NORD-10/S

Hardware Maintenance Manual

NORSK DATA A.S

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Manuals can be updated in two ways, new versions and revisions. New versions consist of a complete new manual which replaces the old manual. New versions incorporate all revisions since the previous version. Revisions consist of one or more single pages to be merged into the manual by the user, each revised page being listed on the new printing record sent out with the revision. The old printing record should be replaced by the new one.

New versions and revisions are announced in the ND Bulletin and can be ordered as described below.

The reader's comments form at the back of this manual can be used both to report errors in the manual and to give an evaluation of the manual. Both detailed and general comments are welcome.

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Documentation Department
Norsk Data A.S
P.O. Box 4, Lindeberg gård
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PREFACE

THE PRODUCT

This manual covers the:

NORD-10/S CPU with its memory and associated peripherals.

This CPU is used in ND 1100/S, ND 1200/S, ND 1300/S and ND 1400/S configurations. For detailed product descriptions see Section 4 of the current ND Sales Notebook. Includes Cabinet, Power Supply with power fail interrupt and automatic restart. Providing space for up to 64 Kw of memory with Memory Error Checking and Correction (ECC). 256 Kw of memory with ND 011 Memory Management System.

THE READER

This manual has been prepared for Norsk Data Service Department field service engineers and technical personnel directly involved with maintaining the NORD-10/S CPU.

PREREQUISITE KNOWLEDGE

A basic knowledge of the hardware in a NORD-10/S computer system. This knowledge can be obtained either by:

- attending the Norsk Data courses of instruction on the NORD-10/S.
  (Introduction to NORD-10/S, the NORD-10/S Input/Output System and NORD-10/S Diagnostics)

or by

- carefully studying the following Norsk Data manuals:

  NORD-10/S Functional Description
  and
  NORD-10/S Input/Output System

THE MANUAL

Maintenance information is provided in seven chapters in this manual. Chapter numbers and a brief description of their contents are listed below:

Chapter 1	—	Technical description and physical layout of the CPU Input/Output system and memory.
Chapter 2	—	Hardware Maintenance Services.
Chapter 3	—	Module Substitution Precautions.
Chapter 4	—	Error symptoms and troubleshooting procedures. The step-by-step procedures to follow when SINTRAN reports an error, when SINTRAN is stopped in error fatal, when SINTRAN is stopped or hanging, when SINTRAN is operational but some terminals do not respond, when the NORD-10/S will not load test programs, when there is no reply from memory, or when the NORD-10/S is dead.
Chapter 5	—	Maintenance information on the CPU, character oriented devices (PIO), mass storage devices and DMA controllers, and on the memory. The section highlights the kind of hardware that will be tested by designated test programs.
Chapter 6	—	Covers the NORD power system.
Chapter 7	—	Site preparation, installation and storage.

RELATED MANUALS

Manuals relating to the general and functional description of the NORD-10/S are as follows:

Norsk Data Number	*Title*
ND—06.009	NORD-10/S Functional Description
ND—06.012	NORD-10/S Input/Output System
ND—06.013	NORD-10/S General Description And Module Description

Manuals that deal with the special systems interfaced with or utilized with the NORD-10/S are as follows:

Norsk Data Number	*Title*
ND—06.007	Big Multiport Memory System
ND—12.004	CDMA — NORD-10 General Information
ND—12.007	CAMAC — CC-NORD-10 General Information
ND—12.006	CAMAC — CC-NORD-10 Hardware
ND—11.013	Error Correction Control (ECC) Disk Controller
ND—12.015	1158 — DR-11-C Interface
ND—11.012	Floppy Disk System
ND—11.010	HAWK Disk Controller
ND—11.009	HAWK Disk System
ND—12.018	HDLC — High Level Data Link Control Interface
ND—12.012	Interface to Pertec Magtape With Formatter
ND—12.020	Universal DMA Interface

Manuals applicable to site preparation and installation are as follows:

Norsk Data Number	*Title*
ND—30.002	Site Preparation Manual

Manuals relating to SINTRAN and test programs are as follows:

Norsk Data Number	*Title*
ND—30.003	SINTRAN III System Supervisor
ND—30.005	Test Program Descriptions for ND-100 and NORD-10 Series Volume 1
ND—30.015	Test Program Descriptions for ND-100 and NORD-10 Series Volume 2

These manuals are described in Appendix D, Documentation Review. In addition special hardware and software loose-leaf books are prepared for each computer by Norsk Data. These are on-site working notebooks containing information about that special computer hardware and software configuration. These notebooks are called Machine Books.

The Norsk Data Service Department also utilizes a Hardware Maintenance Notebook that covers the procedures utilized by the Norsk Data in Norway.

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1 TECHNICAL DESCRIPTION AND PHYSICAL LAYOUT

This section provides a schematic overview of a typical NORD-10/S.

To gain access to the interior of a cabinet, the side plates or doors are merely pulled away from their friction fasteners. A view of the door removing procedure is as shown in figure 1.1.

At figure 1.2 the main component physical layout is shown. The NORD-10/S in figure 1.2 has a rack-mounted floppy.

The NORD-10/S CPU layout is in figure 1.3. The I/O system layout is illustrated at figure 1.4. The fault indicators in the Big Multiport Memory and the I/O racks are at figure 1.5.

HARDWARE MAINTENANCE

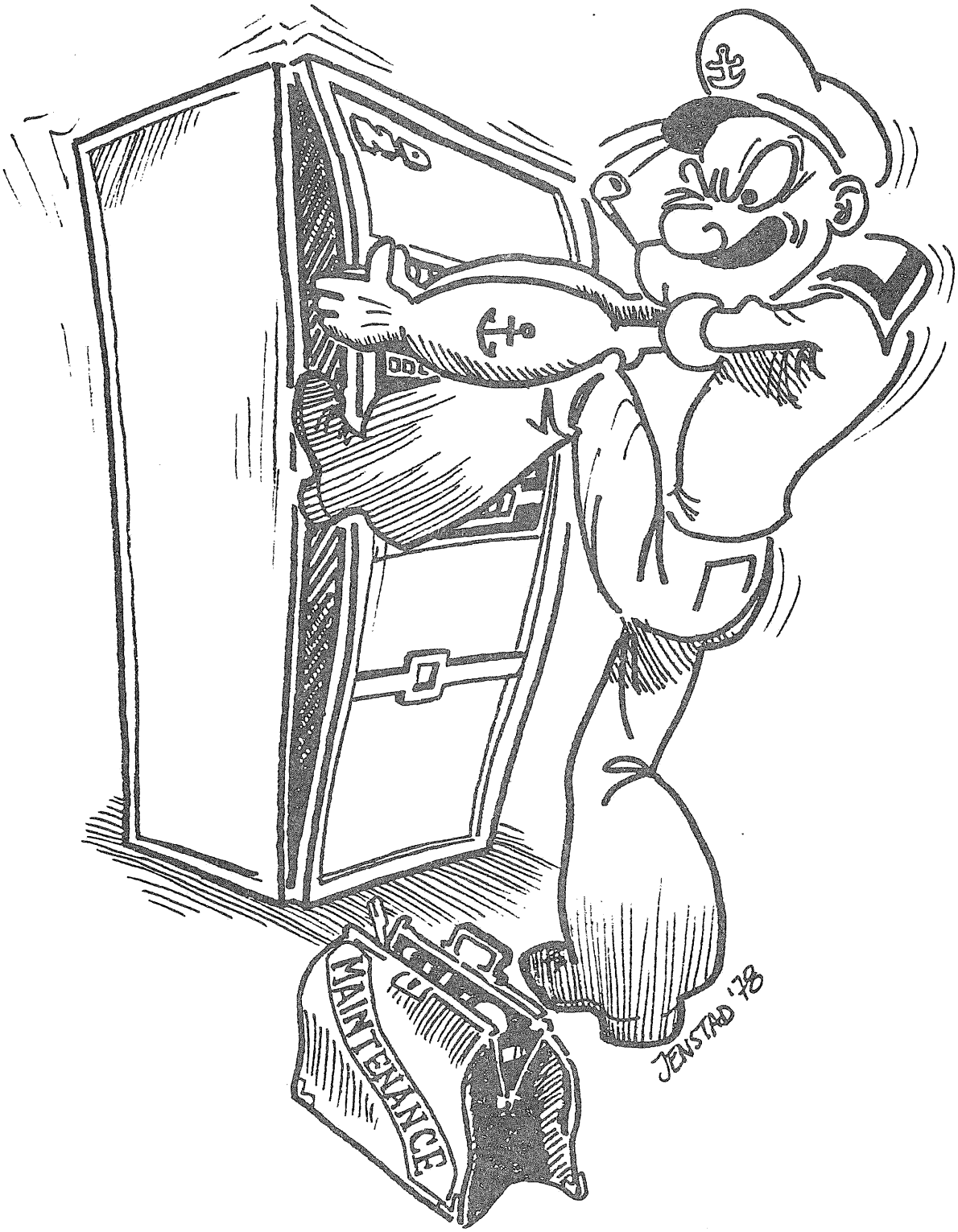


Figure 1.1: DOOR REMOVING PROCEDURE

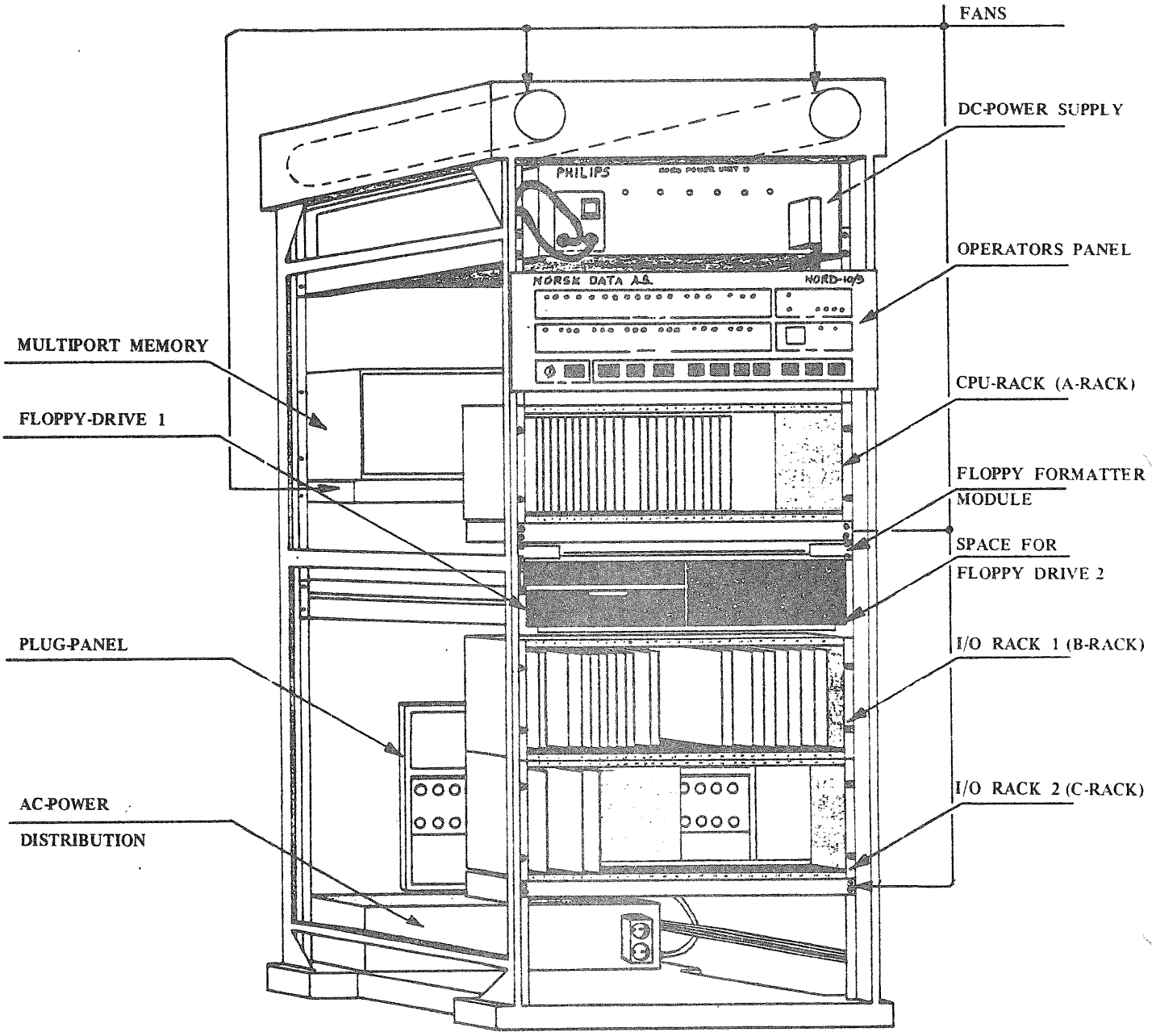


Figure 1.2: NORD-10/S WITH RACK-MOUNTED FLOPPY. MAIN COMPONENT PHYSICAL LAYOUT.

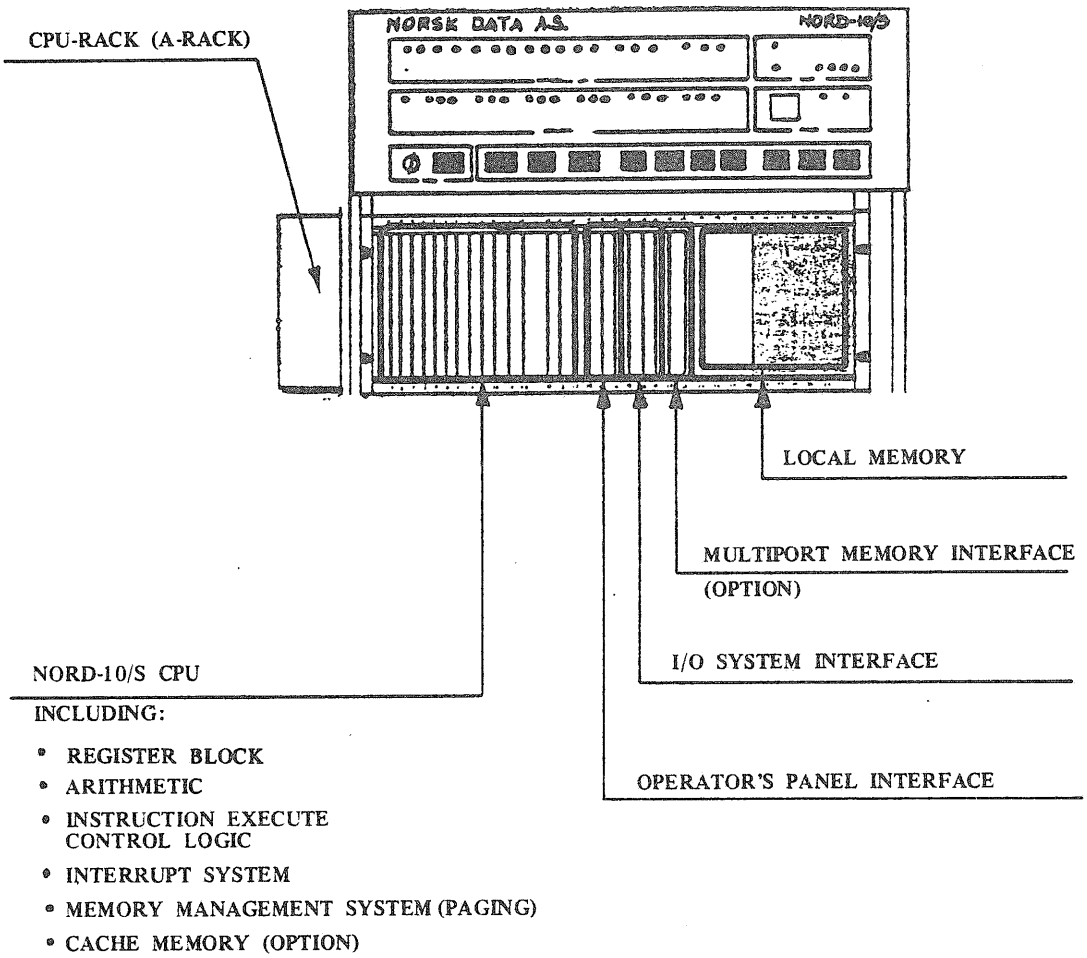


Figure 1.3: NORD-10/S CPU LAYOUT

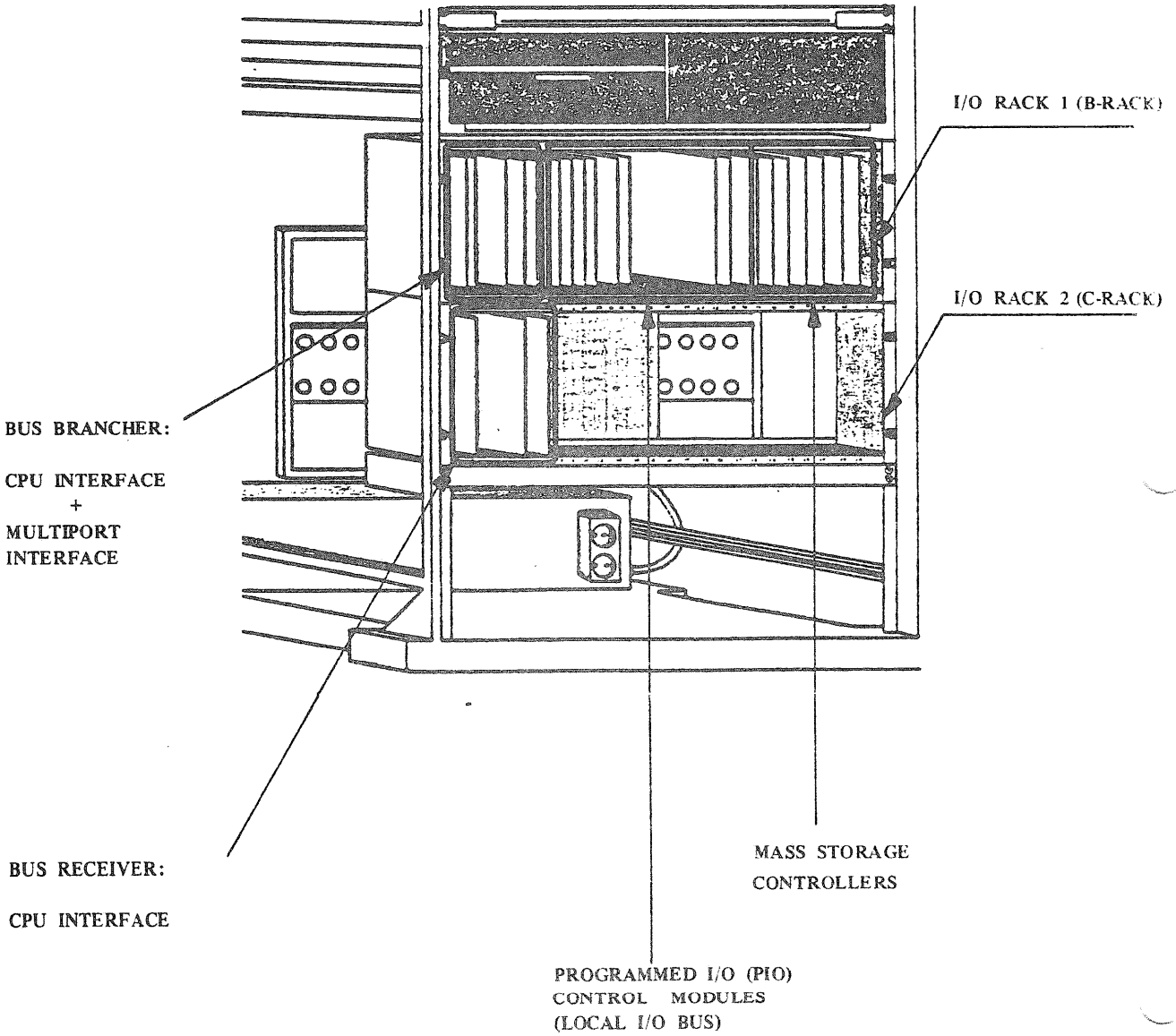


Figure 1.4: NORD-10/S I/O SYSTEM LAYOUT

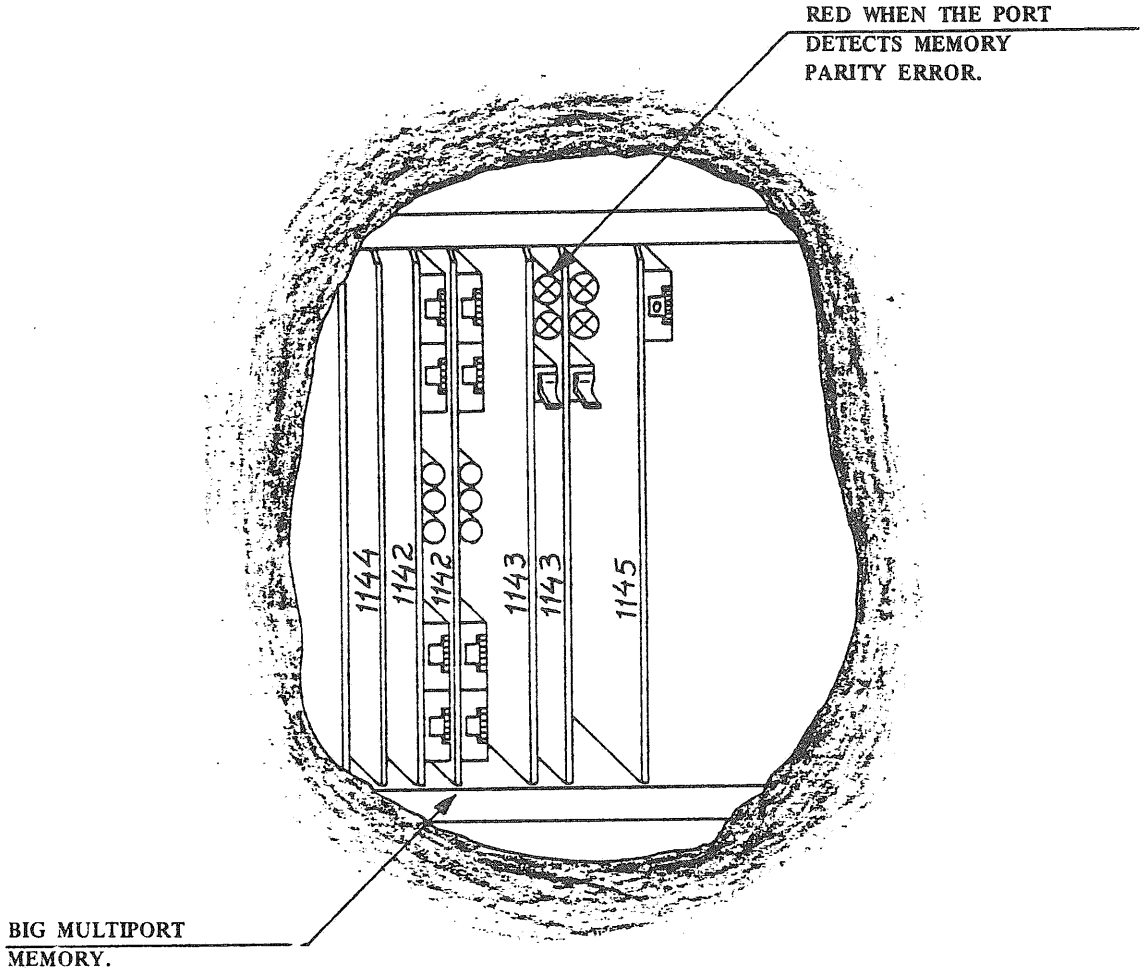


Figure 1.5A: NORD-10/S FAULT INDICATORS

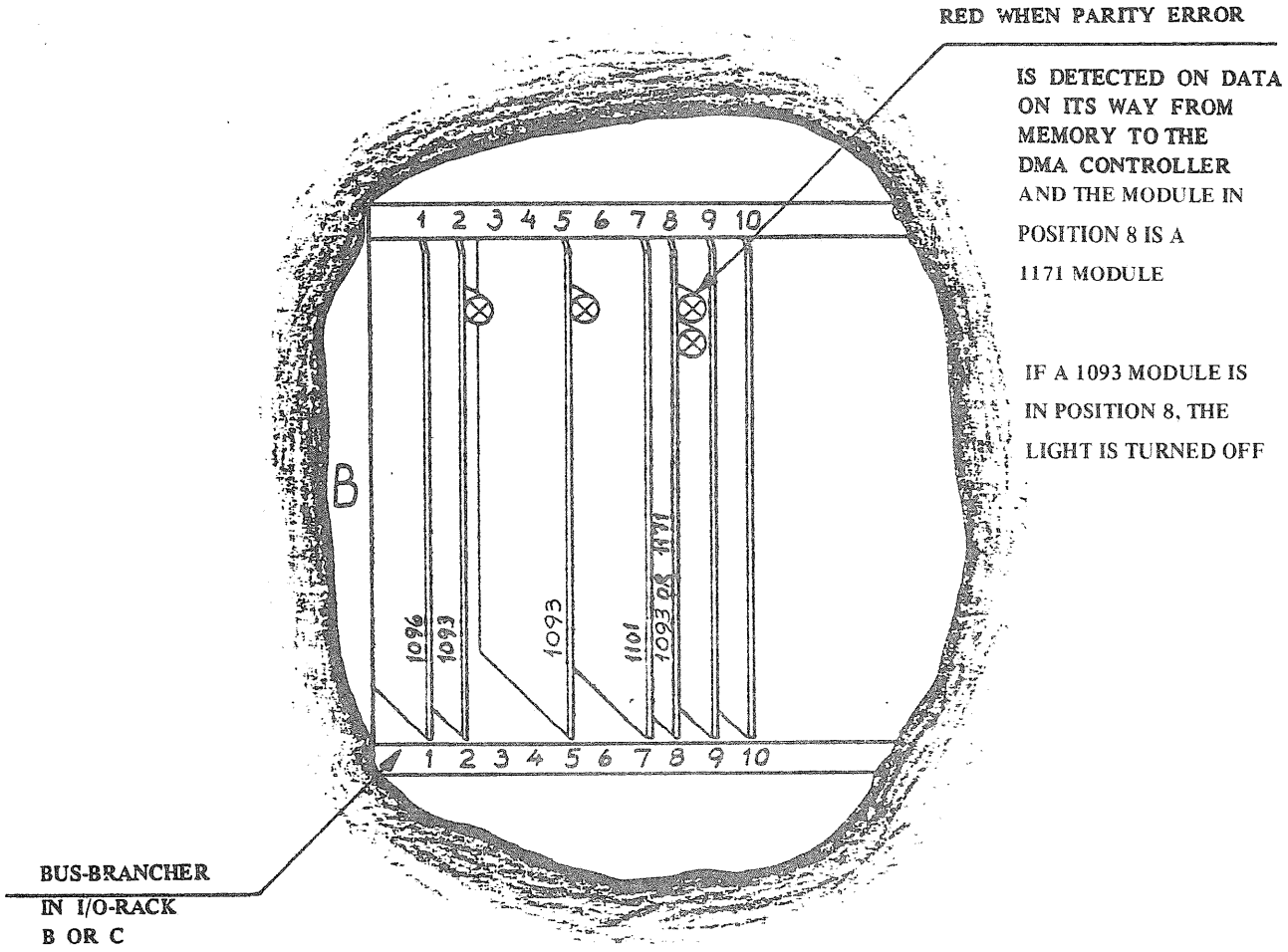


Figure 1.5B: NORD-10/S FAULT INDICATORS

2 HARDWARE MAINTENANCE SERVICES

2.1 *GENERAL*

The following environmental and procedural considerations within a data center are essential to the efficient and reliable operation of the NORD-10/S:

- The temperature should be maintained at 22 degrees centigrade ± 4 degrees.
- The maximum temperature should not exceed 28 degrees centigrade.
- A temperature gradient of a maximum of 2 degrees centigrade per hour should not be exceeded.
- The relative humidity should be maintained at 55% ± 10%.
- The site should be kept clean and dustfree.
- Dust: The air pressure in the computer room should be higher than the air pressure outside the room. Special demands are made on the air-conditioning unit's filter if the air includes corrosive gases, salts, conductive mineral particles or other unusual particles of dust.

Hardware maintenance consists of preventive maintenance and maintenance to correct system failure. Owner preventive maintenance is primarily oriented toward maintaining the environmental conditions indicated above. Norsk Data preventative maintenance carries this into the CPU unit itself. System failures are most often initially detected by the system supervisor. This section covers these three aspects of maintenance from the Field Service Engineers point of view. He needs to know what the user has been instructed to do and what he must do when a machine is functioning normally. In addition the system's failure information available to the system supervisor is outlined and two fundamental preventive maintenance trouble shooting routines available to the Field Service Engineer are set forth.

2.2 *OWNER PREVENTIVE MAINTENANCE*

Maintenance to be done by the owner include:

Level 0 (Daily)

1. Site should be kept clean and dustfree.

2. Maintain temperature in data center at 22 degrees centigrade ± 4 degrees.

3. Maintain the relative humidity at 55% ± 10%.

4. Insure that the air-conditioning unit filters are clean and useable so that the air pressure in the data center is higher than the air pressure outside the room.

In addition to these positive checks the owner should also insure that the following are adhered to:

— The computer power should not be turned off during nights, weekends, etc.

— No operation of any kind should be performed inside the computer without permission from the ND Service Department.

2.3 *PREVENTIVE MAINTENANCE TO BE DONE BY THE ND SERVICE DEPARTMENT*

One means of reducing downtime associated with unexpected system failure is to provide necessary preventive maintenance services. During preventive maintenance the general idea is to tune up the system so that things that are marginal will be identified and remedied on the spot. During preventive maintenance scheduled visits, the Field Service Engineer should exercise the system to identify possible problem areas, talk with the system supervisor and operators, and critically read through related documentation. As a minimum, the maintenance to be done by the ND Service Department includes:

Level 4 (Quarterly)

1. Observe that all fans work properly.

2. Clean air filters.

3. Check power supply output.

4. Check all push buttons and lamps on operator panel.

5. Start up system and ensure that everything is running properly.

and

Level 6 (Annually)

1. Perform lower level maintenance.

2. Clean the computer. If necessary clean the boards, gold-contacts and memory modules with "Isopropanol" and a vacuum cleaner.

3. Start up system and ensure that everything is running properly.

Figure 2-1 shows the Quarterly Maintenance Checklist, CPU-I/O Cabinet that will be used to record these preventive maintenance services. The instructions for using this form are found in the Service Department Hardware Maintenance Notebook.

QUARTERLY MAINTENANCE CHECKLIST
CPU CABINET

- [1] CLEAN/REPLACE AIR FILTER
- [2] CHECK FANS
- [3] CHECK VOLTAGES
- [4] VACUUM CLEAN INTERIOR IF NECESSARY
- [5] CHECK LAMPS
- [6] TIGHTEN ALL SCREWS ONCE A YEAR

Figure 2.1: QUARTERLY MAINTENANCE CHECKLIST, CPU CABINET

2.4 *SYSTEM FAILURES*

A system supervisor is provided with general information about system failures in Section 3 of the ND manual NORD-10/NORD-50 OPERATOR'S GUIDE, ND—60.116.01. This information deals with how faults are detected and how they are corrected.

Error procedures are given for situations where the computer stops (the STOP light is ON), hangs (the STOP light is not ON, but the computer does not respond) or is completely dead (lights are OFF). These procedures are given as diagrams of questions and actions depending on the answers. A procedure is also given for restarting SINTRAN after a system failure. Since error situations are usually detected through error messages from SINTRAN III, these messages are listed, together with suggested operator actions for the different messages.

Section 14 in the SINTRAN III SYSTEM SUPERVISOR manual, ND—30.003.04 contains more detailed information about system failures and the operator is referred to that manual if the information here is not sufficient.

System failures are considered to include all types of errors and irregularities that cause the system to go down or run with lowered performance. Whenever a system failure occurs, it is the system supervisor's responsibility to take control of the installation. He/she should identify the type of system failure, get all the necessary information to describe the state of the computer, and try to get the installation working again.

System failures may be of two types:

- nonfatal errors
- fatal errors

NONFATAL ERRORS are detected by SINTRAN III, and an error message will appear on the user's terminal or on the error message terminal (usually the console terminal).

Only error messages from SINTRAN III monitor will be looked at in Section 4. Some of them may indicate errors in the hardware or in the SINTRAN III operating system.

The different error messages and some additional information about each of them can be found in these manuals.

FATAL ERRORS will almost always be detected by SINTRAN III, but no error message will be given. The system will go into a "stop" condition or will "hang up". The system supervisor is provided with flow diagrams in these manuals that indicate what should be done on site before ND is contacted for maintenance service support.

2.5 *THE CONFIGURATION INVESTIGATOR PROGRAM TROUBLE-SHOOTING TECHNIQUE*

The Configuration Investigator Program can be utilized as a troubleshooting technique by:

1. Run the CONFIGURATION INVESTIGATOR program and keep the hard-copy. This CONFIGURATION INVESTIGATOR program will inform you about:

   — size of the physical memory
   and
   — the input/output interface modules configuration

   It is also advisable to note the physical position of the various input/output modules in the I/O rack and the logical terminal number and their interface modules. (See figures in Section 5.2.2.) If there are any malfunctions of the modules in the I/O rack, these can easily be found by comparing the "GOOD-TIME" copy with the "BAD-TIME" copy. More information concerning CONFIGURATION INVESTIGATOR can be found in Section 5.2.1.

2. Prepare a diskette to be used for dumping the memory content and the content of the registers. This diskette is to be used when the operating system is not responding properly.

   The diskette with the "DUMP" can be examined by a user with some knowledge of the SINTRAN III operating system. This is done by using the SIII-PM-INVESTIGATOR-(SUT 2328) program POST MORTEM INVESTIGATOR. The diskette can also be forwarded to the ND software service for further examination.

Do as follows:

1. Insert a ND-10022 diskette in the floppy.

2. Copy the file DUMPFL:PROG to main directory, user system.

   @COPY-F "DUMPFL-2327:BPUN" (P-10022F:F-U) DUMPFL:BPUN

   Dump as "PROG" version:

   @PLACE-BINARY DUMPFL
   @DUMP "DUMPFL-2327A" 13665 13665

   or as reentrant subsystem:

   @DUMP-REENTRANT DUMPFL, 13665, 13665, DUMPFL

3. To produce a diskette with the MEMTOF stand-alone:

   Insert a formatted diskette in floppy-disk-one unit 0, and start the program DUMPFL.

   @DUMPFL

   There will be some output, but the program requires no input.

4. Take out the diskette and write MEMTOF on the label.

5. Produce a few more diskettes with MEMTOF.

   NOTE!! There is no directory on the diskete containing MEMTOF stand-alone.

2.6 *HOW TO TAKE BACKUP*

2.6.1 *Software Consistency Check*

Before taking any BACKUP, the logical quality of the disks should be checked. This is done by the test program

FILE SYSTEM INVESTIGATOR

on the diskette ND-10022 with file name

FILSYS-INV-2135F.

This program is described in the "Test Program Description" manual in Chapter 17.

Do at least these tests:

DD: Dump the directory entry
LU: List user names
PL,E: Page list. Answer E to the question that PL will ask.
If errors, check the test program description manual for explanation and further steps.
RE: Restart the programs if more disk units are to be checked.

2.6.2 *Disk to Magtape Backup*

Figure 2.2 illustrates two examples of disk to magtape backup.

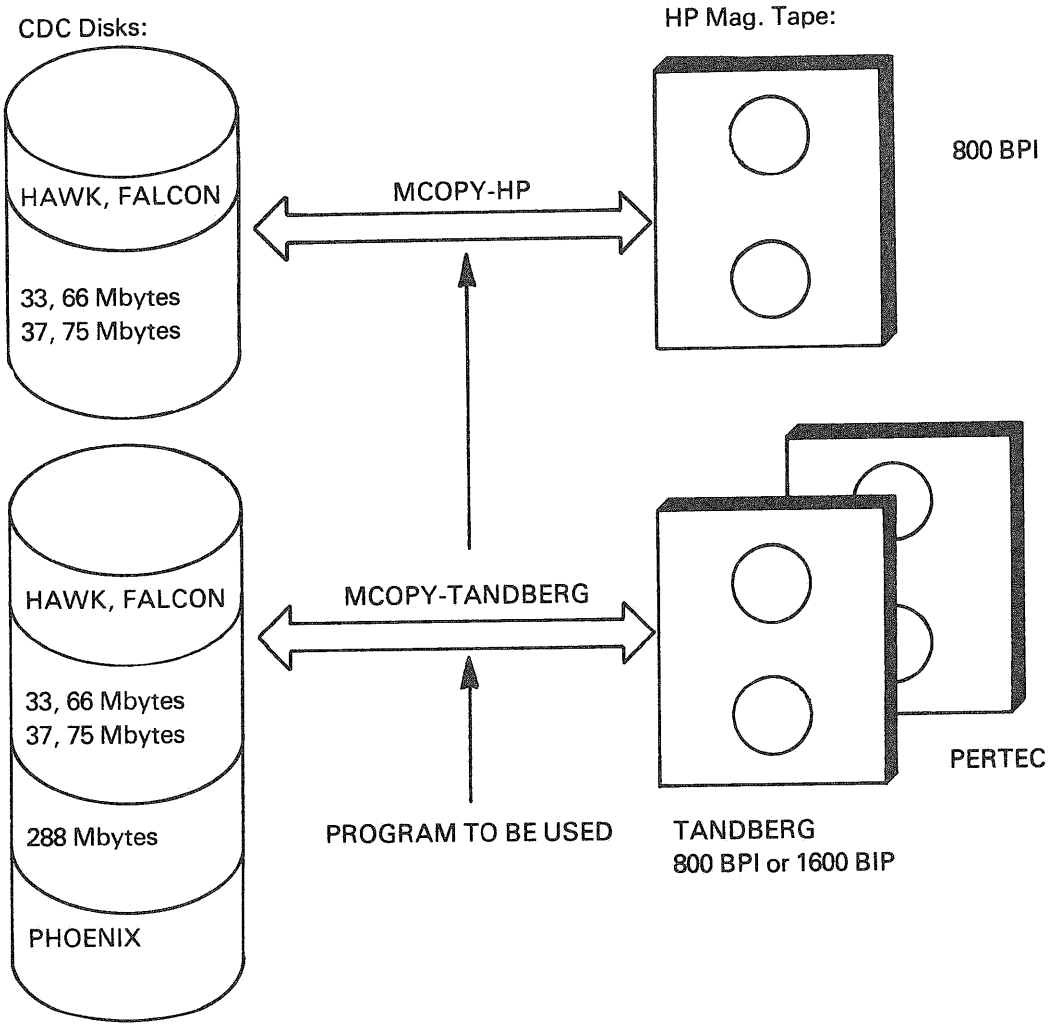


Figure 2.2: DISK TO MAGTAPE BACKUP

2.6.3 *Disk to Disk Backup*

Figure 2.3 illustrates the procedure for obtaining disk to disk backup.

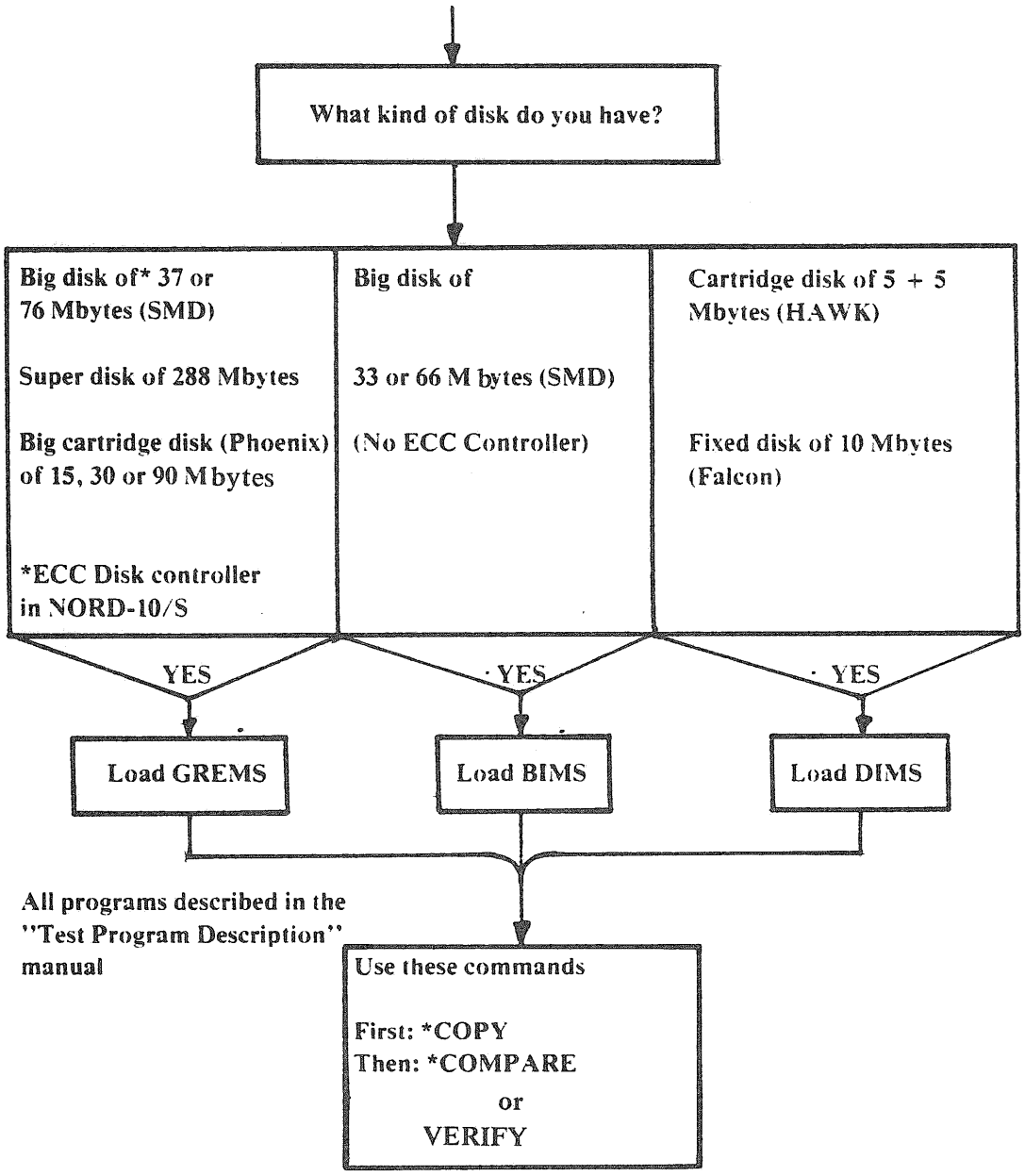


Figure 2.3: PROCEDURE FOR OBTAINING DISK TO DISK BACKUP

3 MODULE SUBSTITUTION PRECAUTIONS

3.1 *GENERAL*

The power in the NORD-10/S should *NOT* be turned off during module removal or replacement.

However, there are three other important factors that must be considered during module substitution. They are the following:

- maintaining programs stored in memory
- the dedicated module locations within the I/O Racks (Racks B and C)
- and, the control of DC power on the external disk units.

These factors are discussed in the following sections.

3.2 *MAINTAINING PROGRAMS STORED IN MEMORY*

The MASTER CLEAR button on the NORD-10/S Operator's Panel must be held depressed during the actual removal or replacement of a module to prevent the loss of a program stored in memory.

If the MASTER CLEAR button is not held depressed during the actual breaking of a contact while removing a module or during the actual re-establishing of contact while inserting a module, the programs stored in memory will be lost. If lost, these programs must be reloaded.

3.3 *DEDICATED MODULE LOCATIONS WITHIN THE I/O RACKS*

The following modules are 24V modules:

1020: Teletype Buffer

1122: 4 AS Current Loop

The module locations for these modules have 24V connections to the back-plane. These 24V modules should not be inserted into other module locations, and other 5V modules should not be inserted into the 24V dedicated module locations. Damage to the 5V modules would be the result.

WARNING 1!!

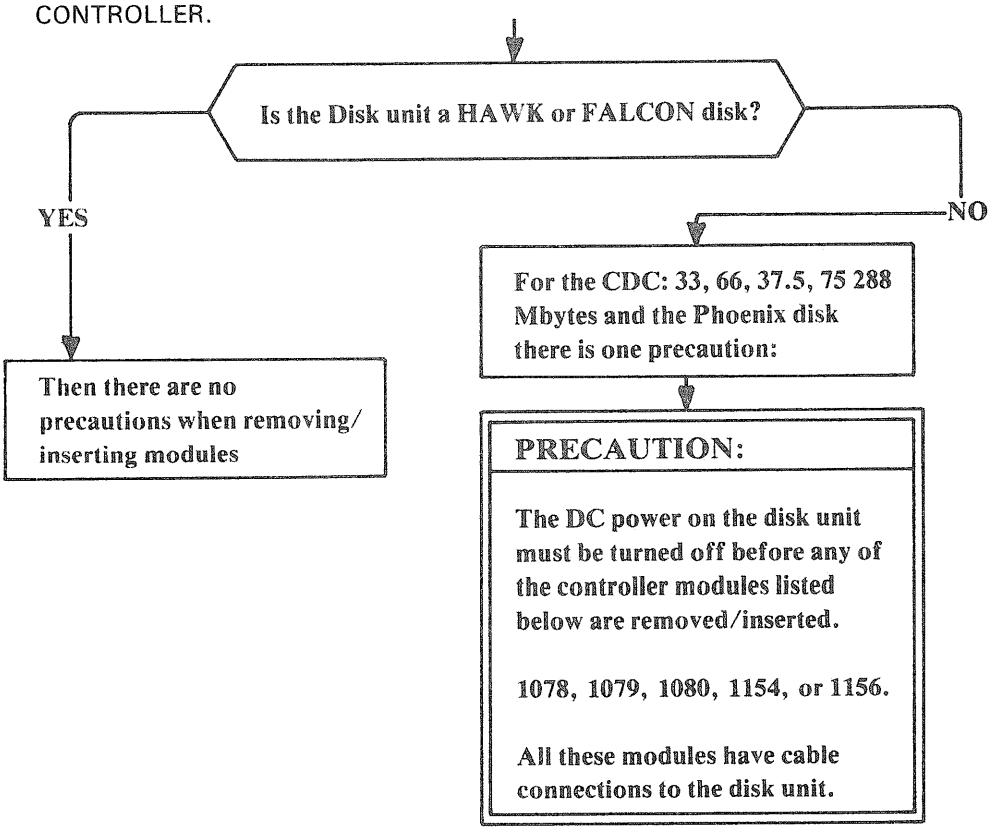
If any of the listed modules found in the input/output rack are removed *DO NOT INSERT ANY OTHER MODULES IN ANY OF THESE POSITIONS.*

3.4 *CONTROL OF DC POWER ON EXTERNAL DISK UNITS*

The module locations in the I/O Racks for disk controllers in the NORD-10/S are identified in Sections 5.3.2.4 and 5.3.2.5. There is a critical DC power problem connected with the removal of some of the modules in these locations.

WARNING 2!!

PRECAUTION WHEN REMOVING/INSERTING MODULES IN THE DISK CONTROLLER.



4 ERROR SYMPTOMS AND TROUBLESHOOTING PROCEDURES

4.1 *GENERAL*

This section outlines the error situations that appear when SINTRAN reports an error, when SINTRAN is stopped in error fatal, when SINTRAN is stopped or hanging, when SINTRAN is operational but some terminals do not respond, when NORD-10/S will not load test programs, when there is no reply from memory, or when the NORD-10/S is dead.

In each of these error situations, a step-by-step troubleshooting procedure is given to correct the error or identify the fault. If the error is not corrected within this section, a reference will be made to the maintenance information in Sections 5 and 6.

4.2 *SINTRAN REPORTS ERROR*

Error situations are usually detected through error messages from SINTRAN. These are classified as NON FATAL ERRORS and the error message will appear on the user's terminal or on the error message terminal (usually the console terminal). These messages are listed, together with suggested operator actions for the different messages in:

— NORD-10/NORD-50 Operator's Guide, ND—60.116.01.

— SINTRAN III System Supervisor, ND—30.003.04.

4.2.1 *SINTRAN III Error Message Format*

At run-time, errors may be detected by the system. Most of the errors will cause the current RT program to be aborted and the error message:

aa.bb.cc. ERROR nn IN rr AT ll; tttt
xx yy

will be printed.

If the error occurs in a background program, the error message will be written on the corresponding terminal. For RT programs, the error message will come to the error message terminal (usually Terminal 1).

The parameters have the following meaning:

aa.bb.cc Time when the error message was printed.
- aa hours
- bb minutes
- cc seconds

nn Error number. For further explanation, refer to the list on the following pages.

rr Octal address corresponding to program name or the program name itself.

ll Octal address where the error occurred.

tttt Explanatory text.

xx, yy Numbers carrying additional information about the error. One or both numbers can be omitted.

Example:

```
@ 01.43.32 ERROR 14 IN BAKD3 AT 114721;
OUTSIDE SEGMENT BOUNDS
```

In case of a transfer error, an additional message TRANSF will be given.

4.2.2 *Run-Time Error Codes*

List of error messages with those that could be caused by hardware faults indicated with an Error Code circle and underlined with a dotted line.

Error Code	*Meaning*	*xx*	*yy*	*Program Aborted*
00	Illegal monitor call			yes
01	Bad RT program address			yes
02	Wrong priority in PRIOR			yes
03	Bad memory page	page no.		
04	Internal interrupt on direct task	level	bit	no
06	Batch input error	error no.		yes
07	Batch output error	error no.		yes
08	Batch system error	error no.	L register	yes
09	Illegal parameter in CLOCK			yes
10	Illegal parameter in ABSET			yes
11	Illegal parameter in UPDAT			yes
12	Illegal time parameters			yes
13	Page fault for non-demand			yes
14	Outside segment bounds			yes
15	Illegal segment number	segment no.		yes
16	Segment not loaded	segment no.		yes
17	Fixing demand	segment no.		yes

Error Code	*Meaning*	*xx*	*yy*	*Program Aborted*
18	Too many fixed pages	segment no.		yes
19	Too big segment	segment no.		yes
20	Disk/drum transfer error	hardware device no.	unit	no (aborted if segment transfer)
21	Disk/drum transfer error	disk address	hardware status	See explanation
22	False interrupt	level		no
23	Device error	hardware device no.	hardware status	no
25	Already fixed	segment no.		yes
26	Mass storage time-out			no
27	Illegal parameter in CONCT			yes
28	Space not available	segment no.		yes
29	MON 64 and MON 65	error no.	(see SINTRAN III Reference Manual)	yes
30	Divide by zero			yes
31	Permit violation			yes
32	Ring violation			yes
33	HDLC, drivers fatal error			yes
34	Illegal instruction			yes
35	RT FORTRAN stack error			yes
36	Privileged instruction			yes
37	IOX error	Address	Level	no
38	Memory Parity	PEA register	PES register	yes

Error Code	*Meaning*	*xx*	*yy*	*Program Aborted*
39	Memory out of range	PEA register	PES register	yes
40	Power fail			no
41	Illegal error in ERMON			yes
42	Overlapping segments	segments		yes
44	Corrected memory error	PEA reg.	PES reg.	no
45	Not demand segments			yes
46	XMSG/Program fatal error			yes
47	XMSG/Driver fatal error			yes
50-69	User defined error (MON 142)	error no.	suberror no.	no
90	FORTRAN run-time error	error no.		no
91	FORTRAN I/O error	error no.		no
100	FTN library error			

4.2.3 *The Run-Time Errors Explained in Detail With Additional Hardware Information*

Only the error messages that could be caused by hardware failures are covered in this section.

03 BAD MEMORY PAGE <PAGE NO>

Explanation: Parity error detected by a memory test routine in SINTRAN during the start-up sequence.

Action: Verify the memory parity error by running a MEMORY-TEST program.

For Example: Run one of the stand-alone test programs such as:

MULTI, T32KMOS

Note 1. The system can run after this error message. It is a good procedure to take backup at this time.

Note 2. Do not run the memory test program MOVER under SINTRAN. The page containing the parity error is not used for swapping.

Note 3. See Section 5.4.2 for information on Memory Test Programs.

13 PAGE FAULT FOR NON-DEMAND

Explanation: An RT-program on a non-demand type segment is trying to use an address outside the segment bounds.
Non-demand segment: segments where all the pages have to be present in memory before start up.
This is probably a user error, but:

Action: Run: MEMORY TEST
PAGING TEST
DISK PARITY TEST
CPU-TESTS

14 OUTSIDE SEGMENT BOUNDS

Explanation: An RT-program on a demand segment tried to use an address outside the segment bounds.

- If error message from user RT-program:
  Suspect the software
- If error message from system RT-program:
  Suspect the hardware

Action:

Run Memory Test Programs
(See Section 5.4)

Test the Memory Management System (Paging)

Test the CPU

Check the disk by running a Parity Check

20 DISK/DRUM TRANSFER ERROR <HARDWARE DEVICE NO> <UNIT>

21 DISK/DRUM TRANSFER ERROR <DISK-ADDRESS> <STATUS>

TRANSF!

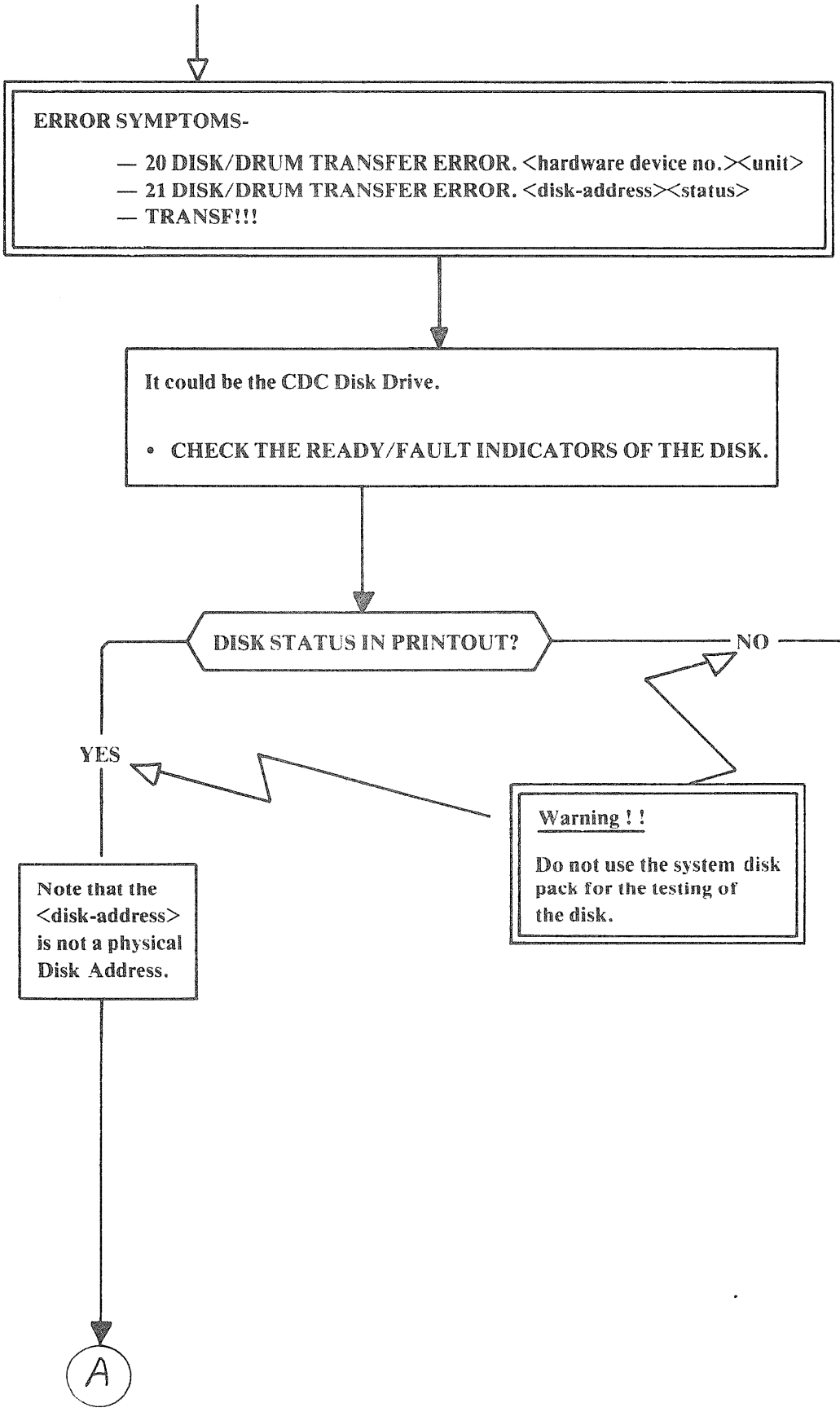
Explanation: Error messages 20 and 21 will normally appear together and indicate a mass storage transfer error. Sometimes, however, only a special error message TRANSF! is printed. This message is printed out when a transfer error occurs during a swapping operation on the disk. Because the error message routine is resident on a segment, and the error has occurred when transferring a page to/from a segment, the simple message TRANSF is stored resident in memory and written out by a special routine which is also resident in memory.

Some hardware device numbers:

500	:	CARTRIDGE DISK HAWK or FIXED DISK FALCON
510	:	CARTRIDGE DISK HAWK or FIXED DISK FALCON DISK SYSTEM 2
1540	:	CDC BIG DISK (33, 66, 37, 76 or 288 MBYTES) or BIG CARTRIDGE DISK PHOENIX
1550:	:	CDC BIG DISK (33, 66, 37, 76 or 288 MBYTES) or BIG CARTRIDGE DISK PHOENIX DISK SYSTEM 2

Action: The following troubleshooting procedure should be followed:

TROUBLESHOOTING PROCEDURE Number 4.1:



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DISK STATUS ANALYSIS:

The Hawk/Falcon DISK STATUS word is found in Figure 5.12, while the status words of the other disks are found in Table 5.1.

The most common error bits will be covered here.

Bit 14 : ON CYLINDER Octal : 40 000

If this bit is not present, suspect:

- The Unit-Select
- The disk
- The disk interface

More information in Section 5.3.2.

Bit 13 : DISK UNIT NOT READY Octal : 20 000

Same as for Bit 14.

