SPKG 162 (601-20)
- P32-17 SPKG 172 (601-20)
- P32-18 SPKG 182 (601-20)
- P32-19 SPKG 192 (601-20)
- P32-20 SPKG 202 (601-20)
- P32-21 SPKG 212 (601-20)
- P32-22 SPKG 222 (601-2E)
- P32-23 SPKG 232 (601-2E)
- P32-24 SPKG 242 (601-2F)

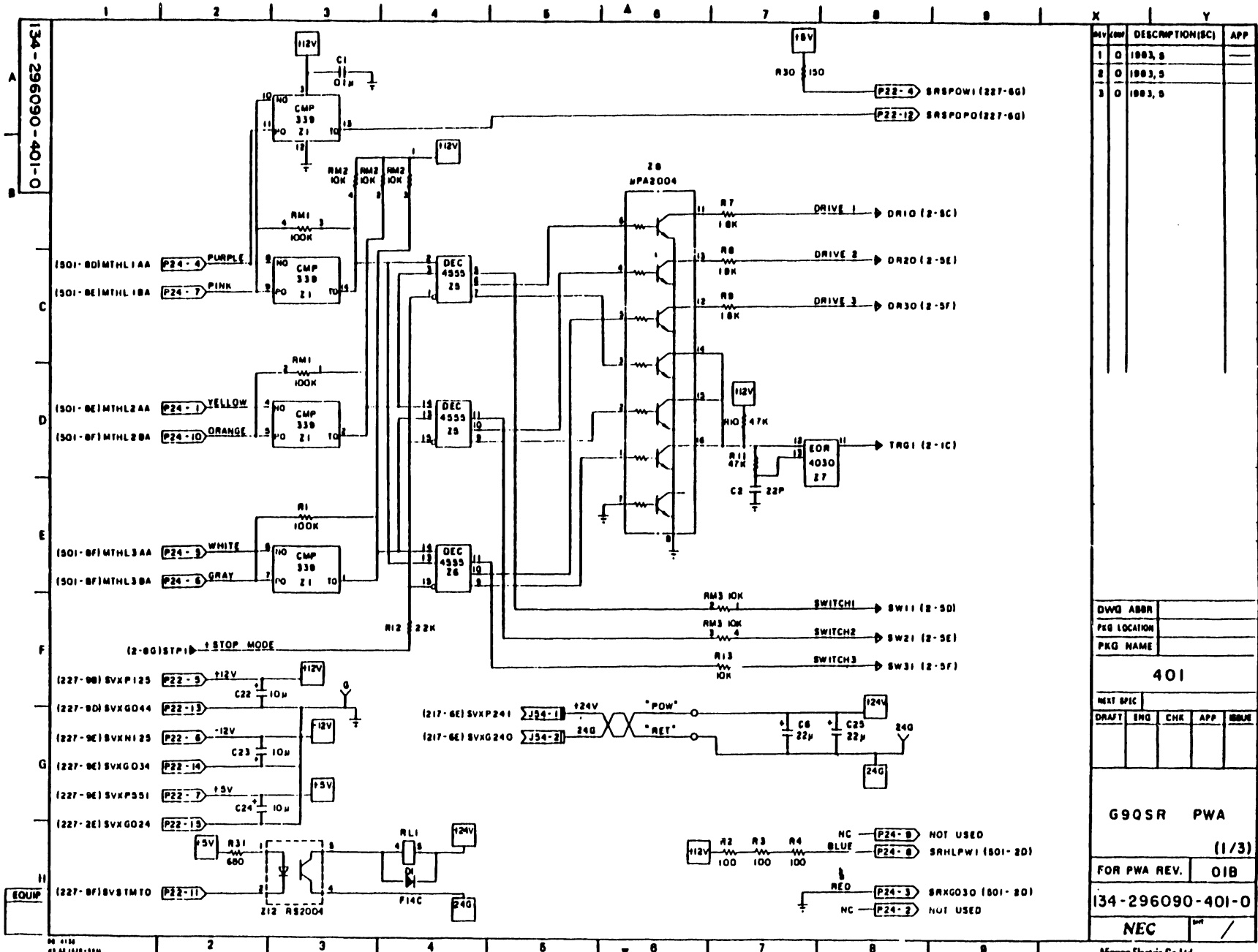
DWG ADDR	
PKG LOCATION	
PKG NAME	

309				