Bit 11 : DMA CHANNEL ERROR Octal : 4 000

Suspect:

- Interface (1092 module)
- Dataways to/from memory

See overview of test programs in Figure 5.10.

Bit 9 : PARITY ERROR Octal : 1 000

Turn to C in this procedure.

Bit 8 : ADDRESS MISMATCH Octal : 400

Turn to C in this procedure.

Bit 7 : HARDWARE ERROR Octal : 200
A feedback signal from the disk unit.

(Continued in next block.)

B

B

(Continued from the previous block.)

Bit 6 : **TIMEOUT Octal 100**

Suspect:

- **The disk unit (Unit-Select)**
- **The interface**

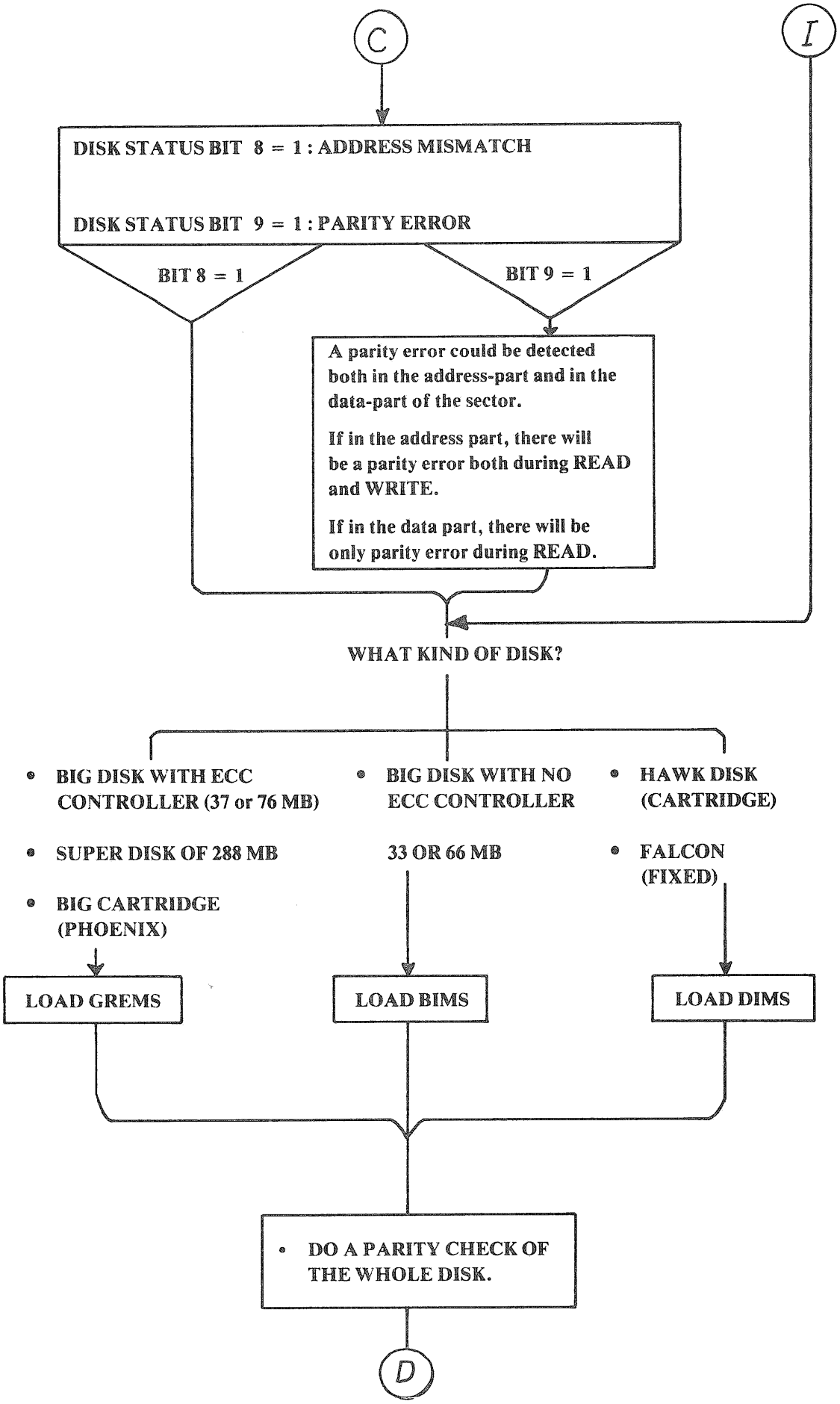
Bit 4 : **INCLUSIVE OR OF ERROR Octal : 20**

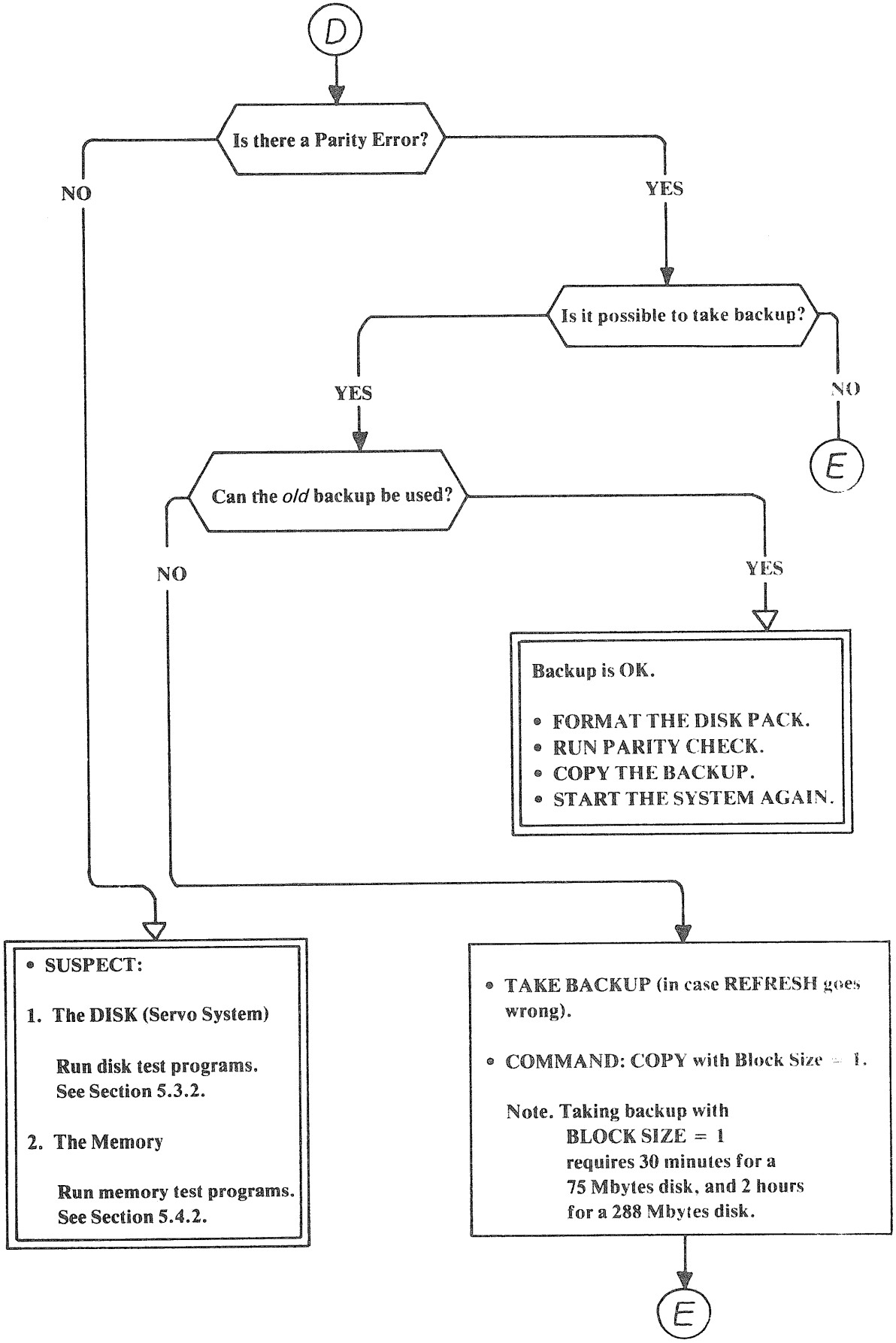
This bit will be set if any of the bits 13-5 are set (11-5 for Hawk/Falcon).

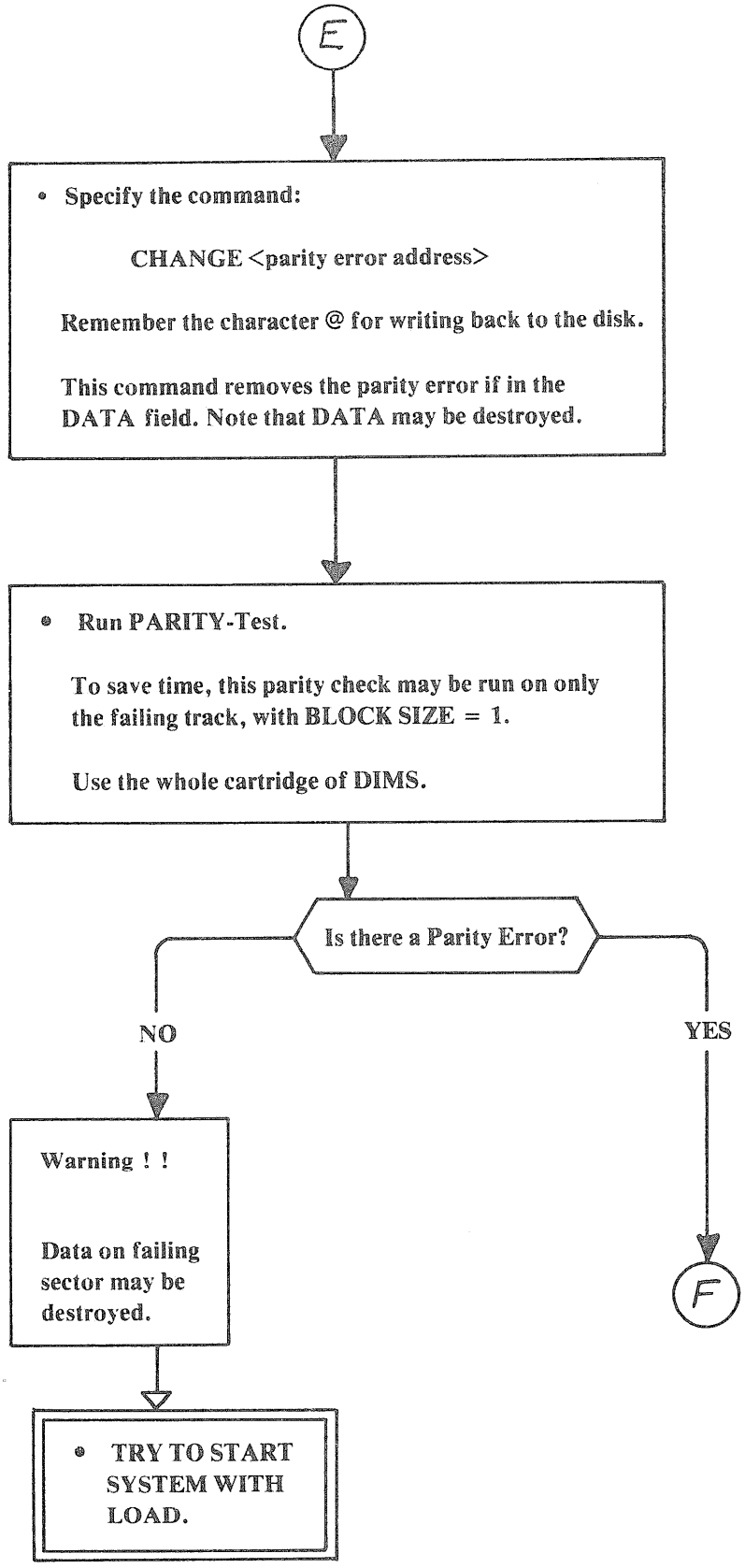
If only this bit is set, and no other, then suspect:

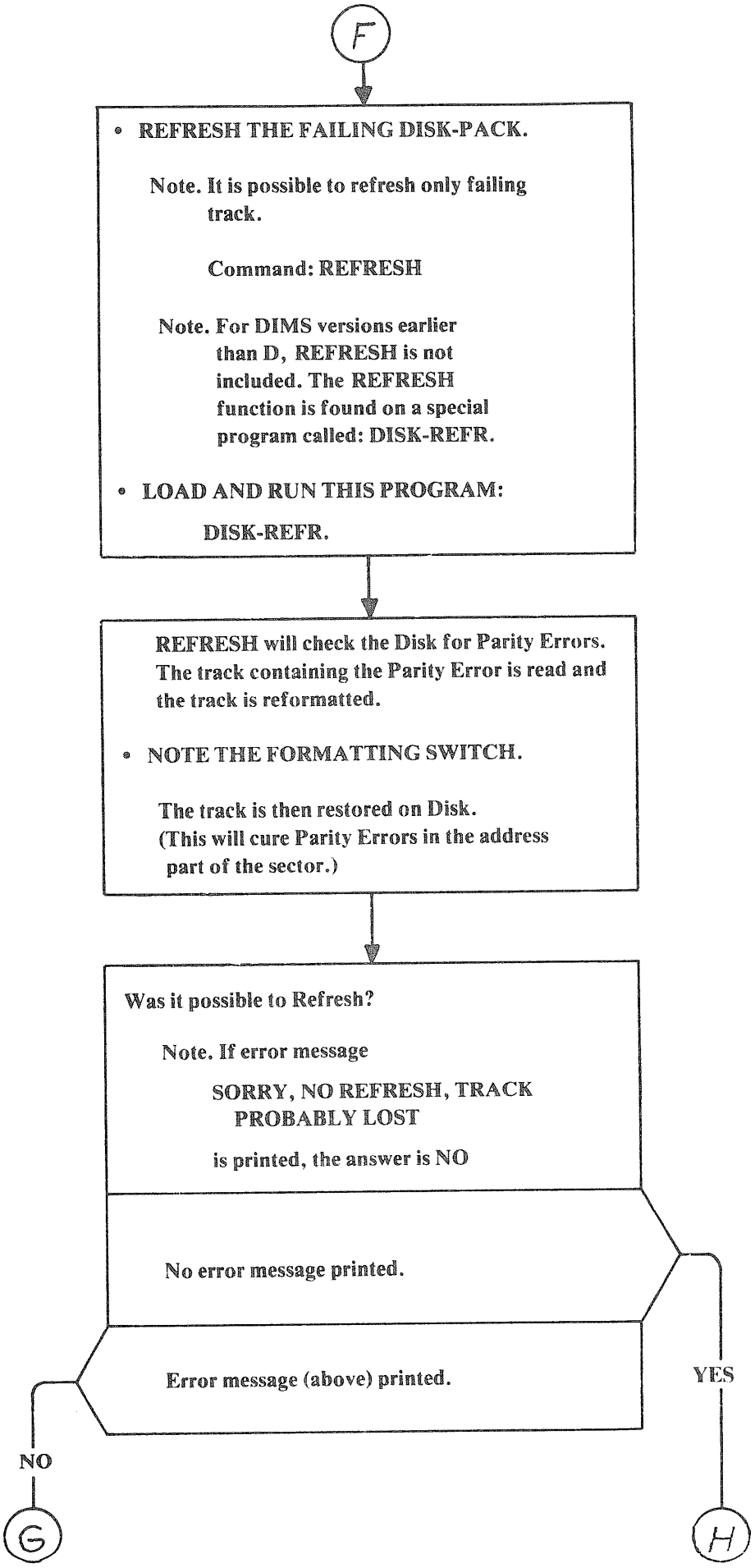
- **The disk (missing read clocks for Hawk/Falcon)**
- **The dataways to/from memory (DMA memory address error for SMD, check brancher light. See section 5.3.1.)**
- **The memory**

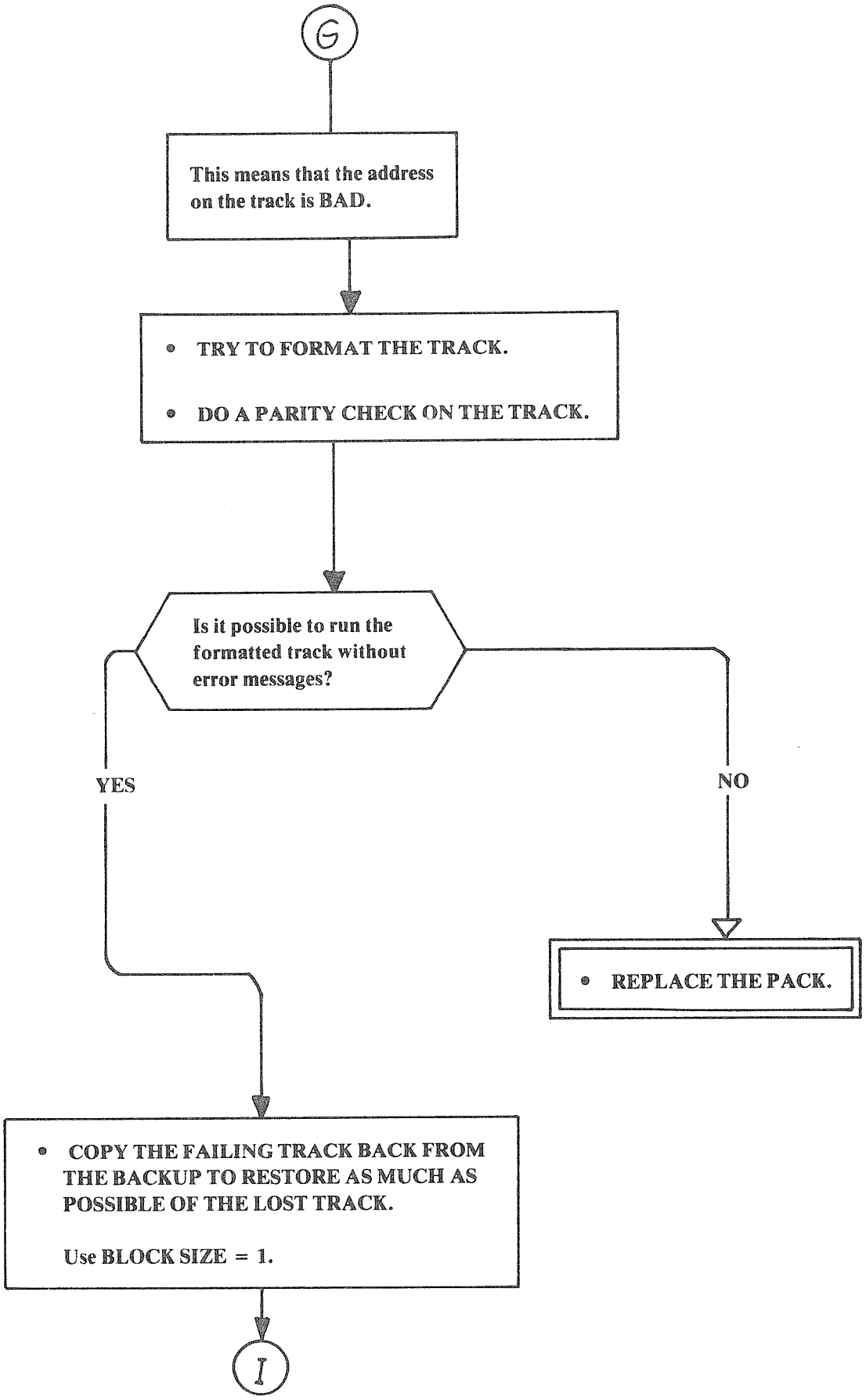
C

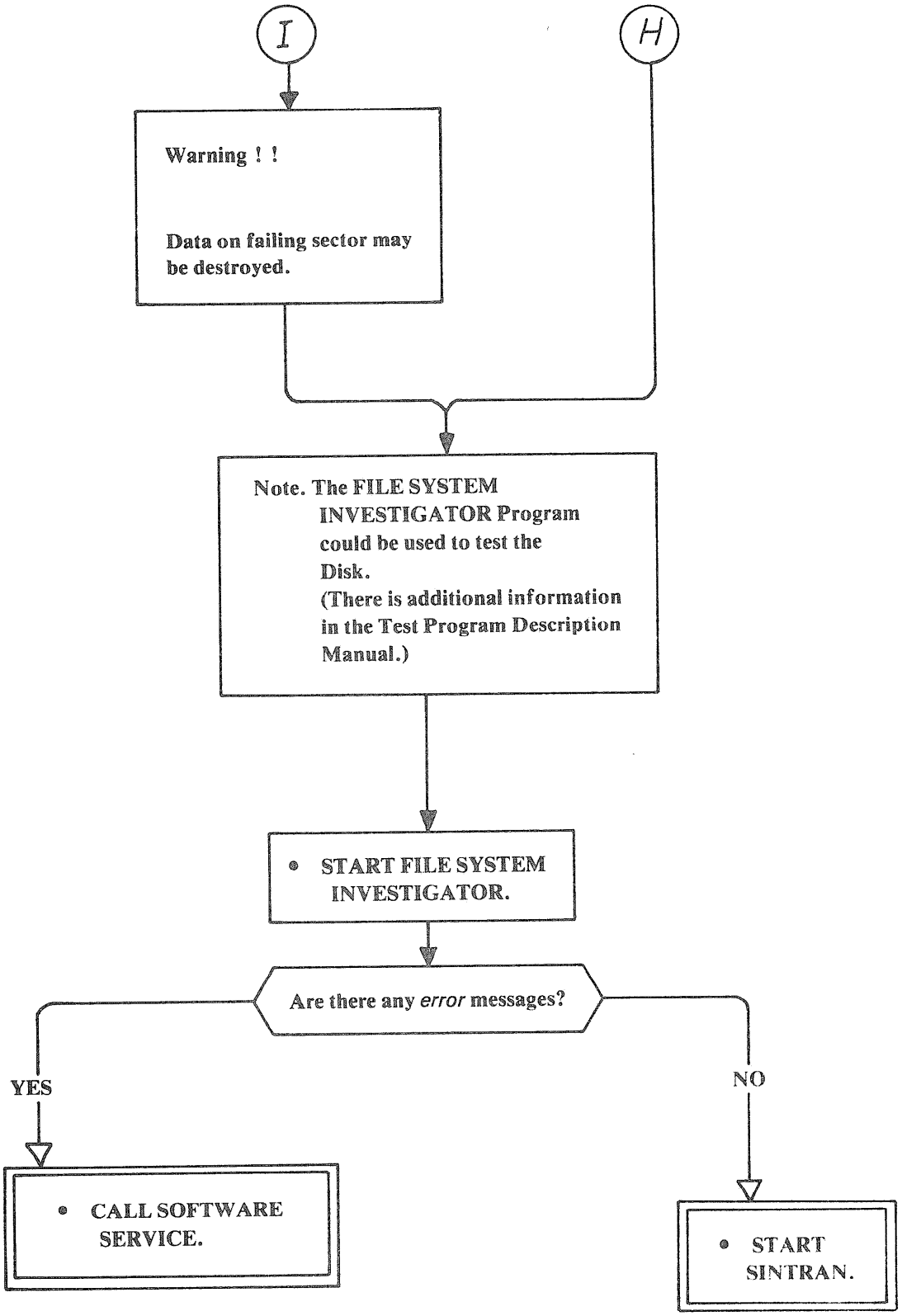

C
I
DISK STATUS BIT 8 = 1 : ADDRESS MISMATCH
DISK STATUS BIT 9 = 1 : PARITY ERROR
BIT 8 = 1
BIT 9 = 1
A parity error could be detected both in the address-part and in the data-part of the sector.
If in the address part, there will be a parity error both during READ and WRITE.
If in the data part, there will be only parity error during READ.
WHAT KIND OF DISK?
• BIG DISK WITH ECC CONTROLLER (37 or 76 MB)
• SUPER DISK OF 288 MB
• BIG CARTRIDGE (PHOENIX)
• BIG DISK WITH NO ECC CONTROLLER
33 OR 66 MB
• HAWK DISK (CARTRIDGE)
• FALCON (FIXED)
LOAD GREMS
LOAD BIMS
LOAD DIMS
• DO A PARITY CHECK OF THE WHOLE DISK.
D


D
Is there a Parity Error?
NO
YES
Is it possible to take backup?
YES
NO
E
Can the *old* backup be used?
NO
YES
Backup is OK.
• FORMAT THE DISK PACK.
• RUN PARITY CHECK.
• COPY THE BACKUP.
• START THE SYSTEM AGAIN.
• SUSPECT:
1. The DISK (Servo System)
Run disk test programs.
See Section 5.3.2.
2. The Memory
Run memory test programs.
See Section 5.4.2.
• TAKE BACKUP (in case REFRESH goes wrong).
• COMMAND: COPY with Block Size = 1.
Note. Taking backup with
BLOCK SIZE = 1
requires 30 minutes for a
75 Mbytes disk, and 2 hours
for a 288 Mbytes disk.
E


E
• Specify the command:
CHANGE <parity error address>
Remember the character @ for writing back to the disk.
This command removes the parity error if in the DATA field. Note that DATA may be destroyed.
• Run PARITY-Test.
To save time, this parity check may be run on only the failing track, with BLOCK SIZE = 1.
Use the whole cartridge of DIMS.
Is there a Parity Error?
NO
YES
Warning ! !
Data on failing sector may be destroyed.
F
• TRY TO START SYSTEM WITH LOAD.


F
• REFRESH THE FAILING DISK-PACK.
Note. It is possible to refresh only failing track.
Command: REFRESH
Note. For DIMS versions earlier than D, REFRESH is not included. The REFRESH function is found on a special program called: DISK-REFR.
• LOAD AND RUN THIS PROGRAM:
DISK-REFR.
REFRESH will check the Disk for Parity Errors. The track containing the Parity Error is read and the track is reformatted.
• NOTE THE FORMATTING SWITCH.
The track is then restored on Disk. (This will cure Parity Errors in the address part of the sector.)
Was it possible to Refresh?
Note. If error message
SORRY, NO REFRESH, TRACK PROBABLY LOST
is printed, the answer is NO
No error message printed.
Error message (above) printed.
YES
NO
G
H


G
This means that the address on the track is BAD.
• TRY TO FORMAT THE TRACK.
• DO A PARITY CHECK ON THE TRACK.
Is it possible to run the formatted track without error messages?
YES
NO
• REPLACE THE PACK.
• COPY THE FAILING TRACK BACK FROM THE BACKUP TO RESTORE AS MUCH AS POSSIBLE OF THE LOST TRACK.
Use BLOCK SIZE = 1.
I


I
H
Warning ! !
Data on failing sector may be destroyed.
Note. The FILE SYSTEM INVESTIGATOR Program could be used to test the Disk.
(There is additional information in the Test Program Description Manual.)
• START FILE SYSTEM INVESTIGATOR.
Are there any *error* messages?
YES
NO
• CALL SOFTWARE SERVICE.
• START SINTRAN.

22 FALSE INTERRUPT <LEVEL>

Explanation: An input/output interrupt is serviced but no response on the IDENT-instruction.

IDENT-CODE 0 is returned

Level:

10 = OUTPUT DEVICES
11 = DMA DEVICES
12 = INPUT DEVICES
13 = REAL-TIME CLOCK, HDLC

Could be caused by software accessing devices not present at the time.

Action: • RUN CONFIGURATION-INVESTIGATOR

23 DEVICE ERROR <DEVICE NO.> <STATUS>

Explanation: All devices are at start-up time run in test mode. DEVICE ERROR will be printed if an ERROR is found in the status-word of the device.

This could at START-UP TIME be

- The DEVICE not being supplied with AC voltage or not on-line.
- The device is connected to a RS-232 interface but not switched on, or on-line.

Action: Turn on the device and restart system to see if the error message occurs again. If it comes again then:

- RUN CONFIGURATION-INVESTIGATOR
  and
  TEST THE DEVICE REPORTING ERRORS.

Note 1 : Standard NORD-10/S device numbers and ident codes are listed in Appendix E.

Note 2 : A special table for asynchronous serial interfaces is found in Section 5.2. See Figure 5.6.

It contains information about:

- SINTRAN TERMINAL NUMBERS
- IOX DEVICE NUMBERS
- IDENT CODE
- LOGICAL DEVICE NUMBER IN OCTAL AND IN DECIMAL

31 PERMIT VIOLATION

32 RING VIOLATION

34 ILLEGAL INSTRUCTION

Explanation: In Error Codes 31, 32 and 34 the probable cause is user software. See Section 14 in SINTRAN III System Supervisor, ND—30.003.04 for additional information.

Action: To verify that hardware is in working condition:

- RUN PAGING-TEST
  and
  CPU-TESTS.

37 IOX ERROR

Explanation: No reply (CONNECT) from addressed I/O device. Probable hardware error on interface or software error (device not present).

Action: RUN CONFIGURATION-INVESTIGATOR to check the state of the different device interfaces.

38 MEMORY PARITY <PEA> <PES>

39 MEMORY OUT OF RANGE <PEA> <PES>

Explanation: In Error Codes 38 and 39 the probable cause is hardware error in memory.

Action:

- Locate the failing module by the information in the parity error address register (PEA) and the parity error status register (PES).

Note! See Section 5.4 for further information.

- Insert a new module and RUN MEMORY TEST PROGRAMS : MULTI, MOVER, T32K MOS

Note! Error 39 could be caused by system software.

40 POWER FAIL

Explanation: The message will be given when SINTRAN automatically restarts after a power failure or STOP-SYSTEM command. MC/20!

Action: If no automatic restart:

- Check that the panel-key is in locked position.
- RUN POWER-FAIL TEST-PROGRAM
- Check if the battery is switched ON.
  (The switch in the Power Supply.)

44 CORRECTED MEMORY ERROR <PEA> <PES>

Explanation: A single data bit read from the LOCAL MEMORY has been corrected.

Note! If solid memory error, this error message will appear once per hour.

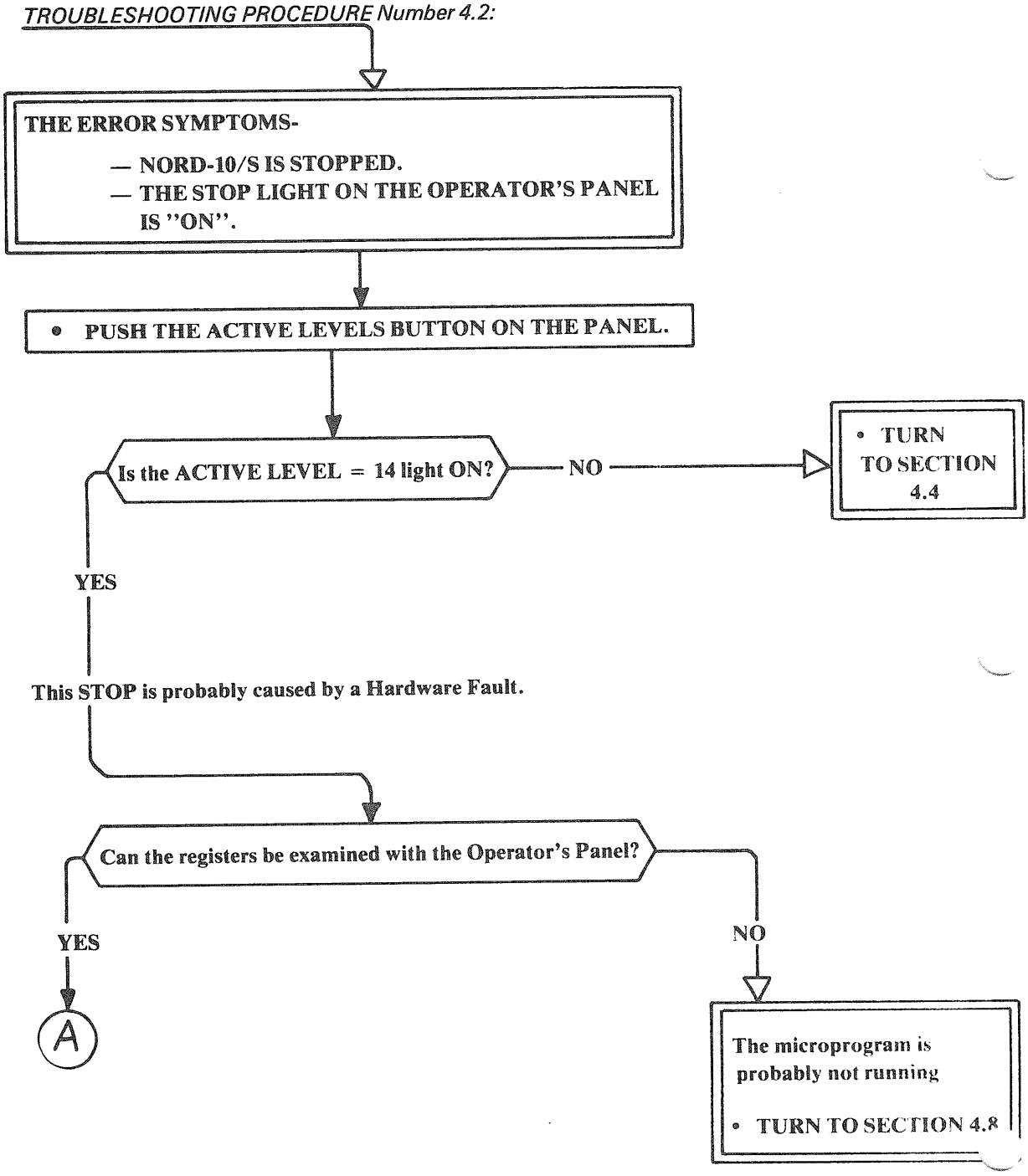
Action: RUN MULTI or MOVER and ERRCOR
% Test program for error-correction in NORD-10/S CPU. (Only local memory.)

4.3 *SINTRAN IS STOPPED IN ERROR-FATAL*

4.3.1 *The Troubleshooting Proceudure*

The troubleshooting procedure to be used when SINTRAN is stopped in ERROR-FATAL is as follows:

TROUBLESHOOTING PROCEDURE Number 4.2:



A

- **MAKE A VISUAL CHECK OF THE FOLLOWING:**

1. **The Disk**

   If the ready light is OFF or if any fault light is ON, check the Disk.

2. **The NORD-10/S Power Supply.**

   - **TURN TO SECTION 6 if: any Power Supply indicators indicate any malfunction.**

3. **The following NORD-10/S Error Indicators:**

   - The ''BRANCHER'' light is ON.

   A Parity Error has been detected of the Memory Data in the I/O Rack position 8 when:

   — the module is a 1093 module and the light is turned OFF, or

   — the module is a 1171 module and the green light is OFF and the red light is ON.

   Note. See Section 5.3.

   - Light in MULTIPORT:

   If the light-emitting diode on the Port Data Module is ON a Memory Parity Error has been detected.

   Note. Only for BIG MULTIPORT

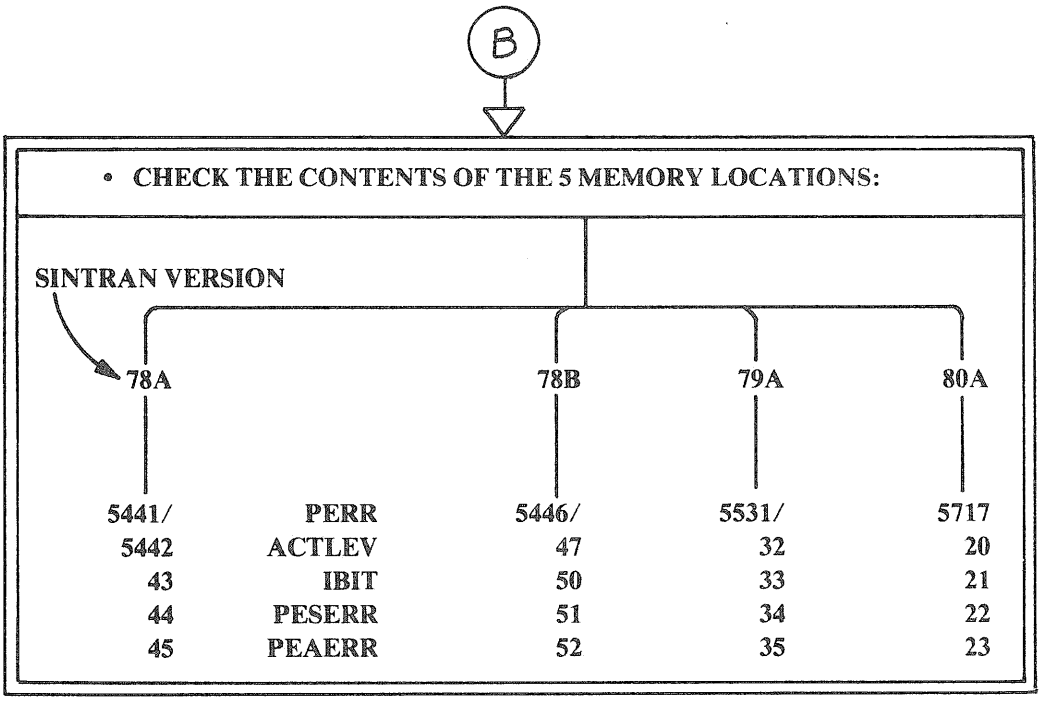
   Note. The light emitting diode will always be ON after a Power OFF. See Section 5.3.

The P-Register on Level 14 will point to the ERROR FATAL-ROUTINE.

An address between 100_8 and 200_8.

For SINTRAN III of 1980, the P-Register = 201_8.

B



IMPORTANT-NOTE!!

THE PERR-ADDRESS COULD ALSO BE OBTAINED BY SUBTRACTING 200_8 FROM THE B-REGISTER ON LEVEL 14.

PERR	=	FAILING ADDRESS	= B reg. level 14 — 200_8
ACTLEV	=	PREVIOUS LEVEL	The PVL-bits are found in a special bit combination. Refer to the Internal Register Table at Appendix B.
IBIT	=	INTERNAL INTERRUPT CODE	
PEAERR	=	SAVED PARITY ERROR ADDRESS	
PESERR	=	SAVED PARITY ERROR STATUS	

4.3.2 *IBIT Behaviour*

A recommended method of handling IBITs is shown in the IBIT Behaviour Chart at Table 4.1

IBIT:	MEANS:	BEHAVIOUR
1	MONITOR CALL	RUN FOUR-CHECK TEST PROGRAM
2	MEMORY PROTECT VIOLATION	RUN PAGING TEST AND CPU-TESTS
3	PAGE FAULT	
4	ILLEGAL INSTRUCTION	RUN CPU-TESTS
5	ZERO INDICATOR SET	
6	PRIVILEGED INSTRUCTION	
7	IOX ERROR NO REPLY FROM ADDRESSED INTERFACE MODULE	RUN CONFIGURATION INVESTIGATOR
10	MEMORY PARITY ERROR	IDENTIFY THIS FAILING MODULE BY DECODING THE PES AND PEA LOCATIONS. (See Section 5.4.3.)
11	MEMORY OUT OF* RANGE	VERIFY THIS BY RUNNING A MEMORY-TEST PROGRAM FOR INSTANCE: MULTI *VERSIONS OF MULTI LATER THAN G HAVE ALSO A SPECIAL MEMORY OUT OF RANGE-TEST AN ECO ON THE 1144 MODULE IN THE MULTIPORT HAVE SOMETIMES ALSO CURED THIS ERROR-STOP
12	POWER FAIL	CHECK POWER-SUPPLY BACKUP-BATTERY. IS THE BATTERY TURNED ON? RUN POWER-FAIL TEST. ALSO INCLUDED IN MULTI. CHECK THE AC-TRIGGER LEVEL OF POWER-SENSE UNIT.

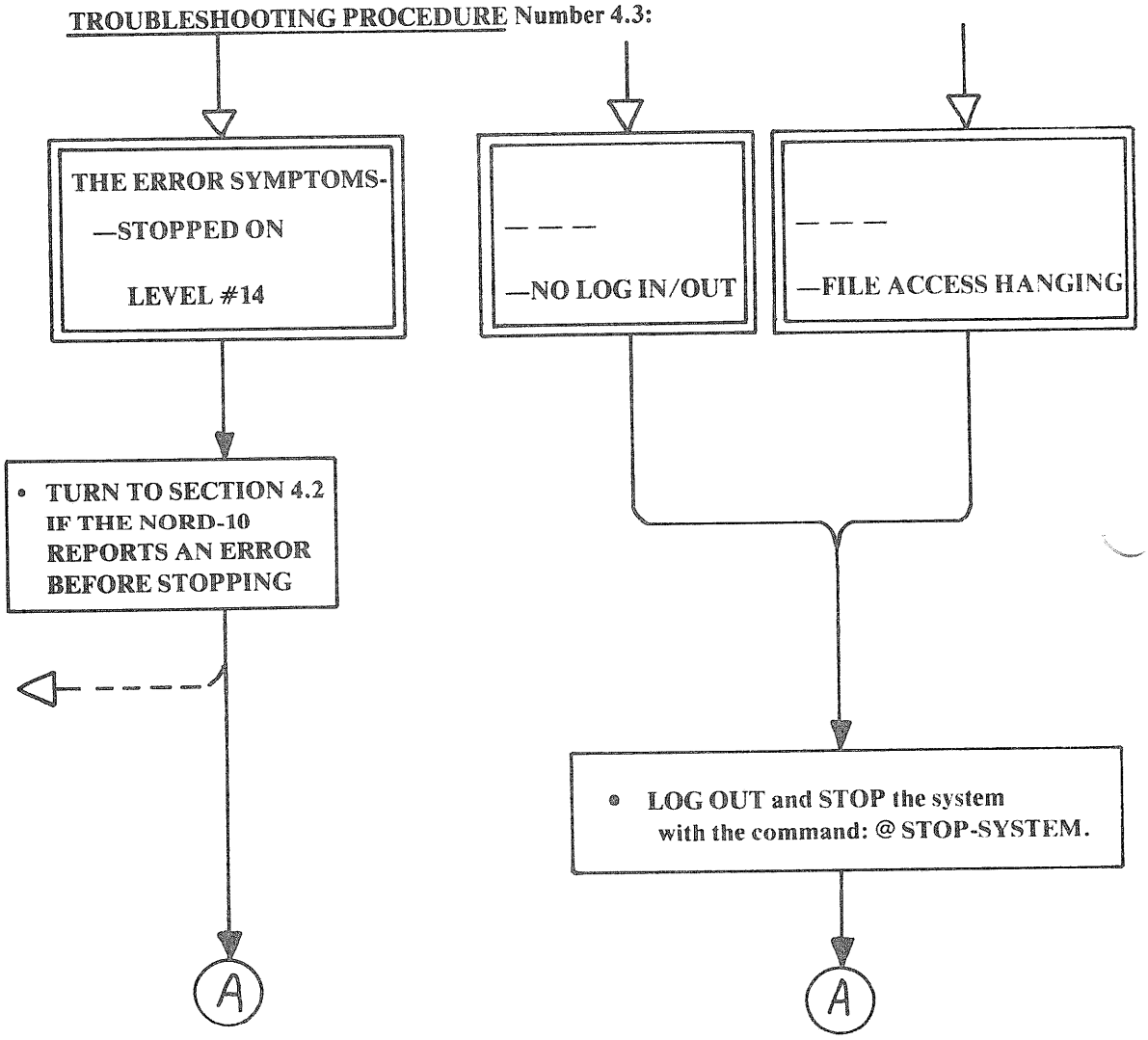
Table 4.1: IBIT BEHAVIOUR CHART

4.4 *SINTRAN STOPPED ON AN INTERRUPT LEVEL DIFFERENT FROM LEVEL 14 OR IS HANGING*

The three error symptoms that indicate that SINTRAN is stopped or hanging are:

- SINTRAN STOPS ON AN INTERRUPT LEVEL #14
- NOT POSSIBLE TO LOG IN/OUT VIA CERTAIN TERMINALS
- ALL FILE ACCESSES ARE HANGING

The correct trouble shooting procedure to follow is:



A

- STOP NORD-10/S BY PUSHING STOP ON THE PANEL IF NOT ALREADY STOPPED

- DO A VISUAL-CHECK INDICATED IN SECTION 4.3 AND COME BACK

- EXAMINE ACTIVE LEVEL = XX
PRINT OUT ON THE CONSOLE-TERMINAL:

- PROGRAM-COUNTER XXR2/*
AND
- L-REGISTER XXR4/*
ON ACTIVE LEVEL

- ALL THE REGISTERS ON LEVEL 0 (R1-R7)

- ALL THE INTERNAL-REGISTERS (I0-I15)

- MEMORY LOCATION 7 AND 10

7/
10/ } Address of Active RT-program

*If this is not possibly caused by a hanging microprogram, push MASTER-CLEAR and try once more. If no response turn to Section 4.8

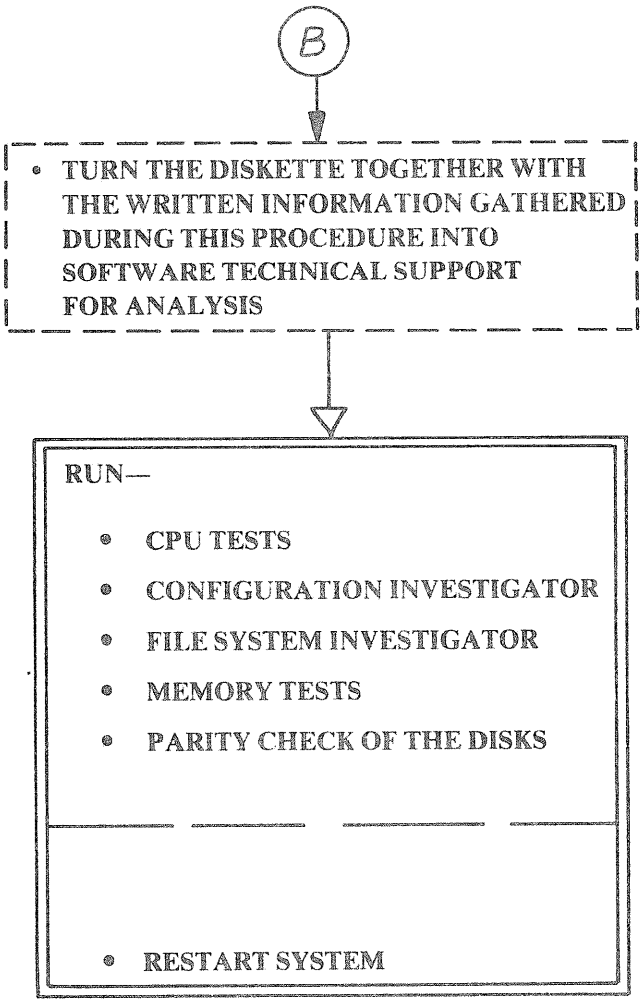
- NOTE THE LATEST COMMAND GIVEN ON ALL THE TERMINALS

- PRESS MASTER-CLEAR
- PLACE THE MEMTOF-STAND ALONE DISKETT* IN THE FLOPPY AND LOAD: 1560&
- INSERT A FORMATTED DISKETT AND TYPE ANY CHARACTER

THE MEMTOF PROGRAM now running will dump MEMORY BANK 0 (SINTRAN III RESIDENT-PART) and the REGISTER-BLOCK onto the diskette.

*See Section 2.1.3

B


B
• TURN THE DISKETTE TOGETHER WITH THE WRITTEN INFORMATION GATHERED DURING THIS PROCEDURE INTO SOFTWARE TECHNICAL SUPPORT FOR ANALYSIS
RUN—
• CPU TESTS
• CONFIGURATION INVESTIGATOR
• FILE SYSTEM INVESTIGATOR
• MEMORY TESTS
• PARITY CHECK OF THE DISKS
• RESTART SYSTEM

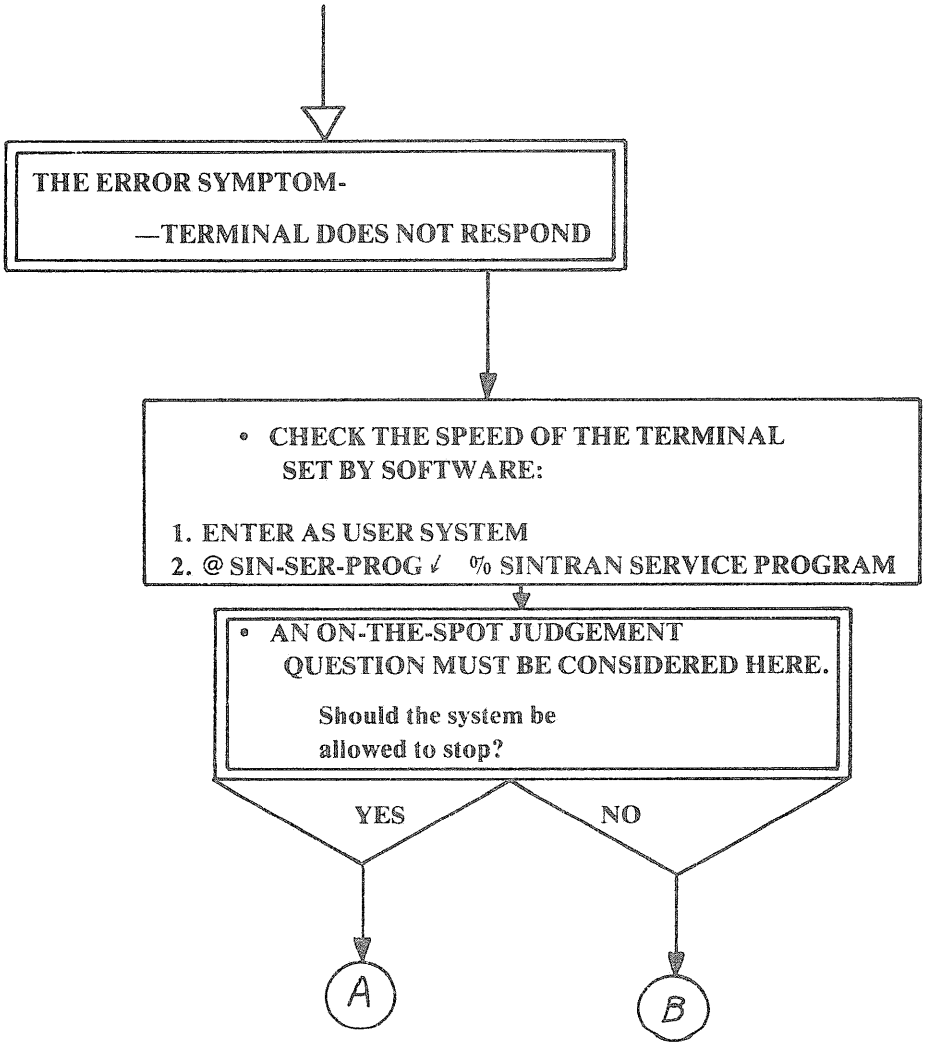
4.5 *SINTRAN WORKING BUT NO RESPONSE FROM CERTAIN TERMINALS*

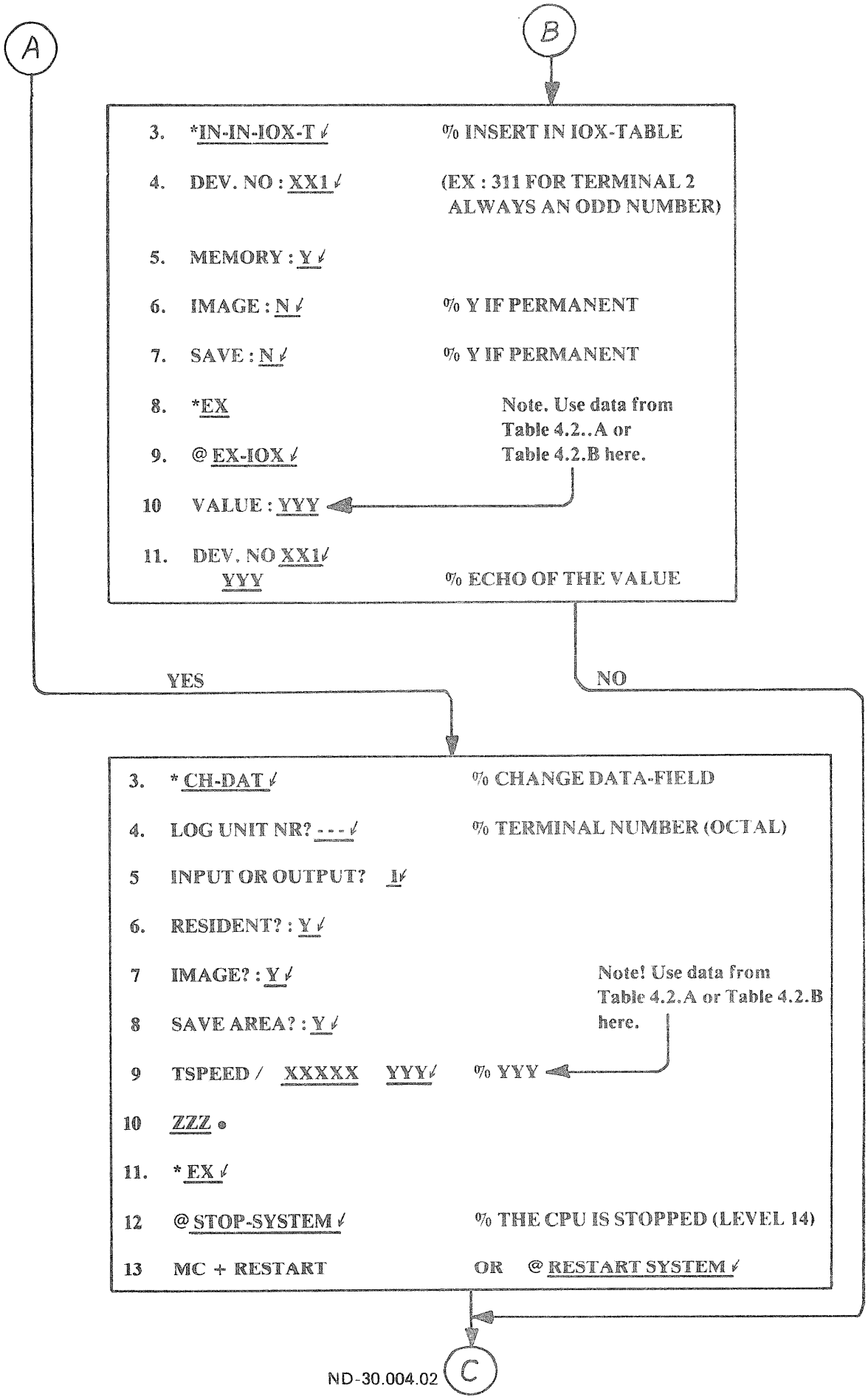
When SINTRAN is working but there is no response from certain terminals then the terminal speed that has been set by software in each terminal not responding should be checked. The procedure for checking the software speed set in a terminal is as indicated below.

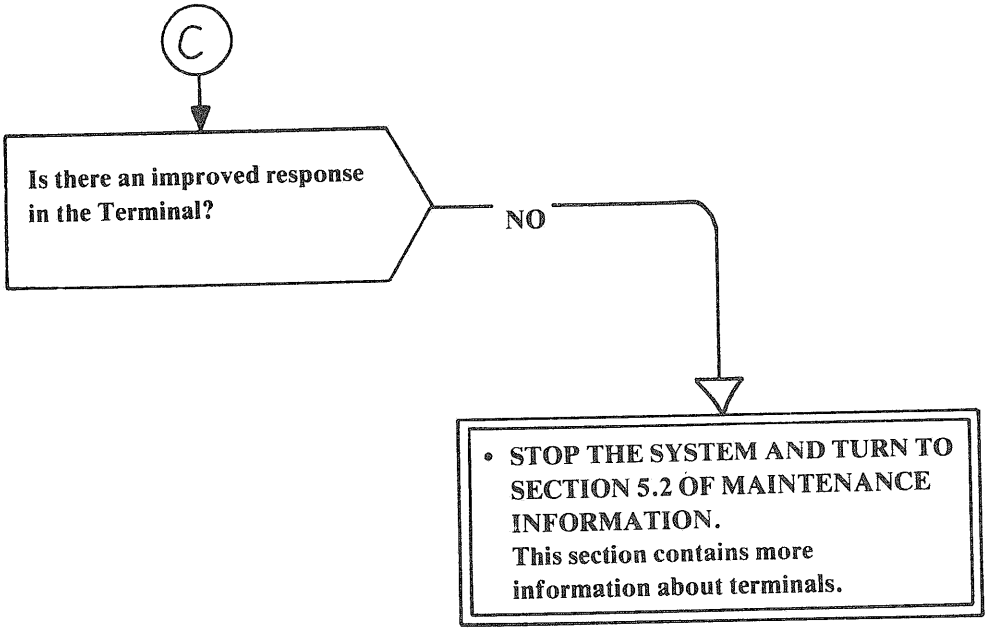
The entries are made at the terminal in the sequence indicated. The data for T-SPEED is obtained from Tables 4.2.A or 4.2.B depending upon whether there is a MULTI-TERM interface (4 terminals-1122 module) or a TERMINAL-BUFFER interface (single terminal 1095 module).

The troubleshooting procedure to follow here is:

TROUBLESHOOTING PROCEDURE Number 4.4:




A
B
3. *IN-IN-IOX-T ↙ % INSERT IN IOX-TABLE
4. DEV. NO : XX1 ↙ (EX : 311 FOR TERMINAL 2 ALWAYS AN ODD NUMBER)
5. MEMORY : Y ↙
6. IMAGE : N ↙ % Y IF PERMANENT
7. SAVE : N ↙ % Y IF PERMANENT
8. *EX
9. @ EX-IOX ↙
Note. Use data from Table 4.2..A or Table 4.2.B here.
10 VALUE : YYY
11. DEV. NO XX1↙
YYY % ECHO OF THE VALUE
YES
NO
3. * CH-DAT ↙ % CHANGE DATA-FIELD
4. LOG UNIT NR? - - - ↙ % TERMINAL NUMBER (OCTAL)
5 INPUT OR OUTPUT? I↙
6. RESIDENT? : Y ↙
7 IMAGE? : Y ↙
8 SAVE AREA? : Y ↙
Note! Use data from Table 4.2.A or Table 4.2.B here.
9 TSPEED / XXXXX YYY↙ % YYY
10 ZZZ •
11. * EX ↙
12 @ STOP-SYSTEM ↙ % THE CPU IS STOPPED (LEVEL 14)
13 MC + RESTART OR @ RESTART SYSTEM ↙
C



While using this procedure, the following should be considered:

- Location TSPEED in the terminals input datafield must be set according to one of the following tables. The initial value of TSPEED is 177777.
- It is not possible to set the speed (by software) of the current loop interface 1020.
- If any one of the speeds for terminals connected to a MULTI-TERM interface (4 AS. CURRENT LOOP 1122) is to be set by software, then the other three must also be set, regardless of the "hard" programmed speed of the interface.
- The speed will not be changed before SINTRAN is started or re-started (i.e., STOP-SYSTEM followed by MASTER-CLEAR, RESTART).
- TSPEED should be changed in RESIDENT, IMAGE and SINTRAN:DATA.