NEXT SFC				
DRAFT	ENG	CHK	APP	ISSUE

G9QSP PWA	
(9/9)	
FOR PWA REV.	OIB
134-296090-309-0	
NEC	/

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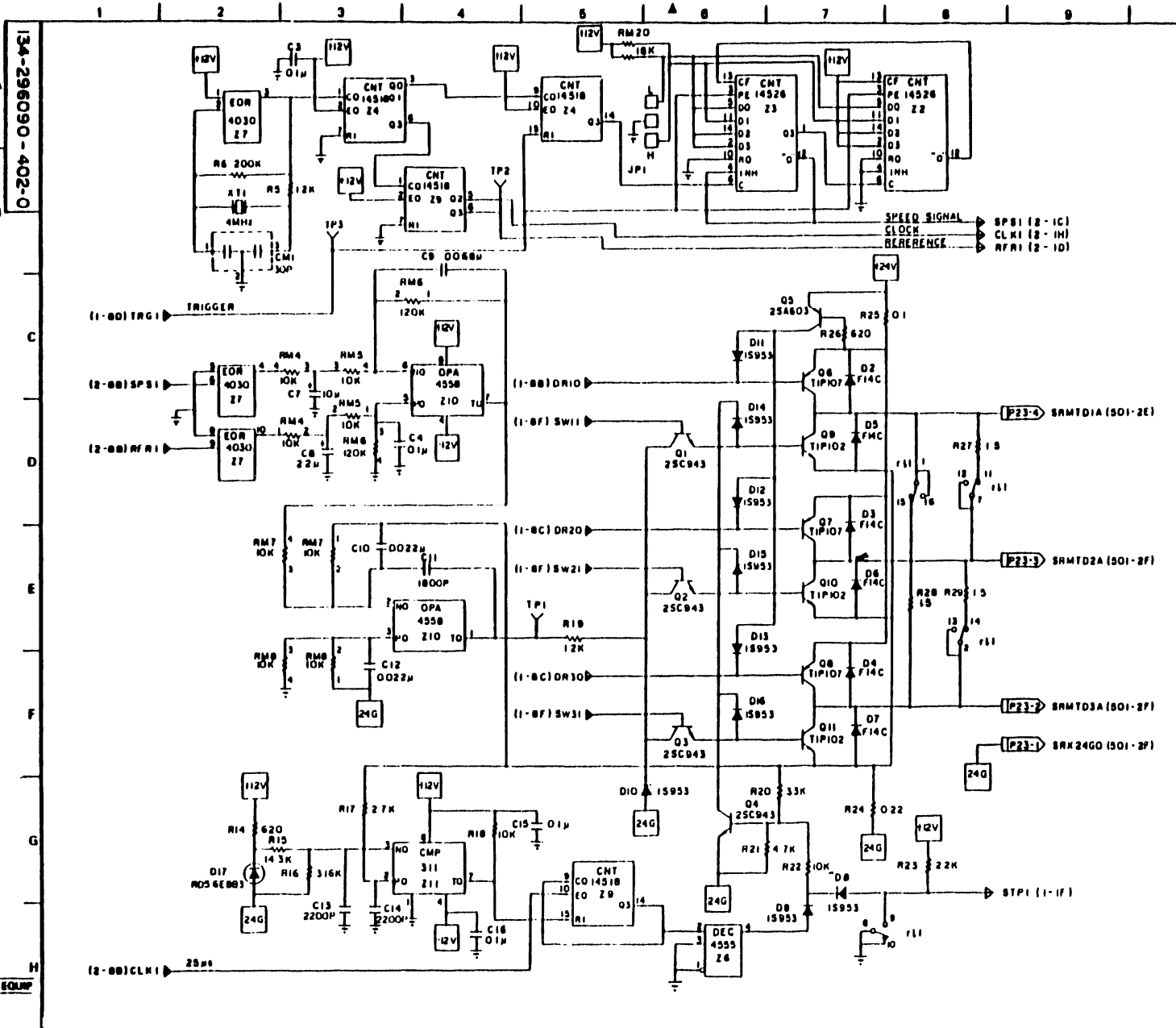
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REV	DATE	DESCRIPTION (SC)	APP
1	0	1003, 5	
2	0	1003, 5	
3	0	1003, 5	

DWG ABBR	
PKG LOCATION	
PKG NAME	
401	
NEXT SPIC	
DRAFT	ENG
CHK	APP
REUSE	
G9QSR PWA	
(1/3)	
FOR PWA REV.	OIB
134-296090-401-0	
NEC	

Mocon Electric Co Ltd



REV	NO	DESCRIPTION (SC)	APP
1	0	1983.5	
2	0	1983.5	
3	0	1983.5	

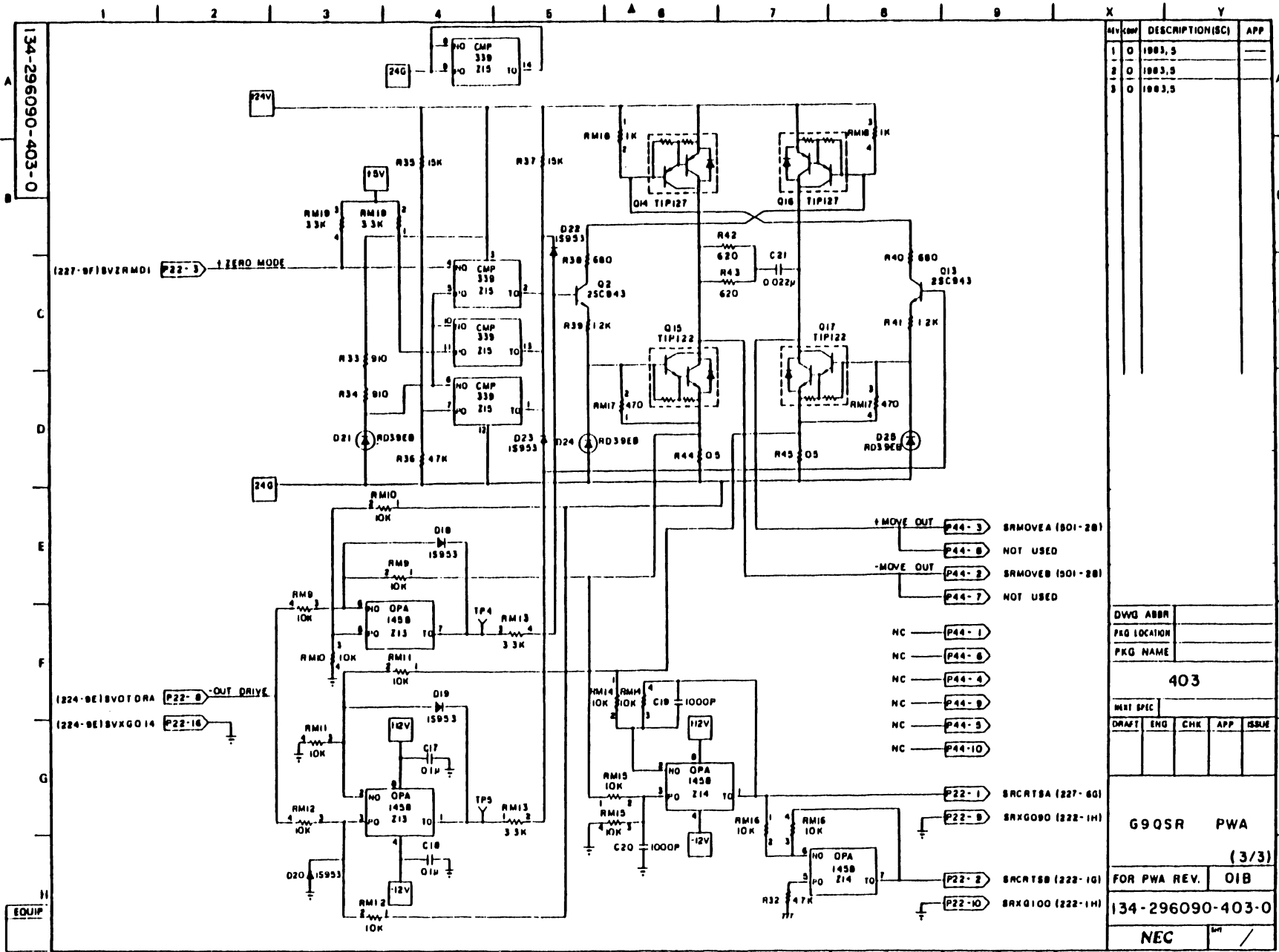
DWG ABBR	
PKG LOCATION	
PKG NAME	
402	
MAT SPEC	
DRAFT	ENG
CHK	APP
ISSUE	
G9QSR PWA	
(2/3)	
FOR PWA REV. 01B	
134-296090-402-0	
NEC	