Baud Rate	*TSPEED*
50	42
75	63
110	377
134.5	104
150	356
200	125
300	335
600	146
1200	273
1800	252
2400	167
4800	231
9600	210

Table

for MULTI-TERM interface (4 terminals-1122 module) (Also for DUAL ASYNC MODEM 1147)

Table 4.2.A: T SPEED - TABLE FOR MULTI-TERM INTERFACE

Baud Rate	*TSPEED*
50	377
75	273
100	356
110	314
150	252
200	335
300	231
600	210
1200	63
2400	42
4800	21
9600	0

Table

For TERMINAL-BUFFER interface (single terminal 1095 module)

Table 4.2.B: T SPEED - TABLE FOR TERMINAL-BUFFER INTERFACE

4.6 *NORD-10/S WILL NOT LOAD TEST PROGRAMS FROM FLOPPY-DISK*

4.6.1 *The Properly Loaded FLOPPY-MONITOR*

The NORD-10/S microprogram will detect that a load sequence has been initiated when:

— bit 8 in the PANEL-STATUS-REGISTER is set (LOAD)

or

— the character & or $ is entered on terminal 1.

A binary bootstrap routine in the microprogram will be entered if:

— LOAD is pushed on the panel

and

— the ALD-Register is equal to 1560

The binary bootstrap routine can also be entered by printing 1560 ahead of the & or $ character.

This microprogram routine will:

— read 200 bytes from FLOPPY DISK CONTROLLER 0, UNIT 0, and TRACK 0.

— assemble these 200 bytes into 100 words.

— store the assembled 100 words in memory from address 0 to 77_8.

The data now residing in memory is a simple bootstrap which will be automatically started (start address 2) by the last character read. The bootstrap can only start if the checksum of the 200 bytes is correct. If the checksum generated by the microprogram is not equal to the checksum on the Floppy a ? will appear on terminal 1 (the console terminal) and the MASTER CLEAR button will be illuminated.

The floppy-loaded bootstrap will read 1K words or 4 sectors from Floppy Unit 0, Track 1 (THE MASTER-BLOCK) to memory starting in address 120_8. If the bootstrap fails to read, the system will stop in WAIT 77. When the error bit (bit 4) in the floppy status-register 2 is set the bootstrap will repeat an attempt to read up to five times before the system stops in WAIT 77.

When 2000 OCTAL words have been read from the Floppy, the remainder of the FLOPPY-MONITOR (500 words) are read from the BIT-FILE on the Floppy.

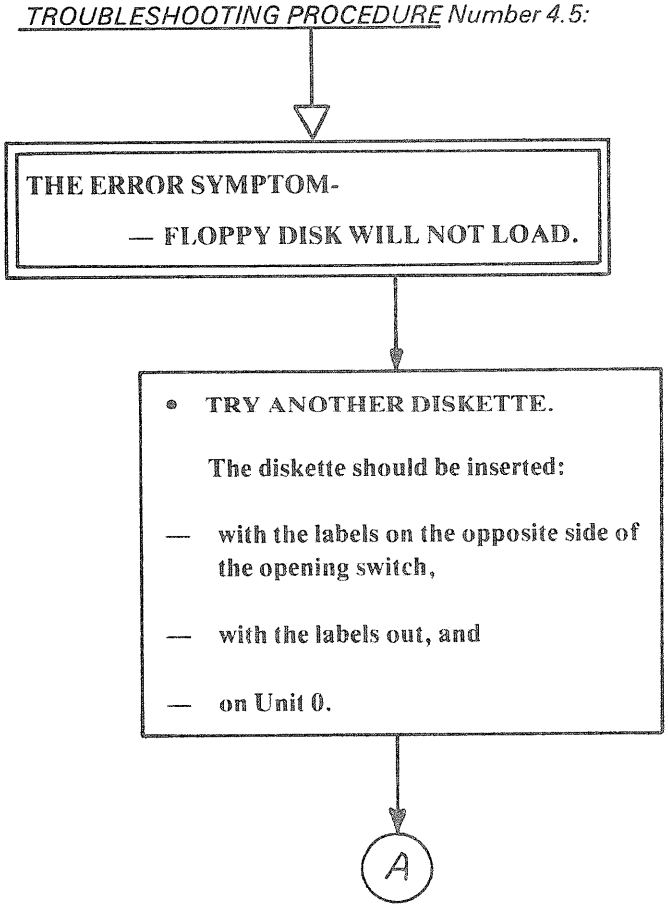
When a MONITOR is properly loaded a * character is printed indicating that the MONITOR is ready to accept one of the two commands:

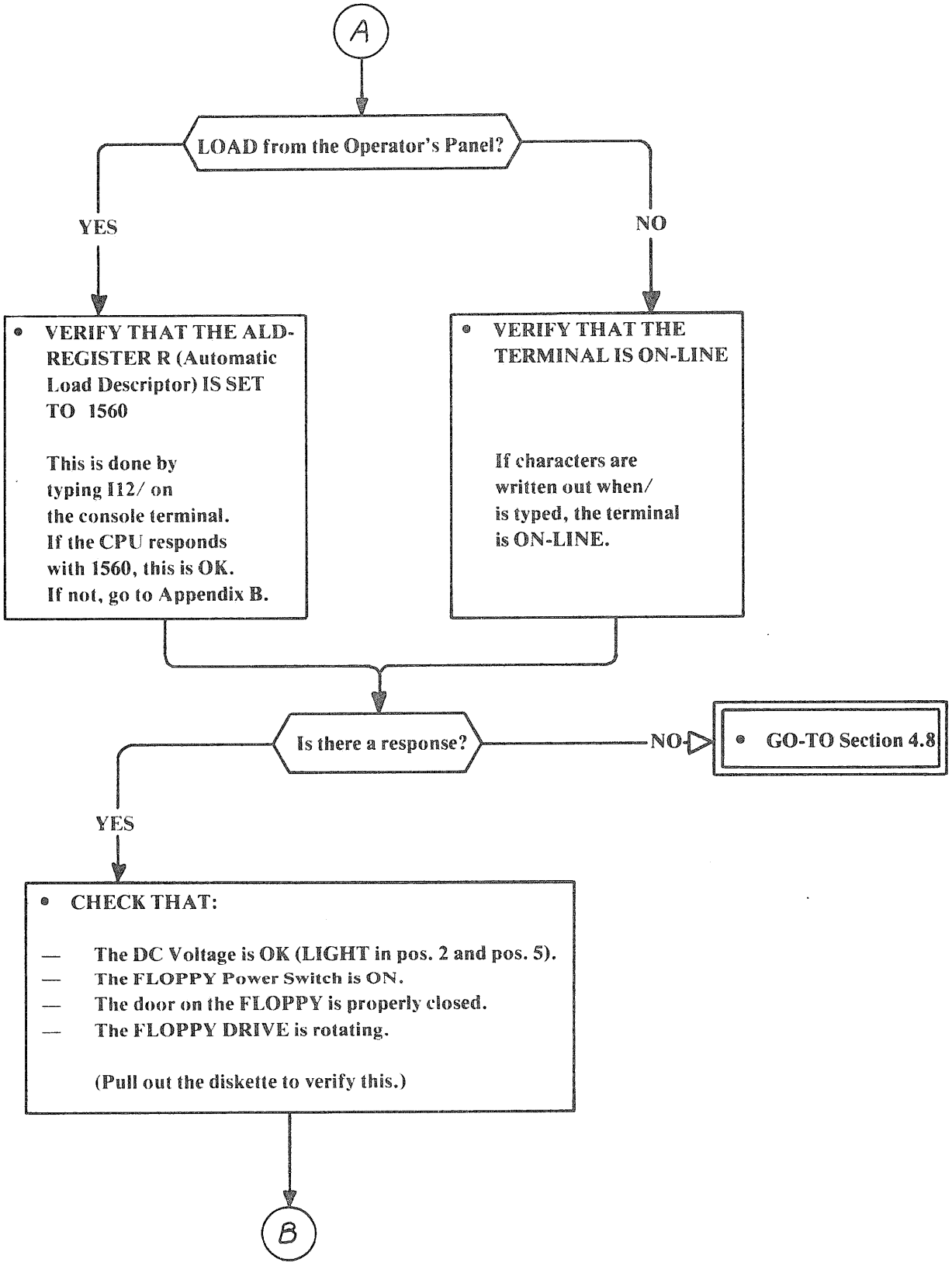
*	**LI-FI <log dev. no.>**	**List the files on the floppy**
*	**LO <file name>**	**Load the specified file.**

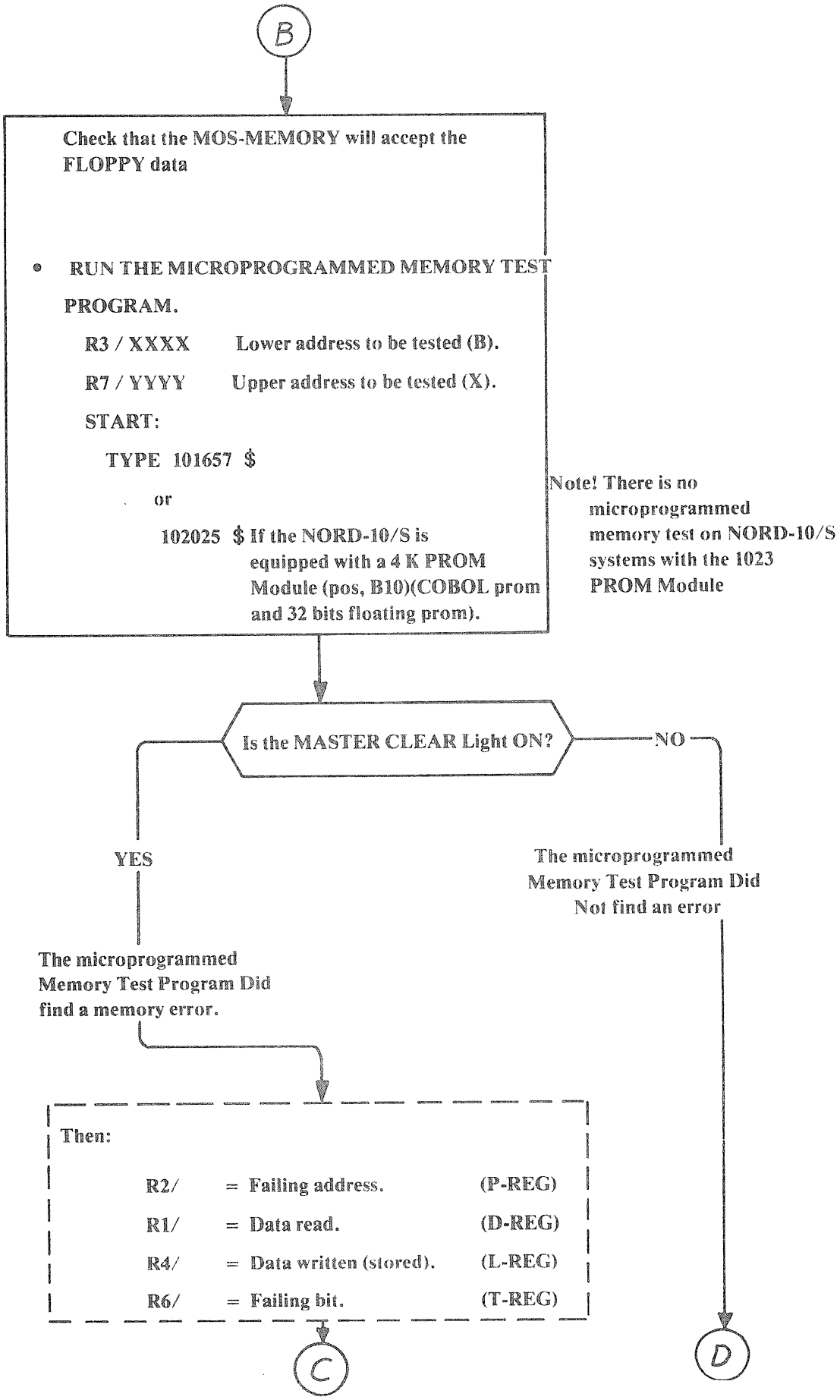
4.6.2 *The Troubleshooting Procedure to be Used When a NORD-10/S Will Not Load Test-Programs From a Floppy Disk*

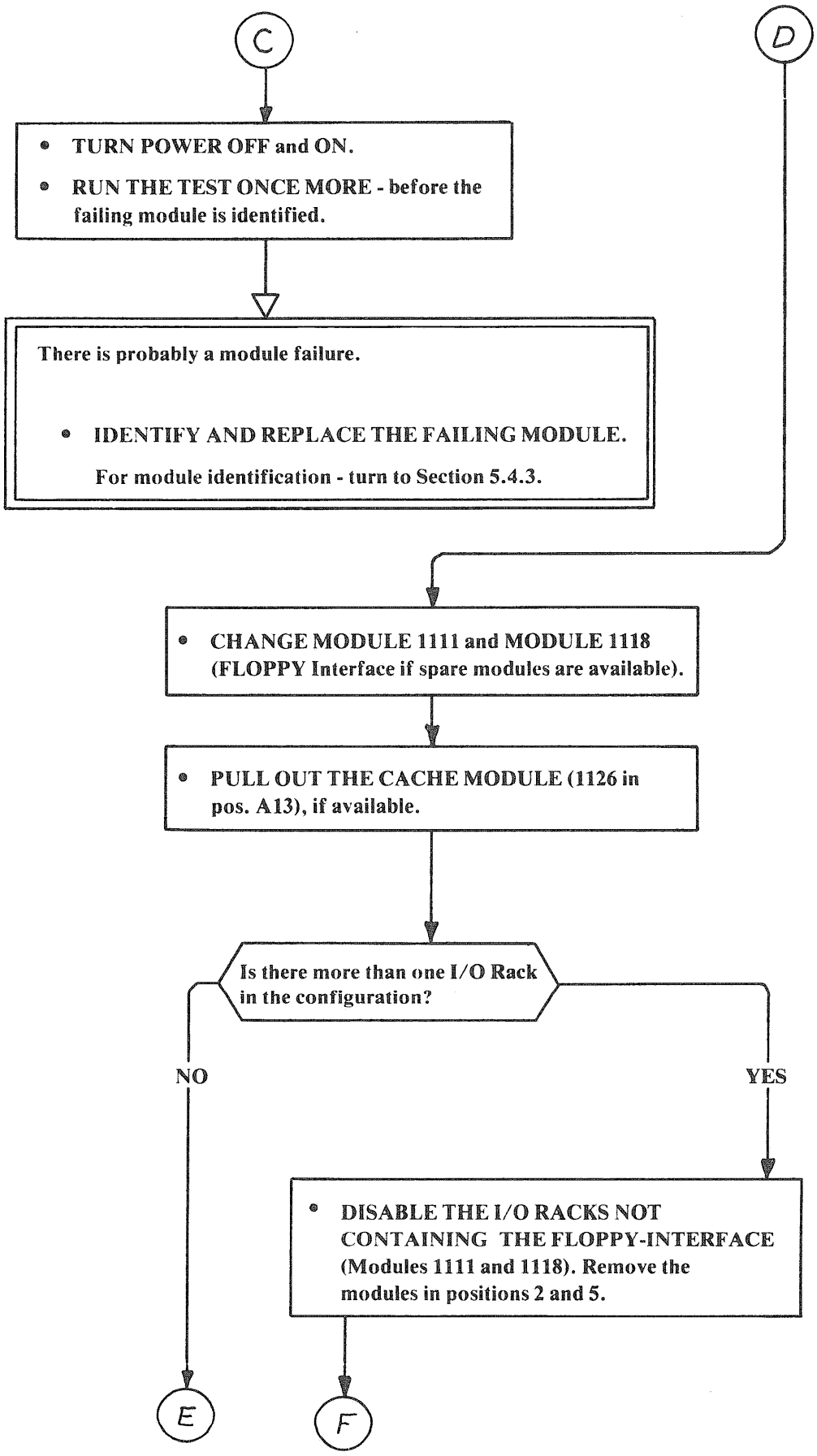
The following troubleshooting procedure should be used when a NORD-10/S will not load programs from a floppy disk.

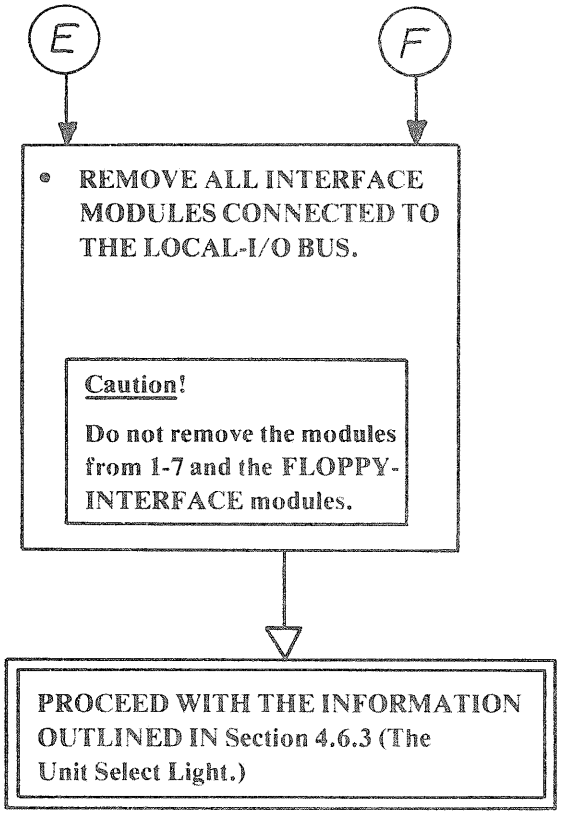
TROUBLESHOOTING PROCEDURE Number 4.5:




A
LOAD from the Operator's Panel?
YES
NO
• VERIFY THAT THE ALD-REGISTER R (Automatic Load Descriptor) IS SET TO 1560
This is done by typing I12/ on the console terminal. If the CPU responds with 1560, this is OK. If not, go to Appendix B.
• VERIFY THAT THE TERMINAL IS ON-LINE
If characters are written out when/ is typed, the terminal is ON-LINE.
Is there a response?
NO
• GO-TO Section 4.8
YES
• CHECK THAT:
— The DC Voltage is OK (LIGHT in pos. 2 and pos. 5).
— The FLOPPY Power Switch is ON.
— The door on the FLOPPY is properly closed.
— The FLOPPY DRIVE is rotating.
(Pull out the diskette to verify this.)
B


B
Check that the MOS-MEMORY will accept the FLOPPY data
• RUN THE MICROPROGRAMMED MEMORY TEST PROGRAM.
R3 / XXXX Lower address to be tested (B).
R7 / YYYY Upper address to be tested (X).
START:
TYPE 101657 $
or
102025 $ If the NORD-10/S is equipped with a 4 K PROM Module (pos, B10)(COBOL prom and 32 bits floating prom).
Note! There is no microprogrammed memory test on NORD-10/S systems with the 1023 PROM Module
Is the MASTER CLEAR Light ON?
NO
YES
The microprogrammed Memory Test Program Did Not find an error
The microprogrammed Memory Test Program Did find a memory error.
Then:
R2/ = Failing address. (P-REG)
R1/ = Data read. (D-REG)
R4/ = Data written (stored). (L-REG)
R6/ = Failing bit. (T-REG)
C
D


C
D
• TURN POWER OFF and ON.
• RUN THE TEST ONCE MORE - before the failing module is identified.
There is probably a module failure.
• IDENTIFY AND REPLACE THE FAILING MODULE.
For module identification - turn to Section 5.4.3.
• CHANGE MODULE 1111 and MODULE 1118 (FLOPPY Interface if spare modules are available).
• PULL OUT THE CACHE MODULE (1126 in pos. A13), if available.
Is there more than one I/O Rack in the configuration?
NO
YES
• DISABLE THE I/O RACKS NOT CONTAINING THE FLOPPY-INTERFACE (Modules 1111 and 1118). Remove the modules in positions 2 and 5.
E
F


E
F
• REMOVE ALL INTERFACE MODULES CONNECTED TO THE LOCAL-I/O BUS.
Caution!
Do not remove the modules from 1-7 and the FLOPPY-INTERFACE modules.
PROCEED WITH THE INFORMATION OUTLINED IN Section 4.6.3 (The Unit Select Light.)

4.6.3 *The Unit Select Light*

The light emitting diode positioned in the opening switch of the floppy-drive is lit when the unit is selected, the head is loaded and the unit is ready for reading.

A "click" sound is heard when the head is loaded. The head-load solenoid operates.

If the light emitting diode is LIT, but there is no "click" sound, the floppy-drive is to be suspected.

If there is no light, this can indicate that the unit is not properly selected. This could be caused by:

- Error in the microprogram that reads from Unit 0.
- Malfunction in the I/O system jamming the signals initiated by the microprogram.
- Error in the formatter.
- Error in the unit.

If there is light in the unit, but the FLOPPY-MONITOR has not started, the cause could be:

- Error in the formatter.
- Error in the unit.
- Memory error *.
- CPU error *.

  Note! * indicates that the instructions read from the Floppy Disk have not been correctly executed.

The two error symptoms to watch for at this time are:

- the Unit Select Light is On, but there is no monitor. See Section 4.6.3.1 for troubleshooting procedure.
- the Unit Select Light is not On. See Section 4.6.3.2 for troubleshooting procedure.

4.6.3.1 *The Unit Select Light is On But There is No Monitor*

The troubleshooting procedure for this error symptom is as given below. It should be noted than an oscilloscope is needed to check the Index-Pulse.

TROUBLESHOOTING PROCEDURE Number 4.6:

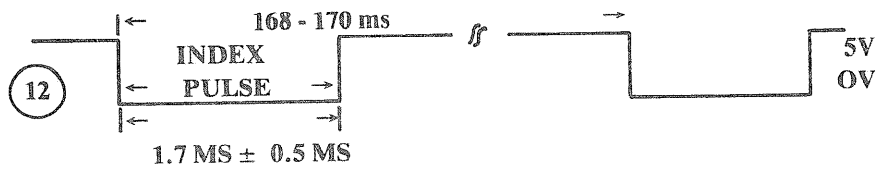
THE ERROR SYMPTOMS-

- **TEST PROGRAMS WILL NOT LOAD FROM FLOPPY-DISK**
- **THE UNIT SELECT LIGHT IS "ON", but**
- **THERE IS NO MONITOR**

- **CHECK OF INDEX-PULSE**

Note! An OSCILLOSCOPE is needed for this.

THE INDEX PULSE IS OBSERVED AT TEST-POINT NR.12 (ON COMPONENT SIDE OF THE BOARD MOUNTED IN THE FLOPPY-DRIVE)



THE INDEX PULSE SHOULD NOT BE LESS THEN 1.2 MS WIDE.

THE INDEX PULSE MAY BE ADJUSTED BY A PLASTIC POT. METER MOUNTED ON THE CHASSIS CLOSE TO THE SPINDLE PULLEY.

A

A

- STOP THE NORD-10/S, if it is not already in ''stop''.
- EXAMINE THE MEMORY TO SEE IF ANYTHING HAS BEEN READ FROM THE FLOPPY.

The addresses should be equal to the following values.

ADDRESSES:	*VALUES:*
0	: 1450
1	: 2600
2	170773
.	.
.	.
60	177540
61	2000
62	176120
63	611
64	0

- ARE THE ADDRESSES EQUAL TO THE FOLLOWING VALUES?

  and

- ARE THE VALUES FOUND IN THE EXAMINED ADDRESSES?

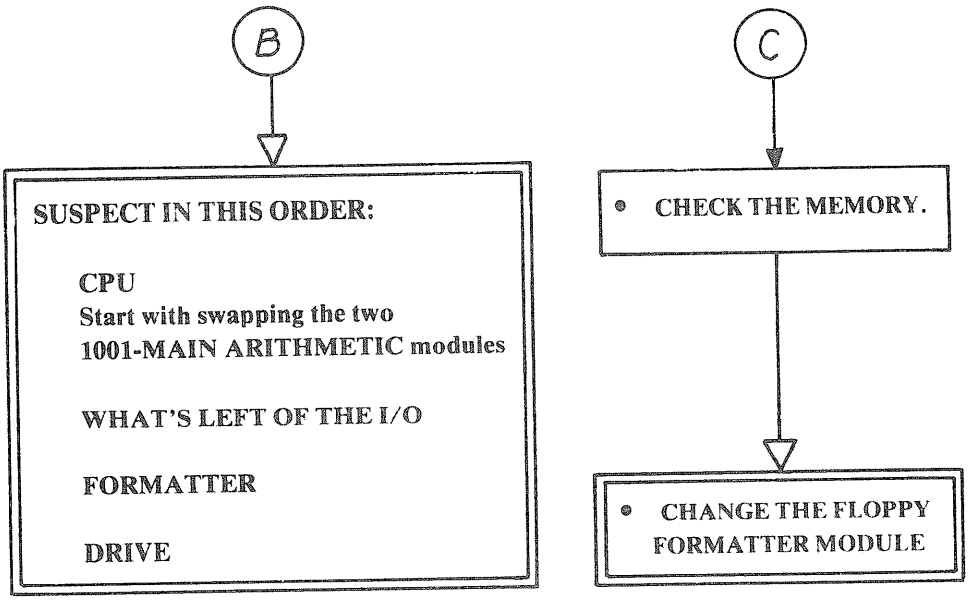
YES

Note! These contents are read from the Floppy

B

NO

C



Note! See Section 4.6.3.2 for procedure

4.6.3.2 THE UNIT SELECT LIGHT IS OFF

The troubleshooting procedure for this error symptom is as given below.

TROUBLESHOOTING PROCEDURE Number 4.7:

THE ERROR SYMPTOMS-

— TEST PROGRAMS WILL NOT LOAD FROM FLOPPY-DISK
— THE UNIT SELECT LIGHT IS OFF.

- CHANGE THE INPUT/OUTPUT SYSTEM MODULES

  - BUS TRANSCEIVER MODULES IN CPU (1127, 1119, 1125)

  - BUS RECEIVE MODULES IN THE I/O RACK (1101, 2 X 1093)

- CHANGE THE FLOPPY FORMATTER MODULE

  CAUTION ! !

  1. Mark the unit formatter flat-cables before they are removed.

     - if the cable is reinserted in reverse a short will occur and smoke will be observable.

  2. Turn off the MAIN-POWER switch of the NORD-10/S before removing the CPU-mounted formatter module.

A

A

- **CHECK THE DC VOLTAGE ON THE FLOPPY DRIVE.**

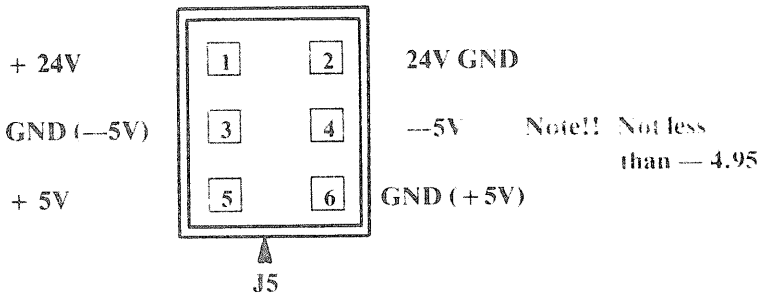
If stand-alone floppy, the voltage is supplied from power-supply in the unit

If rack mounted, the voltage is supplied from the main power supply mounted in the top of the NORD-10/S cabinet, or from a rack mounted power supply.

Voltage verification procedure:

— Pull out the drive

— The voltage can be read on plug J5. J5 is located close to the formatter plug J1. It is accessed from underneath on the rack mounted and to the right side of a stand-alone unit.

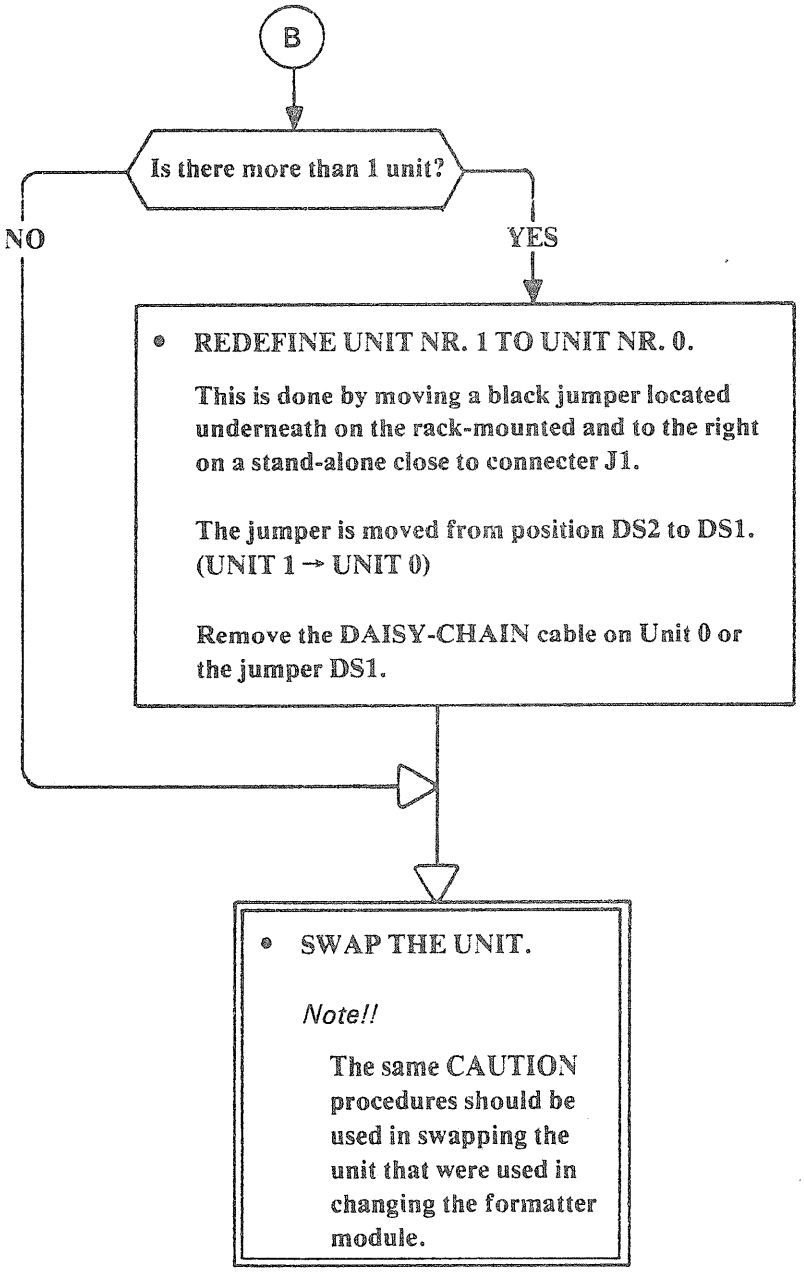


- **CLEAN THE READ/WRITE HEAD.**

Easily done:

- Raise arm with bilt-pad
- The head looks like a six-edged button

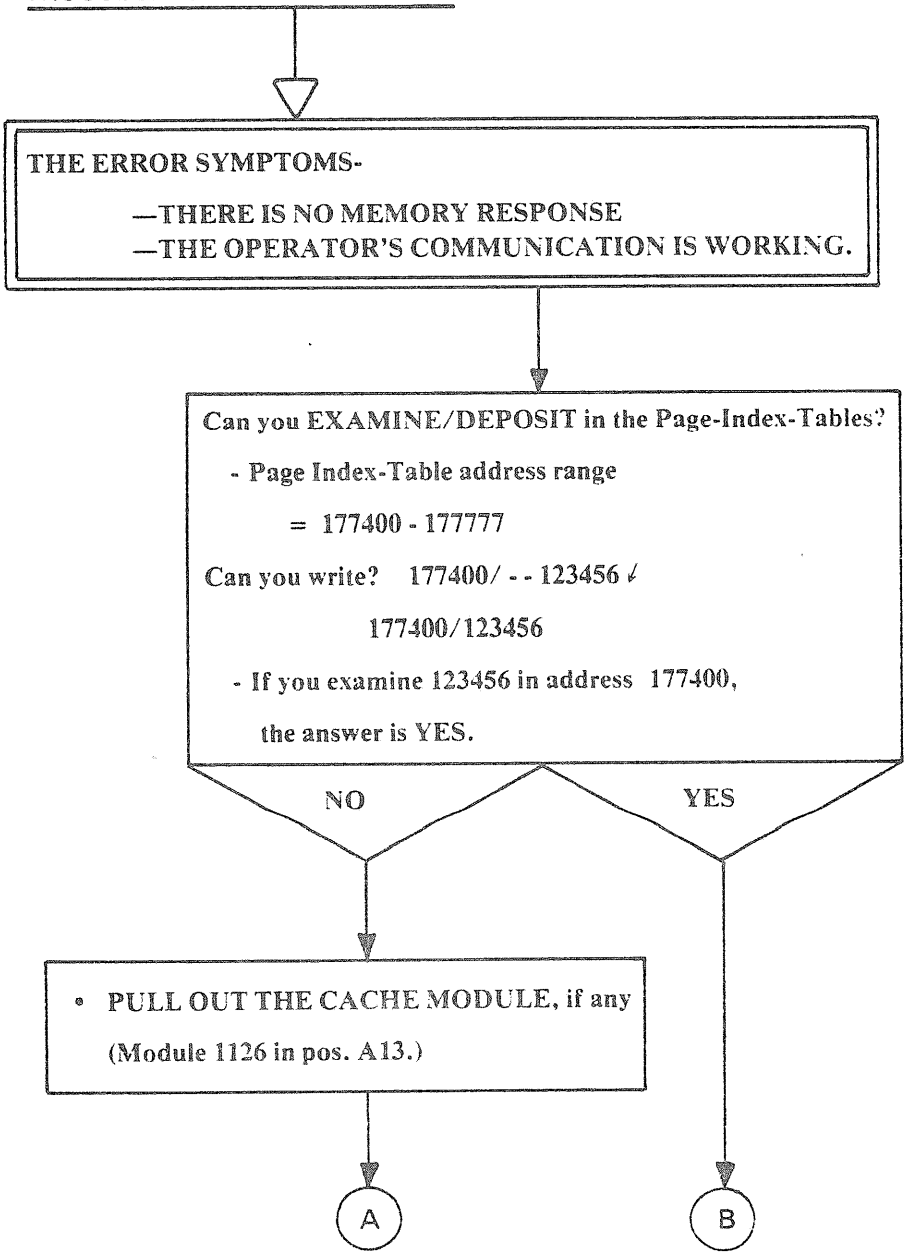
B

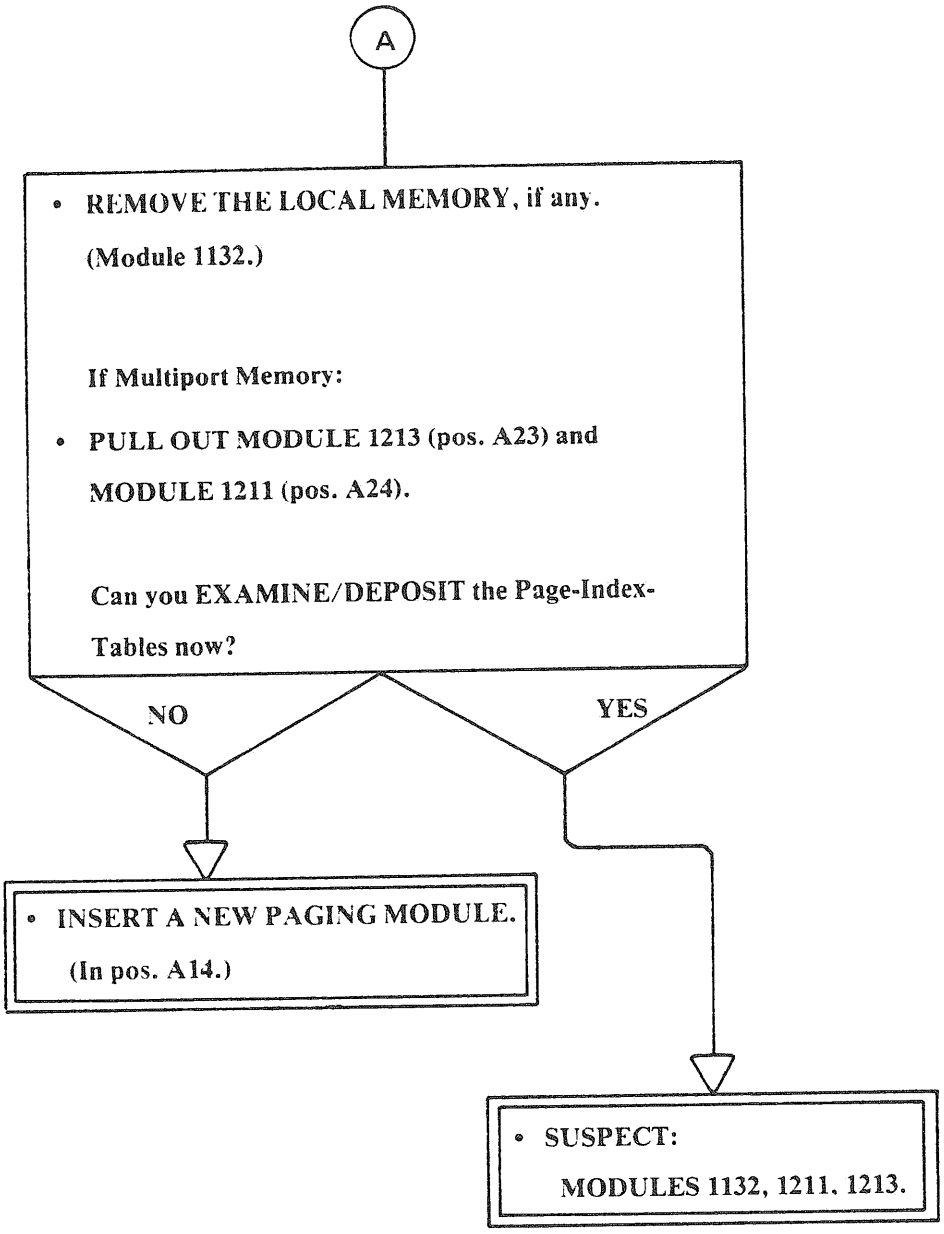

B
Is there more than 1 unit?
NO
YES
• REDEFINE UNIT NR. 1 TO UNIT NR. 0.
This is done by moving a black jumper located underneath on the rack-mounted and to the right on a stand-alone close to connecter J1.
The jumper is moved from position DS2 to DS1. (UNIT 1 → UNIT 0)
Remove the DAISY-CHAIN cable on Unit 0 or the jumper DS1.
• SWAP THE UNIT.
Note!!
The same CAUTION procedures should be used in swapping the unit that were used in changing the formatter module.

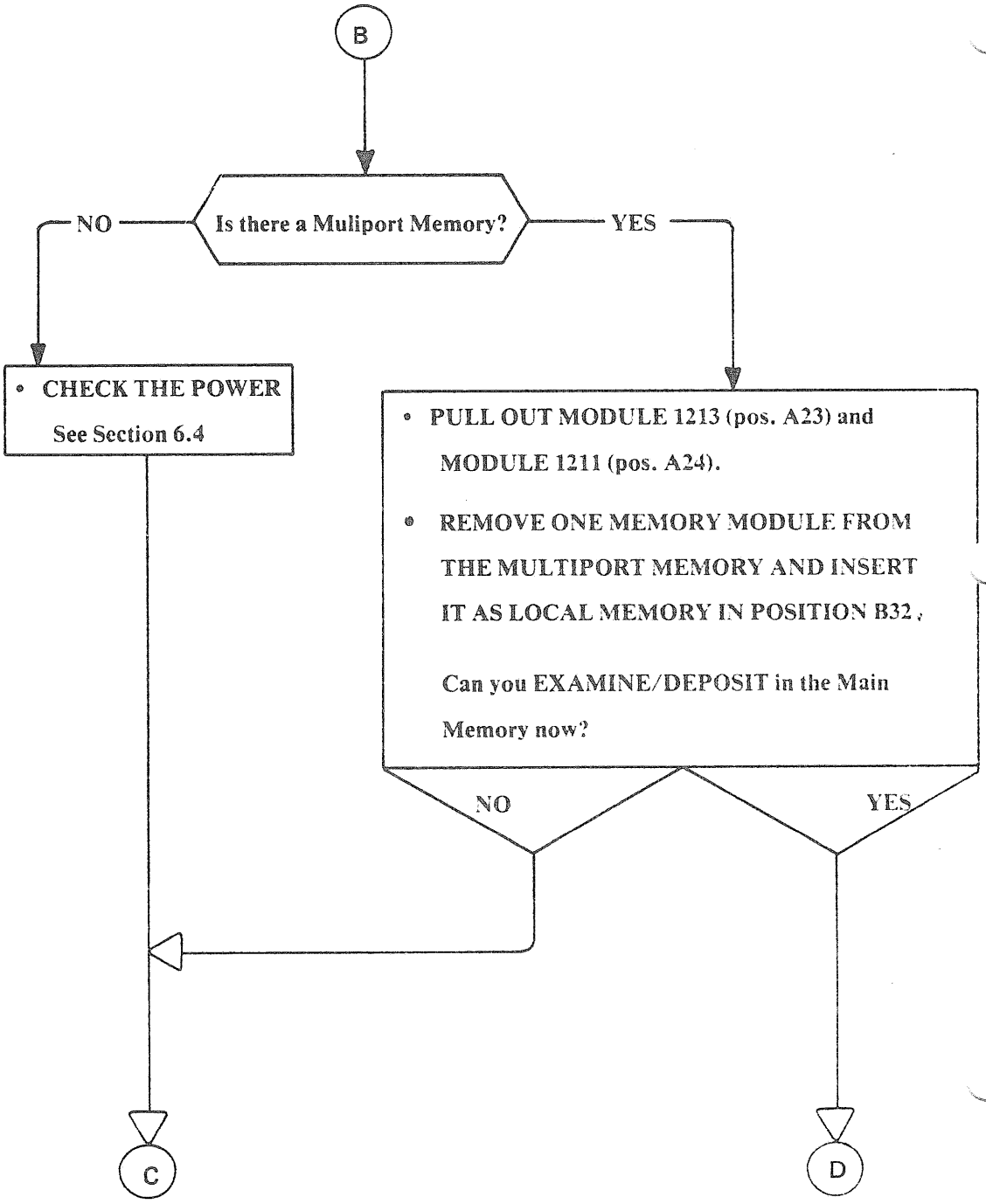
4.7 *NO MEMORY RESPONSE*

If there is no memory response when the Operator's Communication is working and it is possible to Examine/Deposit the Registers in the Register-Block, the following troubleshooting procedure should be used:

TROUBLESHOOTING PROCEDURE Number 4.8:




A
• REMOVE THE LOCAL MEMORY, if any.
(Module 1132.)
If Multiport Memory:
• PULL OUT MODULE 1213 (pos. A23) and
MODULE 1211 (pos. A24).
Can you EXAMINE/DEPOSIT the Page-Index-
Tables now?
NO
YES
• INSERT A NEW PAGING MODULE.
(In pos. A14.)
• SUSPECT:
MODULES 1132, 1211, 1213.


B
Is there a Muliport Memory?
NO
YES
• CHECK THE POWER
See Section 6.4
• PULL OUT MODULE 1213 (pos. A23) and MODULE 1211 (pos. A24).
• REMOVE ONE MEMORY MODULE FROM THE MULTIPORT MEMORY AND INSERT IT AS LOCAL MEMORY IN POSITION B32.
Can you EXAMINE/DEPOSIT in the Main Memory now?
NO
YES
C
D

C

CAUTION ! !

One Local Memory Module can "JAM" the entire memory.

- **REMOVE ALL MODULES EXCEPT FROM ONE POSITION.**
- **TRY AGAIN.**

- **INSERT NEW MODULES IN THIS ORDER:**

  1. **1125 in A22.**
  2. **1119 in A20.**
  3. **1127 in A19.**

D

The Multiport Memory or the CPU DRIVERS/RECEIVER probably are the cause of the failure.

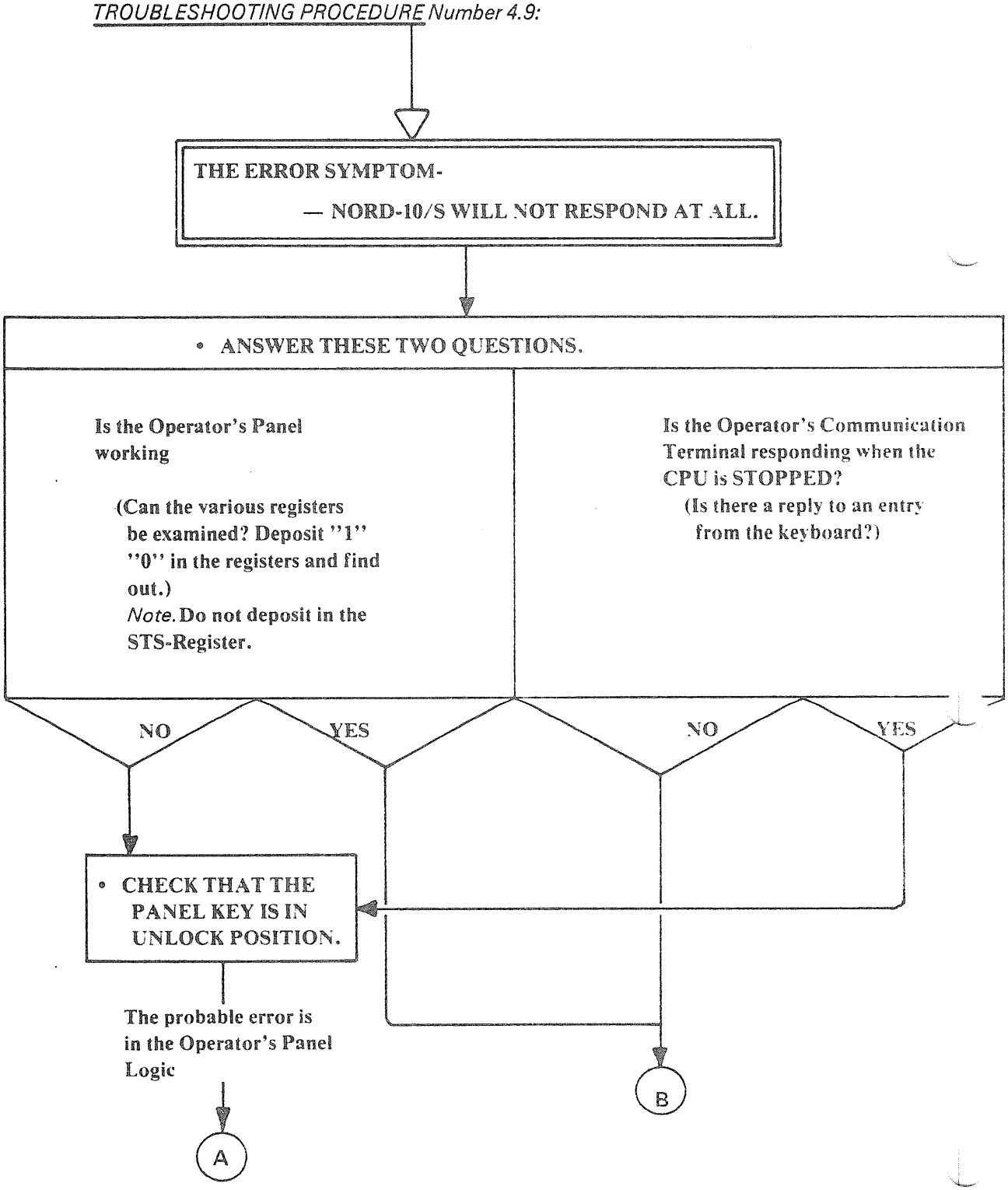
Check them in this sequence:

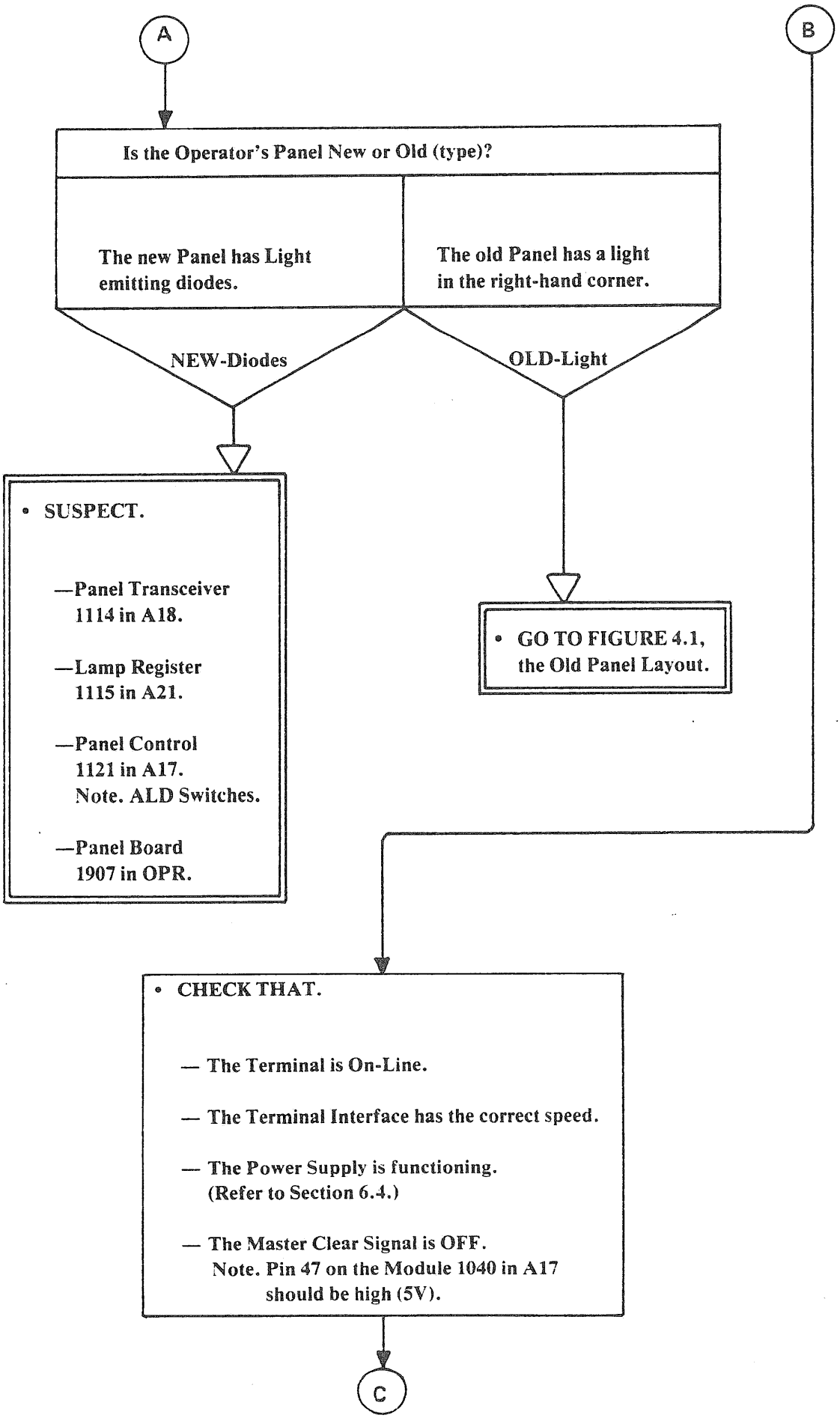
- **1. SWAP THE ADDRESS AND DATA MODULES OF THE CPU IN THE MULTIPORT WITH THE DMA PORT MODULES.**
- **2. SWAP/INSERT NEW MULTIPORT CONTROL MODULES (1090 or 1144).**
- **3. INSERT NEW 1213 AND 1211 MODULES IN CPU.**
- **4. CHECK THE POWER: See Section 6.4.**
- **5. CHECK THE MEMORY INHIBIT LINES. See Section 5.4.4.**

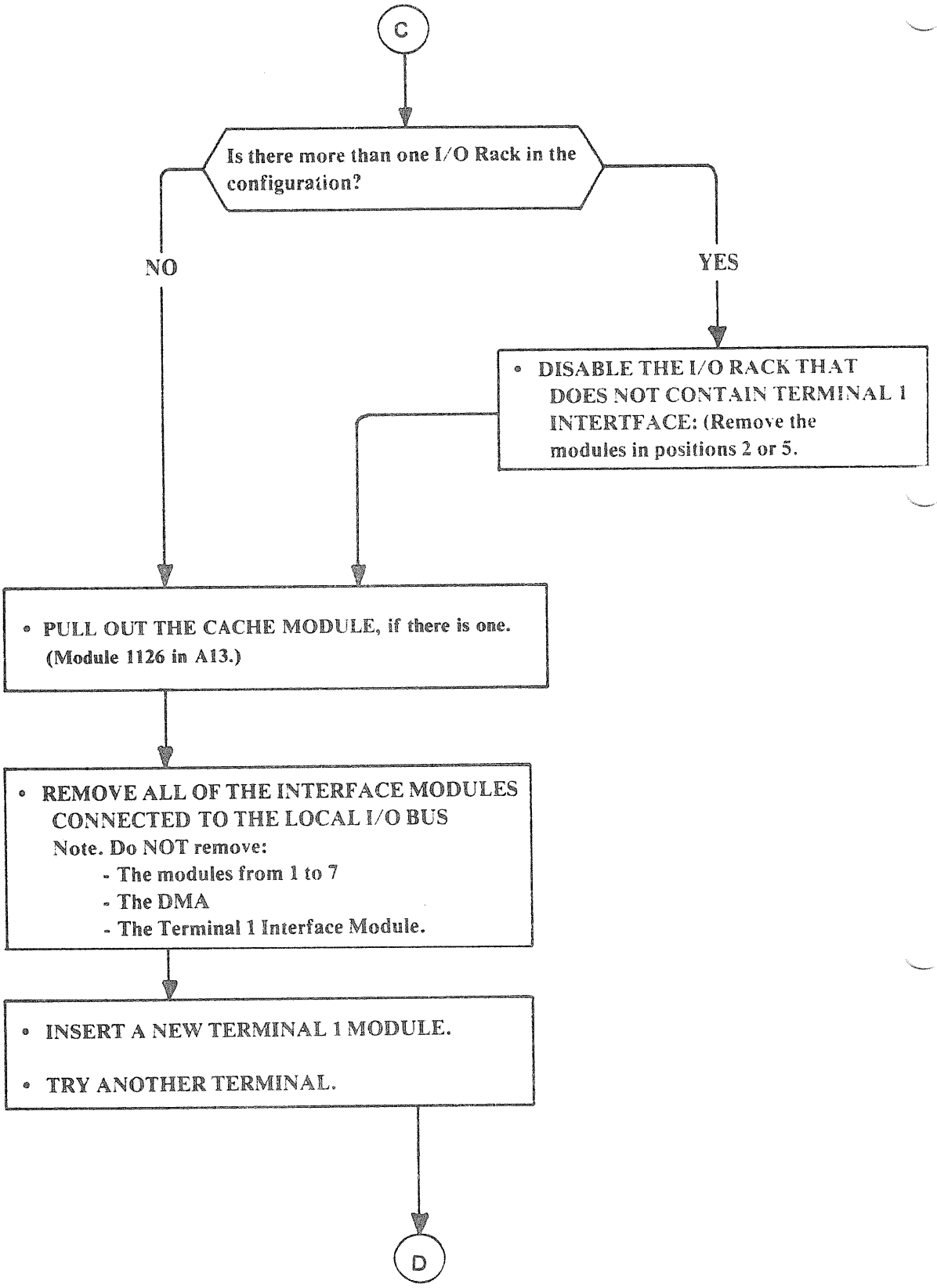
4.8 *THE NORD-10/S IS NOT RESPONDING AT ALL*

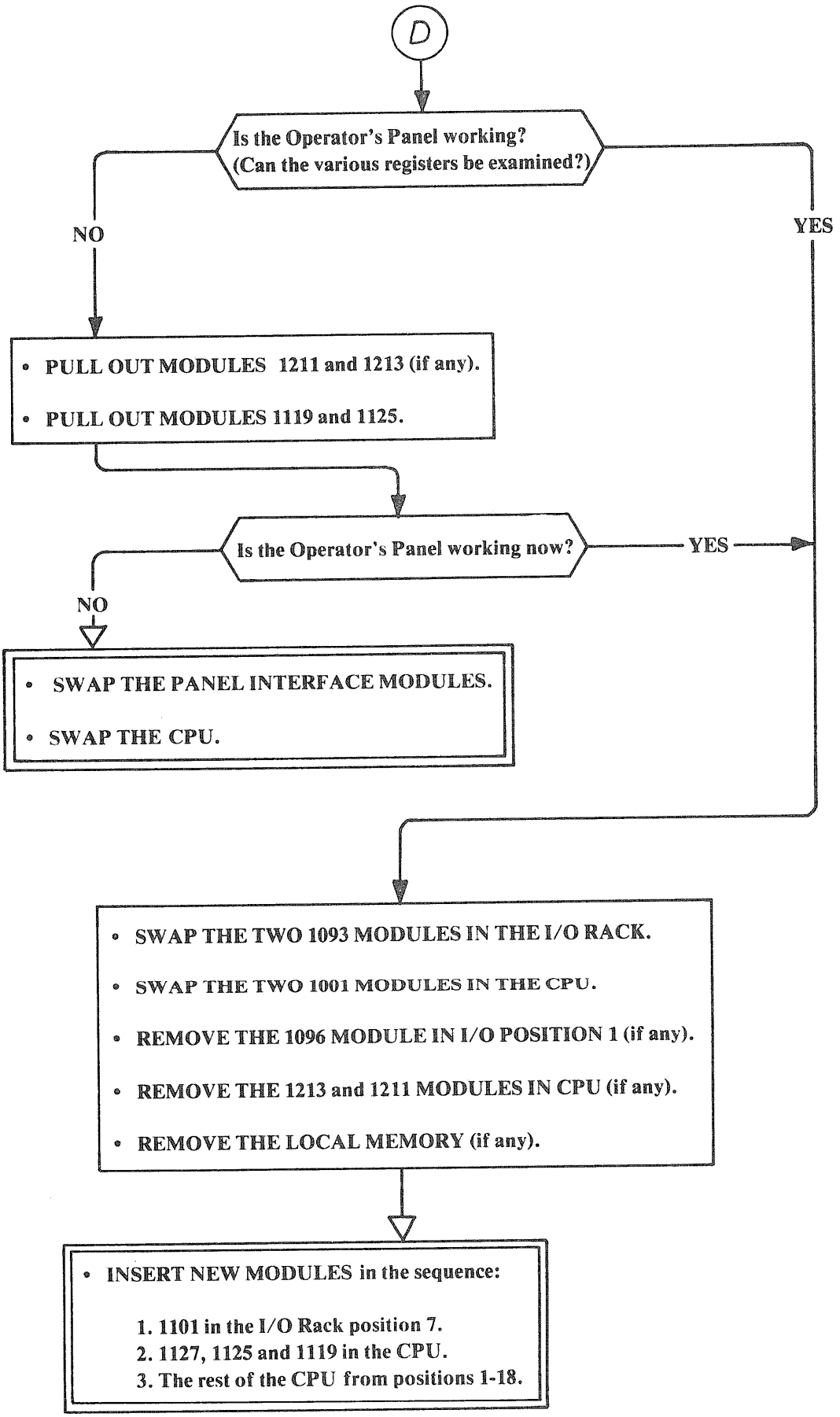
When the NORD-10/S will not respond at all, use this troubleshooting procedure.