SCHEMATIC

Japan Electric Co Ltd

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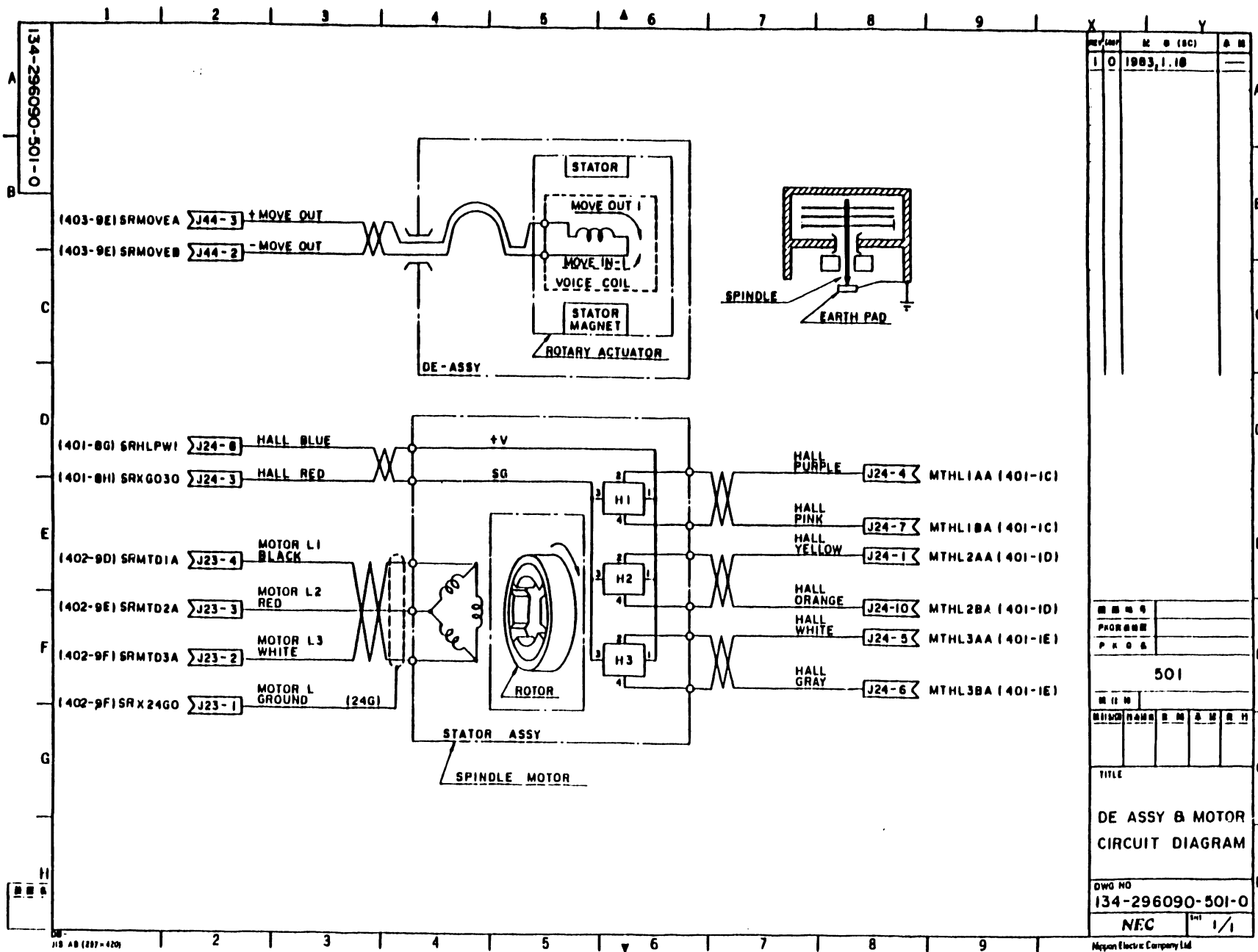
REV	DESCRIPTION (SC)	APP
1	0 1003.3	
2	0 1003.3	
3	0 1003.3	