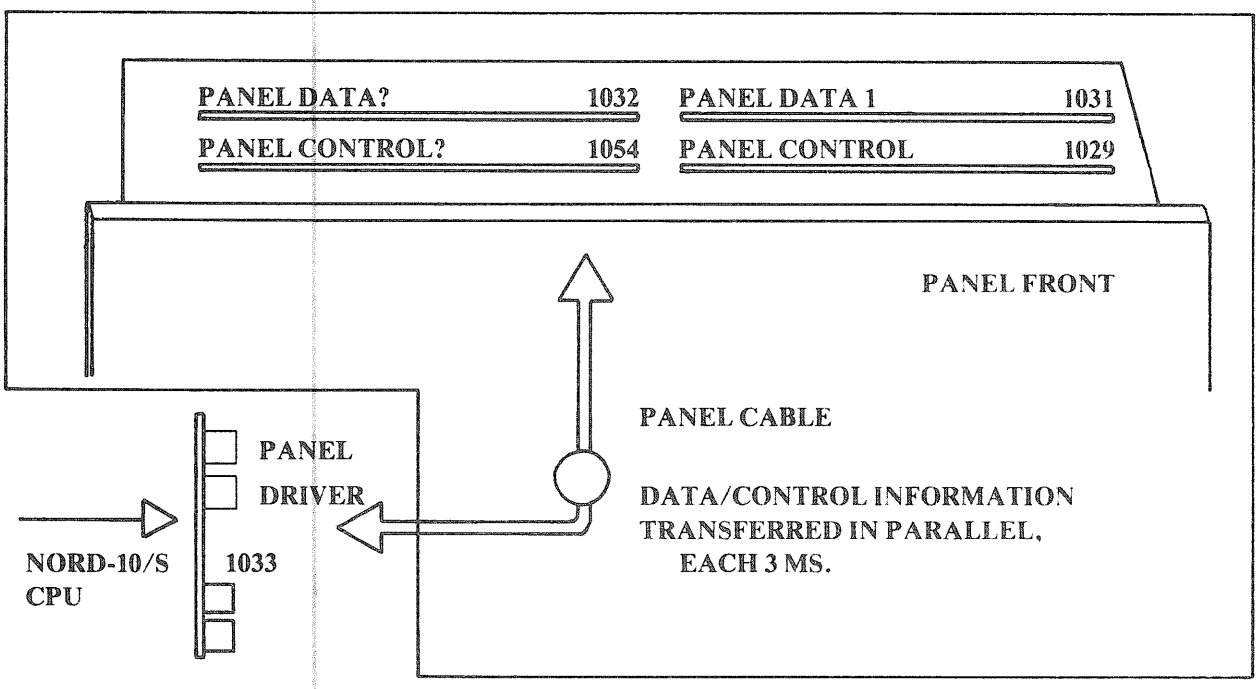
TROUBLESHOOTING PROCEDURE Number 4.9:




A
B
Is the Operator's Panel New or Old (type)?
The new Panel has Light emitting diodes.
The old Panel has a light in the right-hand corner.
NEW-Diodes
OLD-Light
• SUSPECT.
—Panel Transceiver 1114 in A18.
—Lamp Register 1115 in A21.
—Panel Control 1121 in A17. Note. ALD Switches.
—Panel Board 1907 in OPR.
• GO TO FIGURE 4.1, the Old Panel Layout.
• CHECK THAT.
— The Terminal is On-Line.
— The Terminal Interface has the correct speed.
— The Power Supply is functioning. (Refer to Section 6.4.)
— The Master Clear Signal is OFF. Note. Pin 47 on the Module 1040 in A17 should be high (5V).
C


C
Is there more than one I/O Rack in the configuration?
NO
YES
• DISABLE THE I/O RACK THAT DOES NOT CONTAIN TERMINAL 1 INTERTFACE: (Remove the modules in positions 2 or 5.
• PULL OUT THE CACHE MODULE, if there is one. (Module 1126 in A13.)
• REMOVE ALL OF THE INTERFACE MODULES CONNECTED TO THE LOCAL I/O BUS
Note. Do NOT remove:
- The modules from 1 to 7
- The DMA
- The Terminal 1 Interface Module.
• INSERT A NEW TERMINAL 1 MODULE.
• TRY ANOTHER TERMINAL.
D


D
Is the Operator's Panel working?
(Can the various registers be examined?)
NO
YES
• PULL OUT MODULES 1211 and 1213 (if any).
• PULL OUT MODULES 1119 and 1125.
Is the Operator's Panel working now?
YES
NO
• SWAP THE PANEL INTERFACE MODULES.
• SWAP THE CPU.
• SWAP THE TWO 1093 MODULES IN THE I/O RACK.
• SWAP THE TWO 1001 MODULES IN THE CPU.
• REMOVE THE 1096 MODULE IN I/O POSITION 1 (if any).
• REMOVE THE 1213 and 1211 MODULES IN CPU (if any).
• REMOVE THE LOCAL MEMORY (if any).
• INSERT NEW MODULES in the sequence:
1. 1101 in the I/O Rack position 7.
2. 1127, 1125 and 1119 in the CPU.
3. The rest of the CPU from positions 1-18.



Note. The main functions of the four modules mounted in the rear of the Operator's Panel are:

1031
- RECEIVER/DRIVER for DATA BIT 7-0
- Panel STATUS/CONTROL Reg. BIT 7-0

1032
- Same as 1031 but for BIT 15-7

1029
- Control buttons LIGHT-LOGIC
- LEVEL UP/DOWN COUNT-LOGIC

1054
- Control buttons SENSE-LOGIC
- Main Oscillator

1033 (In the CPU)
- ADDRESS BUS (MR) LATCHES
- DATA BUS (IB) LATCHES
- OPR TRANSFER CONTROL-LOGIC
- ALD SWITCH-REGISTER
- ACTIVE LEVEL DECODE (4→16 BITS)

Figure 4.1: THE OLD PANEL LAYOUT

5 MAINTENANCE INFORMATION

This section highlights the kind of hardware that will be tested by designated test programs. The maintenance information is grouped into functional areas as follows:

- CPU
- Character oriented devices (PIO)
- Mass storage devices and DMA controller
- Memory

The test programs utilized to test the NORD-10/S CPU, memory and peripherals are constantly being updated and modified to meet existing and new requirements. It is quite possible that a new version of a test program will behave differently from the old version. For example: the "new" version of a test program may not function as expected while the "old" version of the same program appears to be useable. The Norsk Data Hardware Technical Support Division should be contacted in matters relating to doubtful test programs. This division maintains up-to-date data on test programs. This data includes:

- the version of a test program best suited for use with a CPU and/or its configuration.
- the known but not corrected errors that have been found in the test programs.

An example list of known, but not corrected errors that have been found in test programs is contained in Appendix C.

5.1 *THE CENTRAL PROCESSING UNIT (CPU) OF THE NORD-10/S*

Figure 5.1 gives a summary of the CPU-Rack.

5.1.1 *The CPU*

Figure 5.2 illustrates the hardware test program relationship within the CPU. The type of hardware that is tested by the various test programs can be determined by using this figure.

FUNCTION:	*ON PCB:*	*IN POSITION:*
CPU-REGISTERS: A,T,D,B,X,L,P (STS)	1002(1062)	A4,A5,A6,A7(A1)
ARITHMETIC	1001	A2,A3
ADDRESS-ARITHMETIC	1002	A4,A5,A6,A7
INSTRUCTION EXECUTE CONTROL LOGIC/TIMING	1075,1023 1007,1006 1062/1120	A11,A10 A8,A9 A1,A12
MEMORY MANAGEMENT SYSTEM	1040	A14
INTERRUPT SYSTEM	1008,1058	A16,A15
CACHE MEMORY	1126	A13
OPERATORS PANEL:		
CPU INTERFACE	1114,1115, 1121 1033 OLD PANEL	A18,A21,A17
MAIN MEMORY:		
INTERFACE/DRIVER* FOR ADDRESS	1119/1213*	A20/A23*
INTERFACE/DRIVER*,RECEIVER FOR DATA	1125/1211*	A22/A24*
INTERFACE CONTROL	1127	A19
PARITY GENERATE/CHECK	1125	A22
*IF BIG MULTIPORT		
I/O SYSTEM:		
INTERFACE/DRIVER, RECEIVER FOR ADDRESS	1119	A20
INTERFACE/DRIVER, RECEIVER FOR DATA	1125	A22
INTERFACE CONTROL	1127	A19

Figure 5.1: CPU-RACK SUMMARY

			PROGRAMS: ONE-CHECK	EXTEN-ONE	TWO-CHECK	THREE-CHECK	FOUR-CHECK	FLOATING	RGCHK	PFAIL	CACHE	TEST-PAG	ERRCOR
1	1062	STATUS	1	■	■			■					
2	1001	ARITHMETIC B (MOST SIGN)	2	■	■			■					
3	1001	ARITHMETIC A (LEAST SIGN)	3	■	■			■					
4	1002	REGISTERS (BIT 0 - 3)	4	■	■			■	■				
5	1002	REGISTERS (BIT 4 - 7)	5	■	■			■	■				
6	1002	REGISTERS (BIT 8 - 11)	6	■	■			■	■				
7	1002	REGISTERS (BIT 12 — 15)	7	■	■			■	■				
8	1007	DECODING	8	■	■			■					
9	1006	OR LOGIC	9	■	■			■					
10	1023	1K PROM	10	■	■			■					
11	1075	MICRO ADDRESSING	11	■	■			■					
12	1120	TIME CONTROL	12	■	■			■	■	■			
13	1126*	CACHE	13								■		
14	1040	PAGING	14									■	
15	1058	INTERRUPT CONTROL	15			■	■					■	
16	1008	INTERRUPT REGISTERS	16			■	■						
17	1121	PANEL CONTROL	17			■	■			■	■		
18	1114	PANEL TRANSCEIVER	18										
19	1127	TRANSCEIVER CONTROL	19			■	■						
20	1119	TRANSCEIVER ADDRESS	20										
21	1115	LAMP REGISTER	21										
22	1125	TRANSCEIVER DATA	22										■
23	1213	MPM ADDRESS BUFFER	23										
24	1211	MPM DATA BUFFER	24										
25													
26													
27													
28													
29													
30													
31													
32	1132*	32K RAM											
				INSTRUCTION TEST	INSTRUCTION TEST - ALL LEVELS	INSTRUCTION TEST	INTERRUPT TEST	INTERNAL INTERRUPT TEST	FLOATING TEST	REGISTER TEST	POWER FAIL / INTERRUPT TEST	CACHE TEST	PAGING TEST / ERROR CORRECTION TEST (LOCAL MEMORY)

Figure 5.2: HARDWARE TEST PROGRAM RELATIONSHIPS WITHIN THE CPU

5.1.2 *CPU Test Program Information:*

			MORE INFORMATION FOUND IN:	CHAPTER:
ONE-CHECK	:	Test program for the majority of the instructions.	** 1	2
EXTEN-ONE	:	As for ONE-CHECK but on all levels. Give error printout on terminal 1.	1	2
TWO-CHECK	:	Tests instructions not being tested in ONE-CHECK.	1	3
THREE-CHECK*	:	Interrupt system test.	1	4
FOUR-CHECK*	:	Internal interrupt system test. Gives printout.	1	5
FLOATING	:	Floating test (48 bits format) use T-32B-FLOA if 32 bits floating format (NORD 50). Error printout. NOTE!! PATCH in T-32B-FLOA 2264/05224→052525	1	6
RGCHK	:	Register test. Runs for 2.5 hours.	SELF EXPLANATORY	
PFAIL	:	Power fail test program. Tests: Power-sense unit, interrupt-systems registers and memory.	***2	2
CACHE*	:	CACHE module test.	2	14
TEST-PAG	:	Memory management system test program. Page index tables and protect mechanism are tested. Gives printout.	2	3
ERRCOR	:	Error correction on the 1125 module is tested. NOTE!! Only if local memory is installed.	2	15

* SEE APPENDIX C.

**1 NORD-10 VERIFICATION PROGRAMS

***2 TEST PROGRAM DESCRIPTION.

5.2 *CHARACTER ORIENTED DEVICES (PIO)*

5.2.1 *The I/O Bus*

The basic test program for testing the I/O Bus is the CONFIGURATION INVESTIGATOR. This program will do some investigation of the configurations such as:

— Within the CPU A-Rack

- Floating format (48 or 32 bits)
- What kind of status board (1003 or 1062)
- CACHE module present
- PAGING module present
- ALD switch setting

— Within the MULTIPORT or LOCAL memory

- Check the size of the physical memory. If the memory is not responding or the content is wrong, the word empty is printed followed by the addresses on the terminal

  NOTE 1. If the memory size does not match the EMPTY printout, run a memory test program (See Section 5.4).

  NOTE 2. CONFIGURATION-INVESTIGATOR made for the NORD-100 will not work in the NORD-10/S. There are up to 8 memory banks in the NORD-100, but only 4 memory banks in the NORD-10/S.

— For the I/O

If specified by the operator all IOX instructions from address 0 to 3777 are executed. This will check all I/O devices connected to the local I/O Bus(s) for correct switch-setting. The DMA interfaces will be checked as they always have one module (the Bus Control Module) in the local I/O Bus and also external devices.

The corresponding IDENT-Code is read and checked for all I/O devices responding.

An ERROR message is given if the IDENT-Code does not match the ND-Standard (See Appendix E). The IDENT-Code is read twice to verify that the IDENT-Instruction resets the INTERRUPT.

The following causes will result in error messages:

1. Broken IDENT chain (modules out)
2. I/O system errors
3. Module errors
4. Specially modified modules (BUSY 1095)

— For the DMA

All DMA interfaces detected by the CONFIGURATION INVESTIGATOR are started to perform a memory read operation in test mode. 1k of test data (125252 and 52525) is read from all memory banks available and then checked.

If an error is detected the CONFIGURATION INVESTIGATOR prints out information about:

- The failing DMA device
- Into which memory bank the test-data is read
- Failing address
- Failing data (expected/found)

The following are the causes of DMA error printouts:

1 : The DMA data path

2 : The DMA controller

Note! For items 1 and 2 see Section 5.3.

3 : The memory system

Note! For item 3 see Section 5.4.

NOTE. The ECC Disk Controller will fail if ECO Nr. 529 is not done on the 1078 module.

The two questions asked by the CONFIGURATION INVESTIGATOR are:

1. DEBUG (Y/N)

   If Y is typed there will be no memory-test and all DMA-devices will be read and tested in bank 0.

2. Who specifies the I/O-devices to be checked? User or program (U/P)?

   P = All devices will be checked from IOX device number 0 to 3777.

   U = The user specifies the device numbers to be tested.

   NOTE 1. The numbers have to be seperated with space and/or terminated with a 0.

   NOTE 2. Appendix C contains error information on the CONFI-INV 1672K version.

5.2.2 *Serial, Asynchronous Devices*

This section contains overviews of the devices, the various ways of connecting the devices to the NORD-10/S and test program information.

5.2.2.1 "DISPLAY-TERMINALS"

An overview of "Display-Terminals" is shown in Figure 5.3.

5.2.2.2 SERIAL PRINTERS/PLOTTERS

An overview of serial printers/plotters is shown in Figure 5.4

5.2.2.3 METHODS OF CONNECTING DEVICES TO NORD-10/S

The various methods of connecting the devices to the NORD-10/S are shown in Figure 5.5 together with test/verification programs.

5.2.2.4 CROSS REFERENCES FOR ASYNCHRONOUS SERIAL INTERFACES

The cross references for asynchronous serial interfaces is at Figure 5.6.

PLUG ON DISPLAY, TERMINAL →	CURRENT LOOP 8 PINS BURNDY	RS-232 CANNON.	COMMENTS:
HARD COPY TERMINALS:			
TELETYPE ASR 33	X		Note. Only 1020 Interface Module equipped with automatic START/STOP.
SILENT	X Option	X	
DECWRITER LA 36	X	X Option	
TEXAS OMNI 800	X		SELF–TEST !
DISPLAY TERMINALS:			
VISTAR, GT, GTX	X	X *	* Special EIA → CANNON cable needed.
INFOTON 200/1 200/4 400/4	X	X *	
TANDBERG TDV SDS 77, 78 STANDARD 78 3270 (IBM) 78	X Note. CANNON Plug.	X	CANNON–PLUG for both Current-Loop and RS 232.
TEKTRONIX 4006/4010/4014		X	Graphic functions can be tested with a Special Program-Package under SINTRAN III. A manual is available.
TET with TANDB. VISTAR VIDEO INFOTON	X	X Note. BURNDY Plug.	ND produced hardware inside. Test Program available (but not registrated as of 1/4-80).
NCT NORD COLOUR TERM	X	X	Special Test Program: TNCT plus NORDCOM Colour Terminal manual. SINTRAN-TEST also available. Note. DMA Controller available.
PROCESS PANEL	X		Special Test Program. PROCES–PAN, self explanatory.

Figure 5.3: AN OVERVIEW OF DISPLAY/TERMINAL

		CURRENT LOOP	RS 232	SELF-TEST	COMMENTS:
CENTRONIC	101 A, 102 A, 102 AL 306 308	X	X		Also available with Parallel Interfaces.
VERSATEC	1150 1250		X		Also available with Parallel Interfaces or DMA Interfaces.
VERSATEC	1110, 1200 (PLOTTER)		X		
TALLY	1602, 1612	X	X	X	
TERMINET	340	X	X	X	Also available with Parallel Interface.
CDC	9316	X	X	X *	* Switch is on the Board in the Printer.
DIABLO	1650		X	X	

Note. This CURRENT–LOOP Interface uses a Busy Modified 1095 Module according to ECO Number 585.

This is for the purposes of achieving a Carriage-Return Delay, an Out-of-Paper Delay, an Alarm Delay, etc.

Figure 5.4: AN OVERVIEW OF SERIAL PRINTER/PLOTTERS

NORD 10/S SERIAL DEVICE INTERCONNECTIONS AND TEST/VERIFICATION PROGRAMS

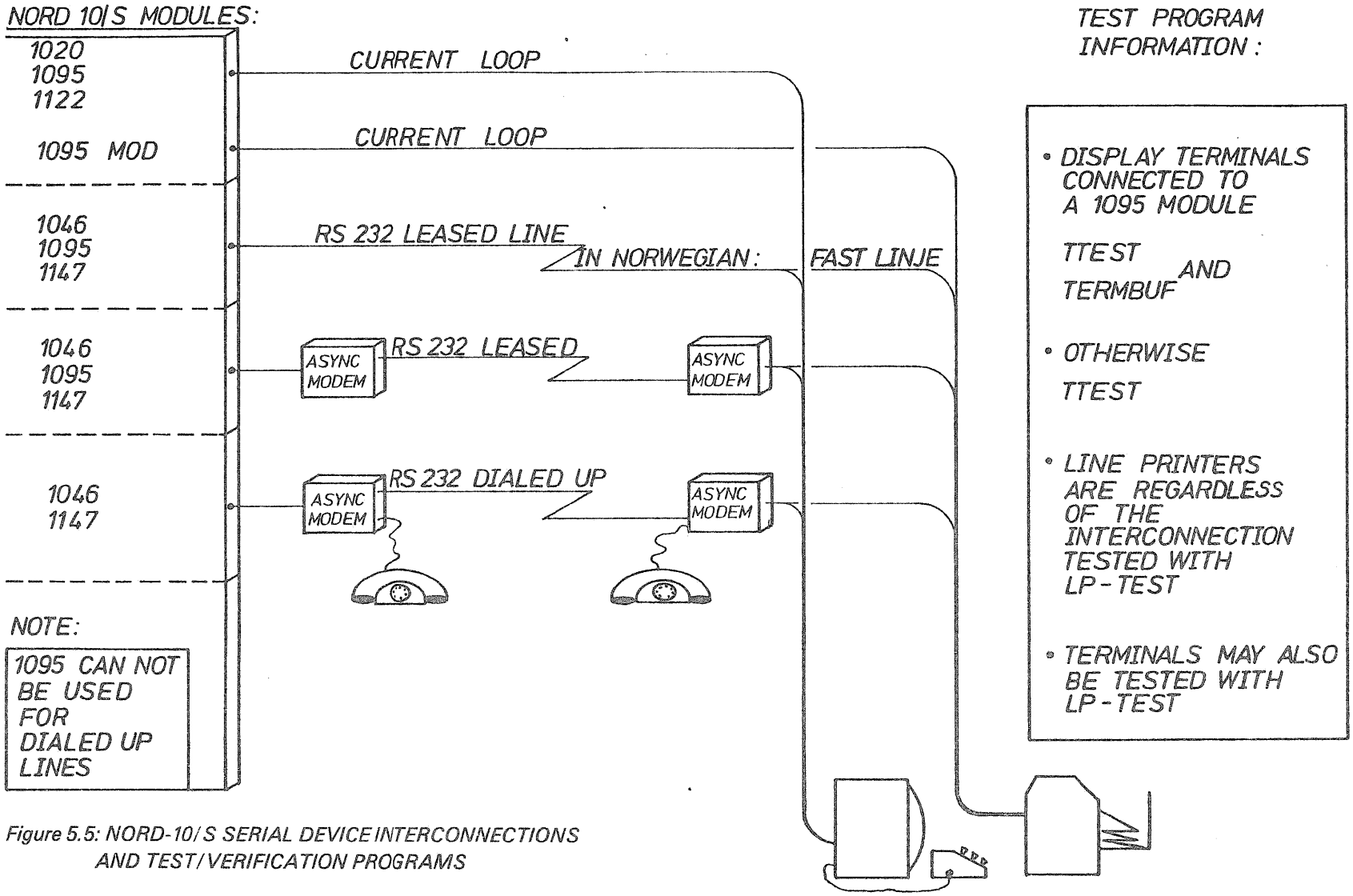


Figure 5.5: NORD-10/S SERIAL DEVICE INTERCONNECTIONS AND TEST/VERIFICATION PROGRAMS

* Note. STRAP FOR SPEEDS < 1200 BAUD

Term. no.	Device no.	Ident	Log.dev. no. oct.	Log.dev. no. dec.	* 1020	* 1046	1095	1122	1147
1	300	(120) 1	1	1					
2	310	(121) 5	11	9					
3	320	(122) 6	42	34					
4	330	(123) 7	43	35					
5	340	44	44	36					
6	350	45	45	37					
7	360	46	46	38					
8	370	47	47	39					
9	1300	50	60	48	Can be used				
10	1310	51	61	49					
11	1320	52	62	50					
12	1330	53	63	51					
13	1340	54	64	52					
14	1350	55	65	53					
15	1360	56	66	54					
16	1370	57	67	55					
17	200	60	7	7					
18	210	61	17	15					
19	220	62	52	42					
20	230	63	53	43					
21	240	64	54	44					
22	250	65	55	45					
23	260	66	56	46					
24	270	67	57	47					
25	1200	70	70	56					
26	1210	71	71	57					
27	1220	72	72	58					
28	1230	73	73	59					
29	1240	74	74	60					
30	1250	75	75	61					
31	1260	76	76	62					
32	1270	77	77	63					

Term. no.	Device no.	Ident	Log.dev. no. oct.	Log.dev. no. dec.	* 1020	* 1046	1095	1122	1147
33	640	124	1040	544					
34	650	125	1041	545					
35	660	126	1042	546					
36	670	127	1043	547					
37	1100	130	1044	548					
38	1110	131	1045	549					
39	1120	132	1046	550					
40	1130	133	1047	551					
41	1140	134	1050	552					
42	1150	135	1051	553					
43	1160	136	1052	554					
44	1170	137	1053	555					
45	1400	140	1054	556					
46	1410	141	1055	557					
47	1420	142	1056	558					
48	1430	143	1057	559					
49	1500	144	1060	560					
50	1510	145	1061	561					
51	1520	146	1062	562					
52	1530	147	1063	563					
53	1640	150	1064	564					
54	1650	151	1065	565					
55	1660	152	1066	566					
56	1670	153	1067	567					
57	1700	154	1070	568					
58	1710	155	1071	569					
59	1720	156	1072	570					
60	1730	157	1073	571					
61	1740	160	1074	572					
62	1750	161	1075	573					
63	1760	162	1076	574					
64	1770	163	1077	575					

Figure 5.6: CROSS REFERENCE LIST FOR ASYNCHRONOUS SERIAL INTERFACES

5.2.2.5 TEST PROGRAM INFORMATION

TERMBUF 1751

Directory Name: ND—10325
User Name: FLOPPY-USER

Comments:

- Purpose - A stand-alone Hardware Test Program for terminal buffer interface.
- Functions - TERMBUF first tests the interface in test mode without a terminal. When a terminal is connected the speed that terminal is set to will be written on the terminal.
- Implementation Instructions - Refer to PD in NORD Software Library.
- Special Considerations - The speed on this program is set by software.

Notes:

1. Test Terminal Buffer Module (1095) in test mode.
2. Program calculates the BAUDE-RATE setting of Received Escape from the terminal.
3. Expects even parity.
4. The program is essentially self-documenting.

TTEST 1206

Directory Name: ND-10324
User Name: FLOPPY-USER

Comments:

— Purpose — A stand-alone Hardware Test Program for teletype and display verification for the NORD-10 and the NORD-10/S.

— Functions — Tests terminals using fixed speed 110-9600 BAUD connected through modules:

Module:

1020	Teletype Buffer
1046	ASYNC MODEM
1095	Current loop/ASYNC MODEM
1122	4 Current loop
1147	2 ASYNC MODEM

— Implementation Instructions - Refer to PD in NORD Software Library.

— Special Considerations - The speed on this program is set by hardware.

Notes:

1. Expects even parity.
2. Sometimes it has to be started twice. See Appendix C.

5.2.3 *Parallel Devices*

Printers and card readers are covered in this section to include overviews and test programs.

5.2.3.1 LINE PRINTERS

5.2.3.1.1 Parallel Data Transfer

Figure 5.7 covers line printers with parallel data transfer.

TYPE		INTERFACE MODULES	SELF-TEST	TEST PROGRAMS:
CDC	9322 9342 9352	1047		LP–TEST (2)
CENTRONIC	101 A 102 A, AL 306 308	1026 MOD.		LP–TEST (1)
VERSATEC	1110 1150 1200 1250	1109 or 1026 MOD.		VERSATEST PARAL–BYTE LP–TEST (3)
CDC	9383 9386 BAND PRINTER 9389	1130	YES But Option	LP–TEST (2)
TALLY	1202 1602	1140	YES	LP–TEST (1)
TERMINET	340	1109	YES	LP–TEST (1) and PARAL–BYTE
DATA PRINTER	1000 LPM	1047 *	YES	LP–TEST (2)

* With ECO 594 and MARKED B2.

( ) = What to answer when LP–TEST asks for a number.

Figure 5.7: LINE PRINTERS WITH PARALLEL DATA TRANSFER

5.2.3.1.2 Test Programs

The test programs to be used for line printers are:

VERSATEST — 2297

Directory Name: ND-10326
User Name: FLOPPY-USER

Comments:

- Purpose - Stand-alone Hardware Test Program to test VERSATEC line printers/plotters.
- Implementation Instructions - Refer to PD in NORD Software Library.
- Special Consideration - Can be loaded and run under SINTRAN.

Additional Information:

- See Section 5.3.4.1 for use with VERSATEC printer/plotter.
- Can be used with the following DMA modules:
  1102, 1022 or 1155, 1013 and 1014.

PARAL-BYTE — 1942

Directory Name: ND-10325
User Name: FLOPPY-USER

Comments:

- Purpose - A Stand-alone Hardware Test Program to test interface ND-653 and a number of external devices.
- Function - Used for Module 1109 and connected printers.
- Implementation Instructions - Refer to PD in NORD Software Library.

Note:

- Self-documenting.

LP-TEST 1878

Directory Name: ND-10324
User Name: FLOPPY-USER

Comments:

- Purpose — A stand-alone Hardware Test Program for CDC, Centronic and Versatec line printers.

- Functions — Tests printers connected either as serial printers or as parallel printers. Tests interface in the test mode. There is a top-of-page test in which short line is printed at the top of the page. The various test pattern outputs are:

  1. The character set rotated.
  2. The character set not rotated.
  3. Lines with from 1 to 33 or 66 characters.
  4. M
  5. M shifted half a character.

- Implementation Instructions — Refer to PD in NORD Software Library.

Note:

- On serial printers the printer prints two lines on top of each other from time to time. See Appendix C.

5.2.3.2 CARD READERS

All card readers delivered from Norsk Data are of the type:

DOCUMATION 400

DOCUMATION 600

DOCUMATION 1000

All use the same interface module:

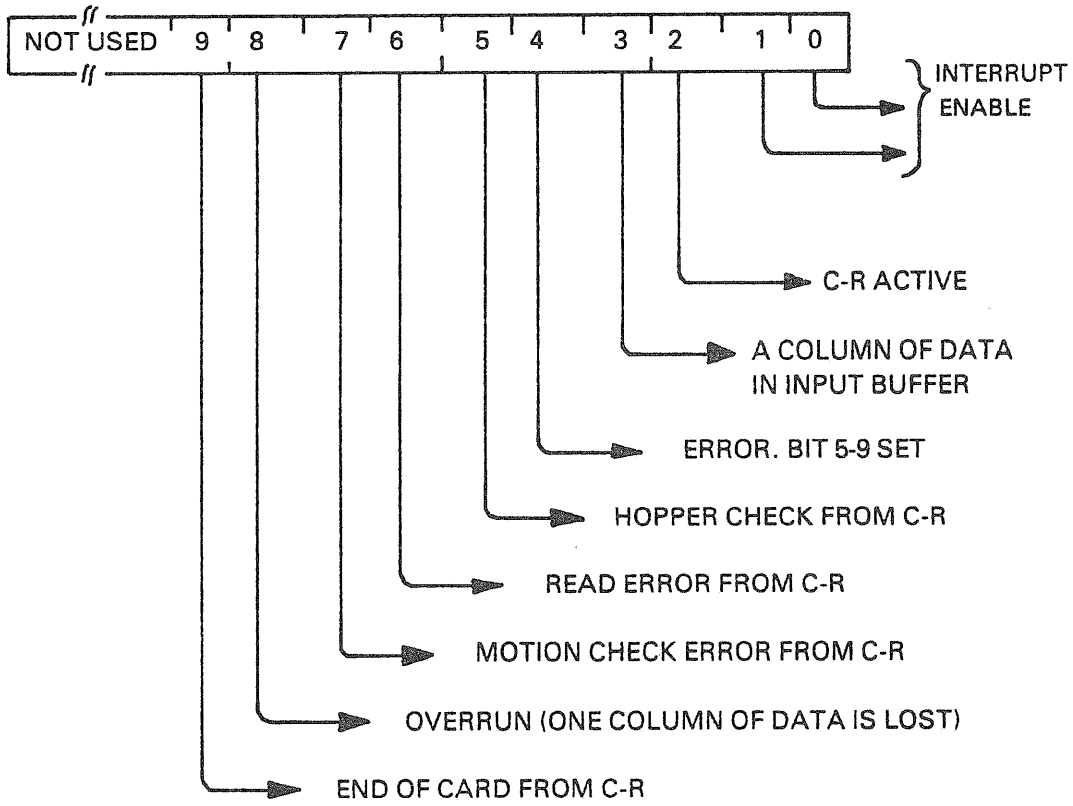
1043

Test Program:

CARD 1642

The program reads the card twice and checks the data. No special test cards are needed. Errors will be reported.

CARD READER STATUS - REGISTER FORMAT:



5.2.4 *Floppy Disk*

The floppy disk controller consists of the modules 1111 and 1118 located in the Local I/O Bus and interconnected with a special plug in the backwiring. Note that the 1118 module is always on the right side of the 1111 module.

5.2.4.1 THE MAIN FUNCTIONS OF THESE MODULES ARE:

1111 : FLOPPY DISK CONTROL

* **DEVICE REGISTER ADDRESS DECODER**
* **TEMPORARY STATUS REGISTER (SR1)**
* **INTERRUPT (LEVEL 11), IDENT MECH/IDENT CODE REG.**
* **AUTO LOAD CIRCUITS**

1118 : FLOPPY DISK DATA

* **1K 16 BITS INPUT/OUTPUT BUFFER**
* **16 BITS WORD TO 8 BITS CHARACTER CONVERT REGISTERS**
* **STATUS REGISTER (BIT 7-4)**
* **BIDIRECTIONAL DATA BUS OF 8 BITS TO/FROM FLOPPY-DISK FORMATTER**

5.2.4.2 FLOPPY DISK TEST PROGRAMS:

FLOPPY-FU — 1986

Directory Name: ND-10324
User Name: FLOPPY-USER

Comments:

— Purpose - A stand-alone Hardware Program to test Floppy Disk Interface and Drive Functions.

— Implementation Instruction - Refer to PD in NORD Software Library.

Notes:

1. Self-documenting.
2. If CPU goes in STOP, push MASTER CLEAR and CONTINUE to proceed.

FLOPPY-RAN — 1988

Directory Name: ND-10324
User Name: FLOPPY-USER

Comments:

— Purpose - A stand-alone Hardware Program to test Random Data and Address Test for Floppy Disk.

— Implementation Instructions - Refer to PD in NORD Software Library.

Notes:

1. Test Routine - Writes on diskette, use a scratch diskette.
2. Self-documenting.

FLOPPY-FORM — 1990

Directory Name: ND-10324
User Name: FLOPPY-USER

Comments:

— Purpose - A stand-alone Hardware Utility Program for diskette formatting.

— Implementation Instructions - Refer to PD in the NORD Software Library.

Notes:

1. Self-documenting.
2. Old data is lost when formatting.

FL-LOOPS — 1996

Directory Name: ND-10326
User Name: FLOPPY-USER

Comments:

— Purpose - A stand-alone Hardware Test Program for debugging-loops for Floppy Disk.

— Implementation Instructions - Refer to PD in NORD Software Library.

Note:

— This program is intended for ND's internal use, mainly production debugging, and should not be distributed to customers.

Additional Information:

— There are descriptions of this Test Program in Appendix B of the Floppy Disk System Manual, ND—11.012.

— Since the Floppy is generally not operating when the loops are wanted, the program must be loaded either in Octal Code from the Console, or with a paper tape.

5.2.5 *Inter NORD-10/S Communication*

5.2.5.1 ASYNCHRONOUS COMMUNCATION TEST PROGRAM DESCRIPTION

CHATA - 1832

Directory Name: ND-10325
User Name: FLOPPY-USER

Comments:

— Purpose - A stand-alone Hardware Test Program to check the transfer of accumulated data between the A-registers of two computers.

— Function - Test the asynchronous modem or current loop connection between two NORD-10/S's or between a NORD-10/S and a NORD-1 or a NORD-20, or a NORD-100.

— Implementation Instructions - Refer to PD in the NORD Software Library.

— Special Considerations - In a SINTRAN-SINTRAN communication between two NORD-10/S's, the ASYNC Modem interface no. 1 is normally set to Device no. 1370 (Terminal 16); no. 2 is set to 1360.

— Special CHATA programs are available for the NORD-1 and the NORD-20.

Notes:

—1. The modules used are:
— for Current Loop:
Module 1095 and 1122
— for Asynchronous Modem (RS 232)
Module 1046 and 1147

—2. Runs/ASYNC/CURRENT LOOP interface in test mode.

—3. Transmits block of 256 characters.

—4. Transmitter prints "T" after transmission receiver prints "R" or an error message.

—5. The program asks for receiver or transmitter first. Answer R on the receiving computer first, and then T on the transmitting computer.

5.2.5.2 SYNCHRONOUS COMMUNICATION TEST PROGRAM DESCRIPTION

TLINE - 1541

Directory Name: ND-10325
User Name: FLOPPY-USER

Comments:

— Purpose — A stand-alone Hardware Test Program to check synchronous modem interfaces.

— Functions — Tests synchronous modem connections (connected with leased or dialed-up lines) between two NORD-10/S's. Runs one synchronous modem interface in test mode. Transmits blocks of 256 words (modem status in the D-register).

  — Modem status may be inspected in the D-register during execution.

— Implementation Instructions — Refer to PD in NORD Software Library.

— Special Considerations — The module used in testing the Synchronous Modem connection between two NORD-10/S's is 1050 Synchronous Modem Buffer. One of these modules in each NORD-10/S plus one modem at each end.

Additional Information:

— In a SINTRAN-SINTRAN communication between two NORD-10/S's, the Synchronous Modem interface is normally set to device Number 150, Number 2 = 140, and Number 3 = 130.

Notes:

—1. The program asks for receiver or transmitter first. Answer R on the receiving computer first, and then T on the transmitting computer.

—2. The transmitter prints "T" after the transmission receiver prints "R" or an error message.

5.2.6 *Real-Time Clock*

Two real-time clock modules are available:

1024 = RTC-N-10
1210 = CLOCK AND PARITY

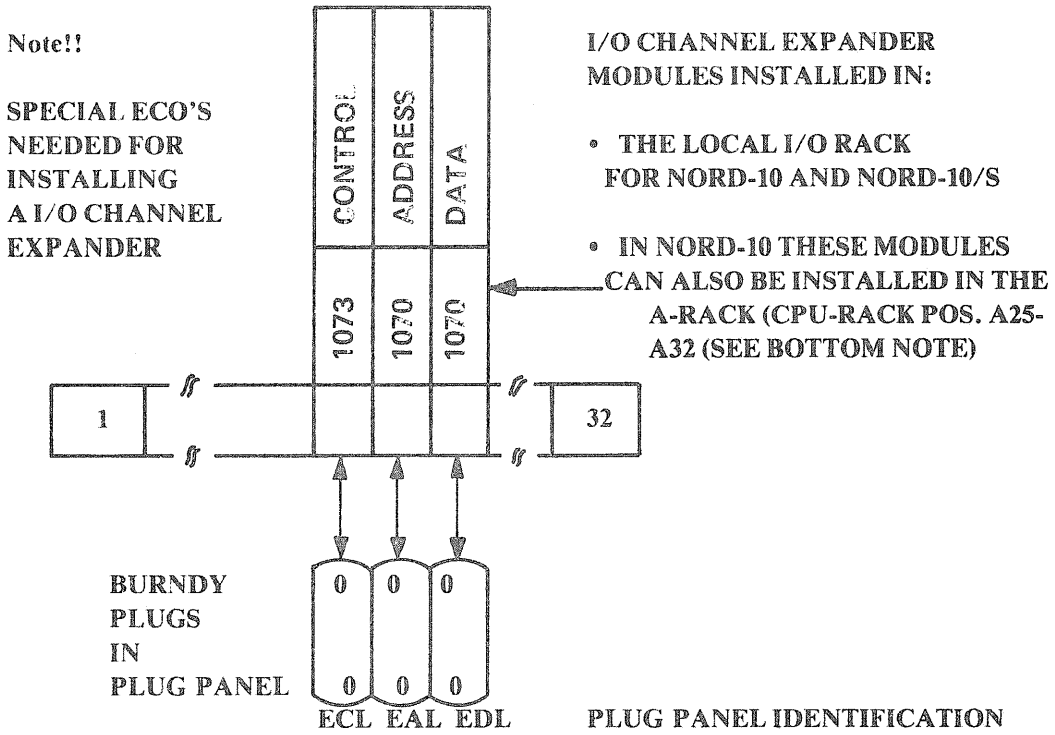
The 1024 module is tested by the TREAL-Test Program.

Note!! TREAL is described in the Test Program Description Manual.

Module 1210 is the Normal N-10/S Real-Time clock. The RTC-12 Test Program is used to test this module.

5.2.7 *I/O Channel Expander*

A schematic overview of the I/O Expander is as:



Note for NORD-10:

The address and data cable is different whether the I/O channel expander is located in the CPU or the I/O rack.

5.3 *DIRECT MEMORY ACCESS (DMA) CONTROLLERS/MASS STORAGE DEVICES*

This section contains an overview of the data-ways between the memory and the DMA Controller, DMA Controller installation precautions and a detailed drawing of the signals between the DMA Controller and the BUS-CONTROLLER module.

The various controllers are depicted with test program information.

The DMA Controllers covered are:

- Disk (Small, Big, Great-Disk)
- Mag-Tape
- Versatec Plotter
- HDLC
- CAMAC
- Universal DMA

5.3.1 *DMA Data-Ways*

Figure 5.8 shows an overview of the data-ways between the memory and the DMA Contoller. The three cases illustrated are:

CASE 1 : TO THE LOCAL MEMORY (NORMAL FOR SMALL DISKS, EXCEPTIONS FOR BIG DISKS)

DATA IS ASSEMBLED INTO 16 BIT WORDS IN THE DMA CONTROLLER AND VIA SPECIAL CABLE TO THE LOCAL I/O BUS AND THEN ONTO THE MAIN I/O BUS (1093 POS 5). THE ADDRESS FROM 1096 ONTO THE MAIN I/O BUS (1093 POS 2). RECEIVED IN THE BUS TRANSCEIVER AND PUT ON TO THE LOCAL MEMORY BUS (NO 1211 OR 1213 MODULE PRESENT)

CASE 2 : TO THE MULTIPORT MEMORY VIA THE MAIN I/O BUS (SMALL DISKS) AS FOR CASE 1, BUT NO LOCAL MEMORY. DATA AND ADDRESS IS CONVERTED TO DIFFERENTIAL LINES AND SENT TO MULTIPORT VIA THE 1211 AND 1213 MODULES.

CASE 3 : DIRECT TO MULTIPORT (NORMAL FOR BIG DISKS). THE ADDRESS IS CONVERTED TO DIFFERENTIAL LINES ON THE 1096 MODULE AND THE DATA ON THE MODULE IN POS. 8 AND SENT TO THE MULTIPORT

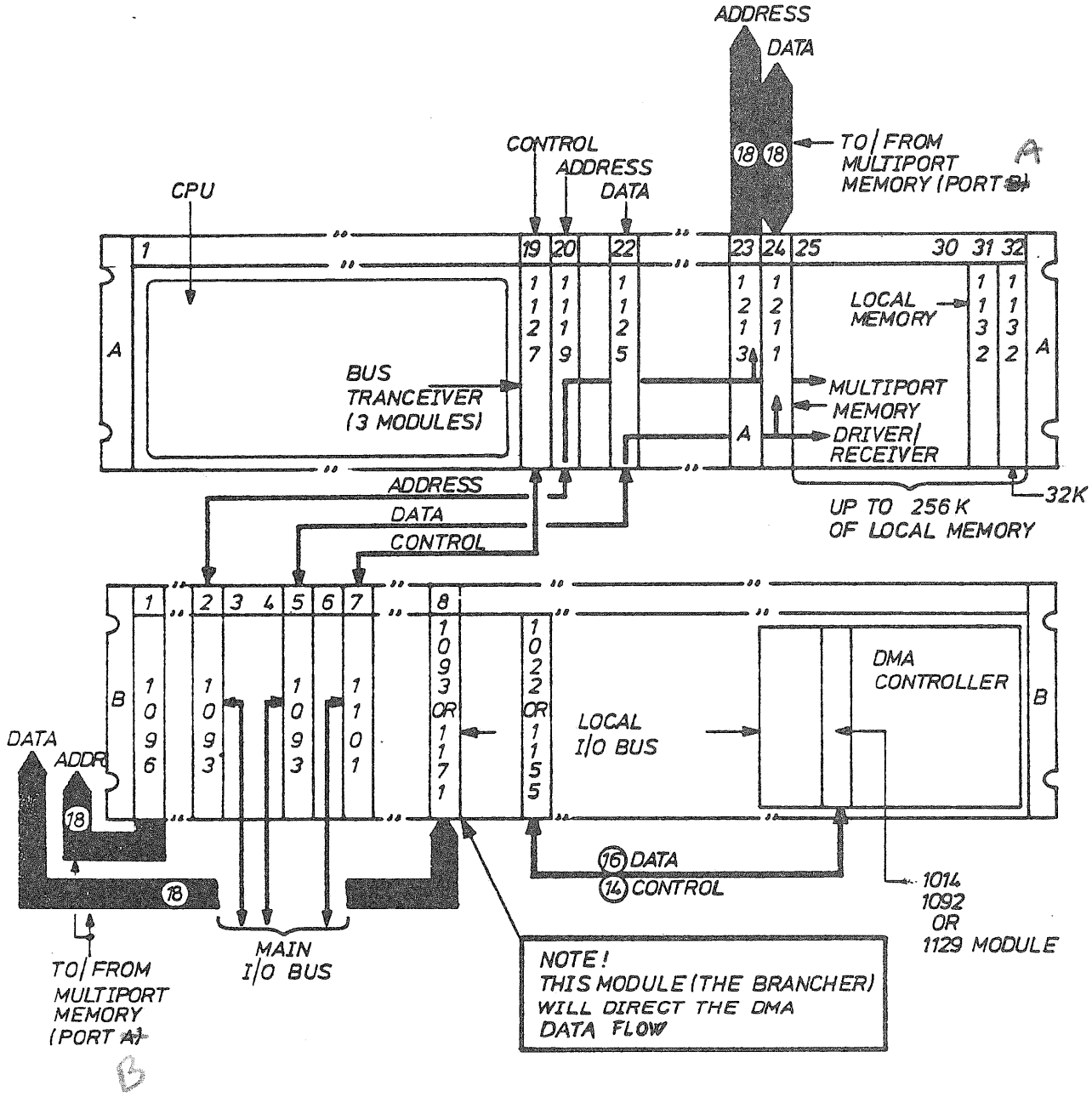


Figure 5.8: DATA-WAYS BETWEEN THE MEMORY AND THE DMA CONTROLLER

5.3.1.1 DESCRIPTION OF THE I/O MODULES FROM POSITION 1 TO POSITION 8 IN THE I/O RACK:

1096 POS 1

Only in use when DMA transfer via the Local I/O Bus of the rack.

- 16 memory address registers also called CAR. (Core Address Registers).
- If CAMAC DMA, the CAMAC has its own CAR-register.
- 18 differential multiport memory address drivers.

Note! Only in use when module is in Position 8.

1093 POS 2

- Converts the main I/O address bus to the Local I/O address bus (IOX-IDENT)
- Converts the local I/O address bus to main I/O address bus (DMA via CPU)
- Light emitting diode indicating presence of +5V.

INTERCHANGEABLE

1093 POS 5

- Converts the local I/O data bus to the main I/O data bus and vice versa.

Note: BY REMOVING THE 1093 MODULE IN POSITION 2 OR 5, THE LOCAL I/O BUS IS DISCONNECTED FROM THE MAIN I/O BUS.

1101 POS 7

LOCAL I/O BUS CONTROL MODULE.

1093 or 1171 POS 8
(THE BRANCHER)

- With this position empty, the DMA data will be routed via the main I/O bus.

  With module present the DMA data will be routed direct to/from multiport memory.
- Parity check/generate logic.
- Converts the local I/O data bus to the differencial multiport data bus and vice versa during a DMA transfer.
- The red or green light emitting diode will be turned Off if the module in Position 8 detects a parity error in the data coming from the multiport memory (module dependent).

The behaviour of the 1093 and the 1171 modules in Position 8 is slightly different. The difference is covered here.

Note! Only 1093 modules with one light-emitting diode should be installed in Position 8. (ECO:513)

1093 with 2 Diodes

- When light is turned OFF, a parity error is detected, but:

  The word with the parity error is written to the disk/mag-tape. Hardware gives no warning. The disk/mag-tape contains at least one word with wrong data so:

  - Isolate the failing module
  - Restart the system with backup

1171 or 1093 With One Diode

- The 1171 module has one read and one green light emitting diode. (1093 has only one red.) When parity error is detected the green light is turned OFF and the red light is turned ON.

  Note! The parity error word is not written to the disk/mag-tape. The core address register is not incremented and this is detected by Software.

  The SINTRAN driver does 40_8 retries. If no success, a disk transfer error message is given on the terminal.

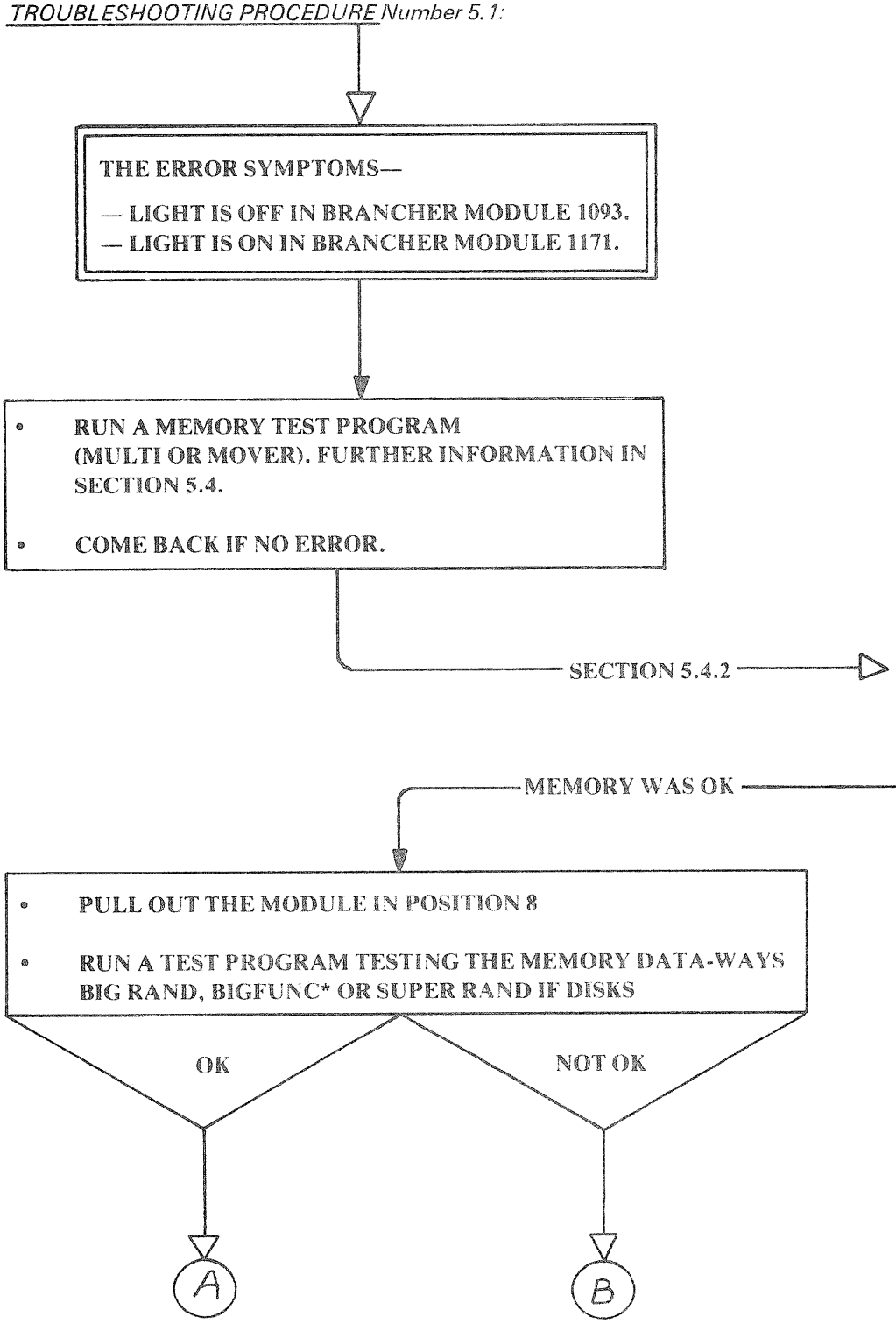
To turn ON the red or green light, push MASTER CLEAR.

Both the 1093 and 1171 modules in I/O Position 8 will generate 2 parity bits when writing to memory and check the same bits when reading from memory.

5.3.1.2 TROUBLESHOOTING PROCEDURE

When light is turned OFF in the Brancher module follow this troubleshooting procedure:

TROUBLESHOOTING PROCEDURE Number 5.1:



A

- IF 1093 MODULE IS IN POS.8, SWAP WITH MODULE IN POS.2 OR 5 AND RUN DATA-WAYS TEST PROGRAMS.
- SWAP DATA PORT MODULES FOR THE DMA WITH THE CPU IN MULTIPORT.
- SWAP ADDRESS PORT MODULES FOR THE DMA WITH THE CPU IN MULTIPORT.
- SUSPECT :

— 1171
— 1144
— 1143
— 1142

BIG MULTIPORT MODULES

B

- SUSPECT:

— 1096
— 2 X 1093
— 1101

In I/O RACK where BRANCHER is located.

* *Note:* BIGFUNC will give error on STATUS BIT 11, DMA CHANNEL error.

5.3.1.3 DMA STANDARD MODULES INTERCONNECTION

Figure 5.9 illustrates the signal distribution between the Bus Controller and the DMA control modules.

5.3.1.4 BUS CONTROLLER INSTALLATION

The following points should be noted in connection with Bus Controller installation:

- **DMA Controllers with 1014 or 1129 modules (DMA Register Modules with no Buffer). Must be located before DMA Controllers with 1092 modules (Buffered).**
- **Bus Controllers for mag tapes should be installed before disk bus controllers.**
- **HDLC should be installed before mag tapes and disks.**
- **Synchronous modem and card reader interface modules should be installed before other I/O interfaces.**

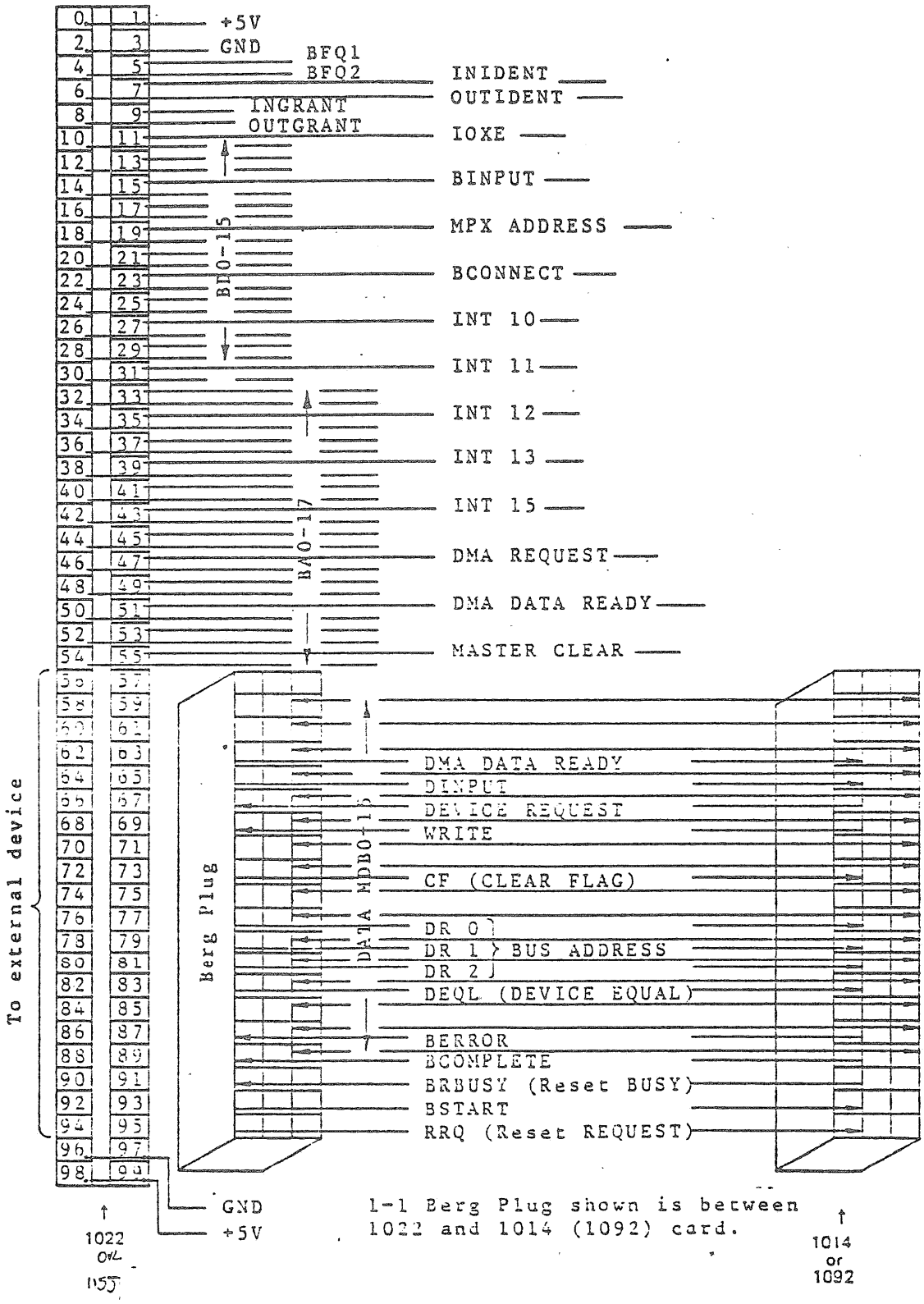


Figure 5.9: DMA STANDARD MODULES INTERCONNECTION

5.3.2 *Disks (Small, Big, Great-Disks)*

5.3.2.1 OVERVIEW OF TEST AND UTILITY PROGRAMS

Figure 5.10 shows an overview of the test and utility programs for disks.

PROGRAM	DISK TYPE	MEMORY DATA WAYS	CONT-ROLLER	UNIT	SCRATCH PACK NEEDED	
TECOD	HAWK AND FALCON DISKS	▩	▩	▩	YES	
DSERV**				▩	YES	ALIGNMENT PACK
DIMS		▨	▨	▩		
CDC-FORM				▩		
DISK-REFR				▩		
SMALL-RAND		▨	▨	▩		
BIG-RAND		▨	▨	▩	YES	
TSTAD	SMD OF 33 OR 66 M BYTES (NO ECC CONTROLLER)			▩	YES	
BIMS		▨	▨	▩		
BIGFUNC	SMD OF 37,76 OR 288 M BYTES AND BIG CARTRIDGE DISK PHOENIX (CMD) OF 30,60 OR 90 M BYTES	▨	▩	▨		
SUPER-RAND		▨	▨	▩	YES	
PASCAN*				▩		
ECC-TEST*			▩			
GREMS		▨	▨	▩		ALIGNMENT ON VERSION G AND LATER

▩ = MAIN TEST AREA

▨ = ALSO TESTED

* NOT FOR PHOENIX

** NOT FOR FALCON

Figure 5.10: OVERVIEW OF TEST/UTILITY PROGRAMS FOR DISKS

5.3.2.2 DISK TEST PROGRAMS

TECOD — 1451

Directory Name: ND-10325
User Name: FLOPPY-USER

Comments:

— Purpose - A stand-alone Hardware (HAR) Test Program to test memory and disk.

— Functions - It does this by performing six different tests:

1 Extra Blocks Test
2. Address Test
3. Disk Arm Test
4. Sector Counter Test
5. Disk Write Protect Test
6. Repeated Pattern Test

— Implementation Instructions - Refer to PD and the revision log in the NORD Software Library.

— Test Routines - Works for 10 Mbytes or Hawk disks. The protect test will not work for Hawk disks.

— Special Considerations - 1. May also be loaded and run in Banks 1, 2 and 3. Bank 1: 1B1560 &, Bank 2: 2B1560 &, Bank 3: 3B1560 &.
2. Unit tests: The program can be adjusted to emphasize the testing of the disk units or the memory. The disk units testing will be emphasized if less memory is specified. The reverse is true.

Notes:

1. Self-documenting.
2. More information in the Test Program Description Manual.

DSERV — 1395

Directory Name: ND-10325
User Name: FLOPPY-USER

Comments:

— Purpose - A stand-alone Hardware Utility Test Program (HUT) used as a disk service program for 10 Mbyte disks.

— Functions - The available commands are:
  A. Disk alignment
  B. Index to burst check
  C. Signal amplitude check and adjacent track erase check.
  D. Position Transducer Check
  E. Position Transducer Oscillator Phasing
  F. Velocity Gain Check
  G. Fine position gain check
  H. Integrator gain check
  I. Digital to analog amplifier check
  J. Odd track pulse and even track pulse
  K. On cylinder delay
  L. Pause
  N. Next check

— Implementation Instructions - Refer to the CDC Disk Maintenance Manual.

Note:

— An alignment pack is needed for alignment and index-to-burst verification.

Additional Information:

— Use restricted to ND Service Personnel.

DIMS — 1453

Directory Name: ND-10324
User Name: FLOPPY-USER

Comments:

— Purpose - A stand-alone Hardware Utility Program (HUT) for 10 Mb disks.

— Functions - CHANGE, COMPARE, COPY, DUMP, PARITY CHECK, SET, TRANSLATE, VERIFY, FORMAT and REFRESH. The principal uses of these functions are used to: FORMAT — format disk packs, COPY — copy from one disk to another (and take backup), REFRESH — refresh tracks, TRANSLATE — translate a logical address to a physical address, PARITY CHECK — for parity checking, often used in connection with FORMAT, VERIFY — compares the contents of two disk areas (memory compare), COMPARE — compares the contents of two disk areas (disk compare).

Notes:

1. DIMS means "Disk Maintenance System".
2. Self documenting.

Additional Information:

— More information in the Test Program Description Manual.
— The Test Program Monitor is a part of this test program.

SMALL-RAND — 2448

Directory Name: ND-10325
User Name: FLOPPY-USER

Comments:

— Purpose - This is a test program for testing random data on random addresses with fixed or random block lengths on CDC Hawk and Falcon Disks.

— Functions -
1. Writes and reads random data on random addresses with fixed (1 sector) or random (1 to 24 sectors) block lengths.
2. Written data is read back and verified.
3. Drives may be started and stopped independently of each other.
4. HELP command lists all commands available.

Notes:

1. Disk drives may be started and stopped independently of each other.
2. Any mixed combinations of the available disk drives may be run in test at the same time.

Additional Information:

— The Test Program Monitor is a part of this test program.

BIG-RAND — 1876

Directory Name: ND-10324
User Name: FLOPPY-USER

Comments:

— Purpose - This is a stand-alone Hardware Test Program for Big Disk Random Data and address tests.

— Functions - Used as a CDC 33 or 66 Mbytes Disk Random Address Test Program. The test includes Random Address, Random Data, and Controller and Disk Read/Write.

— Highlight - The program includes a clock.

— Implementation Instructions - Refer to PD in the NORD Software Library.

— Special Consideration - Function letters should be typed in by the operator at a slow speed. The reaction response of the program is so fast that there is a possibility that the program will misuse the second letter of a unique entry.

Notes:

1. Random data is written in random address.
2. Data is read back and verified.
3. Self-documenting.
4. Use a scratch disk.

TSTAD — 1870

Directory Name: ND-10326
User Name: FLOPPY-USER

Comments:

— Purpose - A stand-alone Hardware Test Program to check big disk addresses.

— Function - Used to check CDC 33 or 66 Mbytes Disk addresses.

— Implementation Instructions - Refer to PD in NORD Software Library.

Note:

— Uses one hour per run.

BIMS — 1871

Directory Name: ND-10324
User Name: FLOPPY-USER

Comments:

— Purpose - A stand-alone Hardware Utility (HUT) Program for big disks.

— Functions - The functions are: CHANGE, CLEAR-DEVICE, COMPARE, COPY, DUMP, FORMAT, PARITY-CHECK, REFRESH (REFORMAT), SET, TRANSLATE, and VERIFY.

— Special Considerations - Function letters (i.e., CH, CL, COM, COP, D, F, P, R, S, T and V) should be typed in by the operator at a slow speed. The reaction response of the program is so fast that there is a possibility that the program will misuse the second letter of a unique entry.

Notes:

1. Similar to DIMS and GREMS.
2. Used for CDC 33 or 66 MB.
3. Self documenting.

Additional Information:

— BIMS means "Big Disk Maintenance System".
— More information in the Test Program Description Manual.

BIGFUNC — 1824

Directory Name: ND-10324
User Name: FLOPPY-USER

Comments:

— Purpose - A stand-alone Hardware Test Program to test the status word and some disk operations.

— Functions - The following tests are done.
1. The core address register is written and read 131072 times.
2. Each of the block address registers is written and read 131072 times.
3. Data are read from the interface in test mode. The status word, the data read and the core address register are checked. Word count is in the range 1-2000B.

The status bits are then checked 8 times, in different sequences by introducing errors and then determining if these errors have been detected by the interface.

— Highlight - The alternative terminal device number function is included.

— Implementation Instructions - Refer to PD in NORD Software Library.

— Special Considerations - Reading and writing are done on a track not used by the SINTRAN III operating system, but it might still be wise to use a scratch pack when running BIGFUNC.

Notes:

1. Self-documenting.
2. The DC voltage on disk units not being tested should be turned OFF. It is not enough to activate the unit disable switch on the Disk Drive (Module A05).

Additional Information:

1. The test repeats itself indefinitely. The program will display the number of completed test cycle runs. The display is incremented at the end of each test run.
2. All errors will be reported by error messages on the terminal.
3. A description of the checking procedure for the status bits is in the manual "Error Correction Control (ECC) Disk Controller", ND-11.013.01.

SUPER-RAND — 2222

Directory Name: ND-10324
User Name: FLOPPY-USER

CAUTION: THIS PROGRAM ACTUALLY WRITES ON DISK. THEREFORE, A SCRATCH-PACK SHOULD BE USED DURING THE TEST.

Comments:

— Purpose - This is a Hardware stand-alone, random address, random data, controller and disk read/write test. The disk addresses and write data are generated by a pseudo-random number generator.

— Function - Example of Operations:
1. At disk address A, a random data pattern (i) is written from main memory.
2. At disk address B, a random data pattern (j) is written from main memory.
3. The written data at disk address A is read back and verified (against i).
4. The written data at disk address B is read back and verified (against j), and the process continues in the outlined fashion. Errors and data mismatches are reported as specified by the test at run time.

— Highlights - Options to be specified at run time:
Retries active? When retries are specified, errors are not reported if they are recoverable by the retry and recovery procedure of the test.
ECC active? If active, *correctable* data errors are not reported.
RT clock? If activated, will print out the time of day value associated with each error report.
The test runs continuously and two disk addresses can be specified and the test will then run simultaneously against both addresses.

— Implementation Instructions - Refer to PD in NORD Software Library.

Notes:

1. In the testing of Phoenix 30, 60 or 90 Mbytes the ECO no. 605 on the 1154 or the ECO no. 611 on the 1156 should be done. If this is not done the test program must allow retries. (After these ECO's, the modules should be marked "B".)
2. Similar to BIG-RAND, but used on 37Mb, 75Mb, 288Mb and PHOENIX-disks.
3. Self-documenting.
4. Use scratch disk.

PASCAN — 2226

Directory Name: ND-10326
User Name: FLOPPY-USER

Comments:

— Purpose - This is a Hardware stand-alone "PACK-SCAN" program for the disk controller with ECC. The intended primary use of the program is for Pack surface analysis.

— Functions - The program will sequentially read through the entire pack and report "hard" and "soft" errors.

There is an option to be specified prior to running the program:

"Address and Data" means that *all* address fields and data fields are read and verified.

"Data only" means that all data fields, but *not* all address fields within each track are read and verified.

— Highlights - Error Reporting:

Hard Error Displays:

1. The current logical (octal) sector address.
2. The controller status register.

Soft Error Displays:

1. The current logical (octal) sector address.
2. The address in main memory where error correction was applied.
3. The two error correction pattern words to be exclusively ORed with data at the main memory address to correct the data.

When an error is encountered and reported, the test will continue the scan until the entire pack is read and "Scan Completed" will then be reported.

— Implementation Instructions - Refer to PD in NORD Software Library.

Notes:

1. "Hard" errors are defined as any error reported in the status word of the controller *except* for a correctable error in the read data which is termed "soft" error (i.e., recoverable through the use of the ECC system).
2. Self-documenting.

Additional Information:

1. This program is also described in the manual "Error Correction Control (ECC) Disk Controller", ND-11.013.01.
2. PASCAN means Pack Scan.

ECCTEST — 2224

Directory Name: ND-10325
User Name: FLOPPY-USER

Comments:

— Purpose - This is a Hardware stand-alone diagnostic program for the disk controller with ECC.

— Functions - The test will do read and write functions to test the functions of the error correction circuitry and it is therefore required that an on-line drive with a disk pack is attached to the controller. The reading and writing are done on a track that is not used by the SINTRAN III Operating System, hence the test does not require a special scratch pack mounted.

The test will completely diagnose the 1133 pcb of the controller and associated control circuitry on other pcb's. Data records with no errors, correctable errors and uncorrectable errors are written and read-back-verified. The process is repeated many times varying the error pattern and its displacement within the data record.

— Highlights - RUN Control and Error Reporting -

The test can be run once, or looped. When in loop mode and errors occur, the test will be aborted and started from the beginning of the test again.

Errors are reported as they occur and a brief description is displayed with status word information.

— Implementation Instructions - Refer to PD in NORD Software Library.

Additional Information:

— This test program is also described in the manual "Error Correction Control (ECC) Disk Controller", ND-11.013.01.

GREMS — 2231

Directory Name: ND-10324
User Name: FLOPPY-USER

Comments:

— Purpose - A stand-alone Hardware Utility (HUT) test and utility program for 37Mb, 75Mb, 288Mb and BIG CARTRIDGE Disks.

— Functions - There are 11 functions: CHANGE, CLEAR-DEVICE, COMPARE, COPY, DUMP, FORMAT, PARITY CHECK, REFRESH, SET, TRANSLATE and VERIFY.

— Test Routine - The procedure to access System 2 (Controller 2) is: Answer X or a space when GREMS asks "from".

— Special Consideration - Function letters (i.e., CH, CL, COM, COP, D, F, P, R, S, T, and V) should be typed in by the operator at a slow speed. The reaction response of the program is so fast that there is a possibility that the program will misuse the second letter of a unique entry.

Additional Information:

— More information in Test Program Description Manual.
— GREMS means "Great Disk Maintenance System".
— When GREMS is reading from the disk, the SINTRAN driver is used and ERROR CORRECTION IS ACTIVE.

5.3.2.3 HAWK AND FALCON DISK CONTROLLERS

At Figure 5.11 is an overview of the unit interconnection for 10 Mb Controller PCB layout.

Figure 5.12 illustrates a 10 Mb Controller status word.

Figure 5.13 shows the 10 Mb Disk Controller.

Figure 5.14 is the 10 Mb Disk Controller block diagram.

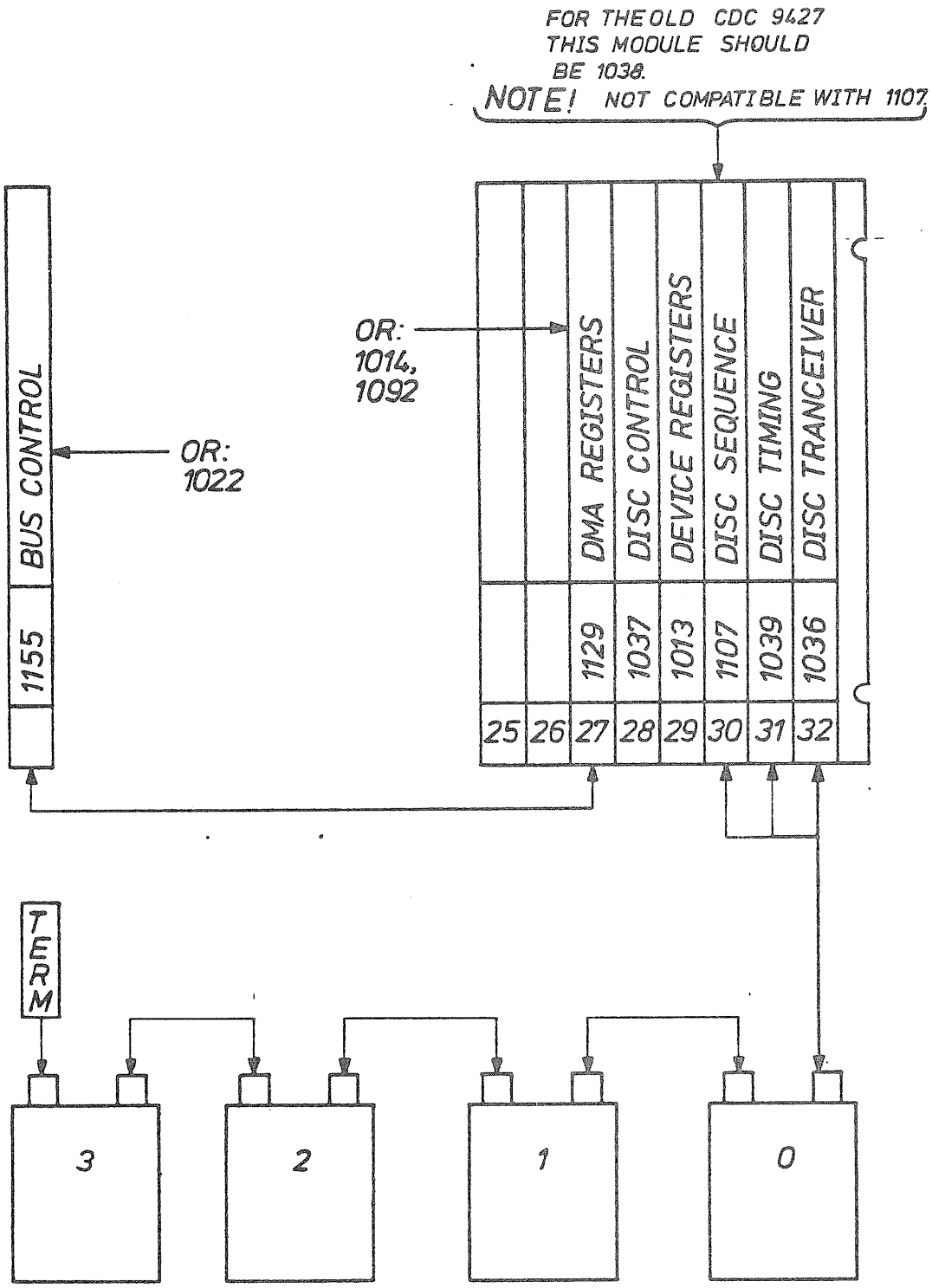


Figure 5.11: 10 M BYTES CONTROLLER PCB LAYOUT, UNIT INTERCONNECTION

The Status Register can be read by an IOX 504 instruction.

The bit assignment is as follows:

Status Word

Bit 00	**Ready for transfer, interrupt enabled**
Bit 01	**Error interrupt enabled**
Bit 02	**Device active**
Bit 03	**Device ready for transfer**
Bit 04*	**Inclusive OR of errors (status bits 5-11)**
Bit 05	**Write protect violate**
Bit 06	**Time out**
Bit 07	**Hardware error**
Bit 08	**Address mismatch**
Bit 09	**Read Parity Error**
Bit 10	**Compare error**
Bit 11	**DMA-channel error: Overrun**
Bit 12	**Transfer complete**
Bit 13	**Transfer on**
Bit 14	**On cylinder**
Bit 15	**Bit 15 loaded by previous control word**

Note!!* **If only Bit 4 is set:
Missing Read Clock (PH3)

Figure 5.12: 10 M BYTES CONTROLLER STATUS WORD

DISK SEQUENCE 1107 (Location B30)

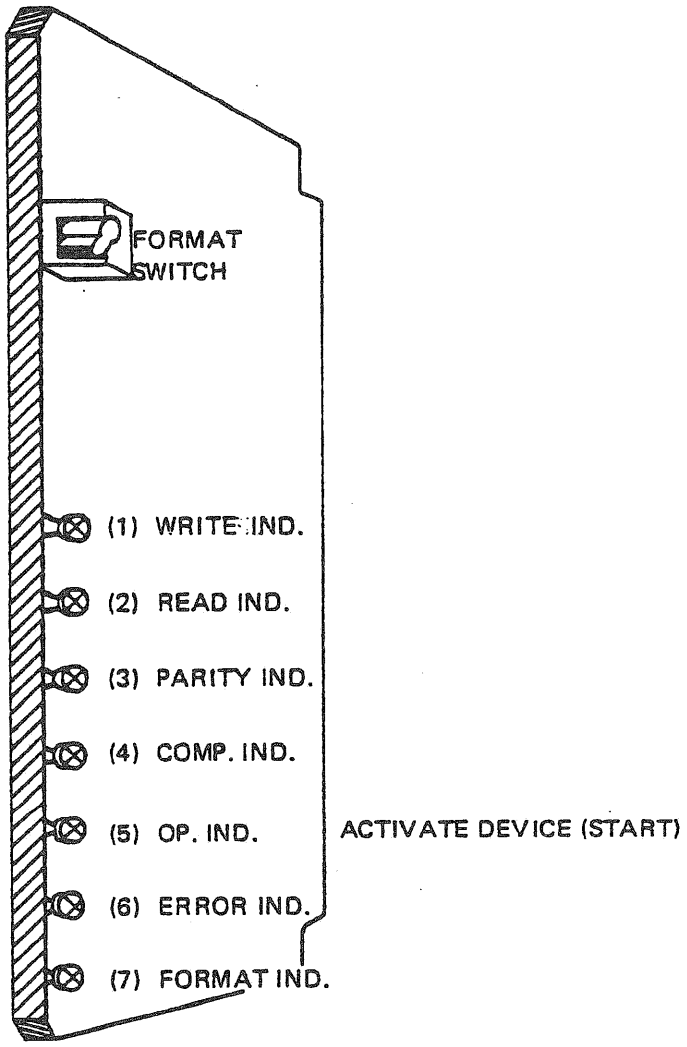


Figure 5.13: 10 M BYTES DISK CONTROLLER

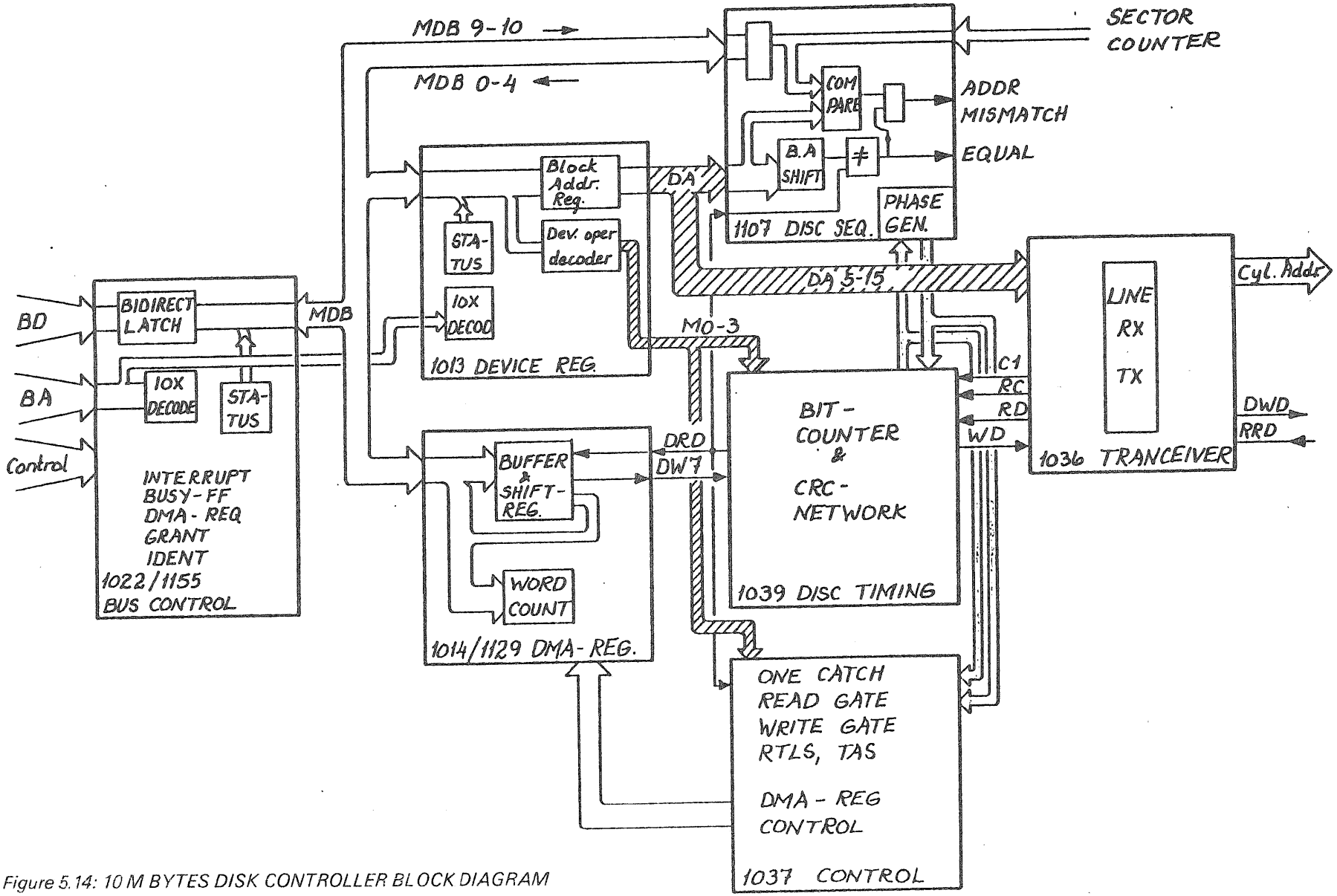


Figure 5.14: 10 M BYTES DISK CONTROLLER BLOCK DIAGRAM

5.3.2.4 33 OR 66 M BYTES CONTROLLER

Figure 5.15 is an overview for the unit interconnection in the SMD Controller PCB layout.

Figure 5.16 illustrates the SMD Controller.

Table 5.1 indicates the *Status Words* for:

- 33 or 66 M Bytes Controllers (SMD)
- 37, 76 or 288 M Bytes (ECC) Controllers
- Big Cartridge (PHOENIX)

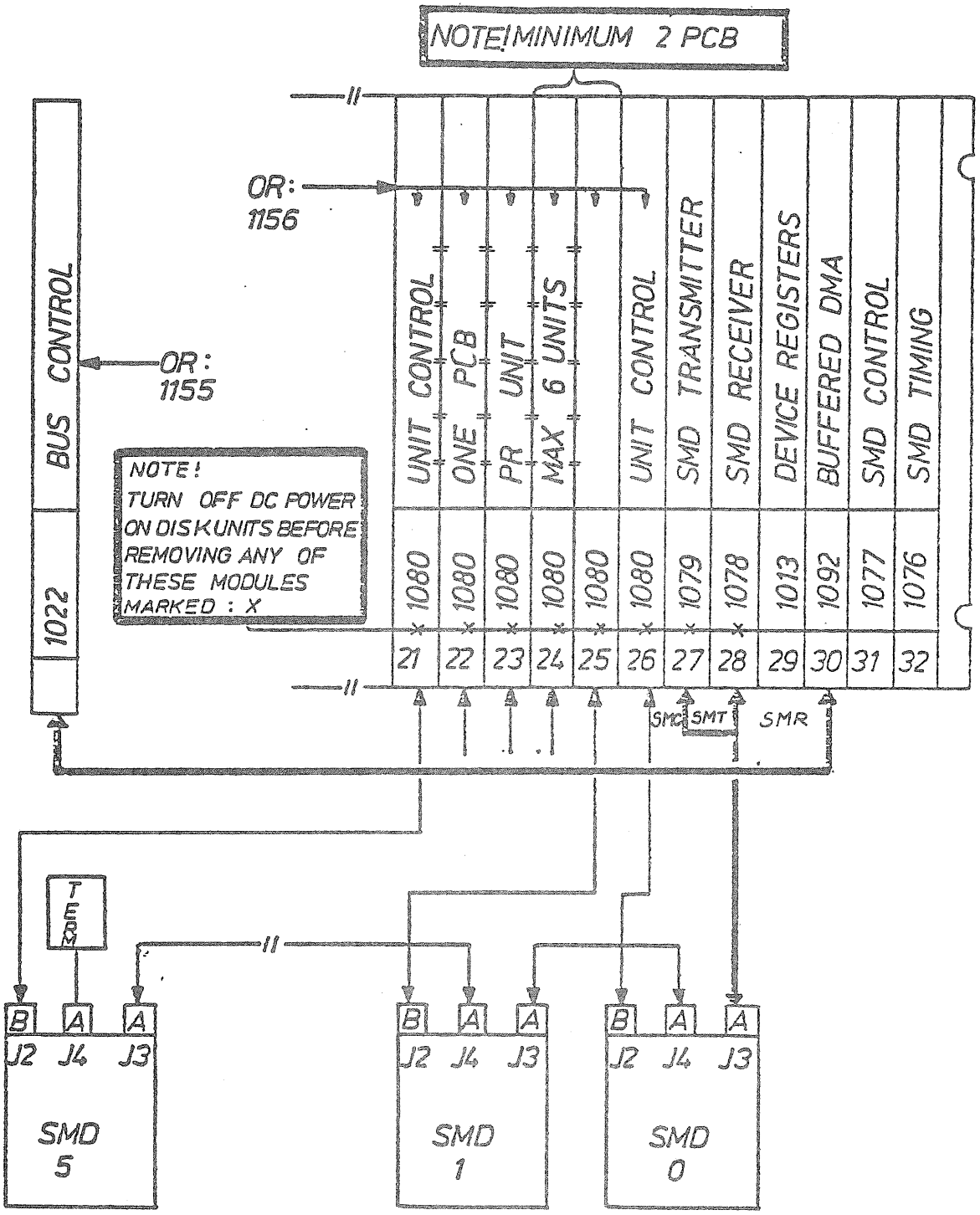


Figure 5.15: SMD CONTROLLER PCB LAYOUT UNIT INTERCONNECTION

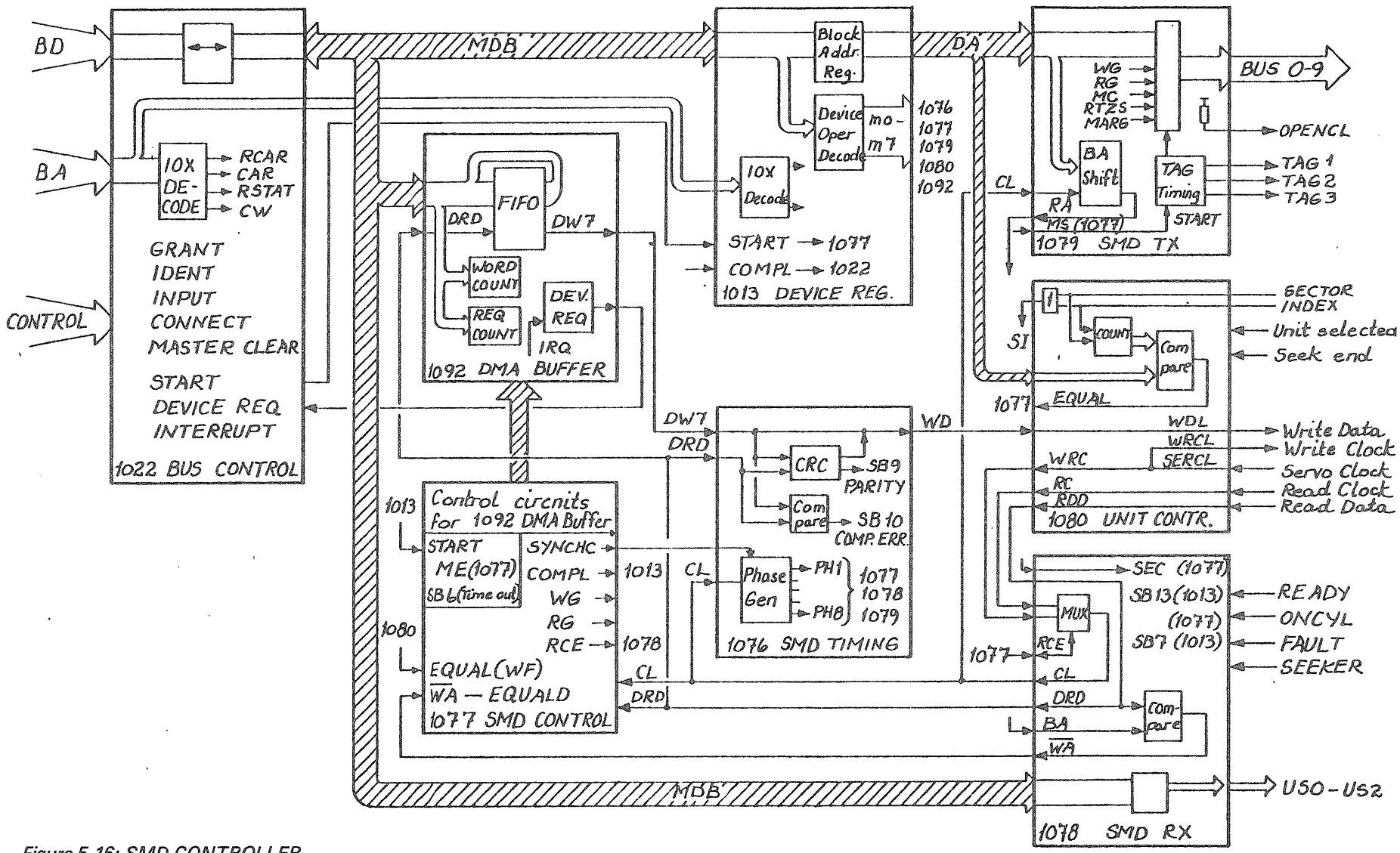


Figure 5.16: SMD CONTROLLER

Status Word

Bit 0:	**Controller not active interrupt enabled**
Bit 1:	**Error interrupt enabled**
Bit 2:	**Controller active**
Bit 3:	**Controller finished with a device operation**
Bit 4:	**Inclusive OR of errors (Bits 5-13)**
Bit 5:	**Illegal load, i.e., load while Status Bit 2 is true or load of block address while the unit is not on cylinder**
Bit 6:	**Timeout**
Bit 7:	**Hardware error (disk fault + missing clocks + missing servo clocks + ECC* parity error)**
Bit 8:	**Address mismatch**
Bit 9:	**Data error**
Bit 10:	**Compare error**
Bit 11:	**DMA channel**
Bit 12:	**Abnormal completion**
Bit 13:	**Disk unit not ready**
Bit 14:	**On cylinder**
Bit 15:	**Register multiplex bit (from CWR Bit 15)**

*** CDC Parity error for 33 or 66 M Bytes Disks**

Note!!* **CRC parity error for 33 or 66 M Bytes disks**

Table 5.1: STATUS WORDS FOR:
33 OR 66 M BYTES CONTROLLERS (SMD)
37, 76 OR 288 M BYTES (ECC) CONTROLLERS
BIG CARTRIDGE (PHOENIX)

5.3.2.5 ECC CONTROLLER

At figure 5.17 is the overview of the Error-Correcting Control (ECC) Controller Printed Circuit Board (PCB) layout for:

- 37, 76 or 2888 M Bytes Disks
- Big Cartridge (PHOENIX) Disks

At Figure 5.18 is the functional block diagram for the NORD-10/S ECC Controller.

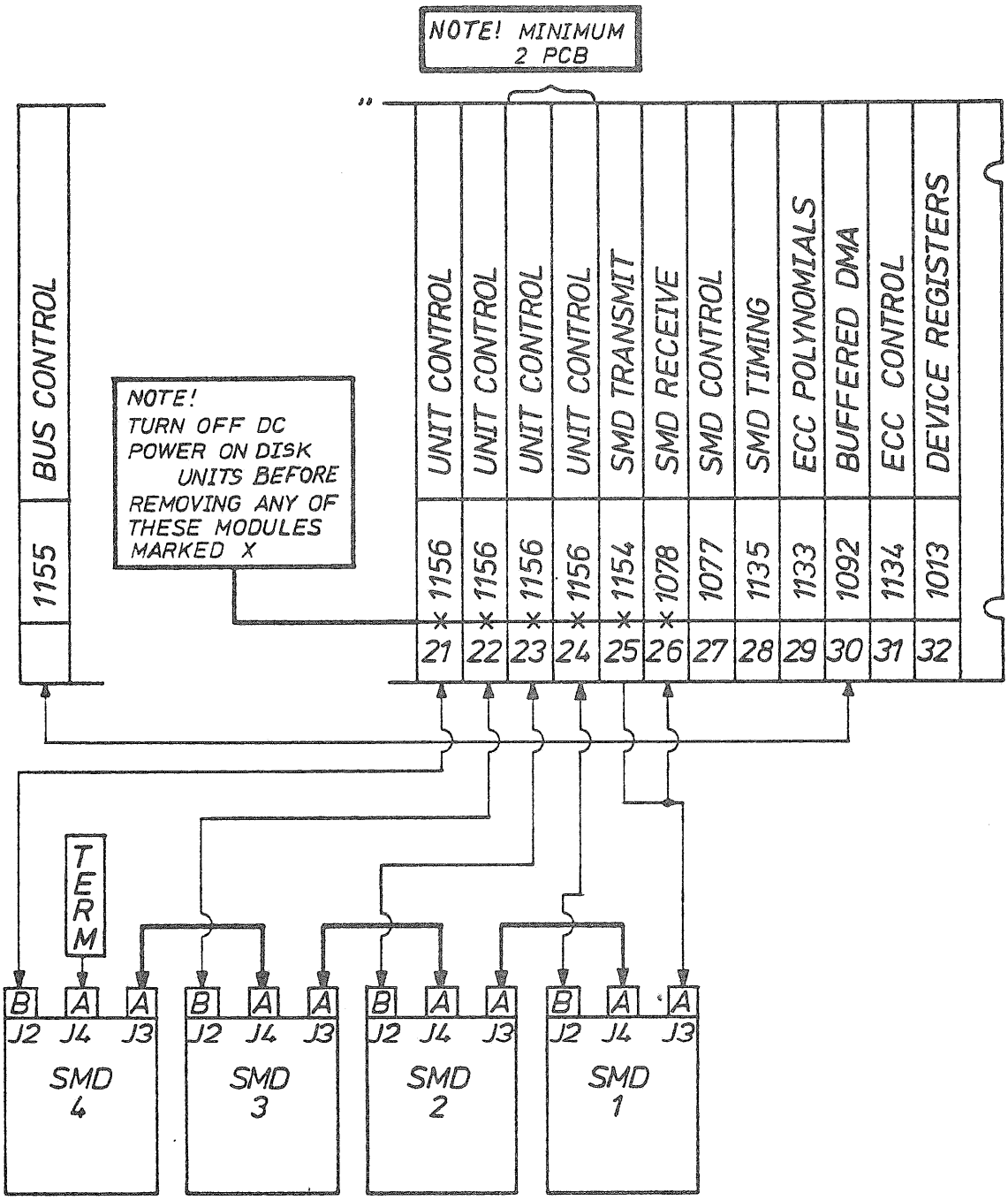


Figure 5.17: ECC CONTROLLER PCB LAYOUT, UNIT CONFIGURATION

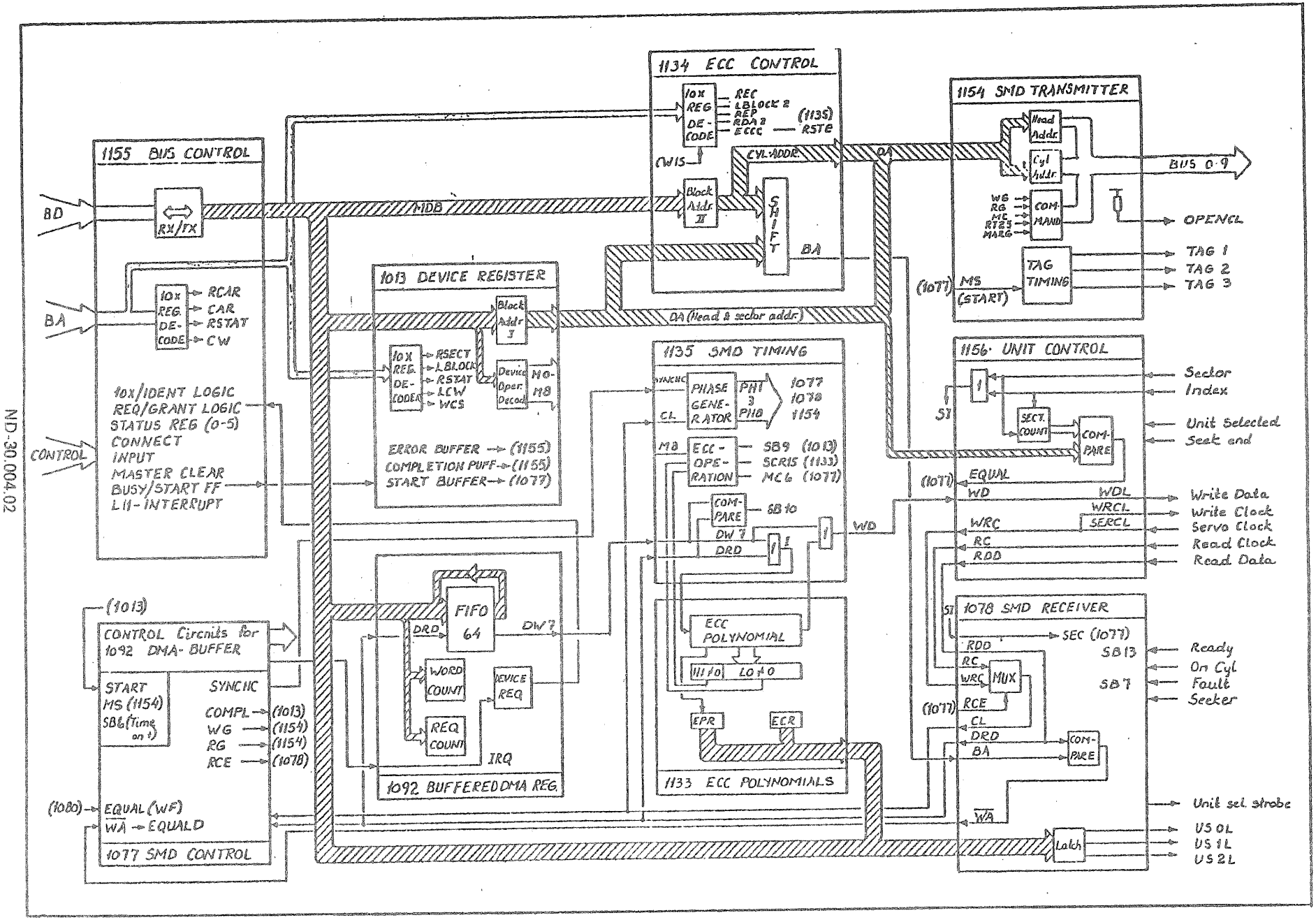


Figure 5.18: NORD-10/S ECC-CONTROLLER FUNCTIONAL BLOCK DIAGRAM

5.3.3 *PERTEC Mag-Tape Controller*

Figure 5.19 gives an overview of a PERTEC Mag Tape Controller.

5.3.3.1 TEST PROGRAM

TANB-MAG — 1559

Directory Name: ND-10324
User Name: FLOPPY-USER

Comments:

— Purpose - A stand-alone HARDWARE Tandberg magnetic tape test program.

— Functions - The program is for the Tandberg TDM Mag Tape, the Pertec 800 (ARM), and the 9000 (Vacuum) Mag Tape. Test DMA-Channel in test mode. Tests all functions.

— Implementation Instructions - Refer to PD in the NORD Software Library.

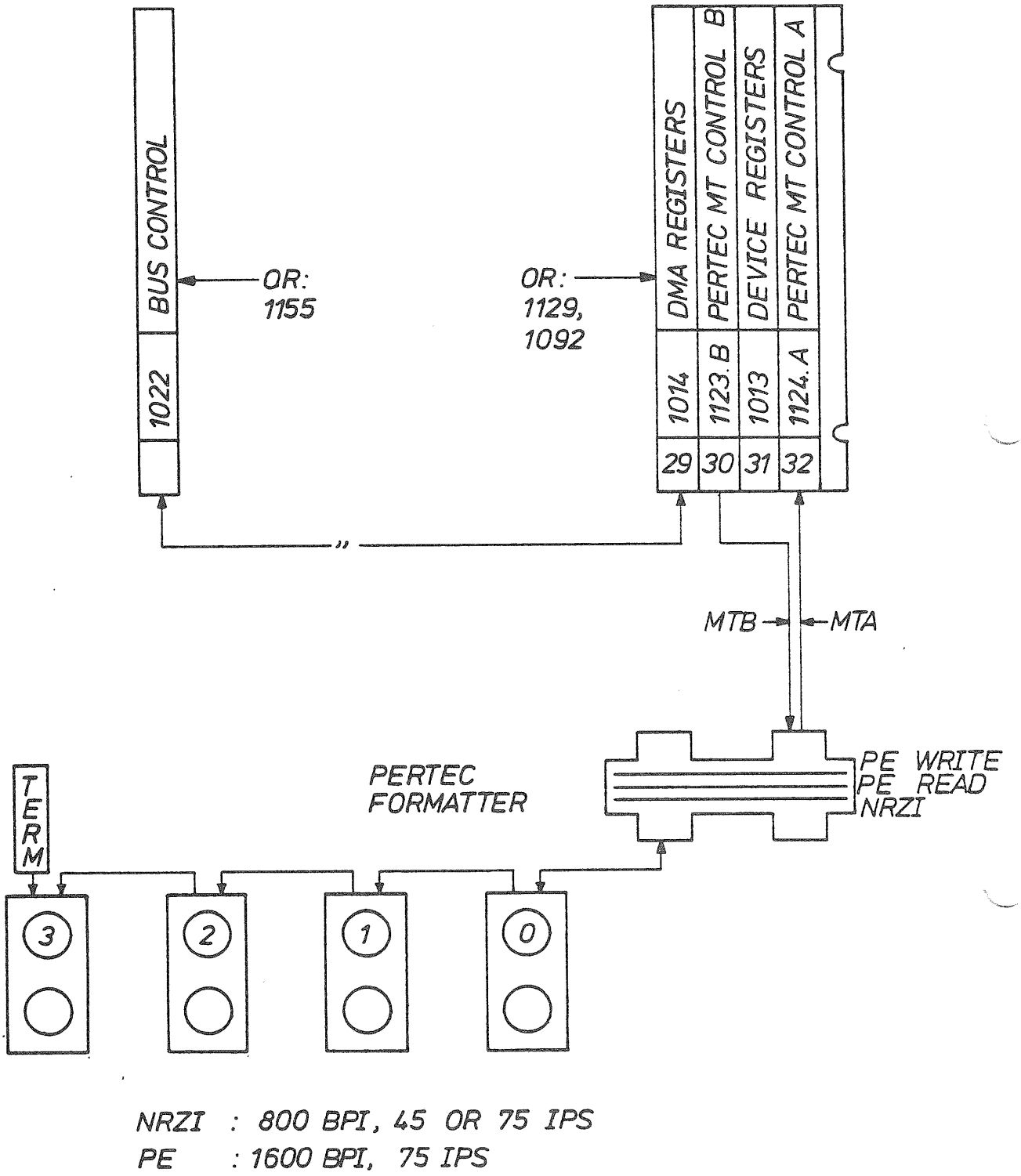
— Test Routines - The stand-alone version tests Mag Tape with the highest unit number that is on-line. If other units are to be tested, turn OFF the unit with a higher unit number.

Notes:

1. Self-documenting.
2. Headings are printed before each test is specified.
3. Error messages are self-explanatory.

Additional Information:

— ND manual, "Interface to Pertec Mag Tape With Formatter" (ND—12.012) contains information on test loops for the Pertec Mag Tape.



NRZI : 800 BPI, 45 OR 75 IPS
PE : 1600 BPI, 75 IPS

Figure 5.19: PERTEC MAG-TAPE CONTROLLER

5.3.4 *VERSATEC Printer/Plotter*

Figure 5.20 gives an overview of the VERSATEC Printer/Plotter.

5.3.4.1 TEST PROGRAM

VERSATEST — 2297

Directory Name: ND-10326
User Name: FLOPPY-USER

Comments:

— Purpose - This is a stand-alone Hardware Test Program to test the VERSATEC printer/plotter.

— Functions - Tests the VERSATEC 1100 and 1200 printer/plotters. Tests in three phases:
  1) Write
  2) Plot, and
  3) Simultaneous Plot/Write.

— Implementation Instructions - Refer to PD in NORD Software Library.

— Test Routine - Works well for the 1100 Printer/Plotter.

— Special Considerations - Can be loaded and run under SINTRAN.

Note:

— Self-documenting.

Additional Information:

— Also used with other line printers. See Section 5.2.3.1.2.

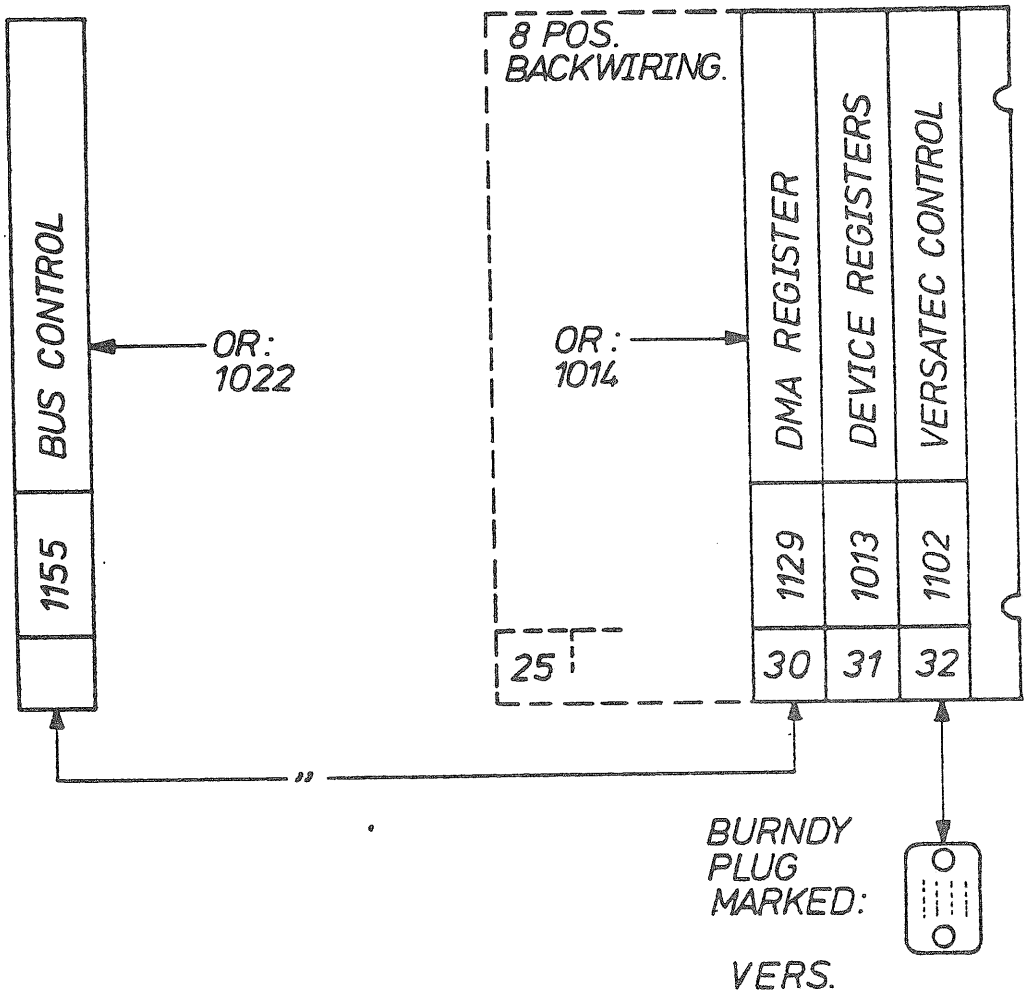


Figure 5.20: OVERVIEW OF THE VERSATEC PRINTER/PLOTTER

5.3.5 *High Level Data Link Control (HDLC)*

The HDLC Controller consists of three modules located in the local I/O Bus. They are as shown in Figure 5.21.

- HDLC I/O = 1 module (1181)
- HDLC DMA = 3 modules

Note!! The HDLC should be placed before the DMA Bus Controllers in the I/O Rack. The reason for this is that the HDLC has no buffer.

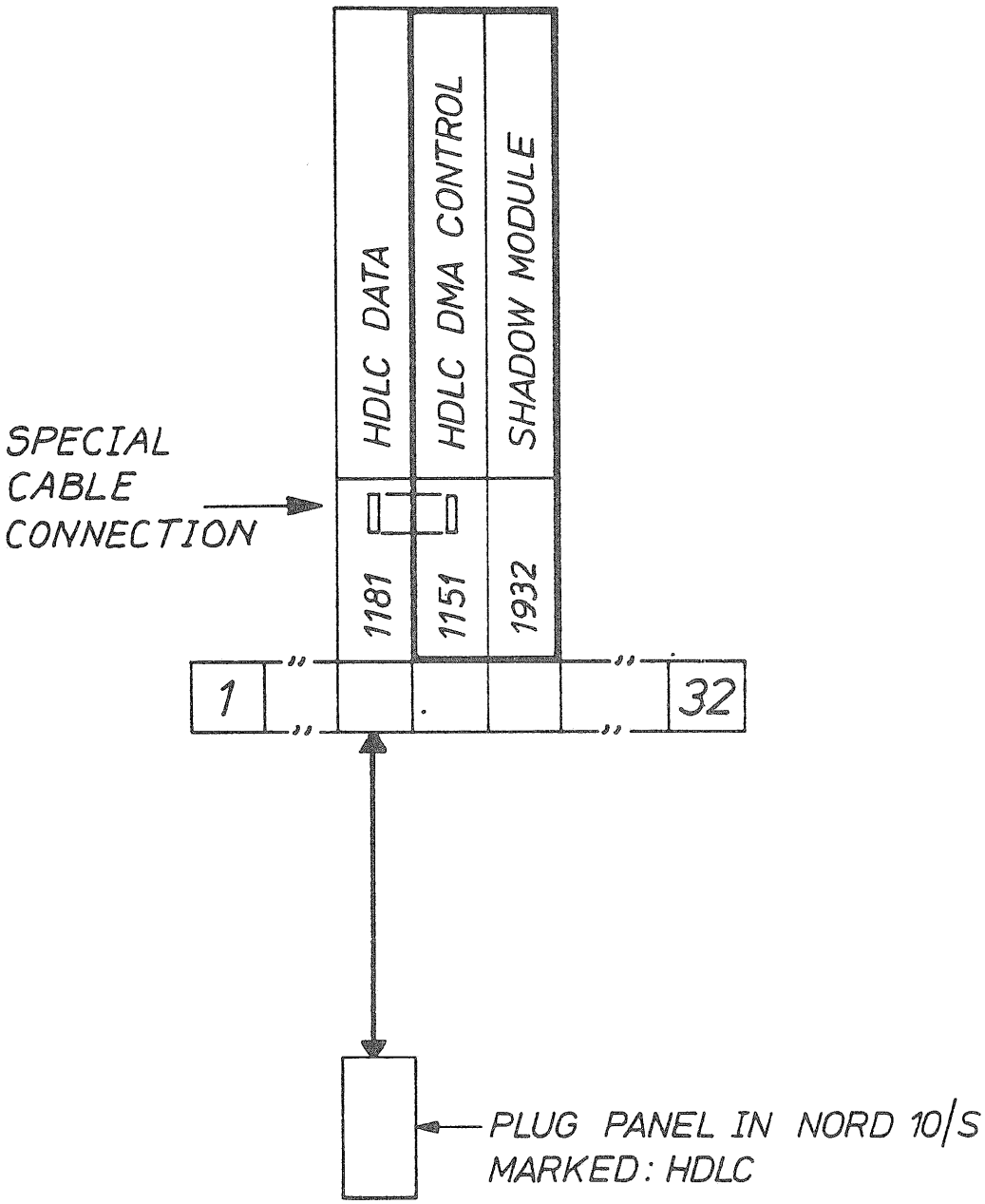


Figure 5.21: THE HDLC CONTROLLER

5.3.5.1 TEST PROGRAM

HDLC-2 — 2370

Directory Name: ND-10324
User Name: FLOPPY-USER

Comments:

— Purpose - Tests the connection between two HDLC controllers in one NORD-10/S (device no. 1640 and device no. 1660). The connection can be in accordance with V24/V.28 (RS-232C) or Intercomputer Link.

This is the HDLC Synchronous Communication Interface Test Program.

— Highlights - Runs one HDLC interface in test mode. Tests interrupt and DMA data.

Runs loop test against modem in local test mode.

— Implementation Instructions - The PD in the NORD Software Library contains the HDLC Test Program Guide.

— Special Considerations - A command is available for bit per second (BPS) speed verification.

Additional information:

1. The operator specifies the block length.
2. Statistics are given at any time.

Notes:

1. HELP command lists all commands available.
2. Command and error reports are self-explanatory.

5.3.5.2 TEST PROCEDURE FOR HDLC COMMUNICATION BETWEEN TWO NORD-10/S'S

1) **On the remote computer load HDCOMB : BPUN.**

   Note 1. **Program available on Floppy.**

   Note 2. **Program unregistered as of 9/6-80.**

   The computer goes into STOP and there is no answer on the terminal.

2) **MAKE the following patches:**

   0/ 1640 → 0 (Carriage Return)
   1/ 1660 → 1640 (Carriage Return)
   61/ CNTRW Generator
   30/ Counts frames for generator
   31/ Counts frames for echo
   101/ Pointer for R cost
   330/ Pointer for T cost
   32/70 → 0 (Carriage Return)
   33/2 → 0 (Carriage Return)
   34/70 → 0 (Carriage Return)
   35/2 → 0 (Carriage Return)

   only for information

3) **Starts the program in address 20 ; 20! or push RESTART**

4) **On the local computer**

   LOAD HDLC-2 : BPUN

   *** CH-DEV : 1640**

   MAINT : N

   *** LOOP-TEST : Each time Carriage Return is pressed, an explanatory message is printed.**

   Warning ! ! The switch must be in upper position and the light ON in systems with the DMA address extender.

   Note!! **Run the test both ways.**

5.3.6 *CAMAC**

An overview of the CAMAC interface-system is at Figure 5.22.

* CAMAC is a standard "interface"-system for connecting peripheral units to the computer. This "interface"-system has been given the international name of CAMAC. (See Appendix A - Glossary.)

5.3.6.1 DOCUMENTATION

A description of the ND-designed control module can be found in ND–12.006, CAMAC CC-NORD-10 HARDWARE.

A description of the ND-designed DMA module can be found in ND–12.004 CAMAC CDMA NORD-10 CAMAC DIRECT MEMORY ACCESS CONTROLLER, General Information.

Note!! See Appendix D, DOCUMENTATION for descriptions of manual content.