DWG ABBR	
FIG LOCATION	
PKG NAME	
403	
MAT SPEC	
DRAFT	ENG
CHK	APP
	ISSUE
G9QSR PWA	
(3/3)	
FOR PWA REV.	OIB
134-296090-403-0	
NEC	

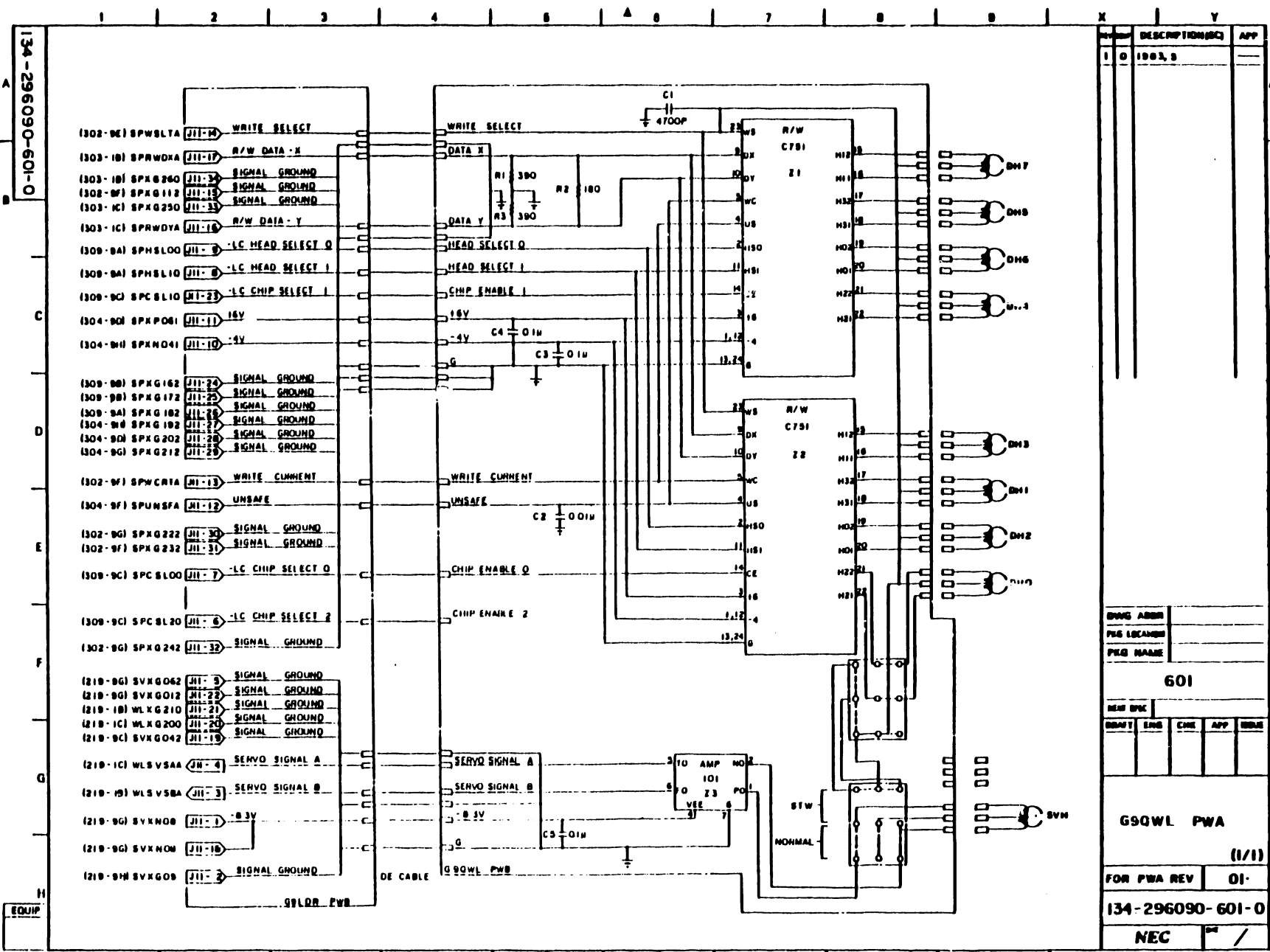
NO 1110	2	3	4	5	6	7	8	9	X	Y
20 42 1010-0001										