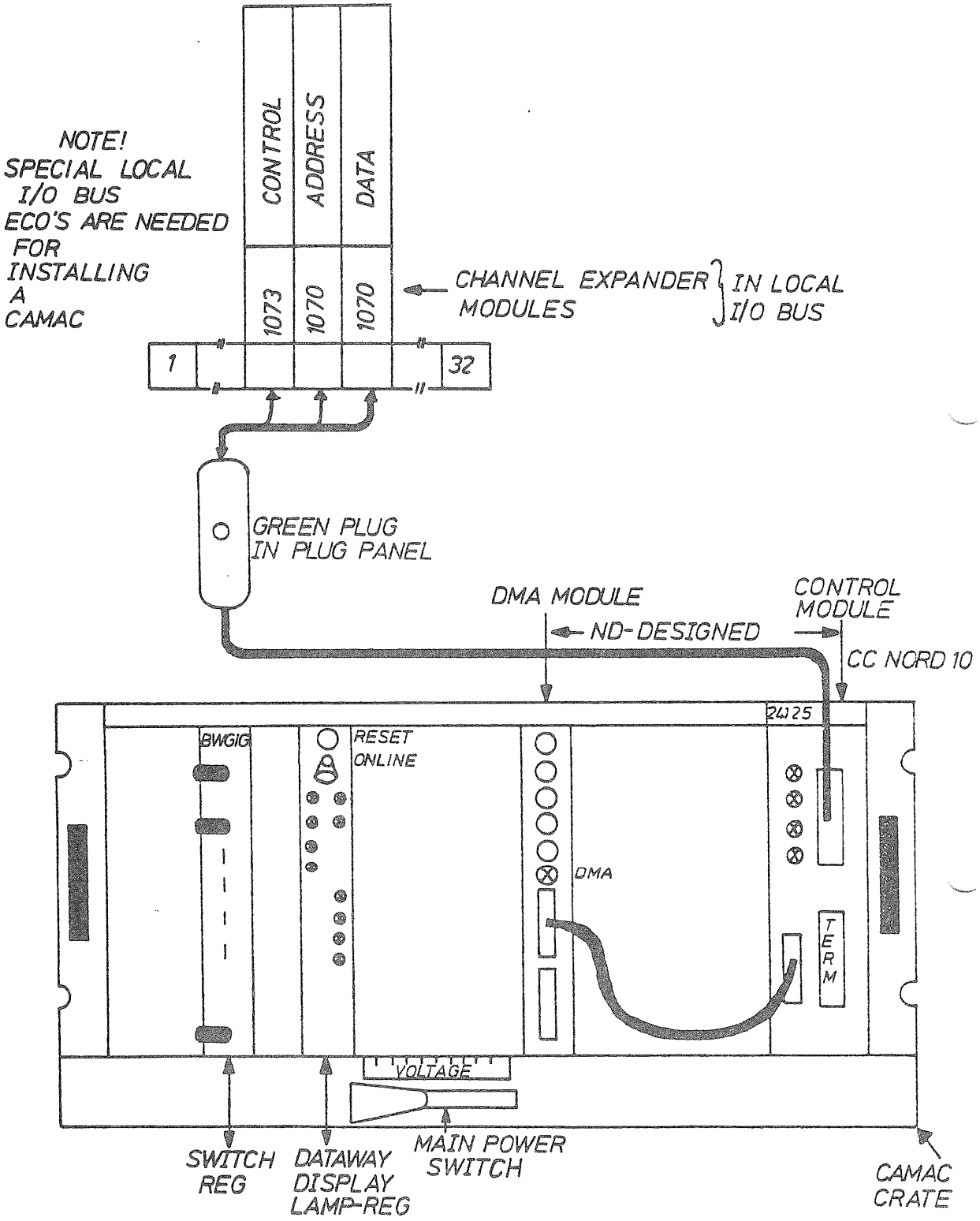


Figure 5.22: OVERVIEW OF THE CAMAC INTERFACE-SYSTEM

5.3.7 *Universal DMA*

The overview of the Universal DMA is at Figure 5.23.

5.3.7.1 MODULE DESCRIPTIONS

1168 DIFFERENTIAL DMA ADAPTOR

- CONVERTS DIFF LINES TO TTL LEVEL AND VICE VERSA (8 BITS PER MODULE)
- SUPPLIES DATA TO/FROM THE 1172 MODULE
- COMPLETELY DATA TRANSPARENT

1172 UNIVERSAL DMA INTERFACE

- IOX/IDENT CONTROL LOGIC (INTERRUPT LEVEL 11)
- REQUEST/GRANT LOGIC FOR DMA TRANSFER
- HANDSHAKE LOGIC FOR COMMUNICATION TO/FROM USER (EXTERNAL) EQUIPMENT
- WORD COUNTER OF 16 BITS
- BOTH PIO AND DMA DATA TRANSFER

Note!! See UNIVERSAL DMA INTERFACE ND850/851 Manual Publication No. ND—12.020.01.

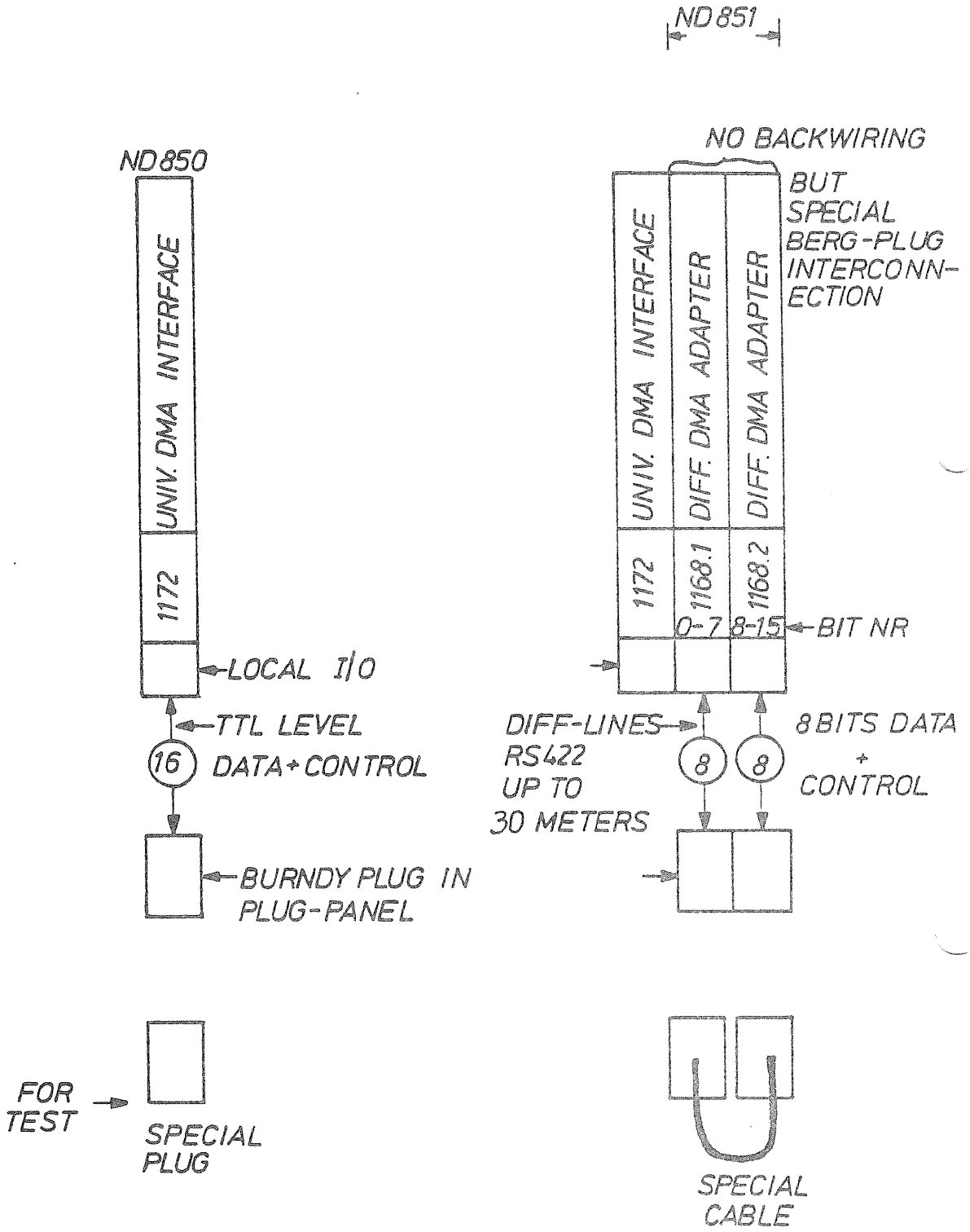


Figure 5.23: OVERVIEW OF THE UNIVERSAL DMA

5.3.7.2 TEST PROGRAMS

S1172-HAR-2235

Directory Name: ND-10326
User Name: FLOPPY-USER

Comments:

— Purpose - Stand-alone Hardware Test Programs for 1172 Universal DMA Interface single card test.

— Functions - Tests one single 1172 Module with Special Test Plug, or tests one 1172 and two 1168 modules with special test cable betweeen the two 1168 modules.

— Implementation Instructions - Refer to PD in the NORD Software Library. Refer also to the Test Programs for ND-850/ND-851 manual, ND-62.010.

DS1172 — 2282

Directory Name: ND-10325
User Name: FLOPPY-USER

Comments:

— Purpose - Stand-alone Hardware Test Programs for 1172 Universal DMA Interface two card test.

— Function - Tests double set of Universal DMA Interfaces with Differential Transceivers 2 x (1172 + 2 · 1168).

— Implementation Instructions - Refer to PD in the NORD Software Library. Refer also to the Test Programs for ND-850/ND-851 manual, ND-62.010.

Notes:

1. Special test cable pair needed.
2. The two 1168 modules should be interchanged to test the whole 16-bit word.

5.4 *MEMORY*

This section describes the hardware modules in use in the two multiport memory systems available - the Big (NEW) and the "OLD" Multiport Memories. The section also contains:

- an overview of the memory test programs
- information about failing memory module(s) identification
- address module switch setting in the NORD-10/S - NORD-50 configuration
- additional helpful hints.

5.4.1 *Multiport Memory System*

5.4.1.1 BIG MULTIPORT MEMORY

Figure 5.24 shows the overview of the Big Multiport Memory.

5.4.1.2 BIG MULTIPORT MEMORY MODULES

1132 : 32K RAM

- **MOS Memory module of 32K x 21 bits.**
- **21 RAM IC's of 16K accessed with even addresses.**
- **21 RAM IC's of 16K accessed with odd addresses.**

  Note!! **The address range of the module is set in the backwiring.**

1142 : MPM ADDRESS

- Lower/upper address range limit switches (octal) (resolution is 32K).
- 21 differential line receivers for address.
- Address range compare logic.

  Note!! LOCAL ADDRESS = SOURCE ADDRESS — LOWER LIMIT.

1143 : MPM DATA

- 18 differential line drivers/receivers for DATA.
- Local tristate DATA bus transceivers (21 bits).
- Parity generate/check/single bit error correct circuits.

1144 : MPM CONTROL

- Priority network for local data and address bus allocation.
- Time-out logic (10 μs).
- MOS Memory refresh logic.

1145 : MPM ERROR LOG

- NORD-10/S service channel interface module in multiport.
- Error log of 512 X 1 bit.

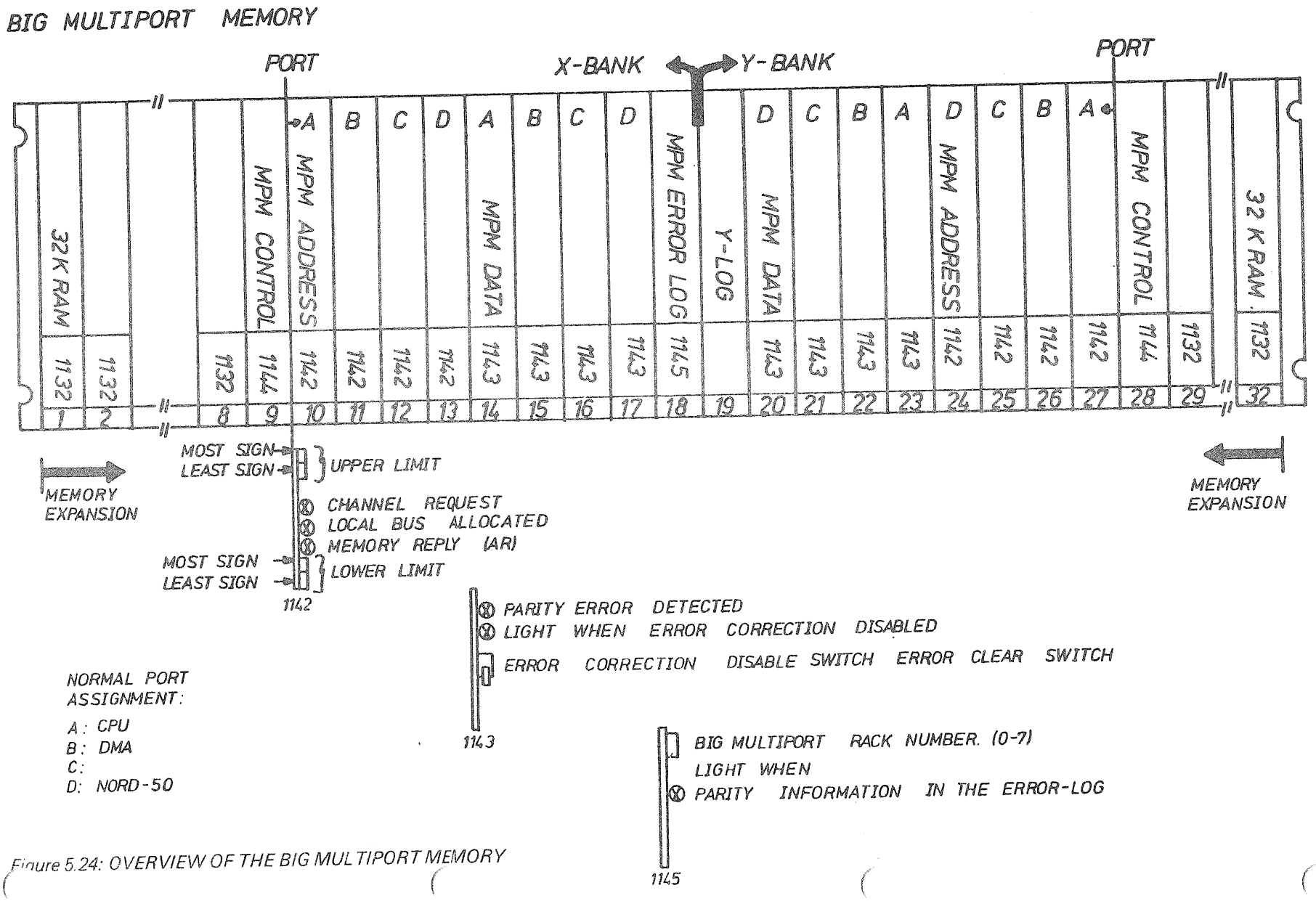


Figure 5.24: OVERVIEW OF THE BIG MULTIPORT MEMORY

5.4.1.3 "OLD" MULTIPORT MEMORY

Figure 5.25 shows the overview of the "Old" Multiport Memory.

5.4.1.3.1 "OLD" Multiport Memory Modules

1081 MPM DATA LINE DRIVER

- **18 differential line drivers/receivers for DATA.**
- **18 tristate line drivers/receivers connected to the X-bank data bus.**
- **18 tristate line drivers/receivers connected to the Y-bank data bus.**
- **Differential line drivers for DATA-AND ADDRESS READY signals.**

1083 MPM ADDRESS LINE DRIVER

- **18 differential line receivers for ADDRESS**
- **X-bank address range (UPPER, LOWER LIMIT-X-BANK)**
- **Y-bank address range (UPPER, LOWER LIMIT-Y-BANK)**
- **Address-range compare logic. Request to X or Y-bank or to none (to another crate).**
- **LOCAL ADDRESS = SOURCE ADDRESS - LOWER LIMIT.**

1089 MPM REFRESH

- **X and Y-bank refresh circuits (oscillator, counter drivers)**
- **Refresh request to X and Y-bank simultaneously each 32 μs.**

1090 MPM CONTROL

- Priority network for local address and data bus allocation
- Time-out logic.

1094 8K RAM

- 18 RAM IC's of 4K accessed with even address
- 18 RAM IC's of 4K accessed with odd address
- Note!! The address range of the module is defined by position coding in the backwiring.

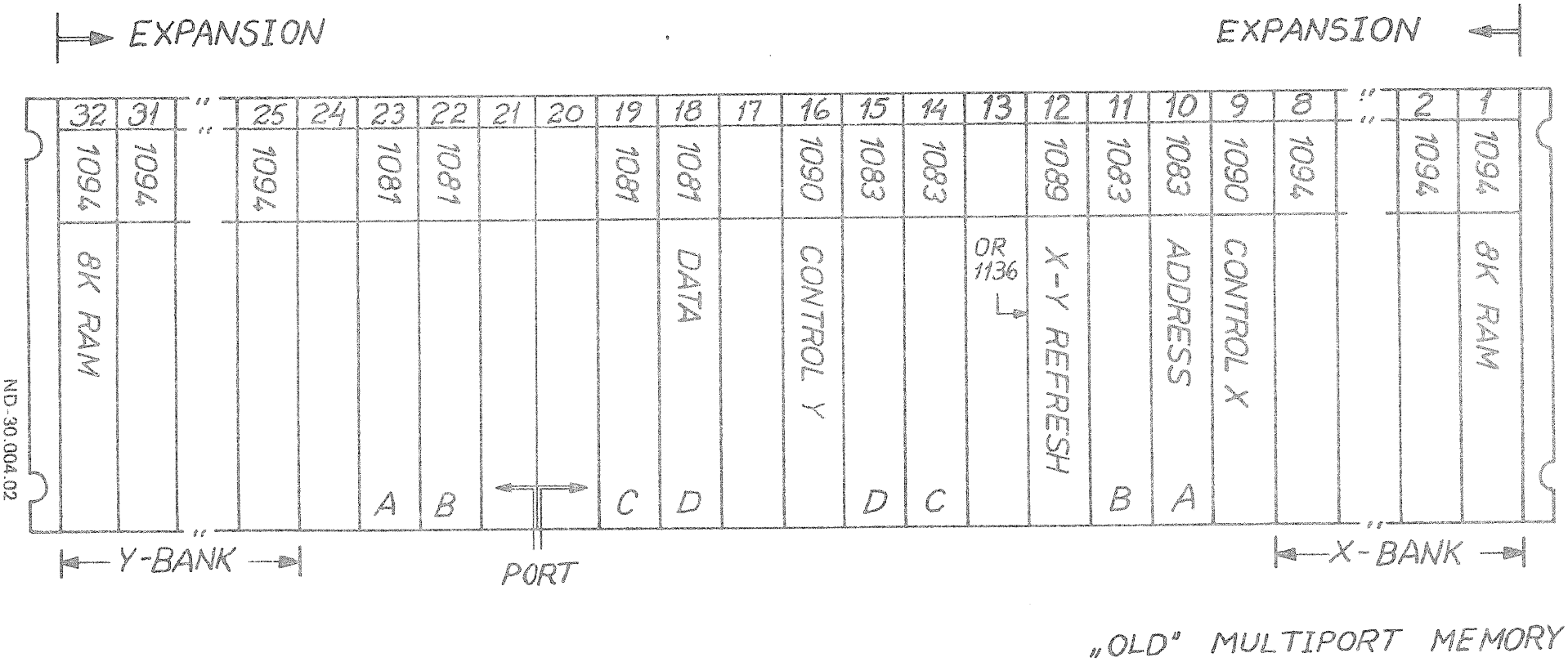


Figure 5.25: OVERVIEW OF THE "OLD" MULTIPORT MEMORY

ND-30.004.02

5.4.2 *Memory Test Programs*

Four memory test programs are described below. Test Program 1 is microprogrammed and resides in the ROM-Memory on Module 1023 or on Module 1167. Tests 2, 3, and 4 are all on Floppy-Disks and are in the ND-10324 Directory.

Test Program 1

MICROPROGRAMMED MEMORY TEST

Comments:

— Purpose - A special test program that tests the main memory.

— Functions-
  1) Tests the Memory Data-Path.
  2) Tests the address lines in address test.

— Highlight - The special program with the NORD-10 microprogram used to test the main memory is a very useful feature. When this special program is used it may quickly be determined whether a given error is caused by the CPU or by the memory.

— Implemenation Instructions - Refer to Chapter 7, "NORD-10 Verification Programs", ND-62.006.01.

— Test Routines - The use of this program is dependent on the ALD Register.

Notes:

1. The program resides in the ROM-Memory Module 1023 or on Module 1167.
2. Table 5.2 is an overview of the test procedure for testing the various memory banks.

Additional Information:

— Section 4.6.2 contains useful information on running this program and on interpretation of Error Messages.

MEMORY BANK	ADDRESS RANGE	STARTED FROM THE TERMINAL WITH:	
0	0- 64k	0B101657$	0B102025$
1	64-128k	1B101657$	1B102025$
2	128-192k	2B101657$	2B102025$
3	192-256	3B101657$	3B102025$
		WHEN 1k PROM MODULE:1023	WHEN 4k PROM MODULE:1167

1 : Set the start and end address via the operator's panel.

2 : Set 101657 or 102025 → ALD-Register on the panel control module (1033 or 1121).

3 : Push LOAD.

Notes:

— 1 No internal memory test if 32 BITS floating PROM (only 1023).

— 2 The microprogrammed memory test program may be run without using the terminal (in case of an error).

Table 5.2: OVERVIEW OF MEMORY BANK TEST PROCEDURE

Test Program 2

MULTI - 1820

Directory Name: ND-10324
User Name: FLOPPY-USER

Comments:

— Purpose - A stand-alone Hardware Test Program used to test the memory and POWER FAIL RESTART (if the panel is locked).

— Functions-
  1) Tests all available memory (1 to 4 banks).
  2) Maps the memory on the terminal.
  3) Runs all DMA interfaces in Test Mode. Memory read from all banks.

— Implementation Instructions - Refer to PD in the NORD Software Library.

— Test Routines - If Pertec mag tape, either load a tape and put it on line, or turn OFF the power on the formatter.

Notes:

1. If power fail occurs and if the PANEL was locked, the program will continue to test where it was interrupted.
2. The test may be used with Module 1095 or Module 1122 as Terminal 1.
3. MULTI reads from DMA devices in test mode. (It may be best to STOP the disk/drum, although this may not be necessary.)
4. If a DMA parity error is detected:
   — the light on the Brancher Module (Position 8) will be turned OFF, or
   — the red light will be turned ON if the 1171 Module is used.
5. It is possible to test for underrun on DMA devices.

Additional Information:

— If a NORD-50 is being used with the NORD-10/S and if it is connected with a running memory test program, it will be activated. The paging and interrupt system must be working. The CACHE will be disabled.
— The program asks for Terminal Speed for use in the Power Fail/Restart Test. The Power Failure/Restart is included in MULTI. A power failure is simulated by removing the AC input.
— Test 4 within MULTI tests the Monitor-Call instruction and the NORD-10/S interrupt system.
— Printouts:
  PEA = Parity Error Address Register.
  PES = Parity Errror Status Register (This is "failing" data.)
— MULTI uses about 20 minutes for each bank. The program will run until the computer is stopped.
— The program can only be loaded and run in Bank 0 (0-64k).

Test Program 3

MOVER — 1863

Directory Name: ND-10324
User Name: FLOPPY-USER

Comments:

— Purpose - This is a Hardware Test Program for checking the memory. It runs stand-alone or under SINTRAN III.

— Functions - This memory test moves around in the memory. The memory is tested by storing patterns and reading them back. The memory is supposed to be contiguous, from address 0 up to the maximal address. The program consists of one block of 0400 words.

— Implementation Instructions - Refer to PD in the NORD Software Library.

— Special Considerations - The program will run under SINTRAN III. See Table 5.3 for a highlight comparison of MOVER running alone or under SINTRAN III.

Note:

— Self-documenting.

STAND ALONE	UNDER SINTRAN
• Tests 1 Bank at the time. Resides from address 1-2735. The program must be LOADED and RUN in the bank to be tested. • Excellent for testing the page index tables. Addresses (177400-177777). • The interrupt or paging system is not turned ON. • The error correction network is disabled.	• Tests the swapping area of the memory. • The logical address space of 64k may be tested. • Load procedure from floppy disk (Unit 0): @ E-D ND F-D-1 0 @ LOAD (ND:F-U) MOVER

Table 5.3: HIGHLIGHT COMPARISON OF MOVER RUNNING ALONE OR UNDER SINTRAN III

Test Program 4

T8KMOS — 1821 (and)
MPM-MAIN — 2177

Directory Name: For T8KMOS-1821 : ND-10325
For MPM-MAIN-2177 : ND-10324
User Name: FLOPPY-USER

Comments:

— This memory test program is called Memory Test Program T 32K.

— The memory test program T32K consists of two programs:

  — The T8KMOS Memory Test Program.

  — The MPM-MAINTENANCE Program.

— Purpose - T8KMOS is a stand-alone Hardware Test Program to check MOS memory modules.
MPM-MAINTENANCE is a stand-alone Hardware Test Program for scanning the big multiport memory error log.

— Functions - The MPM-MAINT Test Program will record errors found by the error correction system in big multiport memory when such a command character is typed on terminal 1. A maximum of 64 different errors can be recorded. Each error can be recorded up to 2048 times without overflow in the error counter.

— Implementation Instructions - Refer to the PD's in the NORD Software Library.

— Test Rountines - Figure 5.26 shows the MPM-MAINTENANCE Test Program Flow Diagram. When running the test program, the Error Log is read at the end of each test and transferred to an accumulated error file in the memory. Section 5.4.2.1 gives the procedure for reading the Error Log.

— Special Considerations - During the 1980's, the Error Log will be readable from a subsystem under SINTRAN.

  — Commands available:
    I : Clear error log and error file.
    C : Clear accumulated error file.
    R : Scan error log and accumulate error in error file.
    D : Display content of error log.
    P : Print accumulated error file.
    H : List commands (HELP).

Notes:

1. Self-documenting.
2. Command characters listed on terminal printout.

Old Versions:

— Earlier paper tape versions use Load-400&.

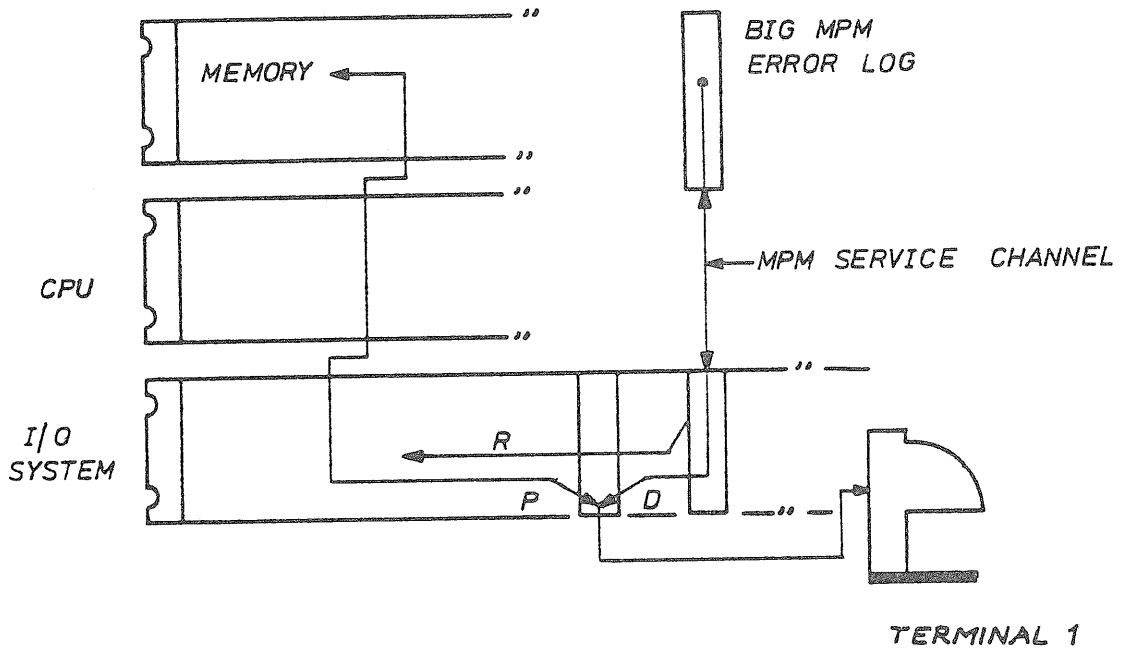
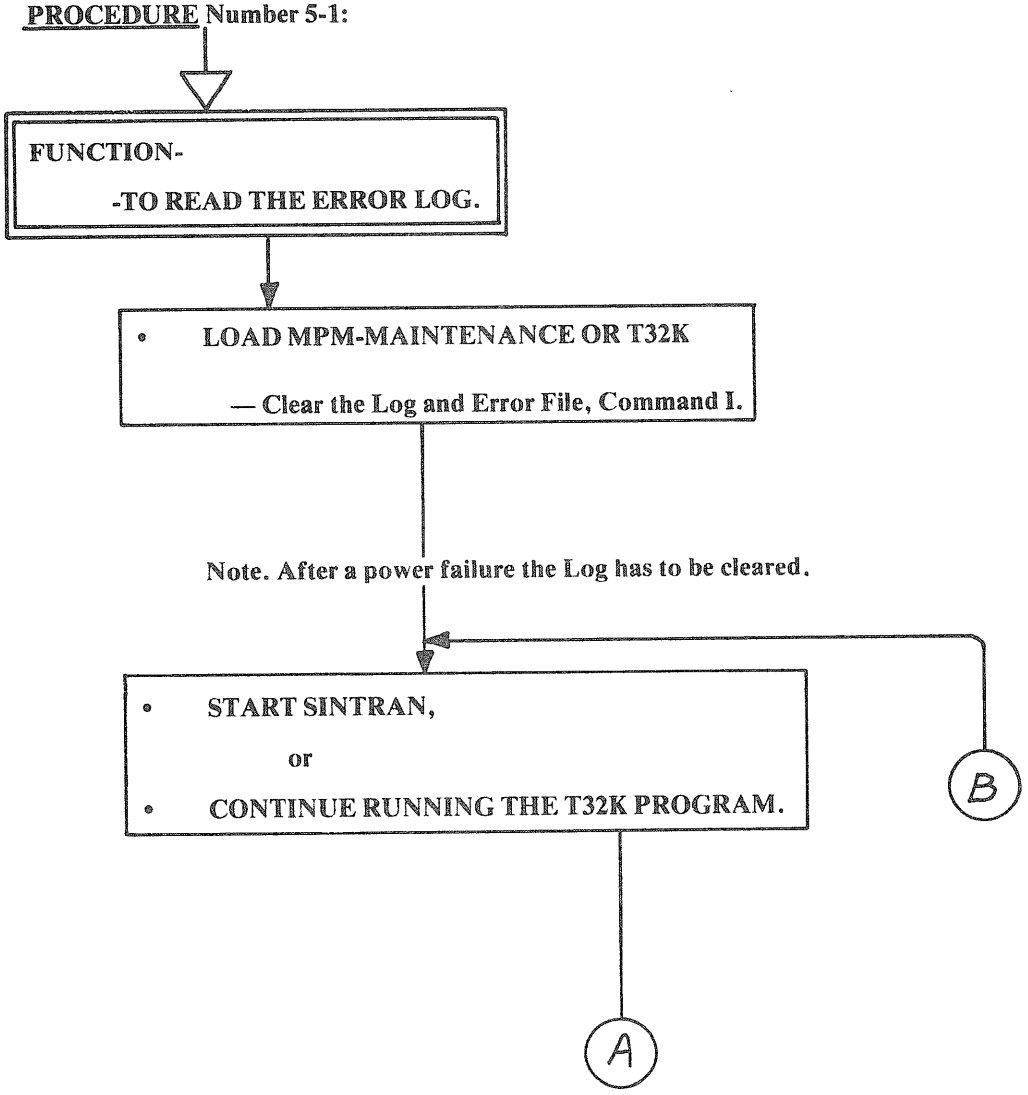


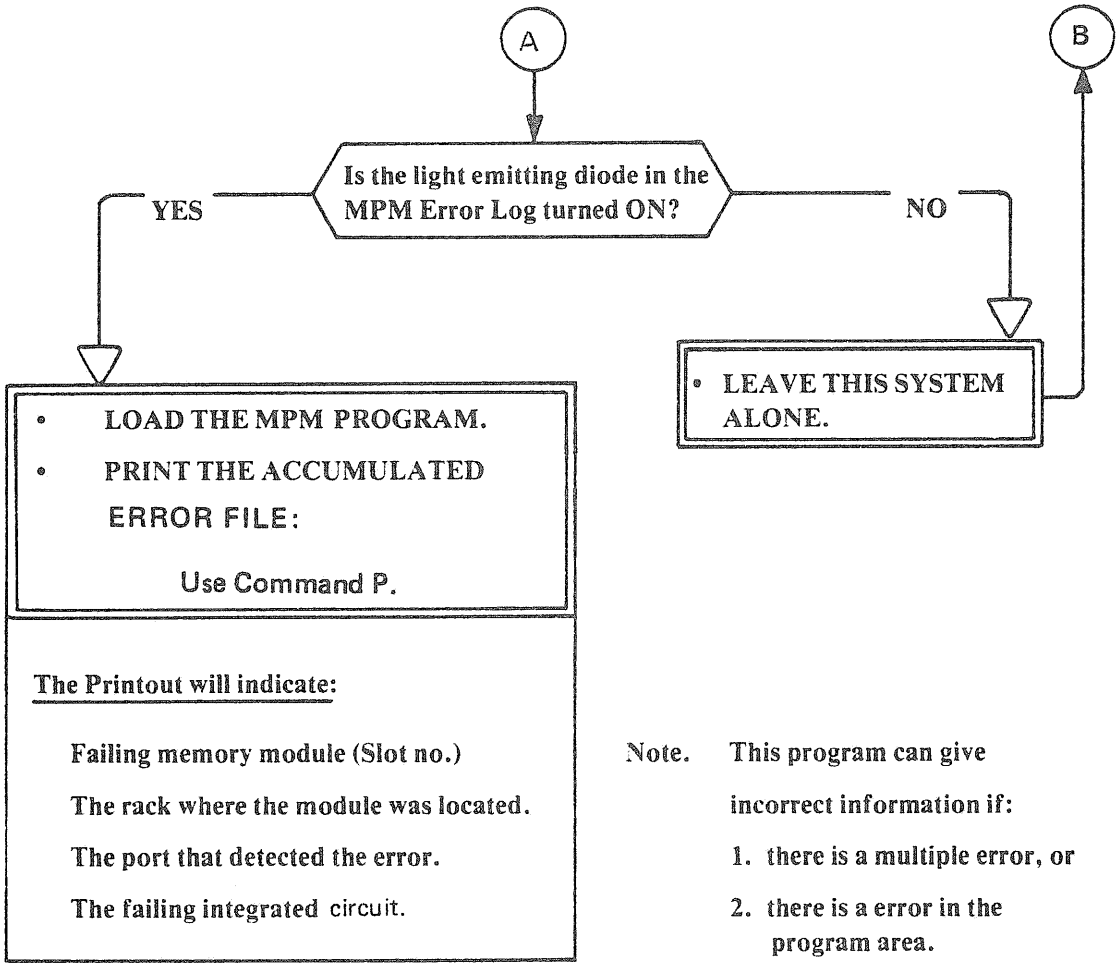
Figure 5.26: MPM-MAINTENANCE TEST PROGRAM FLOW DIAGRAM

5.4.2.1 READING THE MEMORY TEST PROGRAM ERROR LOG:

The procedure for reading the error log is as given below.

PROCEDURE Number 5-1:




A
B
Is the light emitting diode in the MPM Error Log turned ON?
YES
NO
• LOAD THE MPM PROGRAM.
• PRINT THE ACCUMULATED ERROR FILE:
Use Command P.
• LEAVE THIS SYSTEM ALONE.
The Printout will indicate:
Failing memory module (Slot no.)
The rack where the module was located.
The port that detected the error.
The failing integrated circuit.
Note. This program can give incorrect information if:
1. there is a multiple error, or
2. there is a error in the program area.

5.4.3 *Memory Module Identification*

An overview of the Local and Big Multiport (32 K Memory Modules) is at Figure 5.27.

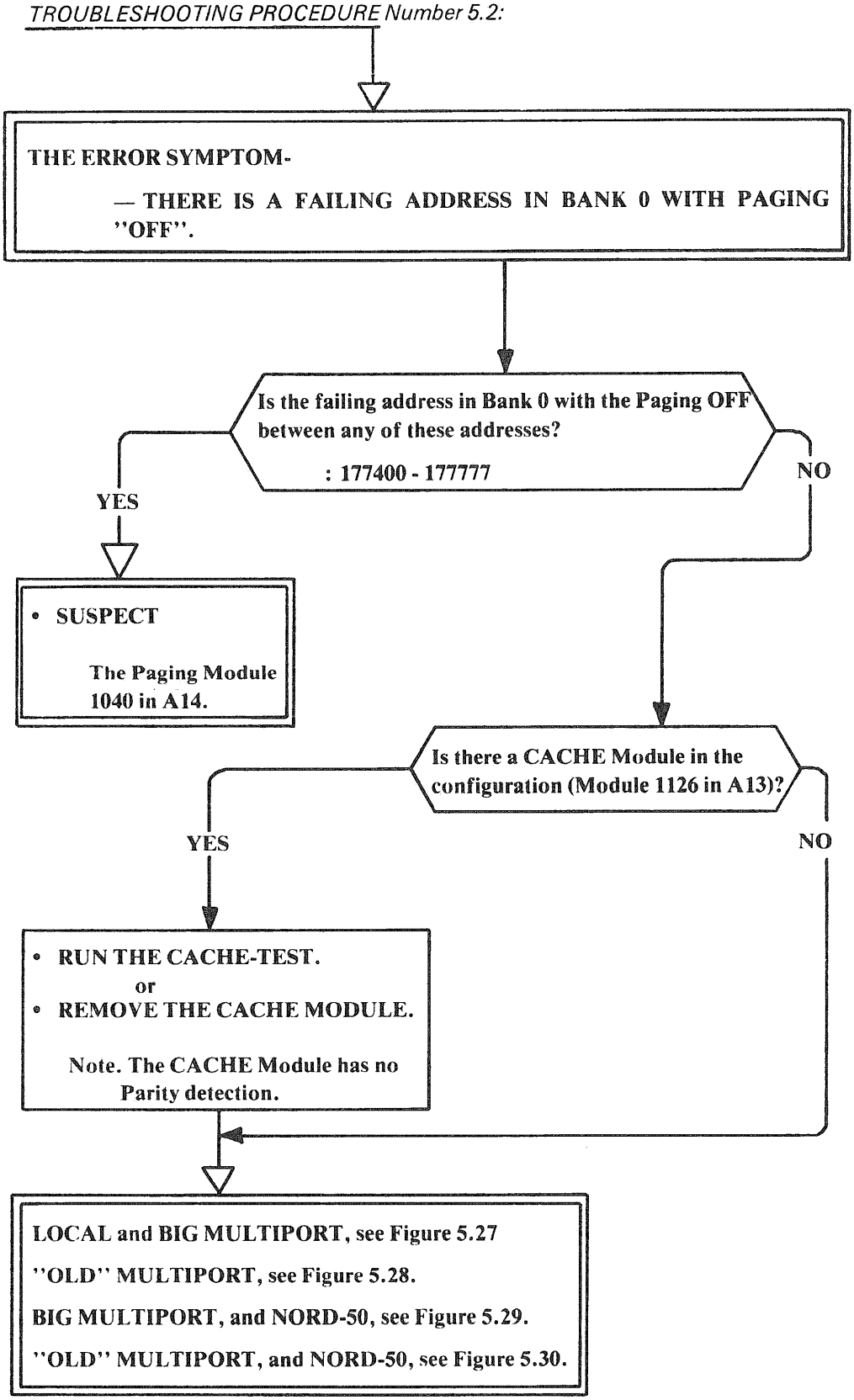
An overview of the "Old" Multiport Memory Module is at Figure 5.28.

An overview of the Big Multiport in the NORD-10/S—NORD-50 Installation is as shown in Figure 5.29.

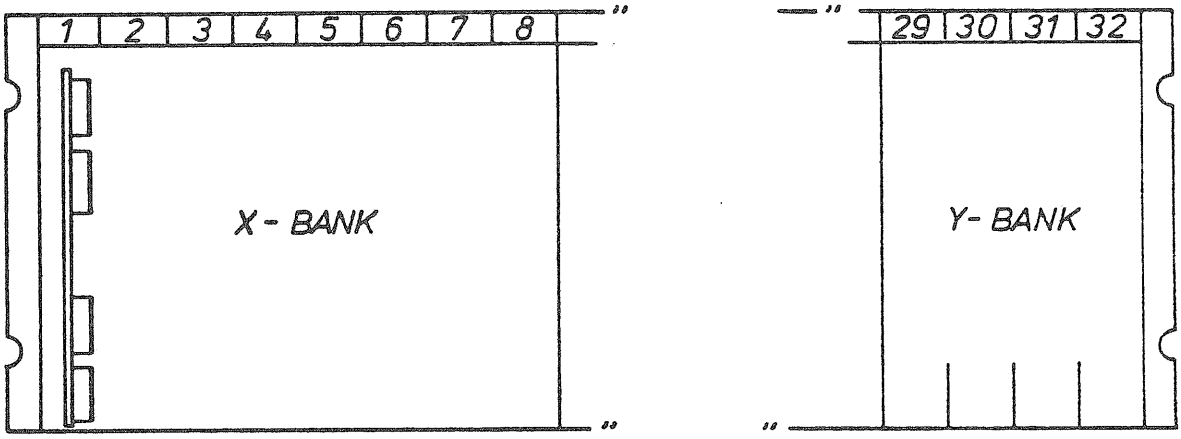
An overview of the "Old" Multiport in the NORD-10/S—NORD-50 Installation is as shown in Figure 5.30.

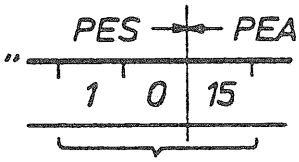
The troubleshooting procedure for memory module identification is as follows:

TROUBLESHOOTING PROCEDURE Number 5.2:



BIG MULTIPORT (32K MEMORY MODULES.)





			POS:
0	0	0	1 OR 32
0	0	1	2 OR 31
0	1	0	3 OR 30
0	1	1	4 OR 29
1	0	0	5
1	0	1	6
1	1	0	7
1	1	1	8

PES = PARITY ERROR STATUS REG.

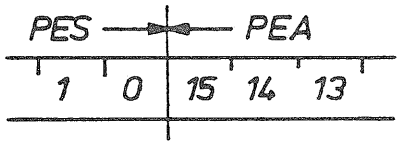
PEA = PARITY ERROR ADDRESS REG.

PES is obtaind by writing I 13 on the console terminal.

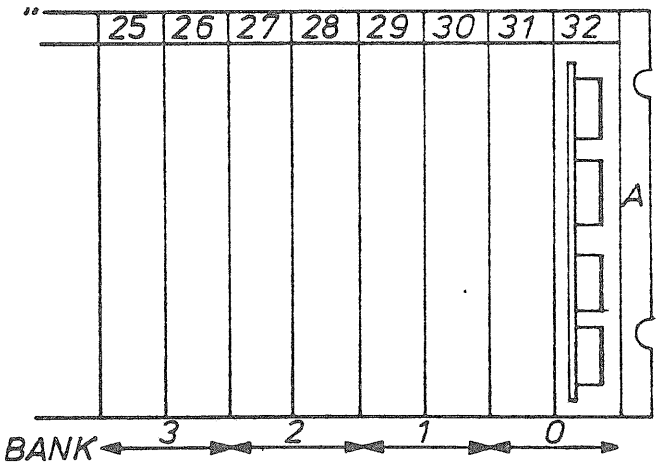
PEA by writing I15

NOTE!
ALWAYS I 13 BEFORE I 15.
Reading PEA will clear PES

LOCAL MEMORY (32 K MEMORY MODULES)



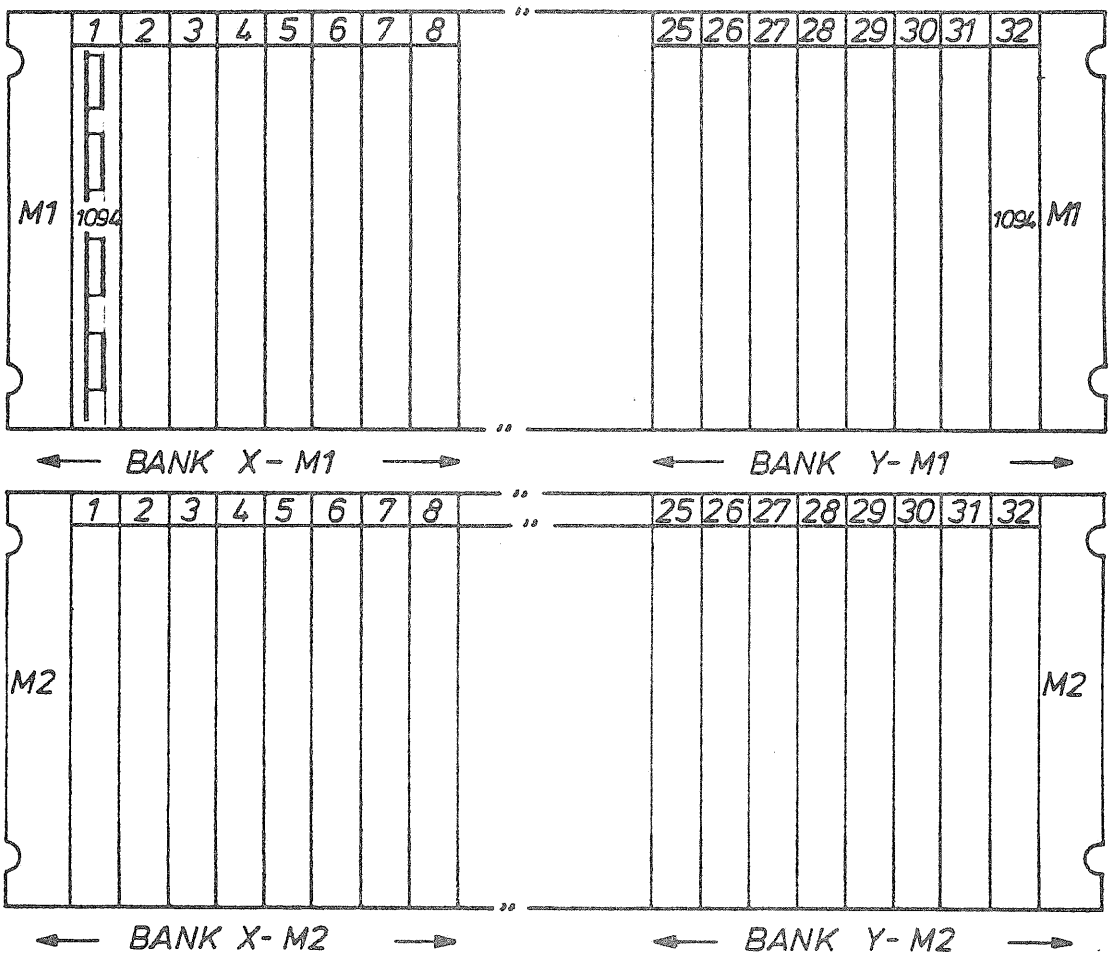
0	0	0	=POS A32
0	0	1	A31
0	1	0	A30
0	1	1	A29
1	0	0	A28
1	0	1	A27
1	1	0	A26
1	1	1	A25



NOTE! 8K MEMORY MODULES MAY ALSO BE USED AS LOCAL MEMORY; THEN ALWAYS IN THE RANGE 0-64K.

Figure 5.27: LOCAL AND BIG MULTIPORT (32 K MEMORY MODULES)

"OLD" MULTIPORT MEMORY ADDRESSING



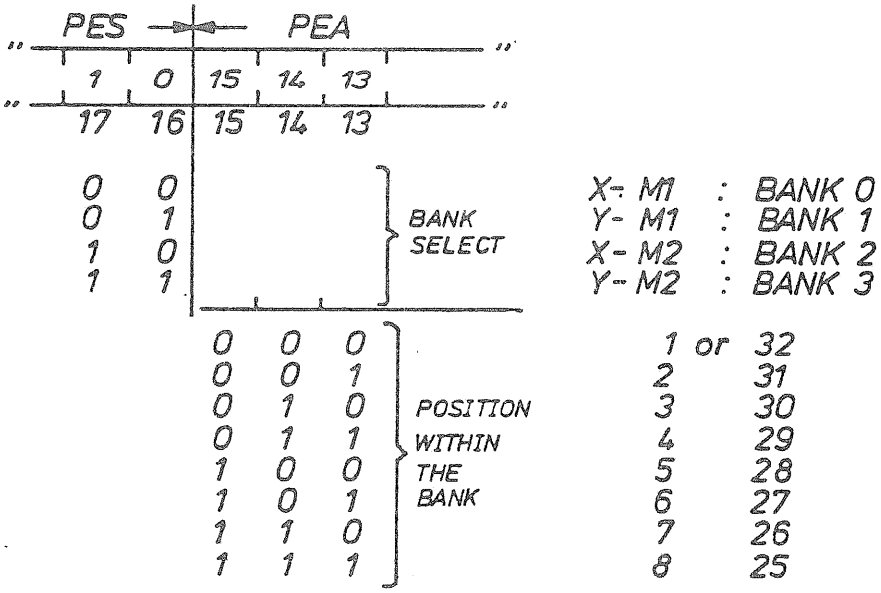
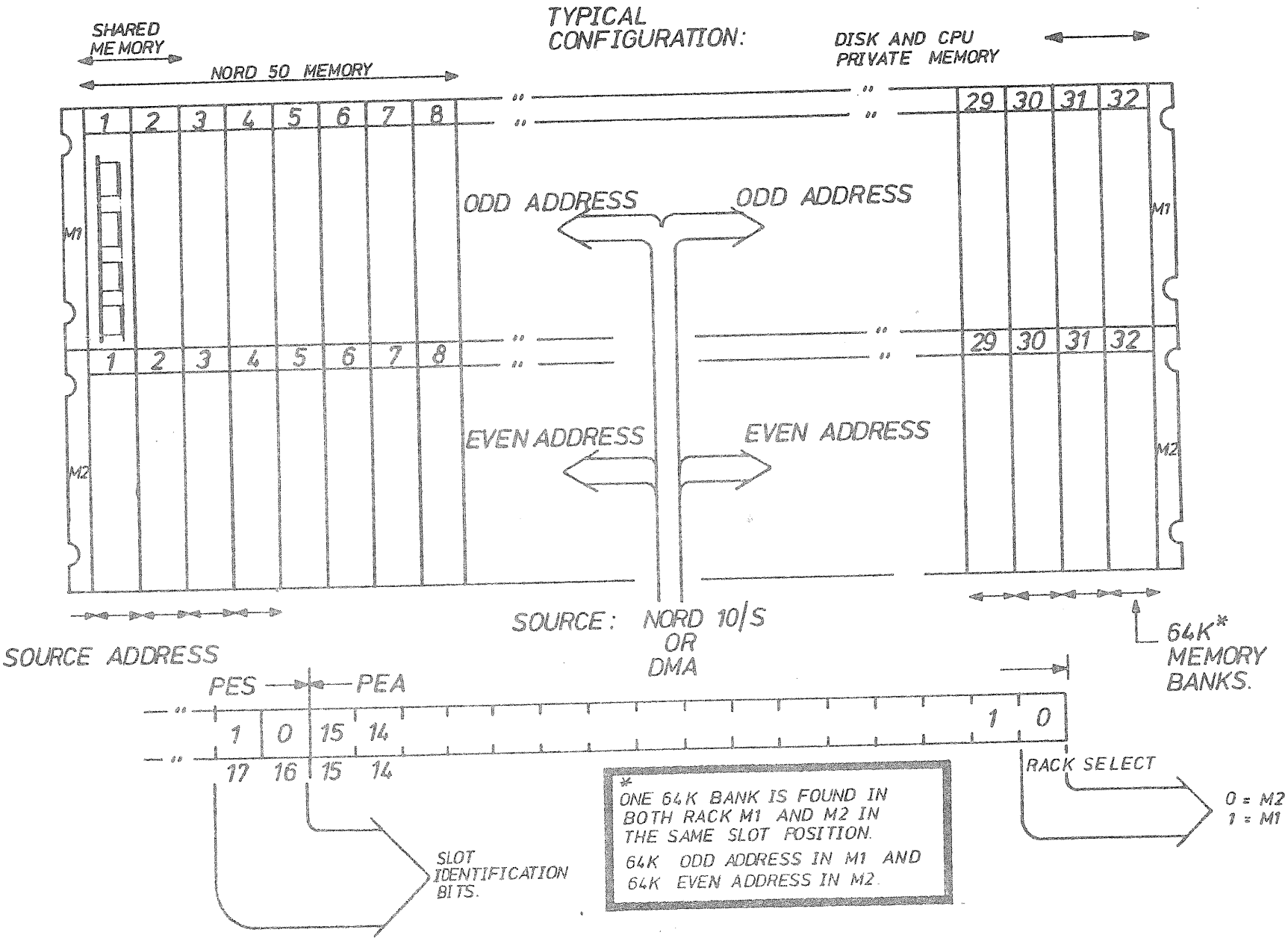


Figure 5.28: "OLD" MULTIPORT MEMORY ADDRESSING



ure 5.29: BIG-MULTIPORT IN NORD-10/S - NO 50 INSTALLATION, TYPICAL CONFIGURATION

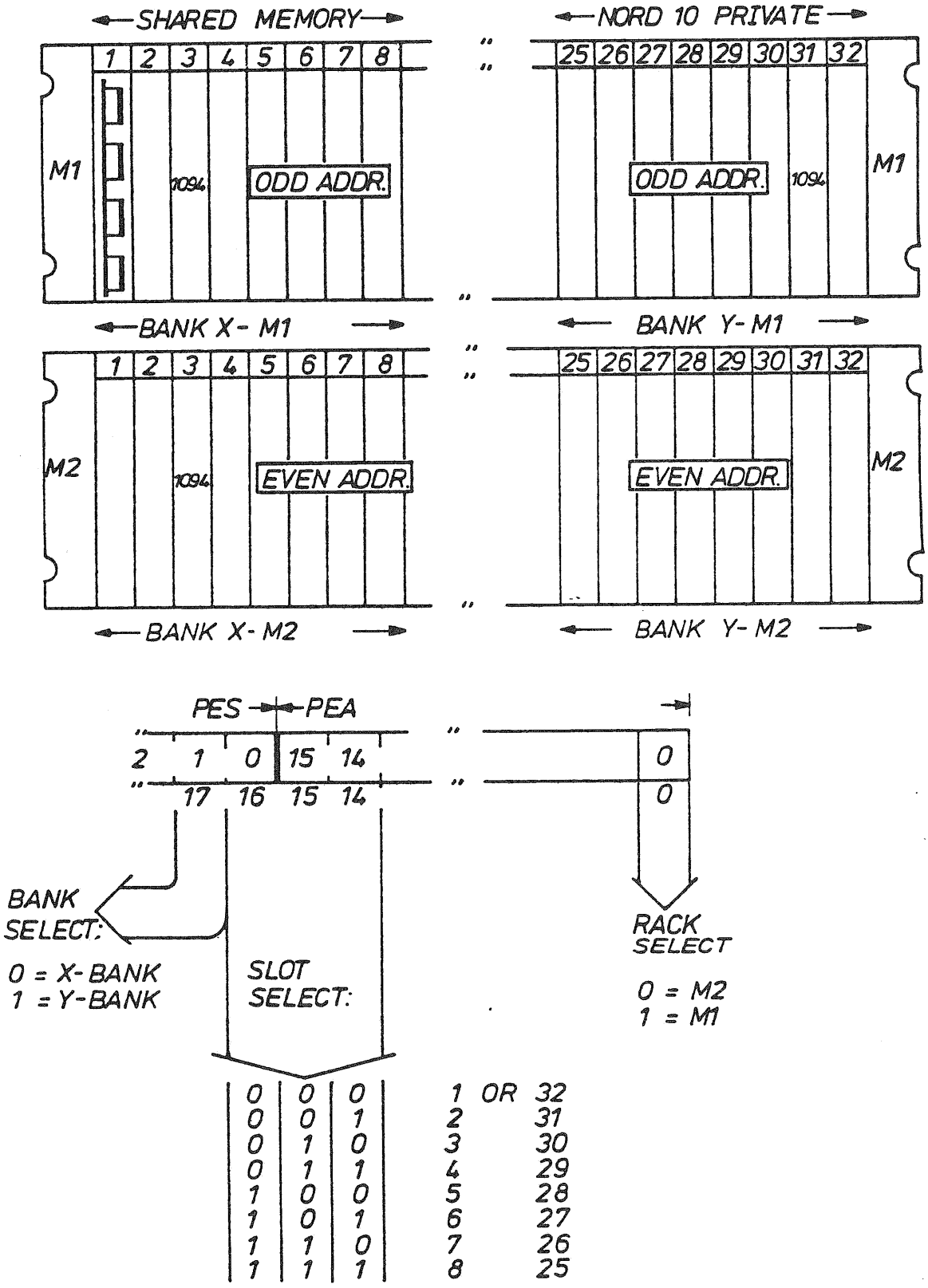


Figure 5.30: "OLD" MULTIPORT IN NORD-10/S - NORD-50 INSTALLATION

5.4.3.1 BIG MULTIPORT AND NORD-50

When a NORD-10/S and a NORD-50 are sharing memory, two big multiport memory racks are used. The NORD-50, being a 32 bit computer, will have the 16 least significant bits in one rack (M1) and the 16 most significant bits in the other rack (M2); either the X-bank (MAX 256K X 32 Bits) or the Y-bank (MAX 128K X 32 Bits).

The CPU and the disk have normally the Y-bank on the two racks as private memory. (The NORD-50 does not have access.)

The X-bank of the two racks is then normally the shared memory accessible from the NORD-10/S, disk and the NORD-50.

The NORD-50 can also have private memory in this bank; memory that can't be reached by the NORD-10/S. The last address NORD-10/S can reach is address 256K.

The NORD-10/S and the DMA read (see) a NORD-50 word as two consecutive 16 bit words.

One word of 16 bits in the lower multiport rack and the next word of 16 bits in the upper multiport rack. The NORD-50 will read this as one 32 bit word by accessing the upper and lower multiport rack in parallel.

To make the communication between a 32 bits channel and a 16 bits channel possible, the addresses of the 16 bits channels are shifted one location right.

Address bit 0 will be shifted to the most significant address bit.

Note! The address range switch setting in the port is set according to the shifted address.

All odd addresses (address bit 0=1) will be routed to the upper multiport rack while all even addresses (address bit 0=0) will be routed to the lower multiport rack.

For multiport memories with flat cables, the shifting of the addresses is done in one special print of 3 X 8 cm (1942) mounted in the Big Multiport plug panel. (Address bit 0 → Bit 20). Refer to Figure 5.32.

For the Old Multiport, the shifting of the address is in the cable. (Address bit 0 → Bit 17). Refer to Figure 5.31.

5.4.4 *Address Module Switch Setting in the NORD-10/S and NORD-50 Configurations*

5.4.4.1 GENERAL

All odd addresses will be routed to the upper Multiport Rack (M1). All even addresses will be routed to lower Multiport Rack (M2).

5.4.4.2 "OLD" MULTIPORT

The switch in the upper rack is set as if the source address started at address 128K (Bit 17 = 1)

SWITCH SETTING	**Upper-Rack:**	**128K**	**136K**	**144K**	**152K**	**160K**	**- - -**	**192K**	**- - -**
SWITCH SETTING	**Lower-Rack:**	**0K**	**8K**	**16K**	**24K**	**32K**	**- - -**	**64K**	**- - -**

See Figure 5.31.

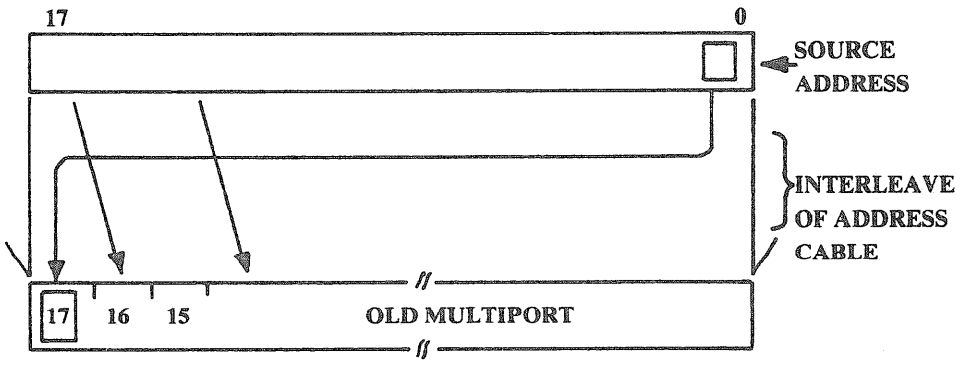


Figure 5.31: INTERLEAVE ADDRESS FOR "OLD" MULTIPORT

5.4.4.3 BIG MULTIPORT

The switch in the upper rack is set if the source address started at address 1024K (Address Bit 20 = 1) (The MSB octal switch should then be either 4,5,6, or 7).

See Figure 5.32.

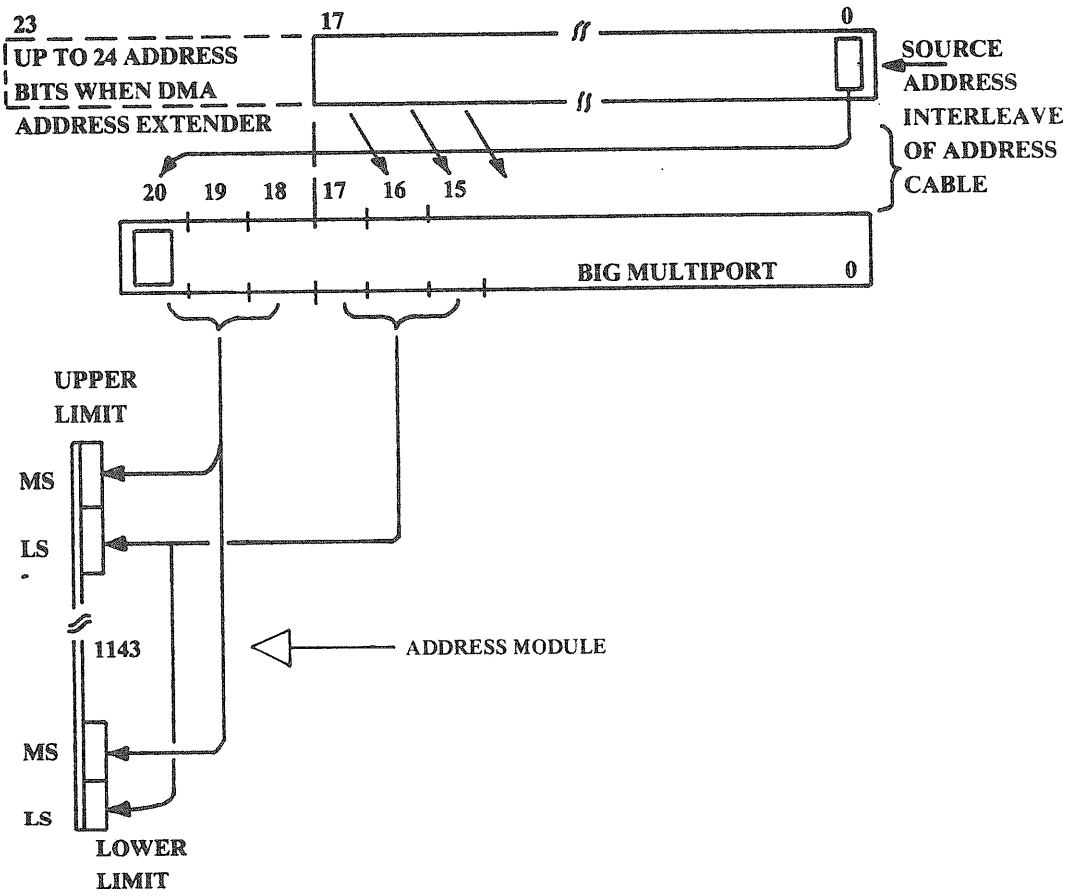


Figure 5.32: INTERLEAVED ADDRESS FOR THE BIG MULTIPORT

5.4.5 *More Hints*

In event that the procedure of interchanging (swapping) memory modules does not help, the following should be tried in the order indicated:

1 SWAP PORT DATA MODULES (1081, 1143).

2 SWAP PORT ADDRESS MODULES (1038, 1142)
Note!! SWITCH SETTING.

3 CHECK THE DC VOLTAGE (+5V, +5V SB, +12V AND −12V) ON BOTH SIDES OF THE MULTIPORT MEMORY.
Note!! SEE SECTION 6.4 FOR FURTHER INFORMATION.

4 TURN POWER "OFF" AND "ON" TO CLEAR ANY HANG-UP SITUATIONS.

5 PULL OUT MEMORY MODULES AND RUN THE MEMORY TESTS WITH A MINIMUM OF MEMORY (1 IF 32K, 2 IF 8K). RUN THE TESTS WITH AN INCREASING NUMBER OF MEMORY MODULES.

6 SWAP CONTROL MODULES (IF MULTIBANK SYSTEM).

7 INSERT A NEW REFRESH MODULE IF "OLD" MULTIPORT (1089 OR 1136).

8 CHECK THE CABLES AND TERMINATION PLUGS.

9 CHECK THE MEMORY INHIBIT LINES:

FOR THE BIG MULTIPORT EACH PORT RECEIVES A MEMORY INHIBIT (M1) LINE FROM THE POWER SUPPLY WHICH FEEDS THE CHANNEL SOURCE.

CHECK THE BIG MPM CONTROL MODULE 1144. IF ANY OF THESE TERMINALS ARE AT GROUND LEVEL (GROUND LEVEL = MEMORY INHIBIT).

91	=	CHANNEL A	(DMA)
89	=	CHANNEL B	(CPU)
87	=	CHANNEL C	
85	=	CHANNEL C	(NORD-50)
95	=	BIG MULTIPORT MEMORY INHIBIT (POWER FAILURE) AND ALL SOURCES USING THE SAME POWER SUPPLY.	

ON THE OLD MULTIPORT A MEMORY INHIBIT IS FOUND ON TERMINAL 55 OF THE 1090 MODULE.

10 ON THE BIG MULTIPORT-

RECONFIGURE THE MULTIPORT BY MOVING THE CHANNELS FROM THE X TO THE Y-BANK OR FROM THE Y TO THE X-BANK.

- MOVE THE MODULES
- CONNECT THE CHANNEL (DATA AND ADDRESS CABLE) TO THE OTHER BANK.

Note!! **Only for the Big Multiport**

11 RUN THE MULTIPORT MEMORY MODULES AS LOCAL MEMORY.

Note!! **Only for the NORD-10/S.**

12 ROUTE THE DMA CHANNEL ONTO THE CPU CHANNEL BY REMOVING THE BRANCHER MODULE (I/O POS 8).

6 THE POWER SYSTEM

This section provides a description of the power units utilized in a NORD-10/S.

6.1 *POWER DISTRIBUTION*

6.1.1 *AC Power Distribution*

Figure 6.1 is an illustration of AC power distribution.

6.1.2 *DC Power Distribution*

Figure 6.2 is an illustration of DC power distribution.

6.1.3 *Description of the Power Distribution System*

The MAIN SWITCH in the AC POWER DISTRIBUTION PANEL will supply the AC VOLTAGE to:

1. The service contact
2. The filter
3. Relay via filter and AC terminal block
4. Power supply AC input via filter and AC terminal block

When the MAIN SWITCH in the power supply is turned on, DC STANDBY VOLTAGE will be supplied to the memory systems. The regular DC voltage will be turned on after pushing the power switch in the operator's panel. By turning the key into the LOCKED position, the operator's panel power switch will be disabled.

The AC voltage will now be supplied from the power supply via the FANS and AUX plug down to the AC terminal strip. The relay will now be energized and the AC will be distributed to the fans, floppy, falcon disk (if available) and to auxiliary cabinets as NORD-10/S I/O or NORD-50. The AC voltage supplied from the NORD-10/S together with the power switch of the auxiliary cabinet will control the AC power sequencing in that cabinet.

For details concerning the power sequencing, refer to the technical/mechanical drawings for the NORD-10/S.

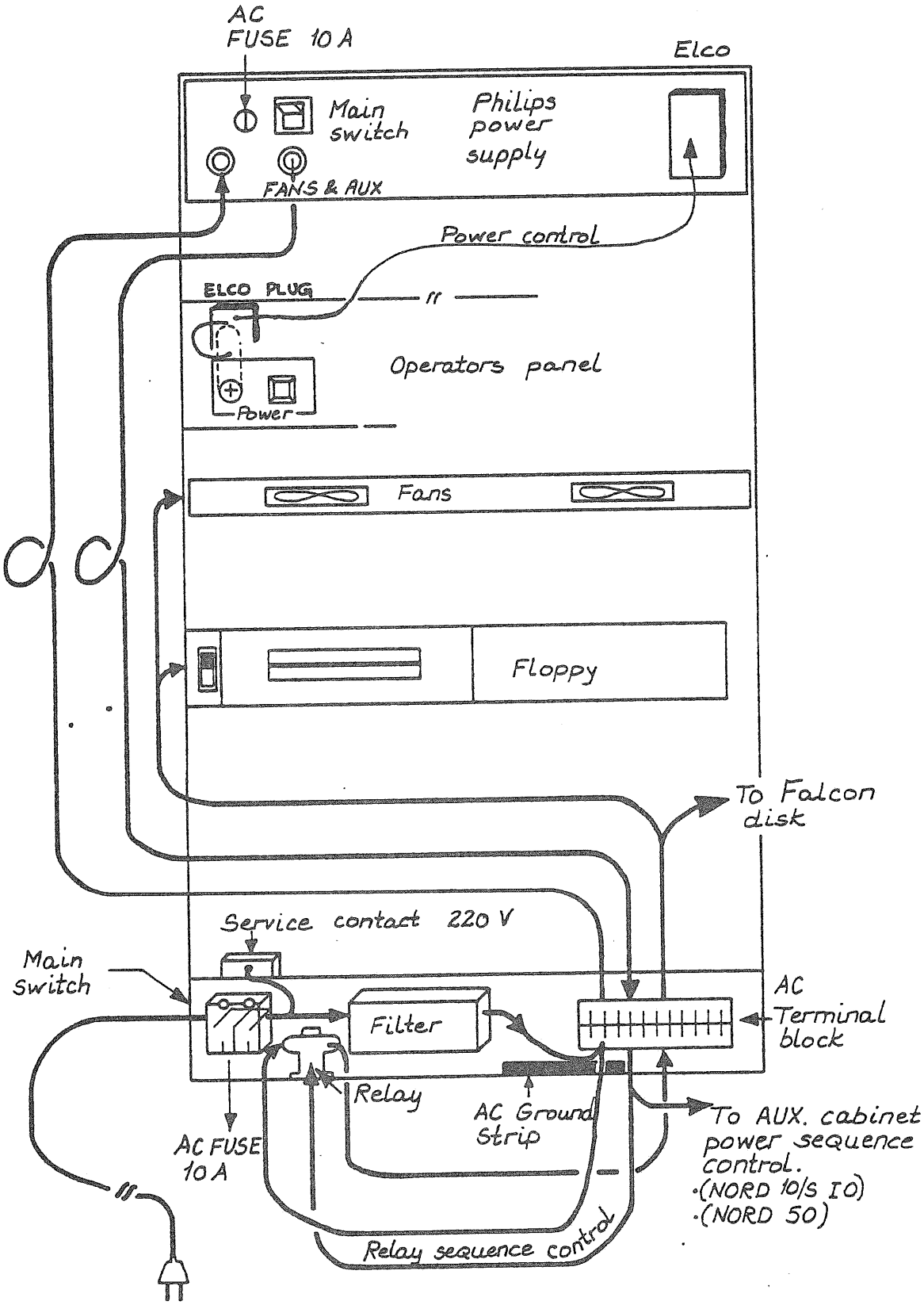


Figure 6.1: AC DISTRIBUTION, AN EXAMPLE

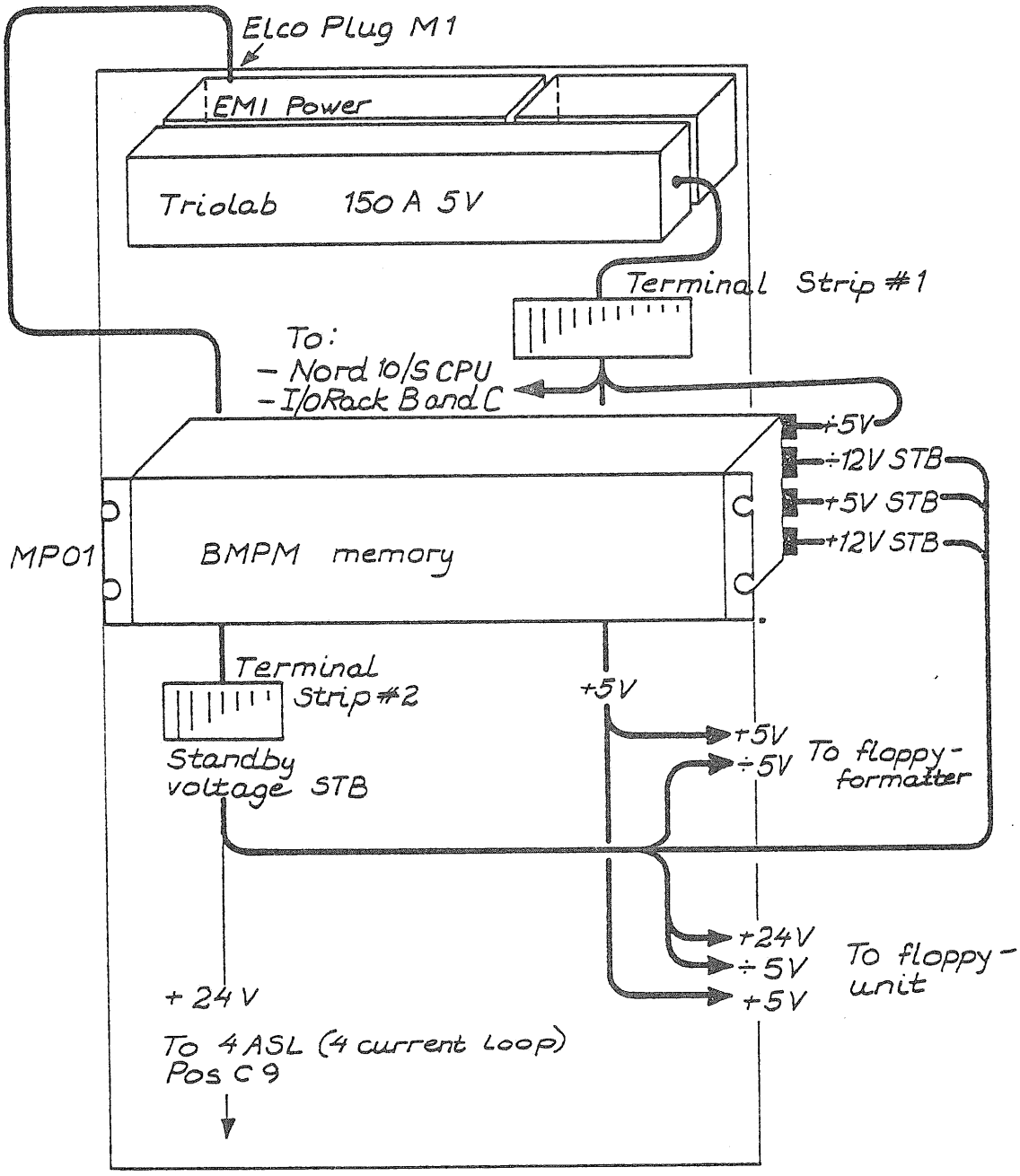


Figure 6.2: DC POWER DISTRIBUTION, AN EXAMPLE

6.2 *EMI AND PHILIPS POWER UNITS*

6.2.1 *EMI Power Unit*

Figure 6.3 gives an overview of the EMI Power Unit.

The EMI Power Unit is available in two versions. Both versions are subdividable into two subversions

VERSION I

NORD Power Unit 10
- Square AC input plug and
  8 pins Burndy as AC output
  2 AC fuses
- 4 pins Burndy as AC input and
  output plug
  1 AC fuse

Note!! ELCO plug is compatible;
AC input is not

VERSION II

NORD Power Unit 10/S
- with alarm
- without alarm

Note!! AC input and DC
output compatible

CAUTION!!
The EMI 10 and 10/S multipower are not compatible

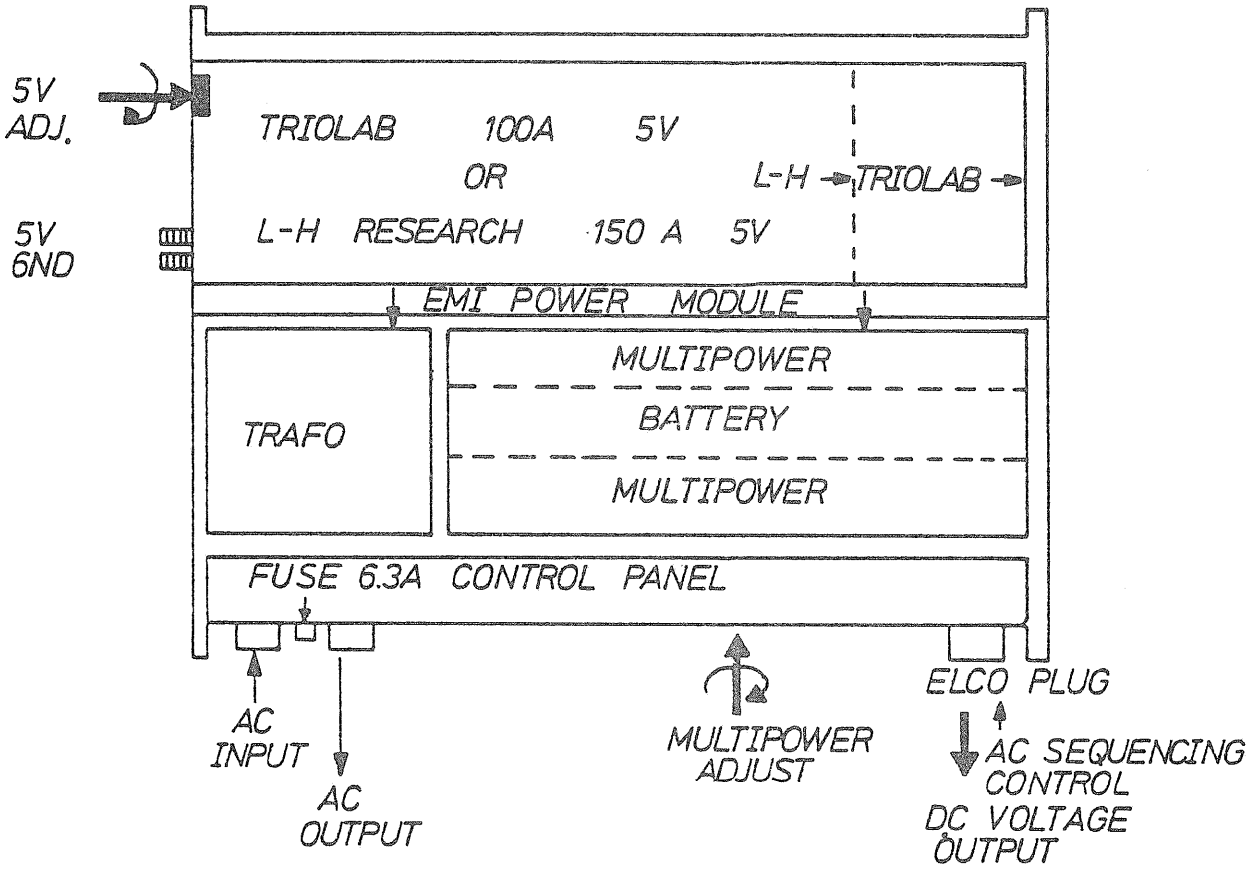


Figure 6.3: EMI POWER UNIT

6.2.1.1 THE L-H RESEARCH POWER SUPPLY

The L-H Research Power Supply can be interchanged with the Triolab Power Supply. A special adaptor module and a grounding cable are needed to install the L-H Research Power Supply unit.

Figure 6.4 gives an overview of the L-H Research Power Supply Adaptor.

The installation procedure is as follows:

1 : Insert new adaptor (1968)

2 : Drill new fasten holes in chassis

3 : Change to bigger AMP (Yellow)

4 : Insert new ground cable

5 : Check that the FLAT-CABLE is inserted correctly.

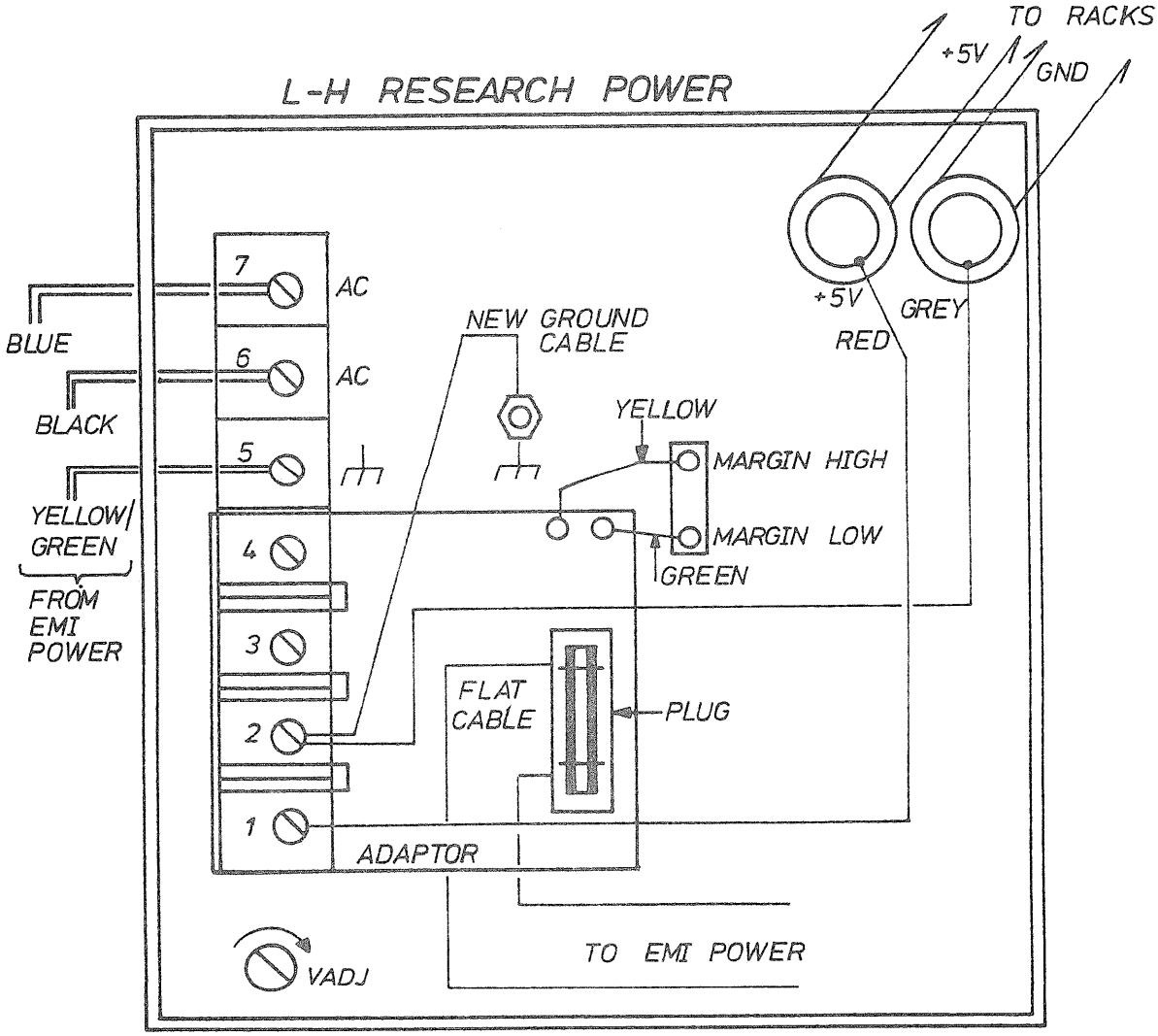


Figure 6.4: L-H RESEARCH POWER SUPPLY ADAPTOR

6.2.2 *PHILIPS Power Unit*

Figure 6.5 gives an overview of the Philips Power Unit.

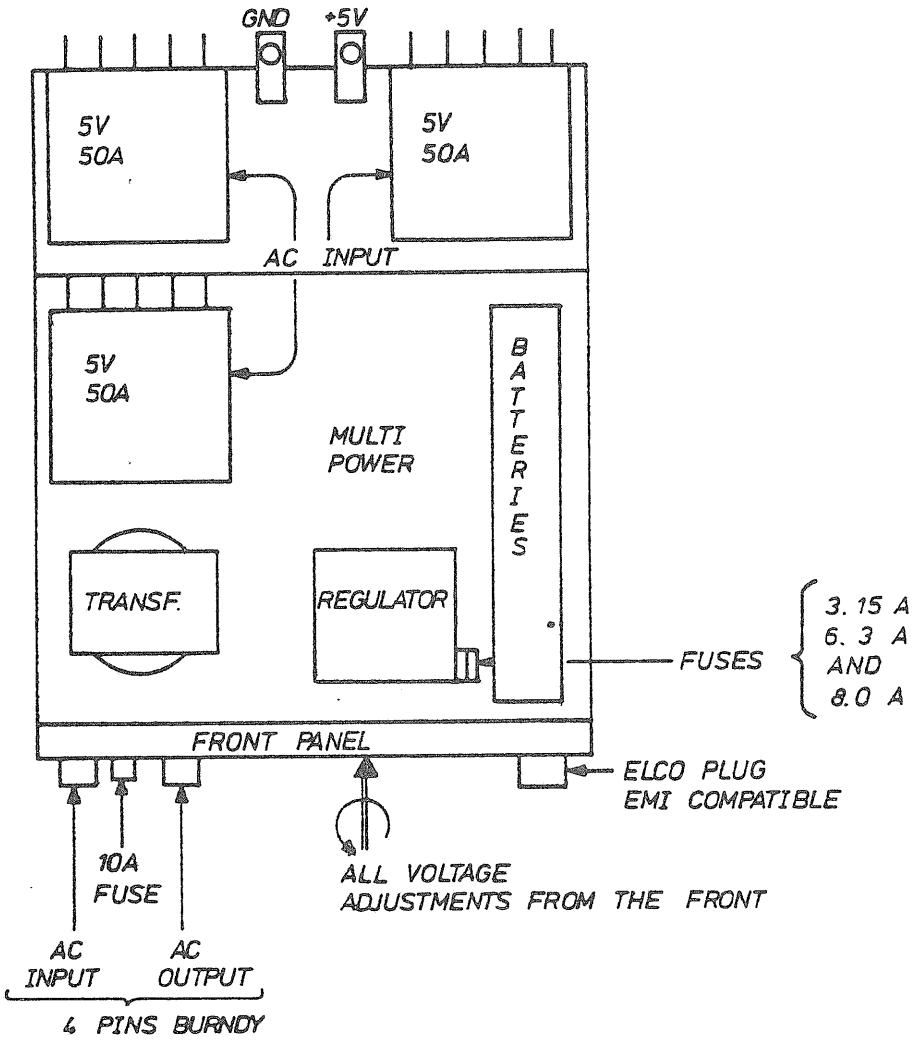


Figure 6.5: PHILIPS POWER UNIT

6.2.3 *Power Unit References*

For additional reference data refer to Table 6.1 below:

POWER UNIT	*REFERENCES*
EMI NORD	Only hardware schematics available
EMI NORD/S	NORD Power Unit 10/S Manual
EMI NORD/S with alarm	NORD Power Unit 10/S With Voltage Monitoring Manual
PHILIPS	NORD Power Unit 10/S PE 1718 Instruction Manual + Additional Information Manual
L-H RESEARCH TRIOLAB	Sealed

Table 6.1: POWER UNIT REFERENCES

6.3 *DC VOLTAGE ADJUSTMENTS*

All DC voltages should be verified on a Board-Extender Module.

The following considerations should be observed while verifying DC voltage:

- All modules normally in use in the configuration should be inserted.
- The voltage should be checked in the middle of the rack. If more then one rack is connected to the same supply, check the middle-rack.
- Check the voltage in the Local Memory in the CPU Rack Position 25.
- Check the MULTIPORT Memory Voltage in Position 8, if OLD and if BIG MPM with X-Bank . Position 29 if only Y-Bank.
- The + 24 volts can only be verified in the I/O slot where the 1122 or 1020 module is located (if any).
- Otherwise only + 5V DC in the I/O Rack(s).

Table 6.2 indicates the sources of the various DC voltages and also gives the voltage tolerances.

VOLTAGE	*TERMINAL*	*GROUND TERM*	*TOLERANCE*
+5V	0,1,98,99	2,3,96,97	4.95 - 5.05 VOLT
+24V	1020 : 70,71	68,69	23 - 24.5 VOLT
+24V	1122 : 60,61 62,63	56,57,58,59	
−5V	58,59	56,57	−4.9 - −5.1 VOLT
+12V* STANDBY	90,91,92,93	96,97	8K MODULES = 11.8 VOLT 32K MODULES = 12.0 VOLT
−12V* STANDBY	94,95	96,97	NOT CRITICAL
+5V* STANDBY	88,89	96,97	4.95 - 5.05 VOLT

* THE STANDBY VOLTAGE IS USED BY THE MOS MEMORY SYSTEMS (LOCAL, MULTIPORT, AND BIG MULTIPORT) TO REFRESH THE MEMORY.

Table 6.2: VOLTAGE SOURCES AND TOLERANCES

6.4 *POWERFAIL ADUSTMENTS*

This section provides the power fail adjustment procedures for the two types of power supplies in use in the NORD-10/S. These power supplies are:

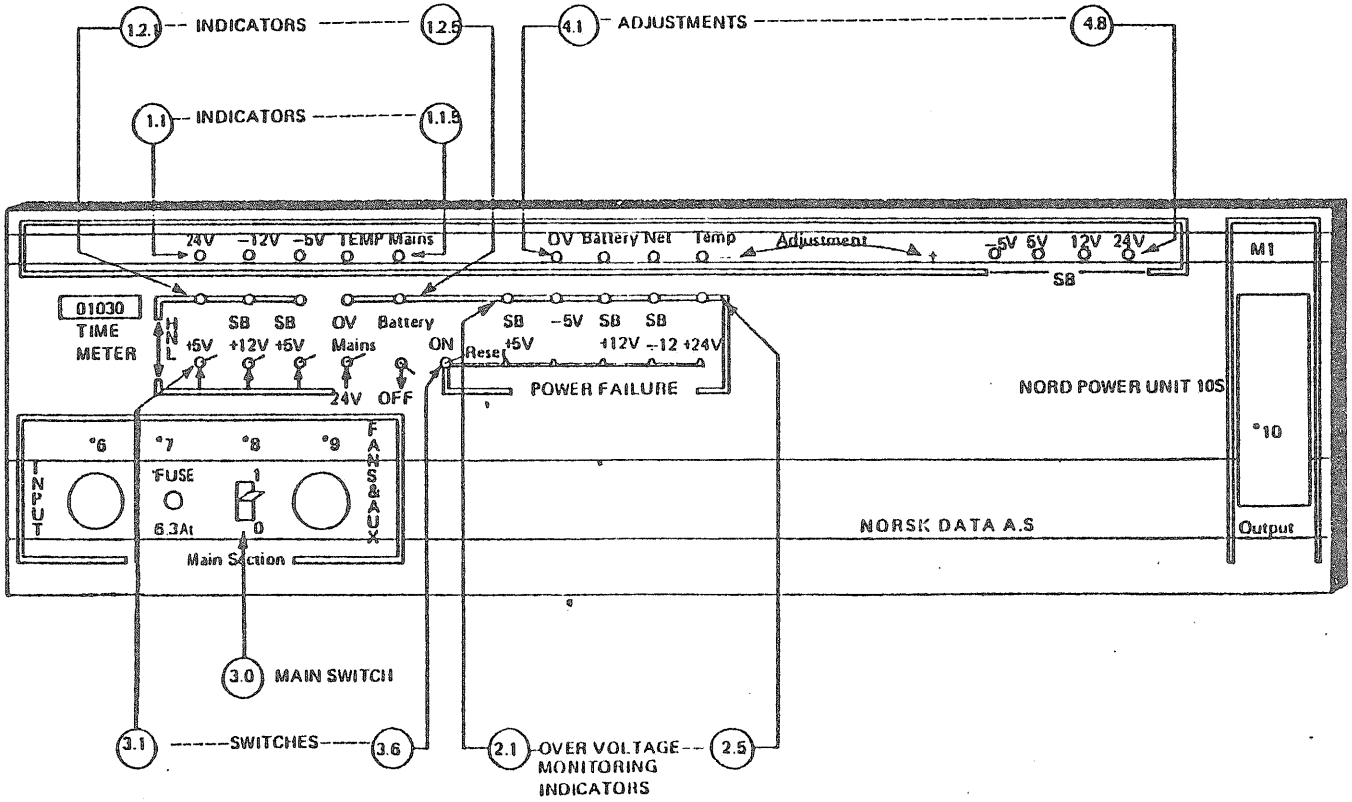
- the EMI Power Units (all types),
  &
- the Philips Power Supply, Type PE1718.

6.4.1 *EMI Power Type*

Figure 6.6 shows the EMI Power Unit Panel. The panel is depicted with an over voltage alarm.

6.4.1.1 THE POWERFAIL ADJUSTMENT PROCEDURE

Figure 6.7 indicates the Powerfail Adjustment Procedure to be used with EMI Power Units. Figure 6.7 should be used in conjunction with the EMI Power Unit Panel shown in Figure 6.6.



Note. Power with overvoltage alarm depicted.

Figure 6.6: EMI POWER UNIT PANEL

1. *CONNECT A VARIABLE TRANSFORMER OR A VARIABLE RESISTOR BETWEEN THE MAINS AND THE POWER UNIT.*

   CONNECT A VOLTMETER TO THE AC LINES.

2. *WRITE INTO MEMORY: 20/124000 (JMP*)*

3. *PRESS MC AND RESTART. LOCK PANEL*

4. *REMOVE BLACK CAPS OVER POT. METER FOR BATTERIES AND NET.*

5. *LOWER INPUT VOLTAGE TO APPROX. 205V.*

6. *TURN POT. METER FOR BATTERIES (On front of Power) FULLY CC. W.. (See Item 4.2.)*

   TURN POT, METER FOR BATTERIES SLOWLY CW. UNTIL THE LAMP LIGHTS UP. (The Lamp is at 1.2.5.)

7. *LOWER INPUT VOLTAGE TO APPROX. 196 V.*

8. *TURN POT. METER FOR NETT C. W. UNTIL POWER INTERRUPT DISAPPEARS. (See Item 4.3.) (The machine goes into CONTINUE.)*

9 *TURN THE POT. METER SLOWLY CC. W. UNTIL THE POWER INTERRUPT COMES ON. (The machine goes into STOP.)*
   CAUTION: Beware of the 1 S. delay.

10 *RAISE INPUT VOLTAGE TO NOMINAL VALUE AND LOWER IT SLOWLY.*

   CHECK THAT BATTERIES ARE TURNED ON BEFORE INTERRUPT OCCURS.

   (The machine goes into STOP.)

   CHECK THAT INTERRUPT COMES ON AT CORRECT SET POINT.

11. *PRESS BLACK CAPS BACK IN POSITION.*

12 *REMOVE THE VARIABLE TRANSFORMER OR RESISTOR.*

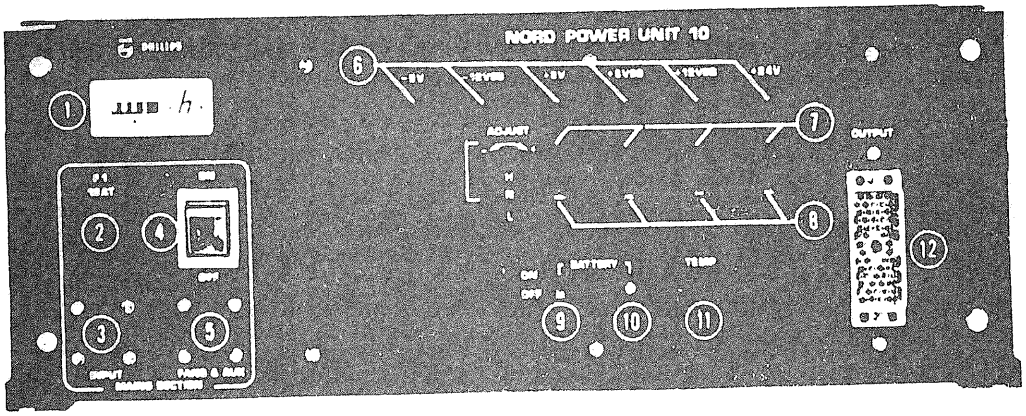
   Note!! The Items are indexed to Figure 6.6.

Figure 6.7: POWERFAIL ADJUSTMENT PROCEDURE, EMI POWER UNITS

6.4.2 *PHILIPS Power Supply, Type PE 1718*

Figure 6.8 shows the Philips Power Supply Unit. Figure 6.9 shows a diagram for the Regulator and Control Unit of the Philips Power Unit.

ACCESS FOR THE REGULATOR 2 CONTROL UNIT

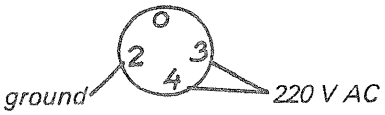


INDEX LOCATIONS:

(1) *Hour meter*

(2) *10 A fuse, delayed action*

(3) *220 V AC mains input*



(4) *Mains power on/off switch. See also* (9)

(5) *Voltage output for fans and auxiliary equipment*

(6) *Indicators (light-emitting diodes) for the various output voltages*

(7) *Adjustment of the +5 V. + 5 VSB. + 12 VSB and +24 V output voltages*

(8) *Switch for stepwise shift of nominal output level*

Position H: Increase nominal voltage by about 5%

Position N: Nominal voltage (set with (7)*)*

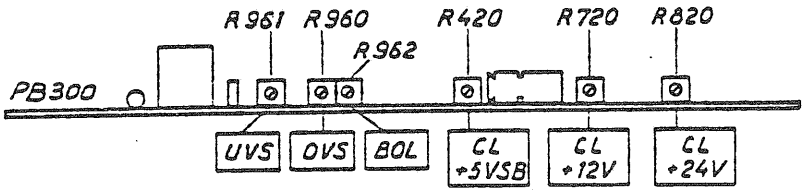
Position L: Decrease nominal voltage by about 5%

(9) *Battery on/off switch. Set to ON position at mains operation*

(10) *Battery indicator. Turns on at battery operation*

(11) *Temperature indicator. Turns on when temperature around battery exceeds about +55° C and does not turn off until temperature has decreased to less than about +40° C*

Figure 6.8: PHILIPS POWER SUPPLY



UVS = Undervoltage sensing
OVS = Overvoltage sensing
CL = Current limit
BOL = Battery operation limit

Figure 6.9: REGULATOR AND CONTROL UNIT, PHILIPS POWER SUPPLY

6.4.2.1 THE POWERFAIL ADJUSTMENT PROCEDURES

Figure 6.10 gives the procedures for power failure adjustments for:

— battery adjustments

— undervoltage adjustments
and
— overvoltage adjustments

Figure 6.10 should be used in conjunction with Figures 6.8 and 6.9.

General: For the three adjustments listed below, perform the initial step of:

CONNECT THE CPU TO A POWER FAILURE ADJUSTMENT BOX OR TO A MAINS TRANSFORMER.

CONNECT A VOLTMETER TO THE SAME AC LINE.

---

1. Battery Adjusmtents:

TURN THE BATTERY SWITCH ON. (See Item 9.)

ADJUST MAINS VOLTAGE TO 205V.

PULL THE POWER SUPPLY OUT. (The Regulator and Control unit is now accessable from the top.)

TURN THE POTENTIOMETER R962 FULLY COUNTERCLOCKWISE.

TURN THE POTENTIOMETER R962 SLOWLY CLOCKWISE UNTIL THE YELLOW BATTERY INDICATOR (LED) AT THE FRONT TURNS ON. (See Item 10.)

INCREASE THE MAINS VOLTAGE SLOWLY UNTIL THE INDICATOR GOES OUT. CHECK THAT THE VOLTAGE IS ABOUT 211 ± 3V.

2 *Undervoltage Adjustment:*

ENTER THE FOLLOWING INSTRUCTION: 20/124000 AND PRESS RESTART.

SWITCH THE KEY TO LOCK POSITION.

DECREASE THE MAINS VOLTAGE TO 196V.

TURN THE POTENTIOMETER R961 FULLY COUNTERCLOCKWISE.

TURN THE POTENTIOMETER R961 CLOCKWISE UNTIL THE CPU GOES TO STOP.

INCREASE THE VOLTAGE SLOWLY UNTIL THE CPU GOES INTO CONTINUE MODE AGAIN.

THE MAINS VOLTAGE SHOULD THEN BE 202 ± 3V.

Overvoltage Adjustment:

3 *The Philips Power Supply Unit has an Overvoltage Sensing capability.*

ADJUST THE POTENTIOMETER R962 SO THAT THE CPU GOES TO STOP WHEN THE MAINS VOLTAGE IS 245V.

DECREASE THE MAINS VOLTAGE. THE CPU SHOULD THEN RUN AGAIN WHEN THE MAINS VOLTAGE IS 239 ± 3V.

Note! The Items are indexed to Figure 6.8.

Figure 6.10: POWERFAIL ADJUSTMENTS FOR PHILIPS POWER SUPPLY.

7 SITE PREPARATION, INSTALLATION AND STORAGE

7.1 *SITE PREPARATION AND INSTALLATION*

The site for a computer configuration containing a NORD CPU should be prepared according to the procedures laid down in the ND Site Preparation and Installation Manual, ND—30.002. These procedures are also valid for relocation of the NORD-10/S. Care should be taken to utilize the grounding and mains distribution data that relates to the NORD-10/S when using this manual.

7.2 *STORAGE*

That portion of the Site Preparation and Installation Manual that relates to storage of NORD equipment also applies to the NORD-10/S.

APPENDICES

DETAILED CONTENTS

+ + +

APPENDIX A

GLOSSARY

A.1 *DEFINITIONS*

A-Rack (pp 5—25)
CPU-Rack.

"Bad-Time" copy (pp 2—6)
A copy taken during an apparent malfunction.

BAND PRINTER (pp 5—16)
Line Printer.

BAUD (pp 5—12)
Transfer speed for serial data transfer (bits per second).

Berg Plug (pp 5—33)
Back wiring plug used in the NORD-10/S.

Board(s) (pp 2—3)
A board is a module. The preferred term in ND is module.

Bootstrap Routine (pp 4—31)
A program which runs in an otherwise empty computer and controls the loading and execution of another program.

CACHE Memory (pp 1—5)
Hidden memory used to speed up the memory access.

Calcomp Plotter 1 (pp E—2)
A plotter manufactured by CALOMP.

Card (pp 5—33)
A card is a module. Module is the preferred ND name.

Console terminal (pp 4—33)

Console-Terminal (pp 4—25)
The same. This is the special terminal that communicates with the NORD-10/S when the NORD-10/S is in STOP mode.

CPU Rack (pp 6—9)
The 19" rack that contains the CPU module.

Crate (pp viii, 5—68, 5—75)

CRATE
The same as a rack. Rack is the preferred ND term.

DAISY-CHAIN (pp 4—43)
Two or more units connected to the same controller. Serial coupled.

Data ways (pp 5—25)
Data paths.

Device No. (pp 5—23)
The number assigned to a major piece of equipment like a CPU. Device is a common name for terminals, paper tape, card readers, line printers, etc. Devices transfer information to/from the computer via the accumulator. Each device has a unique logical device number which SINTRAN III uses when accessing the device.

DISC (pp 5—52)
Earlier name for DISK. See disk.

D-register (pp 5—24)
Register in the NORD-10/S displayed when pushing D on the Operator's Panel.

Dump (pp 2—6)
Memory content copied onto a diskette.

ELCO (pp 6—2)

Elco Plug (pp 6—3)
Plugs manufactured by ELCO.

Error message terminal (pp 2—5)
Terminal where error messages are printed.

Error symptom (pp vi)
Computer behavior when not working properly.

FAST LINJE (pp 5—11)
This is the Norwegian term for leased line. It is explained on page 5—11.

Gold-contacts (pp 2—3)
Contacts on the modules that are made of gold.

"Good-Time" copy (pp 2—6)
A copy taken when all modules are known to be functioning in the I/O rack.

I/O Rack (B or C) (pp 1—8)
Racks for the I/O modules.

INTERLEAVE (pp 5—93)
Memory interconnecting technique in a NORD-10/S-NORD-50 configuration.

IOX 504 instruction (pp 5—50)
504 is the device number when executing an IOX instruction.

Instruction Execute (pp 1—5)
Control Logic
Modules controlling the instruction-execution in the NORD-10/S CPU.

"Isopropanol" (pp 2—3)
A liquid for cleaning gold connectors.

L-Register (pp 4—25)
A register in the NORD-10/S.

Logical terminal number (pp 2—6)
See device number.

Memory-modules (pp 2—3)
Modules containing the memory integrated circuits.

Module (pp 3—1)
A hardware device that is of standardized design for easy replaceability. Module is the name for Norsk Data printed-circuit boards. Also referred as cards. Modules are placed in racks.

Multiport Rack (M1) (pp 5—93)

Multiport Rack (M2) (pp 5—93)
The first multiport rack is marked M1, the second M2, etc.

ND Standard (pp 5—6)
The standard for Norsk Data.

Octal Code (pp 5—22)
Bit combination represented with octal numbers.

Operating System (pp 2—6)
SINTRAN III is the Norsk Data operating system. The operating system is that part of the software which supports the sharing of resources. A resource may be memory, processors or different devices.

"PACK SCAN" program (pp 5—45)
PASCAN - 2226.

Pack Surface Analysis (pp 5—45)
Disk pack analysis.

Paging (pp 1—5)
Dividing the memory into pages of 1k, controlled by the memory management system.

PARITY ERROR (pp 4—9)
Error on data read from memory.

PATCH (pp 5—4)
Modification.

P-Register (pp 4—21)
Program register in the NORD-10/S.

Rack (pp 1—5)
The framework that holds the modules.

REFRESH (REFORMAT) (pp 5—42)
Rewriting the disk address.

Register block (pp 1—5)
The eight CPU register are called the register block.

RT Program (pp 4—3)
Real-time programs. These programs are terminal independent and have user assigned priorities. They are controlled through special commands in SINTRAN III.

Scratch diskette (pp 5—21)
The same as for scratch pack.

SCATCH PACK (pp 5—35)
Formatted disk poack containing data of no importance. Used for testing.

Servo System (pp 4—12)
Hardware for moving disk heads.

SHADOW MODULE (pp 5—64)
Module connected (soldered) to another module.

SINTRAN (pp 2—5)
SINTRAN III is the Norsk Data operating system. The operating system is that part of the software which supports the sharing of resources. A resource may be memory, processsors or different devices.

SINTRAN-SINTRAN communication (pp 5—23)
Programs for exchanging data between two NORD computers.

Stand-alone-Program (pp 5—23)
Stand-alone
This is a program that contains its own bootstrap and hence can execute without any operating system. A characteristic of most of the ND test programs.

System failure (pp 2—1)
An error situation resulting in the inability of the system to continue normal processing.

Terminal 1 (pp 4—2)
Terminal 1 = Console Terminal.

TERMINAL 1 MODULE (pp 4—50)
The same as Console Terminal interface module.

Triolab (pp 6—3)
Name of the 5V power supply.

Troubleshooting procedure (pp vi)
Procedure to follow when the computer is not working properly.

Watch Dog (pp E—3)
Special interface for time watching.

X-bank (pp 5—75)
The memory unit located at the left side of the multiport rack.

y-bank (pp 5—75)
The memory unit located at the right side of the multiport rack.

A.2 *ABBREVIATIONS*

ADJ. (As in 5V ADJ., pp 6—5) Adjust.

acc. (As in One bit acc., pp B—2.) One bit accumulator.

ADDR. (As in ODD ADDR., pp 5—91.) Address.

Addr. (As in Block Addr. Reg., pp 5—52.) Address.

Addr. (As in Cyl. Addr., pp 5—52.) Cylinder address.

addr. (As in "sector addr.", pp 5—58.) Address.

Alt. (As in Alt. page table, pp B—2.) Alternative.

APPROX. (As in APPROX. 205V.,pp 6—12.) Approximately.

Async. (As in Async 13)Asynchronous.

Asynchr. (As in Asynchr. Modem 1, pp E—2.) Asynchronous.

Aut. (As in Aut. Load Descr., pp B—2.) Automatic.

AUX. (As in AUX. cabinet, pp 6—2.) Auxiliary.

CC. W. (As in SLOWLY CC. W., pp 6—12.) Counterclockwise.

COMP. (As in COMP. IND.) Compare.

Comp. (As in Comp. Err.,pp 5—55.) Compare.

CONTR. (As in 1080 UNIT CONTR., pp 5—55.) Controller.

C.W. (As in C.W. UNTIL, pp 6—12.) Clockwise.

CW. (As in CW. UNTIL,, pp 6—12.) Clockwise.

cyl. (As in Cyl. Addr., pp 5—52.) Cylinder.

dec. Decimal (As in "Log dev. no. dec., pp 5—12.) Logical device number in decimal.

des. Decimal.

Descr. (As in Aut. Load Descr., pp B—2.) Descriptor.

DEV. Device. (As in DEV. NO., pp 4—28.)

Dev. Device. (As in Dev. oper decoder, pp 5—52.) Device operation decoder.

dev. Device. (As in log. dev. no., pp 5—12.) Logical device number.

DIFF. (As in DIFF. DMA ADAPTER, pp 5—70.) Differential.

Dig. (As in Dig. Reg. 2 Input, pp E—3.) Digital.

Dyn. (As in Dyn. overflow, pp B—2.) Dynamic.

etc. And so forth.

ERR. (As in COMP. ERR., pp 5—55.) Error.

GEN. (As in PHASE GEN., pp 5—52.) Generator.

Ident. (As in Ident Code.) Identification.

i.e. "that is"

IND. (As in READ IND, pp 5—51.) Indicator.

Inh. (As in Cache Inh. Limit Reg., pp B—2.) Inhibit.

Instr. (As in Illegal Instr., or Privileged Instr., pp B—2.) Instruction.

Inter. (As in Internal Inter., pp B—2.) Interrupt.

Log. (pp 5—12.) Logical.

mag. Magnetic (As in Magtape.)

MOD. (As in 1026 MOD., pp 5—16.) Modified.

no. Number. (Also No.)

NR. Number. (As in UNIT NR. 1, pp 4—43.)

Nr. Number. (As in ECO Nr. 529., pp 5—6.)

oct. Octal. (As in Log. dev. no. oct., pp 5—12.)

OP. (As in OP. IND., pp 5—51.) Operation.

POS. Position. (As in 8 POS. BACKWIRING, pp 5—62.)

pos. Position. (As in pos. A13, pp 4—34.) (Also pos, POS.)

POT. Potentimeter. (As in POT. METER, pp 6—12.)

prom. Programmed read only memory.

REFR. REFRESH.

REC. (As in IDENT MECH/IDENT CODE REG., pp 5—20.) Register.

Reg. (As in Dig. Reg. 1 Input, pp E—3.) Register.

reg. Register. (Also Reg., reg.) (As in Block Addr. Reg., pp 5—52.)

reg. (As in Cache Inh. Limit reg., pp B—2.) Register.

S. (As in 1 S., pp 6—12.) Second.

sel. (As in Unit sel. strobe, pp 5—58.) Select.

SEQ. (As in 1107 DISC SEQ., pp 5—52.) Sequence.

SIGN. Significant (As in (MOST SIGN.), pp 5—3.)

Stat. (As in Stat. overflow, pp B—2.) Static.

Synchr. (As in Synchr. Modem 1, pp E—2.) Synchronous.

TANDB. Tandberg. (pp 5—9.)

Term. Terminal. (pp 5—12.)

TRANSF. (pp 6—7.) Transformer.

UNIV. (As in UNIV. DMA INTERFACE, pp 5—70.) Universal.

V. (As in 5V., pp 6—14.) Volts.

VERS. VERSATEC (Printer/Plotter). (pp 5—62.)

Viol. (As in Protect Viol., pp B—2.) Violation.

via "by way of".

VSB. (As in 5VSB., pp 6—14.) 5 Volt Stand-by.

A.3 *ACRONYMS*

↓	(pp 4-28) Carriage return.
%	(pp 4-27) Comment indicator.
!	(pp 4-8) Start Program in main memory.
$	(pp 4-31, 4-34) Octal LOAD.
&	(pp 4-31) Binary LOAD.
( )	(pp 4-28) Content of.....
/	(pp 5-66) Examine Register or Memory cell.
1672K	(pp 5-7) K = 1024 words.
5V	(pp 6-7) 5 volts.
400&	(pp 5-24) A command to load paper tape.
5V	(pp 4-38) 5 volts.
II	(pp 4-2) Octal address where the error occurred (in an error message).
A	(As in 50A fuse, pp 6-7) Ampere.
A	(As in 101 A, pp 5-16) Ampere.
aa.bb.cc	(pp 4-2) Time. aa = hours, bb = minutes, cc = seconds.
ABSET	(As on pp 4-3) Software mnemonic.
AC	(pp 6-6) Alternating current.
ACM	(As in ACM 3, ACM 4, pp E-2) Accumulator to core module.
ACTLEV	(As in PREVIOUS LEVEL, pp 4-22) Previous active interrupt level.
A/D	(As in A/D Converter, pp E-3) Analog/digital.
ADR	(As in SET ADR, pp B-2) Address.
ADDR	(pp 5-26) (As in ADDR MISMATCH, pp 5-52) Address.
ALD	(pp 4-33) Automatic Load Descriptor.
AMP	(As in AMP (Yellow), pp 6-6) Fasteners made by AMP corp.
AR	(As in (AR), pp 5-74) Address ready.
A.S	(As in NORSK DATA A.S) Aksjeselskap = Corporation.
AS	(As in 4 AS Current Loop, pp 3-2) Asynchronous.
AS	(As in 4 AS. CURRENT LOOP 1122, pp 4-29) Asynchronous.

ASL	(As in To 4 ASL, pp 6-3) = 4 AS Current Loop.
ASR	(As in TELETYPE ASR 33, pp 5-9) Teletype type.
ASYNC	(As in ASYNC MODEM, pp 5-11) Asynchronous Modem.
Async	(As in Async 14/Photo 2, pp E-4) Asynchronous Modem.
At	(As in 6.3At, pp 6-11) Fuse tolerance.
AUX	(As in AUX plug, pp 6-1) Auxiliary.
B	(pp 5-2) Bank. Base Register.
BA	(pp 5-52, 5-55) Block Address.
BAKD3	(As in BAKD3 AT 114721;, pp 4-2) Background program D3.
BAO	(As in BAO-17, pp 5-33) Memory Address bus.
BAUD	(As in 1200 BAUD, pp 5-12) Transfer rate.
BCOMPLETE	(pp 5-33) Completion signal.
BCONNECT	(pp 5-33) Connect signal.
BD	(pp 5-52) Data bus.
BDO	(As in BDO-15, pp 5-33) Data bus.
BERROR	(pp 5-33) Error signal.
BFQ	(As in BFQ2, pp 5-33) Oscillator signal.
BIDIRECT	(As in BIDIRECT LATCH, pp 5-52) Bidirectional (two ways) latch.
BIGRAND	(pp 5-30) A test program.
BIMS	(pp 4-11) A test program, Big Disk Maintenance System.
BINPUT	(pp 5-33) Input signal.
BMPM	(As in BMPM Memory, pp 6-3) Big multiport memory.
BOL	(pp 6-15) Battery operation limit.
BPI	(As in NRZI : 800 BPI, pp 5-60) Bits per inch.
BPUN	(As in "DUMPFL-2327:BPUN", pp 2-6) Compiler output format.
BPUN	(As in HDCOMB:BPUN, pp 5-66) Compiler output format.
BRBUSY	(pp 5-33) Reset BUSY signal.
BSTART	(pp 5-33) Start signal.
BUFF	(As in COMPLETION BUFF, pp 5-58) Buffer.
BUSY	(pp 5-6) Busy signal.