Mocon Electric Co Ltd

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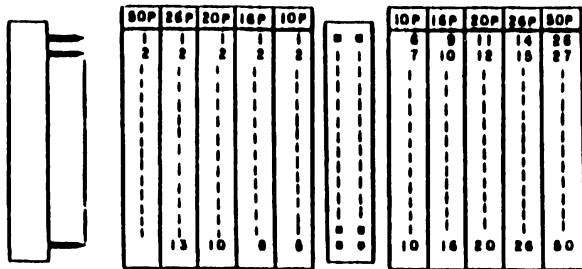
NO.	DESCRIPTION	APP.
1	1003, 9	

SWNG ADDR	
PUG LOCASH	
PUG NAME	
601	
REV	ENG
CHK	APP
DATE	ISSUE
G9QWL PWA	
(1/1)	
FOR PWA REV	01
134-296090-601-0	
NEC	PC /

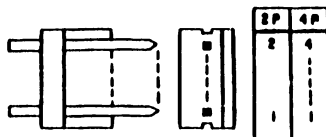
90 010
20 40 1000-100

Wapac Electric Co Ltd

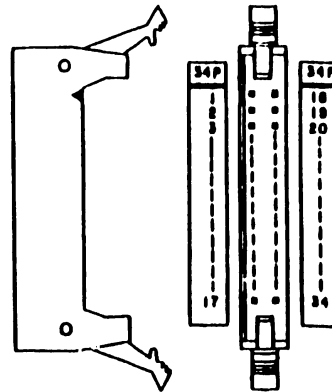
CONNECTORS PIN LAYOUT



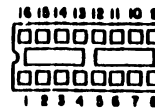
PWA	10P	16P	20P	26P	30P
GGTKW				P6D	
GGQSV	P56	P56	P56 P56 P57	P50	P53
GGQSP				P32	P31
GGQSR	P24 P44	P22			



PWA	2P	4P
GGQSV	P54	
GGQSR		P23



DE ASSY (P11)



PWA	16P
GGQSV	J15C J15D
GGTKW	J15A J15B

REV	DATE	DESCRIPTION(S)	APP
1	0	1983.6.1	

DWG ADDR	
PKG LOCATION	
PKG NAME	

NEXT SPEC				
DRAFT	ENG	CHK	APP	ISSUE

I/O CONNECTORS

134-296090-021-0

NEC REV 1/1

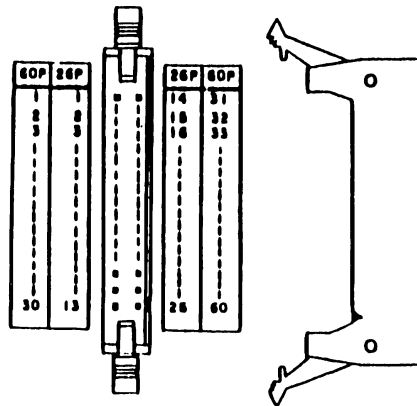
134-296090-021-0

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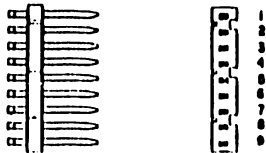
EQUIP

134-296090-022-0

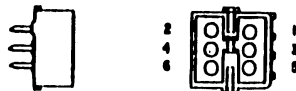
INTERFACE CONNECTORS



POWER CONNECTOR



3-DC INPUTS OPTION



REV	DATE	DESCRIPTION (SC)	APP
1	0	1983.9.	

DWG ABBR		
FIG LOCATION		
PKG NAME		

NEXT SPEC				
DRAW	ENG	CHK	APP	ISSUE

INTERFACE CONNECTOR	
a	
POWER CONNECTOR	

134-296090-022-0	
NEC	REV 1/1

Nippon Electric Co., Ltd

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EQUIP

00-0100
JIS A4 (148x210)

WANG

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