BWGIG	(pp 5-68) Name of a CAMAC module.
C	(As in 1158 DR-11-C, pp vii) Version number.
C	(pp B-2) Carry.
C	(pp B-2) Error Code, as in C0, C1, C2, etc.
C-R	(As in C-R ACTIVE, pp 5-19) Carriage Return.
CAMAC	(pp 5-67) Not an acronym. International name for an "interface"-system.
CAR	(pp 5-55, 5-58) Core Address Register.
CARDR	(pp C-2) Card reader.
CATSY	(As in CATSY 1, pp E-3) (Digital) Cassette tape system.
CC	(pp vii) CAMAC CRATE - as in the NORD-10 INTERFACE.
CDC	(pp 4-8) Control Data Corporation.
CF	(pp 5-33) Clear Flag.
CH	(As in CH-DAT, pp 4-28) Change (CHANGE-DATA). A command.
CH	(As in CH-DEV: 1640, pp 5-66) Change.
CH	(As in FOUR-CH-1418D, pp C-4) Check.
CH	(As in THREE-CH-1528C, pp C-4) Check.
CHATA	(As in CHATA-1832, pp 5-23) A test program.
CILR	(As in Cache Inh. Limit reg., pp B-2) Cache Inhibit Limit Register.
CL	(pp 6-15, 5-55, 5-58) Current limit.
cm	(As in 8 cm, pp 5-92) Centimeter.
CMD	(As in PHOENIX (CMD), pp 5-35) Cartridge Module Drive.
CNTRW	(As in 61/CNTRW Generator, pp 5-66) Control word.
COMPL	(pp 5-55, 5-58) Completion Signal
CONCT	(As on pp 4-4) Software mnemonic.
CONFI	(As in CONFI-INV, pp 5-7) Configuration.
CONT	(As in SI plus CONT, pp B-2) CONTINUE - button on Operator's Panel.

COP	(pp C-3) Copy.
CPU	(pp v) Central Processing Unit.
CR	(pp 5-19) Carriage Return.
CRC	(As in CRC-NETWORK, pp 5-52) Cycle redundancy check.
CSR	(pp B-2) Cache Status.
CW	(pp 5-55, 5-58) Control Word.
CWIS	(pp 5-58 top) Control Word decode signal.
D	(pp 5-83) D-Register.
DA	(pp 5-52) Internal Data bus.
D/A	(As in D/A convertor, pp E-3) Digital/Analog.
DAT	(As in CH-DAT, pp 4-28) Data. (Change data field.) A command.
DC	(pp 6-1) Direct Current.
DEBUG(Y/N)	(pp 5-6) Debugging facility asked for.
DEQL	(pp 5-33) Device Equal.
DEV	(As in CH-DEV:1640, pp 5-66) Device.
DIABLO	(pp 5-10) A Text Printer.
DIFF	(As in DIFF LINES, pp 5-69) Differential.
DIMS	(pp 5-38) Utility test program for 10Mb disks.
DINPUT	(pp 5-33) Data Input.
DISC	(As in DISC TIMING, pp 5-49) Disc or disk.
DMA	(pp 4-10) Direct Memory Access.
DP	(pp B-2) Destination or P-Register.
DR	(As in DR 2, pp 5-33 and in 1158 DR-11-C, pp vii) Relates to a digital input/output module.
DRD	(pp 5-55, 5-58) Serial data read (disk).
DS	(As in DS2 to DS1, pp 4-43) Position location on the module in a Floppy Disk Drive.
DS	(As in DS 1172 - 2282, pp 5-71) A test program.
DSERV	(pp 5-37) A test program.
DUMPFL	(As in DUMPFL:PROG, pp 2-6) Copy File. (Also COPY-F.)
DW	(As in DW 7, pp 5-52, 5-58) Data Write.
DWD	(pp 5-52) Data Write to Disk.

ECC	(As in BIG DISK WITH ECC, pp 4-11) Error Correction Control.
ECC	(As in ERROR CORRECTION CONTROL DISK CONTROLLER, pp vii) The title of a manual.
ECC	(pp 4-11) Memory Error Checking and Correction (ECC).
ECC	(As in ECC-TEST, pp 5-35 and 5-56) Error Correction Control.
ECCC	(pp 5-58 top) Error Correction Control Controller.
ECCR	(As in Error Correction Control reg., pp B-2) Error Correction Code Register.
ECL	(pp 5-25) External Channel line driver.
ECO	(As in "an ECO on the 1144 Module", pp 4-23 and "the ECO Nr. 529", pp 5-6) Engineering Change Order.
ECR	(pp 5-58) Error Count Register.
E-D	(As in @E-D ND, pp 5-81) ENTER-DIRECTORY. A SINTRAN command.
EIA	(As in Special EIA, pp 5-9) EIA is the name of a plug.
ELCO	(As in ELCO PLUG, pp 6-2) Product name.
EMI	(As in EMI Power Unit, pp 6-4, EMI Power Type and EMI NORD, pp 6-8) Manufacturer's name - Elektro Mekanisk Industri, Horton.
EPR	(pp 5-58) Error Pattern Register.
EQUALD	(As in WA-EQUALD, pp 5-55, 5-58) Signal name.
ERMON	(As on pp 4-5) Software mnemonic.
ERRCOR	(pp 4-19, 5-3) Error Correction.
ES	(As in ES-PICT-2216, pp C-2) Product name - E-Sunderland Picture System.
EX	(pp 4-28) Exit. A command.
EXTEN	(As in EXTEN-ONE-1519, pp C-2) A test program.
F	(As in (P-10022F:F-U), pp 2-6) Floppy.
F-D	(As in @E-D ND F-D-1 0, pp 5-81) Floppy Disk.
F-U	(As in (P-10022F:F-U), pp 2-6) Floppy-User.
F-U	(As in (ND:F-U), pp 5-81) Floppy-User.
FALCON	(As in FALCON Disk Controllers, pp 5-48) Model name of a disk drive from CDC. (A type of disk unit.)

FF	(As in BUSY-FF, pp 5-52, 5-58) Flip-flop.
FI	(As in LI-FI, pp 4-32) (List) Files.
FIFO	(pp 5-55) First In - First Out (Buffers).
FILSYS	(As in FILSYS-INV=2135F, pp 2-8) File System.
FL	(As in FL-LOOPS, pp 5-22) Floppy.
FLOA	(As in T-32B-FLOA, pp 5-4) Floating.
FORM	(As in CDC-FORM, pp 5-35) Formatting.
FORMAT	(As in FLOPPY-FORMAT, pp 5-22) A test program.
FORTRAN	(pp 4-5) Formula Translator. (A language.)
FTN	(As in FTN library error, pp 4-5) FORTRAN Compilers, Run Time Systems and Libraries.
FU	(As in FLOPPY-FU, pp 5-21) A test program.
FUNC	(As in BIG FUNC, pp 5-30) A test program.
GND	(pp 4-42) Ground.
GRANT	(pp 5-52) Signal in the I/O System.
GREMS	(pp 5-48) Test and utility program for cartridge disks.
HAR	(pp 5-71) Hardware Test Program.
HASP	(As in HDLC HASP 2, pp E-3) Used in IBM communication software.
HAWK	(As in HAWK Disk Controllers, pp 5-48) Model name of a disk drive from CDC. (A type of disk unit.)
HDCOMB	(As in HDCOMB:BPUN, pp 5-66) A test program.
HDLC	(pp vii) HIGH LEVEL DATA LINK CONTROL Interface.
HP	(pp 2-9) Hewlett-Packard.
HPMAG	(pp C-3) Hewlett-Packard magnetic tape.
HUT	(pp 5-38) Hardware Utility Programs.
I/O	(pp 5-96) Input/Output.
IB	(As in "DATA BUS (IB) LATCHES", pp 4-52) CPU Data Bus.
IBIT	(As in IBIT: MEANS: pp 4-23) INTERNAL INTERRUPT CODE, See pp 4-22.
IC	(As in 21 RAM IC's of 16K, pp 5-72) Integrated Circuits.
IDENT	(As in IDENT CODES, pp C-1, IDENT-instruction, pp 4-17, IDENT-Code, pp 5-5, IDENT CODE REG., pp 5-20, pp 5-52) Identification.

Ident	(pp 5-12) Identification.
IIC	(pp B-2) Internal Interrupt Code.
IIE	(pp B-2) Internal Interrupt Enable.
INFOTON	(pp 5-9) A type of display.
INGRANT	(pp 5-33) DMA control signal.
INIDENT	(pp 5-33) Interrupt control signal.
Inh	(As in Cache Inh. Limit reg., pp B-2) Inhibit.
INT	(As in INT 12, pp 5-33) Interrupt.
INTER	(As in INTER-T-2233, pp C-2) Interrupt(s).
INV	(As in FILSYS-INV-2135F, pp 2-8) Investigator.
INV	(As in FILSYS-INV-2135, pp C-3) A test program. Investigate.
IOX	(As in IOX error, pp 4-4, IOX-IDENT, pp 5-28, 5-69, IOX DECODE, pp 5-52) Input/Output Instruction.
IOXE	(pp 5-33) I/O control system which indicates "IOX instruction in progress".
IPS	(As in 75 IPS, pp 5-60) Inches per second.
IRQ	(pp 5-55, 5-58) Initiate request.
JMP	(As in 20/12400 (JMP), pp 6-12) A jump instruction.
K	(As in 32 K, pp 5-88 and in T32KMOS, pp 4-6) KILO (WORDS) = 1024 WORDS.
K	(As in K One bit acc., pp B-2) KILO. One-bit accumulator. Bit 2 in the STATUS-register.
Kw	(As in 64 Kw, pp v) Kilo(words) = 1024 words.
L-H	(As in L-H Research Power Supply, pp xiv and L-H RESEARCH, pp 6-5) Manufacturer's name.
LA	(As in DECWRITER LA 36, pp 5-9) A product code for a type of DECwriter printer.
LBLOCK	(pp 5-58 top) Load Block Address Register.
LED	(As in INDICATOR (LED), pp 6-16) Light Emittimg Diode.
LI	(As in LI-FI, pp 4-32) List (files).
LINJE	(As in FAST LINJE, pp 5-11) Norwegian for "line", = leased line.

L11	(As in L11-INTERRUPT, pp 5-58) Interrupt to level 11.
LO	(pp 4-32) Load. A command.
LOG	(As in ERRORLOG, pp 5-84, and BIG MPM LOG module, pp E-3) Storage of error information.
LP	(pp in LP-TEST, pp 5-11) A Line Printer Test Program.
LPM	(AS in 1000 LPM, pp 5-16) Line Printer model. (Lines per minute.)
LS	(pp 5-94) Least significant.
LU	List user names.
M	(As in 10 M BYTES, pp 5-56) Mega.
M	(pp 5-18) The character M.
M	(As in (M1), pp 5-95) Multiport rack M1.
M	(pp B-2) Multishift. Bit in status register.
magtape	(pp 5-32) Magnetic Tape.
MAIN	(As in MPM-MAIN - 2177, pp 5-82) Maintenance.
MAINT	(As in MAINT:N, pp 5-66) Maintenance.
MARG	(pp 5-55) A signal. Control word bit 10. Start marginal recovery cycle.
MAX	(As in MAX 6 UNITS, pp 5-54) Maximum.
MB	(As in 30 or 90 MB, pp 2-10 and pp 5-58 top) Megabytes.
MBYTES	(pp 5-35) Megabytes.
MC	(As in PRESS MC, pp 6-12) Master Clear. A button on the Operator's Panel.
MC	(pp 4-28 and 5-55) Master Clear.
MCL	(As in MCL (1077), pp 5-58) Master Clear.
MCL	(As in Light MCL, pp B-2) Light Master Clear button.
MCOPY	(As in MCOPY-HP, pp 2-9 and pp C-3) Copy magnetic tape. A test program.
MDB	(pp 5-52 and 5-55) Main I/O Data Bus. (Also MD.)
MDBO	(As in DATA MDBO-15, pp 5-33) Data Bus.
MECH	(As in MECH/DENT, pp 5-20) Ident mechanism/Ident code register.

MEMTOF	(As in MEMTOF stand-alone, pp 2-7 and THE MEMTOF PROGRAM, pp 4-25) Memory to floppy program.
MO	(As in MO - 3, pp 5-52) Modus 0-3.
MOD	(As in 1095 MOD, pp 5-11) Modified 1095 Module.
MON	(As in MON 64, pp 4-4) Monitor Call Instruction.
MOS	(As in T32KMOS, pp 4-6) Metal Oxide Semiconductor.
MOVER	(pp 4-6) A Test Program to test memory.
MP	(As in MP 01, pp 6-3) Multiport memory 1.
MPM	(pp 6-9) Multiport Memory.
MPX	(As in MPX ADDRESS, pp 5-33) Multiplexed.
MR	(As in "ADDRESS BUS (MR) LATCHES", pp 4-52) Memory Address Bus (18 bits). CPU Address Bus.
MS	(As in 0.5 MS, pp 4-38) Millesecond.
MS	(As in MS (1077), pp 5-55) Modus-strobe. A disk interface signal.
MS	(pp 5-94) Most significant.
MS	(pp 4-38) A signal. A ten microsecond pulse each time the controller goes active. Initiates the controller.
ms	(As in 170 ms, pp 4-38) Millesecond.
MT	(As in PERTEC MT CONTROL B, pp 5-60) Magnetic-tape.
MTA	(pp 5-60) Magnetic-tape label in plug panel.
MTB	(pp 5-60) Magnetic-tape label in plug panel.
MULTI	(pp 5-30) A Test Program to test the memory and POWER FAIL RESTART.
MULTI	(As in "a MULTI-TERM interface", pp 4-27) Multiple.
MULTI	(As in MULTI POWER, pp 6-7) Multiple. In this diagram, MULTI means "more than one regulator".
MUX	(pp 5-55) Multiplex integrated circuit.
N	(As in DEBUG(Y/N), pp 5-6) No, as in Yes/No.
N	(As in MAINT:N, pp 5-66) No, as in Yes or No.
NCT	(As in NCT NORD COLOUR TERM, pp 5-9) NORD Colour Terminal.
ND	(pp v) Norsk Data.
ND	(As in @E-D ND F-D-1 0, pp 5-81) ND is the Directory Name in the SINTRAN command.
nn	(pp 4-2) Error number (in an error message).

NO	(As in HARDWARE DEVICE NO, pp 4-7) NO = number.
NOOP	(pp B-2) No-operation.
NORD	(As in NORD power system, pp vi) Nordisk = Scandinavian. Trademark for ND computers.
NR	(As in BIT NR, pp 5-70) Number.
NRZI	(pp 5-60) Magtape terminology - No-Return to Zero, IBM.
O	(As in O Stat. overflow, pp B-2) Overflow. (Static overflow.)
OMNI	(As in TEXAS OMNI 800, pp 5-9) Product name of a terminal type.
ONCYL	(pp 5-55) On Cylinder. Signal from disk. Indicates that the heads are positioned over a data track and that head settling is finished.
OPENCL	(pp 5-55) Open Collector.
OPR	(pp 4-49) Operator's Panel Switch Register.
OPR	(As in OPR to X-reg) pp C-4) Operator's Panel.
OR	(pp 5-49) Either/OR (e.g., either 1155 or 1022).
OR	(As in "Inclusive OR of errors", pp 5-50) OR-function.
OUTGRANT	(pp 5-33) I/O system control signal.
OUTIDENT	(pp 5-33) I/O system control signal.
OVS	(pp 6-15) Overvoltage sensing.
0V	(pp 6-11 and pp 4-38) Zero volt.
P	(pp 5-85) Program Counter.
P	(As in (P-10022F:F-U), pp 2-6) PD + number 10022F.
P	(As in Command P, pp 5-85, pp 5-83) Print command in MPM-MAIN program.
PAC	(pp B-2) Panel Control.
PAG	(As in TEST-PAG, pp 5-3) Paging test program.
PAN	(As in PROCES-PAN, pp 5-9) (Process) panel.
PARAL	(As in PARAL-BYTE, pp 5-16) Parallel.
PAS	(pp B-2) Panel Status.
PASCAN	(pp 5-45) A test program. Pack Scan.
PB	(As in PB300, pp 6-15) Printed Board number 300 (Philips).
PCB	(As in PCB LAYOUT, pp 5-49, PCB layout, pp 5-48, pp 5-56) Printed Circuit Board.

PCB	(As in ONE PCB, pp 5-54) Printed Circuit Board.
pcb	(As in 1133 pcb, pp 5-46) Printed circuit board.
PCR	(pp B-2) Paging Control.
PD	(As in PD in NORD Software Library, pp 5-14) Program description.
PE	(As in Type PE 1718, pp 6-13) A type of power supply.
PE	(As in PE WRITE, pp 5-60) Phase Encoded - for Mag-tape.
PEA	(pp 4-18) Parity Error Address Register.
PEAERR	(As in PEA Error, pp 4-22) SAVED PARITY ERROR ADDRESS.
PERR	(pp 4-22) FAILING ADDRESS.
PERTEC	(As in PERTEC Mag-tape Controller, pp 5-59) Manufacturer's name.
PES	(pp 5-80) Memory Error Status Register.
PES	(pp 4-5, 4-18) Parity Error Status Register.
PES	(pp B-2) Parity Status.
PESERR	(As in PES Error, pp 4-22) SAVED PARITY ERROR STATUS.
PFAIL	(pp 5-3) Power Fail.
PGS	(pp B-2) Paging Status.
PH	(As in PH1 and PH8, pp 5-55, 5-58) Phase. PHx refers to the eight different phases of the controller during a transfer.
PHILIPS	(As in PHILIPS Power Unit, pp 6-7) Manufacturer's name.
PHOENIX	(pp 5-35) Commercial name for disk units. Cartridge Module Drive (CMD).
PICT	(As in ES-PICT-2216, pp B-2) Picture.
PIL	(As in PIL0, PIL1, PIL2, pp B-2) Current interrupt level.
PIO	(pp vi, 5-5) Character oriented devices.
PIO	(pp 5-69) Programmed Input/Output.
PM	(As in SIII-PM-INVESTIGATOR, pp 2-6) (See above.) A test program.
POS	(As in POS 2, pp 5-28) Position.
PR	(As in PR UNIT, pp 5-54) Per, as in "one per unit".

PROCES	(As in PROCES-PAN, pp 5-9) Process (panel).
PROG	(As in DUMPFL-PROG, pp 2-6 and "PROG" version, pp 2-6) Program.
PROM	(As in "1K PROM", pp 5-3) Programmed read only memory.
prom	(As in "cobl prom and 32 bits floating prom", pp 4-34) Programmed.
PVL	(pp B-2) Previous Level.
PVL	(As in PVL-bits, pp 4-22) Previous Level Indicator-bits.
Q	(As in Q Dyn. overflow, pp B-2) Dynamic.
R	(pp 5-23) Register (general). RESTART.
R	(As in R cost, pp 5-66) Routine.
R	(pp 5-83) Read Error Log command.
R	(As in R 960, pp 6-15) Register number 960.
RAM	(pp 5-3) Random Access Memory.
RAN	(As in FLOPPY-RAN, pp 5-21) Random Test Program.
RAND	(As in SUPER RAND, pp 5-40) Random Test Program.
RBA	(pp 5-58 top) Read Block Address. (A test.)
RC	(pp 5-52, 5-55) Read Clock. Read clock from the disk. Enables the read clock from the disk when reading sync. byte, address, address parity, data and data parity. Otherwise the write clock is enabled. In test mode the test oscillator is always enabled.
RCAR	(pp 5-55, 5-58) Read Core Address Register.
RCE	(pp 5-55, 5-58) Read Clock Enable.
RD	(pp 5-52) Read Data.
RDD	(pp 5-55) Read Disk Data. Serial read data.
REC	(pp 5-58, top) Read Error Count.
REFR	(As in DISK-REFR, pp 4-14) REFRESH. A command.
REG	(As in DMA-REG, pp 5-52 and SWITCH REG, pp 5-67) Register.
REP	(pp 5-58, top) Read Error Pattern.
REQ	(As in DEVICE REQ, pp 5-55, 5-58) Request.
REQ	(As in REQ COUNT, pp 5-55, 5-58) Request.

RG	(pp 5-55, 5-58) Read Gate. Enables the read data lines in the disk unit and the controller (address, parity and data).
RGCHK	(pp 5-3, C-2) Register Check. A test program.
ROM	(pp 5-78) Read Only Memory.
rr	(pp 4-2) Octal address corresponding to program name (In an error message).
RRD	(pp 5-52) Received Read Data.
RRQ	(pp 5-33) Reset REQUEST.
RS	(As in a RS-232 interface, pp 4-17 and RS 422, pp 5-70) S = serial. (International standard.)
RSTAT	(pp 5-55, 5-58) Read Status.
RSTE	(As in (1135) RSTE, pp 5-58 top) Reset ECC.
RT	(As in RT-program, pp 4-25) Real time.
RT	(As in RT programs, pp 4-2) Real time.
RTC	(As in RTC-12, pp 5-25) Real-Time Clock.
RTCH	(As in 1024=RTCH N-10, pp 5-25) Real-time clock.
RTLS	(As in RTLS, TAS, pp 5-52) Return to Address Zero. A command to disk.
RTLS	(pp 5-55) See RTLS.
RX	(pp 5-52, 5-55) Receive.
RX	(As in RX/TX, pp 5-58) Receive/Transmit.
S	(As in NORD-10/S) SUPER.
S	(As in S1172, pp 5-71) Utility test program for Universal DMA.
SB	(pp 6-11) (As in SB 9 and SB 10, pp 5-55, 5-58) Status bit. (SB 0 is status bit 0. Interrupt on not active is enabled.)
SB	(As in 5V SB, pp 5-95) Stand-by.
SCR	(As in SCR15 (1133), pp 5-58) Seek Condition Register.
SEC	(pp 5-55, 5-58) Sector clock, either from the disk of from a test oscillator in test mode.
SERCL	(pp 5-55) Phase-locked 9, 677 MHz clock generated from the servo track.
SI	(As in SI plus CONT, pp B-2) Single Instruction + Continue.
SI	(pp 5-55) Sector + index pulses.
SIGN	(As in MOST SIGN, pp 5-74) Significant.

SINTRAN	(pp 5-81) Sintef Translator. Sintef = Selskap for Industriell og Tesknisk Forskning.
SMD	(As in SMD CONTROLLER, pp 5-54, 76 Mbytes (SMD), pp 2-10, SMD OF 33 OR 66 M BYTES, pp 5-35) Standard Module Drive - CDC Disk Drive.
SR	(pp 5-20) Status Register.
SRS	(pp 5-35) A test program.
STB	(As in 12V STB, pp 6-3) Standby.
STS	(As in CPU-Register, pp 5-2) Status Register.
STS	(pp B-2) Status.
STS	(STS-Register, pp 4-48) Status Register.
SUT	(As in SUT 2328, pp 2-6) Software Utility Program.
SYNCHC	(pp 5-55, 5-58) Synchronize. 8 "ones" have been read in phase 1 or 4.
T	(pp 5-23) T-Register.
T	(As in T32KMOS, pp 4-6) Test.
T	(As in T-32B-FLOA, pp 5-4) Test.
T	(As in T cost, pp 5-66) Program label.
T	(As in T32K, pp 5-82) Test.
T32KMOS	(pp 4-6) A Test Program for testing the memory with BMPM.
TAG	(As in TAG Timing, pp 5-55) See TAG 1L, TAG 2L and TAG 3L.
TAG	(AS in TAG 2 or TAG 3, pp 5-55) See TAG 1L, TAG 2L and TAG 3L.
TALLY	(pp 5-10) A Serial Printer manufactured by TALLY.
TECOD	(pp 5-36) A test program.
TCODR	(pp C-3) Test of core and drum.
TDM	(As in Tandberg TDM MagTape, pp 5-59) Tandberg Dual Magtape.
TDV	(As in TANDBERG TDV, pp 5-9) A display terminal.
TEMP	(pp 6-11) (Also Temp) Temperature.
TESTMONO	(As in TESTMONO-1534, pp C-2) Test Program for colour monitor.
TERM	(As in MULTI-TERM interface, pp 4-27 and 5-48) Terminal.
TERMBUF	A Test Program for Terminal Buffer Interface. (See TERMINAL-BUFFER interface, pp 4-27)

TERMINET	(pp 5-10) A Line Printer (General Electric, U.S.A.).
TET	(As in TET with, pp 5-9) Text-Editing Terminal (NORTEXT).
TG	(As in TG Floating Rounding, pp B-2) A status bit.
TLINE	(As in TLINE-1541, pp 5-24) A test program.
TNCT	(As in TNCT plus NORDCOM, pp 5-9) Test NORD Colour Terminal program (TNCT).
TNCT	(pp C-2) Test for NORD colour terminal.
TRA	(As in TRA0, TRA3, TRA4, pp B-2) Instruction: TRA.
TRAFO	(pp 6-5) Transformer.
TRANSF	(pp 4-2) Transfer error (in an error message). (Also TRANSF!
TREAL	(As in TREAL-Test Program, pp 5-25) Test Real Time Clock.
TREPU	(pp C-2) Tape reader and tape punch. A test program.
TRIOLAB	(pp 6-5) Power supply manufacturer.
TRR	(As in TRR0, TRR3, TRR10, pp B-2) Instruction: TRR.
TSPEED	(As in "the initial value of TSPEED is 177777", pp 4-29 and "the data for T-SPEED", pp 4-27) Terminal Speed.
TSTAD	(pp 5-41) A test program.
TTEST	(pp 5-11) A Teletype and Display Verification Test Program.
TTEST	(pp 5-11) Terminal Test.
TTL	(As in TO TTL LEVEL, pp 5-69) Integrated circuit type (transistor logic).
tttt	(pp 4-2) Explanatory text (in an error message).
TX	(pp 5-52) Transmit.
TX	(As in RX/TX, pp 5-58) Transmit.
UPDAT	(pp 4-3) Update.
US	(As in US 0 and US 2, pp 5-55) Unit Select Signal to Disk.
US	(As in US 0L, US 1L and US 2L, pp 5-58) Unit Select Signal to Disk.
us	(As in 10 us, pp 5-73 and 32 us, pp 5-75) Micro-seconds.
UVS	(pp 6-15) Undervoltage sensing.
V	(As in 5V, pp 4-38) Volt.
VADJ	(pp 6-6) Voltage adjustment.
VERSATEC	(pp 5-9) (As in VERSATEC Printer/Plotter) A manufacturer.

VISTAR	(As in VISTAR, 6T, 6TX, pp 5-9) A display terminal.
VSB	(As in 5 VSB 300, pp 6-15) Volt standby.
W	(As in W16 and W17, pp B-2) Switches 16 and 17 on the Operator's Panel.
WA	(As in WA-EQUALD, pp 5-55, 5-58) Wrong Address-Equal. Specified address did not match with the address read from the disk.
WD	(pp 5-52) Write Data. Serial write data (address when formatting).
WD	(As in EQUAL (WF), pp 5-55 and 5-58) Write Format.
WDL	(pp 5-55) Write data on differential line drive.
WG	(pp 5-55, 5-58) Write Gate. Enables the write data lines in the disk and the controller.
WRC	(pp 5-55) Write Clock. Servo clock from the disk used as write clock in the controller.
WRCL	(pp 5-55) Write Clock on differential lines. Delayed servo clock used as write clock to the disk.
X	(As in "of 512 X 1 bit", pp 5-73) Multiply.
XMSG	(As in XMSG/Program, pp 4-5) A software label.
xx	(pp 4-2) Numbers carrying additional information (in an error message).
Y	(As in DEBUG(Y/N), pp 5-6) Yes, as in Yes/No.
YY	(pp 4-2) Numbers carrying additional information (in an error message).
Z	(pp B-2) Zero error.

APPENDIX B

NORD-10/S INTERNAL REGISTERS AND ALD

Figure B.1 shows the Internal Registers of the NORD-10/S and Figure B.2 illustrates the Automatic Load Descriptor (ALD) Register.

BIT NO.	PAS Panel Status I0/ TRA0	PAC Panel Control TRR0	STS Status I1/ TRA, TRR 1	PGS Paging Status I3/ TRA3	PCR Paging Control TRR3	PVL Previous Level I4/ TRA4	IIE, IIC Internal Inter. I6/ TRR, TRA(code	CSR Cache Status I10/ TRR10	ALD Aut. Load Descr. I12/ TRA12	CILR Cache Inh. Limit reg. TRR12	PES Parity Status I13/ TRA13	ECCR Error Correction Control reg. TRR15	BIT NO.
0	Selected Register	Light Selected Register	Alt. page table	Virtual Page Number	Bank No. / Ring No.	0		Cache UPDATE	ADDRESS	Lower Limit (Page No.)	Addr. bit 16	Test 0	0
1			TG Floating Rounding			1 DP	Monitor Call (1)	Cache ON			Addr. bit 17	Test 15	1
2			K One bit acc.		Bit 2 = 1 = 0	0	Protect Viol. (2)				During FETCH	0=multiple error 1=ANYerro	2
3	Selected Level		Z Zero error		Level	PVL0	Page Fault (3)				During DMA	Disable	3
4			Q Dyn. overflow			PVL1	Illegal Instr. (4)						4
5			O Stat. overflow			PVL2	Zero error (5)						5
6			C Carry	Page Index Table No.		PVL3	Privileged Instr. (6)				BLOCK Memory error		6
7	EXAM		M Multishift		Alternative Page No.	1	IOX Error (7)				Overrun		7
8	LOAD	Light LOAD	PIL0			1	Memory Parity Error(10)				Error Correction		8
9	SI + CONT	Light CONTINUE	PIL1	Interrupt Level Indicator	Page No.	1	Memory out of Range (11)				C0		9
10	RESTART		PIL2			1 IRR	Power Fail (12)				C1 Error	x	10
11	DEPOSIT/ ENT. REG.		PIL3			0					C2 Code		11
12	SET ADR	Light MCL				1			0 = Octal 1 = Binary	Upper Limit (Page No.)	C3		12
13	NOOP	Reset LOAD				0			Mass Storage		C4 Upper byte		13
14	W16		PAGING ON	Permit Violation Interrupt		1			Restart		Lower byte	xx	14
15	W17		INTERRUPT ON	Interrupt During Fetch		1			Extension				15

x = 21 bits modules

xx = 18 bits modules

Figure B.1: INTERNAL REGISTERS — NORD-10/S

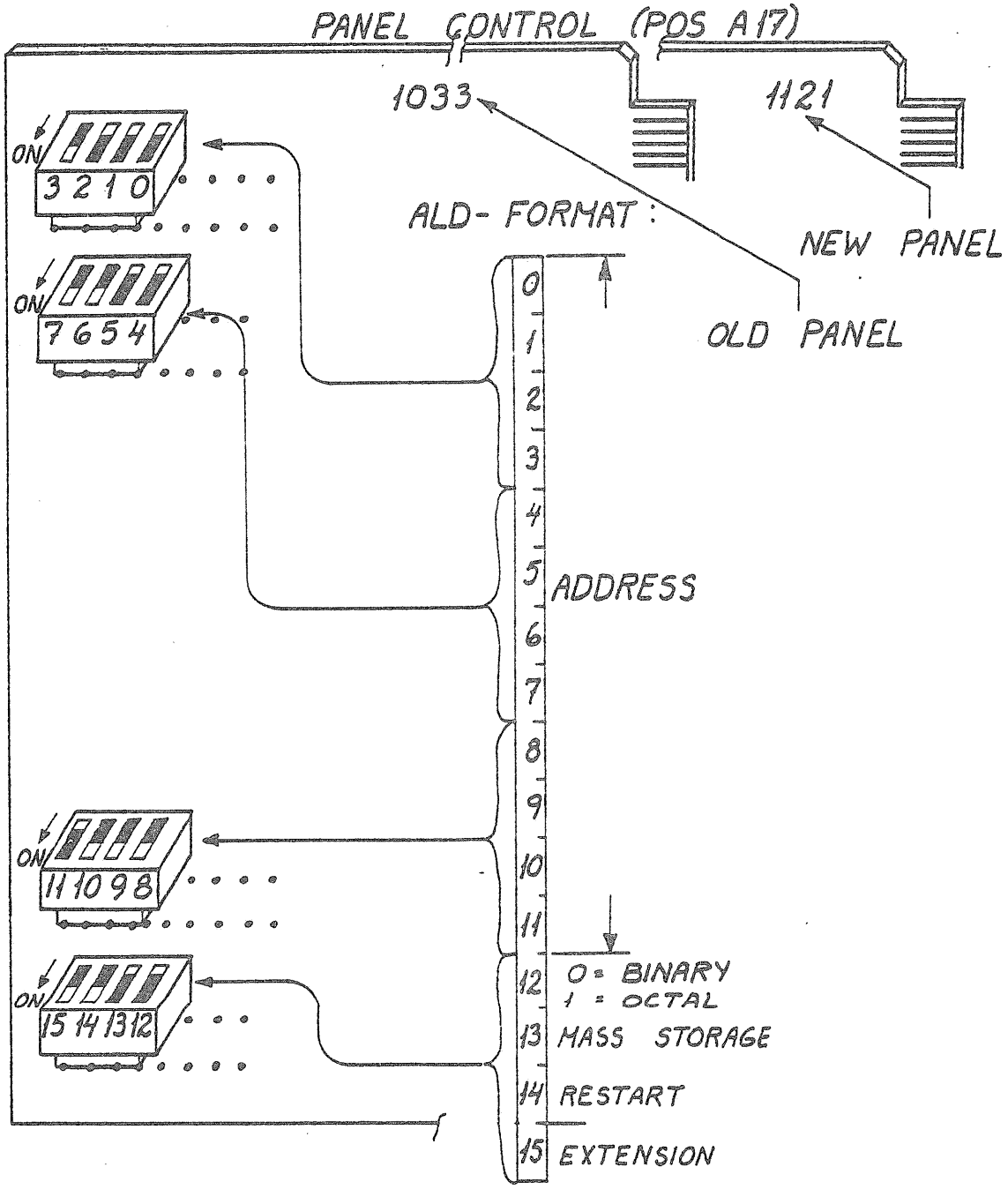


Figure B.2: ALD — AUTOMATIC LOAD DESCRIPTOR-REGISTER

APPENDIX C

TEST PROGRAM OVERVIEW

The ND test programs that can be used to test the NORD-10/S are available on the following diskettes:

TEST PROGRAMS

10324	—	TEST PROGRAMS NO. 1 FOR NORD-10, NORD-12 and ND-100
10325	—	TEST PROGRAMS NO. 2 FOR NORD-10, NORD-12 and ND-100
10326	—	TEST PROGRAMS NO. 3 FOR NORD-10, NORD-12 and ND-100

The programs that are on-site with a NORD-10/S CPU application are found in the Software Notebook. This notebook contains the current description of the test programs on-site.

The programs are to be used to test:

1 CPU

2 MEMORY

3 INPUT/OUTPUT

4 MASS STORAGE

5 UTILITY PROGRAMS FOR DISK/MAGTAPE

An overview of the test program is as follows:

CPU TEST PROGRAMS

Program Name	*Test Program Diskette*	*Purpose*
ONE-CHECK-1192	ND—10325	Instruction check
TWO-CHECK-1190	ND—10325	Instruction check
THREE-CH-1528	ND—10325	Instruction check
FOUR-CH-1418	ND—10325	Instruction check
EXTEN-ONE-1519	ND—10324	Instruction check, all levels
RGCHK-1543	ND—10325	Register
CACHE-2063	ND—10325	Cache
PAGING-A	ND—10325	Paging
TREAL-1399	ND—10326	Real-Time clock
FLOATING-1529	ND—10325	48 bit floating
T-32B-FLOA-1860	ND—10325	32 bit floating
PFAIL-1355	ND—10324	Power fail restart

MEMORY TEST PROGRAMS

MULTI-1820	ND—10324	Memory
T8KMOS-1821	ND—10325	8K MOS modules
T32KMOS-2178	ND—10324	32K MOS modules
ERRCOR-2112	ND—10325	Error correction (memory)—NORD-10
MPM-MAINT-2177	ND—10324	Big multiport memory log
MOVER-1863	ND—10324	Memory test
MEM-TEST-2304	ND—10326	Memory test using S1172 (Universal DMA)

TEST PROGRAMS FOR INPUT/OUTPUT DEVICES

TREPU-1269	ND—10325	Tape reader and tape punch
TTEST-1206	ND—10324	Terminals
TNCT-2039	ND—10326	Nord colour terminal
ES-PICT-2216	ND—10326	Picture system test
S1172-HAR-2235	ND—10326	Test DMA interface
DS1172-2282	ND—10325	Test DMA interface
INTER-T-2233	ND—10326	Test of external interrupts 1127
PROCES-PAN-1865	ND—10325	Process panel check
FLOPPY-FU-1986	ND—10324	Floppy disk
TESTMONO-1534	ND—10326	NORDCOM
TLINE-1541	ND—10325	Synchronous modem
CARDR-1642	ND—10325	Card reader
TERMBUF-1751	ND—10325	Terminal interface ND 253
FLOPPY-RAN-1988	ND—10324	Floppy Disk
CHATA-1832	ND—10325	Asynchronous inter computer link
CONFI-INV-1672	ND—10324	Configuration Investigation
LP-TEST-1878	ND—10324	Line Printers
PARAL-BYTE-1942	ND—10325	Parallel Byte interface
VERSATEC-TEST-2297	ND—10326	Versatec printer/plotter
HDLC-2-2307	ND—10324	HDLC test program

TEST PROGRAMS FOR MASS STORAGE

SUPER-RAND-2222	ND—10324	To test the controller and 38/75/288Mb disks. Writes on disks.
ECCTEST-2224	ND—10325	Error correction facility test for 38/75/288Mb controller. Doesn't write on disks.
BIGFUNC-1824	ND—10324	Function test for 33/66 and 38/75/288Mb disks. Writes on disks.
BIG-RAND-1876	ND—10324	Random data and address test for 33/66Mb disks. Writes on disks.
DSERV-1395	ND—10325	Adjustment program for cartridge disks.
TECOD-1451	ND—10325	Test of cartidge disks and controller.
TANB-MAG-1559	ND—10324	Test program for Pertec/Tandberg Magnetic tape stations.
HPMAG-1523	ND—10326	Hewlett Packard magnetic tape.
TCODR-1299	ND—10326	Test of core and drum.

UTILITY PROGRAMS FOR MASS STORAGE

PASCAN-2226	ND—10326	Pack verification program for 75/288Mb disks.
GREMS-2231	ND—10324	Utility program for 37/75/288Mb disks.
TSTAD-1870	ND—10326	To check big disk addresses.
BIMS-1871	ND—10324	Utility program for 33/66Mb disks.
DIMS-1453	ND—10324	Utility program for cartridge disks.
DRUMS-1297	ND—10326	Drum maintenance system.
FILSYS-INV-2135	PRO-10022	To check and investigate the contents of a directory on disks (all disks).
FL-LOOPS-1996	ND—10326	Debugging loops for floppy disk.

KNOWN BUT NOT CORRECTED ERRORS IN TEST.PROGRAMS.

ISSUED: 3 JUNE 1981

When other errors than the ones listed here are found, please report to : Dag Grønvold Technical Support, ND-Norway.

	PROGRAM NAME	DESCRIPTION	TYPE
NEW==>	BIGFUNC-1824I ND-10324A	Does not work with the MMD-9730 150 Mb-disk because of different timing on RTZ.	100
	CONFI-INV-1672M ND-10324A	The program gives the error message "NO IDENT FOUND" if the dev.no. now beeing tested is a 1095 card either modified for current-loop printer , with busy or RS232/V24 is selected, and the connected device is not ready.	10,100
	CONFI-INV-1672M ND-10324A	The program does not work with a 1172-card, It looks for Terminal 45 and 46 instead of the Universal DMA-device, and gives the error message "NO IDENTCODE FOUND".	10
	CONFI-INV-1672M ND-10324A	There is no checksum on HDLC I/O, but the program search for it and gives out an error message.	
NEW==>	CONFI-INV-1672M ND-10324A	If STC-controller is placed as controller 2 program gives error message "NO IDENT FOUND"	100
	DIMS-1453F GREMS-2231G ND-10324A	When doing DUMP the program first reads disc contents into memory, and then dumps memory. If there is an error, ex.: READ UNIT NOT READY, the error-message will occur but then the program dumps the memory of computer even though it has not read the disc.	10,100
	GREMS-2231G ND-10324A	When FORMATTING after the Disk-drive has previously been switched off, an error will occur on first address on disk. Second try will pass.	100
	GREMS-2231G ND-10324A	When using the REFRESH function the refresh will not be done properly if only BAD TRACKS are refreshed. Until this error is corrected one should do the refresh on all tracks.	10,100
NEW==>	GREMS-2231G ND-10324A	Does not work with the MMD-9730 150 Mb-disk.	100
	HDLC-2-2370A ND-10324A	If the program is run on one machine connected to others via HDLC and they are running under SINTRAN, they will stop. The program cannot be run on more than one machine at the time. Recommended speed: 76.8 kbaud or less.	10,100
	T-32B-FLOA-1860B ND-10325A	If used on a machine with the 1023-1K-PROM the program will give an error-message in the floating-division test no. 9 (FDV 09). This is due to different rounding.	10
	TTEST-1206A ND-10324A	Problems in connection with the 1147 card. The program must be started twice.	10,100

APPENDIX D

DOCUMENTATION REVIEW

Descriptions of manual content within functional groups are as follows:

NORD-10/S MANUALS

1. NORD-10/S Input/Output System ND—06.012

   This manual describes the main building blocks of the NORD-10/S and their functions, from a hardware point of view. It is written for technical and maintenance personnel requiring detailed information about the NORD-10/S, and should also be of interest to software personnel. Some knowledge of digital techniques and computer systems in general is recommended. Knowledge of the NORD-10/S instruction set found in the NORD-10/S Reference Manual is necessary.

2. NORD-10/S Functional Description ND—06.009

   This manual describes the NORD-10/S Input/Output system architecture and principles from a hardware point of view, those parts of the I/O system common to all device controllers, the DMA data flow and the I/O interrupt system. It is written for technical and maintenance personnel requiring a good understanding of the connection of I/O interfaces to the NORD-10/S computer system and software personnel who program I/O interfaces. Familiarity with the NORD-10/S CPU at the level described in the NORD-10/S Functional Description is required, along with some knowlege of the NORD-10/S instruction set and assembly programming, which can be found in the NORD-10/S Reference manual.

3. NORD-10/S ND—06.013
   General Description and Module Description

   This contains a short description of the main components of the NORD-10/S, followed by a description of the circuits found on each printed circuit board.

MANUALS FOR THE SPECIAL SYSTEMS INTERFACED OR USED WITH THE NORD-10/S

1. Big Multiport Memory System ND—06.007

   This manual gives a general and detailed description of the Big Multiport Memory System architecture, including memory, service and control channel specifications, and installation. It is written for technical and maintenance personnel needing a good understanding of this system, and installation personnel. Familiarity with the NORD-10, NORD-100, and NORD-50 at the level described in their Functional Descriptions is required.

2. CDMA — NORD-10 General Information ND—12.004

   This manual gives a detailed description of the principles of operation. It contains a summary of the programming specifications and includes diagrams of the timing and the logic. It is written for those who want to use CAMAC, or to know how it works. No previous knowledge is required.

3. CAMAC — CC-NORD-10 General Information ND—12.007

   This manual gives genral informaiton on the operation of the CC-NORD-10 crate controller. The conteoller interfaces CAMAC crates directly to the input/output bus of the NORD-10 computer. It contains informastion on the physical and electrical specifications, interrupt handling, LAM handling and Link Bus characteristics. It gives information about addressing and data formats and the probrammable operations on CC-NORD-10. It should be of interest to all those who want to understasnd how CAMAC works.

4. CAMAC — CC-NORD-10 Hardware ND—12.006

   This manual is written for CAMAC users. It describes the programming specifications and contains logic diagrams, parts list and signal definition list.

5. (Error Correction Control) ND—11.013
   Disk Controller

   This manual is a reference manual and user's guide for the ECC disk controller. It contains a general description of the ECC disk controller, and descriptions of the addressing concept, sector format, the interface signals and the error correction code. Controller functions are illustrated by timing diagrams. Interrupt generation and handling, a debugging guide and description of the logic boards are also included. Knowledge of disk controller function and operation is required.

6. 1158 DR-11-C Interface ND—12.015

The manual gives an introduction to the 1158 DR-11-C interface. It contains hardware descriptions and programming specifications. Various test possiblities are given along with block diagrams and logic diagrams.

7. Floppy Disk System ND—11.012

This manual is a reference manual and user's guide for the Floppy Disk System. It describes the system itself, the interface and the formatter. General knowledge of the purpose and functioning of floppy disk systems is required.

ND—11.010

8. HAWK Disk Controller

This manual is a reference manual and user's guide for the NORD-10/HAWK — Disk Controller. It describes NORD-10/HAWK programming specifications, the interface signals, disk addressing, the write and read operation, interrupt generation and handling, status generation, and the control word. Knowledge of the HAWK Disk System is required.

9. HAWK Disk System ND—11.009

This manual contains a description of the major components of the HAWK Disk System, the Read/Write basic principles, the Read/Write Head Assembly, the interface signals, power distribution, the servo system, seek operations, sectoring, Read/Write/Erase Operations and fault handling and detection.

10. HDLC — High Level Data Link Control Interface ND—12.018

This manual gives a functional descirption of the High Level Data Link Control Interface. It contains various standards and procedures and gives programming specifications. It has logic diagrams for the HDLC and a detailed description of the Multiprotocol Communication Controller is given.

11. Interface to Pertec Magtape With Formatter ND—12.012

This manual deals with the signals between 1123 and 1124. It contains programming specifications and a description of the formatter. It also gives hardware information and contains logic diagrams.

12. Universal DMA Interface ND—12.020

This manual is intended as a user's guide to interfacing and programming the ND850 Universal DMA Interface and ND851 Differential DMA Adapter. It describes the hardware and defines the electrical and mechanical specifications and the programming specifications. It includes programming examples, circuit schematics, parts list and test programs. The reader should be acquainted with the NORD-10/S Reference Manual, ND-06.008.

SITE PREPARATION AND INSTALLATION

1. SITE PREPARATION AND INSTALLATION MANUAL ND—30.002

This is a reference manual for technical personnel and customers actively involved in the preparation of a computer site for Norsk Data equipment. It is used as a reference document by the System Integration Department configurations, the NORD-10/S, the NORD-50, the ND-100 and the ND-500. It should only be used by a customer after consultation with the System Integration Department, Norsk Data.

SINTRAN AND TEST PROGRAMS

1. SINTRAN III SYSTEM SUPERVISOR ND—30.003

This manual is the guide for system supervisors administering data centers implemented under SINTRAN III. It is written for operators controlling the daily operation of the system and for system supervisors who program and operate the system. No previous knowledge is required for operators. System supervisors should have a genr5al knowledge of SINTRAN III from a user's point of view.

2. TEST PROGRAM DESCRIPTIONS FOR ND-100 AND NORD-10 SERIES VOLUME 1 ND—30.005

3. TEST PROGRAM DESCRIPTIONS FOR ND-100 AND NORD-10 SERIES VOLUME 2 ND—30.005

These manuals contain the descriptions of the test programs used with the NORD-10/S and the ND-100 CPUs. They are written for field service engineers and technical personnel directly involved with testing or maintaining the NORD-10/S and the ND-100 CPUs. They contain detailed information on the contents and structure of each test program and the procedure for their implementation. The manuals are the central reference documents for these test programs. In-depth knowledge of the function of these CPUs is required.

Volume 1 — The most used test programs.

Volume 2 — The least used test programs.

SPECIAL CONFIGURATION NOTEBOOKS ON SITE WITH EACH CPU

1 HARDWARE MACHINE BOOK SPECIAL

At the time a CPU application for a customer is completed at Norsk Data a comprehensive in-depth description of the CPU by serial number is assembled by the Production Department and sent to the customer at the time of acceptance delivery of the CPU. This description includes a computer configuration form with product information, a card assembly chart, logic diagrams, wiring lists, program specifications and plug lists, memory data, the operator's panel, and the power system. Space is provided for modifications of equipment and for the filing of the customer copy of the Hardware System Field Report.

2 SOFTWARE MACHINE BOOK SPECIAL

At the time a CPU application for a customer is completed at Norsk Data the applicaiton software programs are assembled by the NORD Data Center Software Support on floppy disks. Program documentation and technical manuals are sent with the floppies to the site. A current record of these programs is maintained by Software Support at Norsk Data. The on-site record is maintained in the Software Notebook.

3. HARDWARE MAINTENANCE NOTEBOOK SPECIAL

This notebook is a procedure guide for the Field Service Engineer. It identifies the information contained in the Data Base CPU Picture, the On-Site Fault Analysis Procedure, and the forms, records, and reports used to control maintenance.

APPENDIX E

STANDARD NORD-10/S DEVICE NUMBERS AND IDENT CODES

Logical Device No. Octal(Decimal)	*Device No.*	*Interrupt Level*	*Ident Code (octal)*	*Device*	*SINTRAN III*
	4- 7	13	4	Memory Parity N-12	
	10- 13	13	1	Real Time Clock 1	
	14- 17	13	2	Real Time Clock 2	
	30- 33	12	16	NORD-50/1	
	34- 37	10	16	ACM 5	
	40- 43	10	15	ACM 1	
	44- 47	10	25	ACM 2	
	50- 53	10	40	ACM 3	
	54- 57	10	41	ACM 4	
	60- 77			NORD-50/1 Regs.	
6	100-107	10-12	4	Synchr. Modem 1	
16 (14)	110-117	10-12	14	Synchr. Modem 2	
30 (24)	120-127	10-12	20	Synchr. Modem 3	
31 (25)	130-137	10-12	24	Synchr. Modem 4	
26 (22)	140-147	10-12	30	Synchr. Modem 5	
27 (23)	150-157	10-12	34	Synchr. Modem 6	
7	200-207	10-12	60	Asynchr. Modem 1	Terminal 17
17 (15)	210-217	10-12	61	Asynchr. Modem 2	Terminal 18
52 (42)	220-227	10-12	62	Asynchr. Modem 3	Terminal 19
53 (43)	230-237	10-12	63	Asynchr. Modem 4	Terminal 20
54 (44)	240-247	10-12	64	Asynchr. Modem 5	Terminal 21
55 (45)	250-257	10-12	65	Asynchr. Modem 6	Terminal 22
56 (46)	260-267	10-12	66	Asynchr. Modem 7	Terminal 23
57 (47)	270-277	10-12	67	Asynchr. Modem 8	Terminal 24
1	300-307	10-12	1(120*)	Teletype 1	Terminal 1
11 (9)	310-317	10-12	5(121*)	Teletype 2	Terminal 2
42 (34)	320-327	10-12	6(122*)	Teletype 3	Terminal 3
43 (35)	330-337	10-12	7(123*)	Teletype 4	Terminal 4
44 (36)	340-347	10-12	44	Teletype 5	Terminal 5
45 (37)	350-357	10-12	45	Teletype 6	Terminal 6
46 (38)	360-367	10-12	46	Teletype 7	Terminal 7
47 (39)	370-377	10-12	47	Teletype 8	Terminal 8
2	400-403	12	2	Paper Tape Reader 1	
12 (10)	404-407	12	22	Paper Tape Reader 2	
3	410-413	10	2	Paper Tape Punch 1	
13 (11)	414-417	10	22	Paper Tape Punch 2	
4	420-423	12	3	Card Reader 1	
14 (12)	424-427	12	23	Card Reader 2	
5	430-433	10	3	Line Printer 1	
15 (13)	434-437	10	23	Line Printer 2	
10 (8)	440-443	10	11	Calcomp Plotter 1	
50 (40)	444-447	10	12	Card Punch 1	
51 (41)	454-457	10	13	Card Punch 2	

* 4 CURRENT-LOOP MODULE 1122

Logical Device No. Octal(Decimal)	*Device No.*	*Interrupt Level*	*Ident Code (octal)*	*Device*	*SINTRAN III*
	500- 507	11	1	Disk System 1	
	510- 517	11	5	Disk System 2	
	520- 527	11	3	Magtape Controller 1	
	530- 537	11	7	Magtape Controller 2	
	540- 547	11	2	Drum 1	
	550- 557	11	6	Drum 2	
1006 (518)	560- 577	12-13	156	HDLC HASP 1	
1022 (18)	600- 607	11	4	Versatec 1	
	610- 617	11	11	Core-to-Core 1	
1007 (519)	620- 637	12-13	157	HDLC HASP 2	
1040 (544)	640- 647	10-12	124		Terminal 33
1041 (545)	650- 657	10-12	125		Terminal 34
1042 (546)	660- 667	10-12	126		Terminal 35
1043 (547)	670- 677	10-12	127		Terminal 36
	700- 707	12	11	CATSY 1	
	710- 717	12	21	CATSY 2	
	720- 727			A/D Converter	
	730- 737	10	10	D/A Converter	
	750- 753	13	5	BIG MPM LOG module	
	770- 773	12	17	Dig. Reg. 1 Input	
	774- 777	10	17	Dig. Reg. 1 Output	
	1000-1003	12	26	Dig. Reg. 2 Input	
	1004-1007	10	26	Dig. Reg. 2 Output	
	1010-1013	12	27	Dig. Reg. 3 Input	
	1014-1017	10	27	Dig. Reg. 3 Output	
	1020-1023	12	43	Dig. Reg. 4 Input	
	1024-1027	10	43	Dig. Reg. 4 Output	
	1030-1033	12	116	NORD-50/2	
	1034			Watch Dog	
	1035			Process Output 1	
	1036			Process Output 2	
	1037			Process Output 3	
	1040-1043	12	15	Process Input 1	
	1044-1047	12	25	Process Input 2	
	1050-1053	12	40	Process Input 3	
	1060-1077			NORRRRRD-50/2 Reg.	
1044 (548)	1100-1107	10-12	130		Terminal 37
1045	1110-1117	10-12	131		Terminal 38
1046	1120-1127	10-12	132		Terminal 39
1047	1130-1137	10-12	133		Terminal 40
1050	1140-1147	10-12	134		Terminal 41
1051	1150-1157	10-12	135		Terminal 42
1052	1160-1167	10-12	136		Terminal 43
1053 (555)	1170-1177	10-12	137		Terminal 44
1070 (56)	1200-1207	10-12	70	Asynchr. Modem 9	Terminal 25
1071	1210-1217	10-12	71	Asynchr. Modem 10	Terminal 26
1072	1220-1227	10-12	72	Asynchr. Modem 11	Terminal 27

Logical Device No. Octal(Decimal)	*Device No.*	*Interrupt Level*	*Ident Code (octal)*	*Device*	*SINTRAN III*
1073	1230-1237	10-12	73	Asynchr. Modem 12	Terminal 28
1074	1240-1247	10-12	74	Async 13/Photo 1	Terminal 29
1075	1250-1257	10-12	75	Async 14/Photo 2	Terminal 30
1076	1260-1267	10-12	76	Async 15/Photo 3	Terminal 31
1077 (63)	1270-1277	10-12	77	Async 16/Photo 4	Terminal 32
1060 (48)	1300-1307	10-12	50	Teletype 9	Terminal 9
1061	1310-1317	10-12	51	Teletype 10	Terminal 10
1062	1320-1327	10-12	52	Teletype 11	Terminal 11
1063	1330-1337	10-12	53	Teletype 12	Terminal 12
1064	1340-1347	10-12	54	Teletype 13	Terminal 13
1065 (53)	1350-1357	10-12	55	Teletype 14	Terminal 14
1066 (54)	1360-1367	10-12	56	Teletype 15	Terminal 15
1067 (55)	1370-1377	10-12	57	Teletype 16	Terminal 16
1054 (556)	1400-1407	10-12	140		Terminal 45
1055	1410-1417	10-12	141		Terminal 46
1056	1420-1427	10-12	142		Terminal 47
1057	1430-1437	10-12	143		Terminal 48
1060	1500-1507	10-12	144		Terminal 49
1061	1510-1517	10-12	145		Terminal 50
1062	1520-1527	10-12	146		Terminal 51
1063 (563)	1530-1537	10-12	147		Terminal 52
	1540-1547	11	17	Big Disk System 1	
	1550-1557	11	20	Big Disk System 2	
	1560-1567	11	21	Floppy Disk 1	
	1570-1577	11	22	Floppy Disk 2	
23 (19)	1600-1607	11	14	Versatec 2	
	1640-1657	12-13	150	HDLC NORD NET-1	
	1660-1677	12-13	151	HDLC NORD NET-2	
	1700-1717	12-13	152	HDLC NORD NET-3	
	1720-1737	12-13	153	HDLC NORD NET-4	
	1740-1757	12-13	154	HDLC NORD NET-5	
	1760-1777	12-13	155	HDLC NORD NET-6	

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Section:

* * * * * * * * * * SEND US YOUR COMMENTS!!! * * * * * * * * * *

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* find needless information

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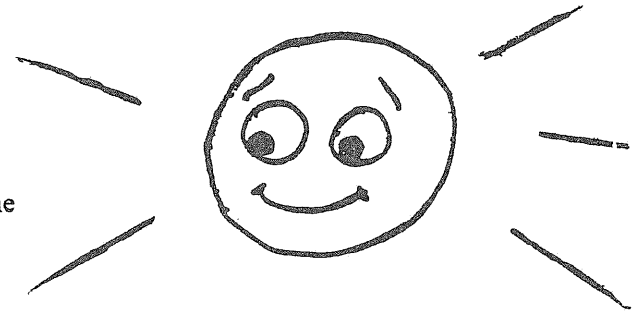

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Manual name: NORD-10/S - Hardware Maintenance Manual Manual number: ND–30.004.02

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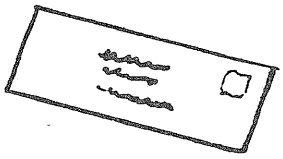

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