[redacted]

```
  33333333      44             88888          000000
        33     44            88     88      000   000
       33     44            88       88     00     00
     33      44    44        88     88      00     00
   33333    44     44         88888         00     00
       33   4444444444       88     88      00     00
        33         44       88       88     00     00
  33    33         44        88     88      000   000
   333333          44          88888          000000


  PPPPPP    EEEEEE   VV       VV     AA        LL
  PP   PP   EE       VV       VV    AAAA       LL
  PPPPPP    EEEE      VV     VV    AA  AA      LL
  PP        EE         VV   VV    AAAAAAAA     LL
  PP        EE          VVVV     AA       AA   LL
  PP        EEEEEEE      VV      AA       AA   LLLLLLL
```

T E C H N I C A L   B U L L E T I N
====================================

T B - 0 0 1
===========

Nov. 02, 1988

HT-3480-1

3480 PRODUCT ENGINEERING

DEPARTMENT: 9261

V A L E N C I A   P L A N T

S P A I N

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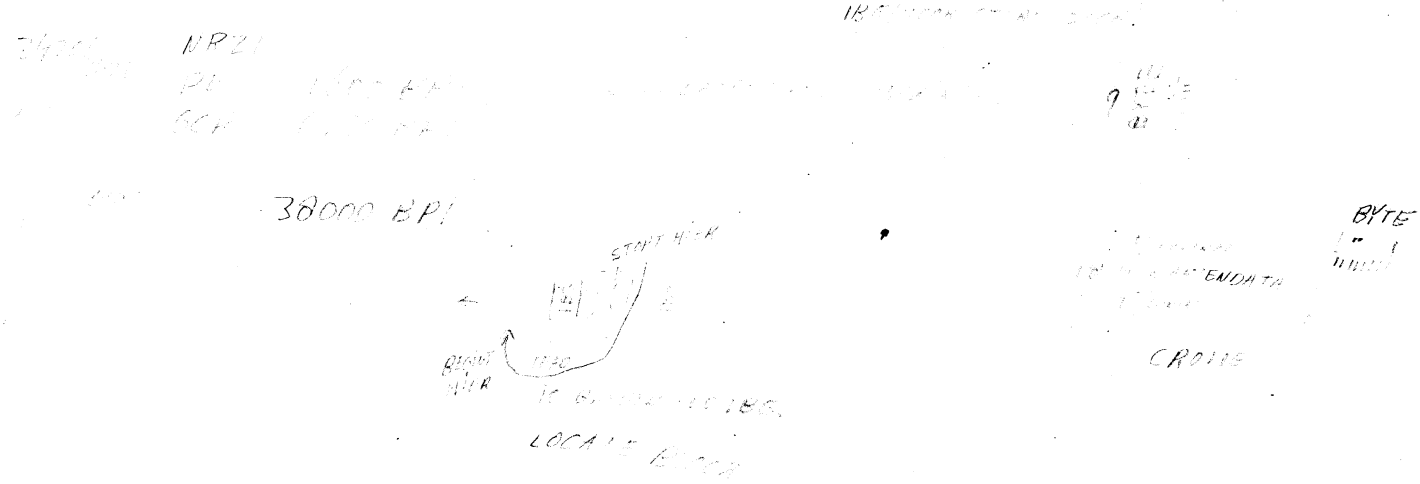


1.0 BAD TRACK INVESTIGATION PROCEDURE

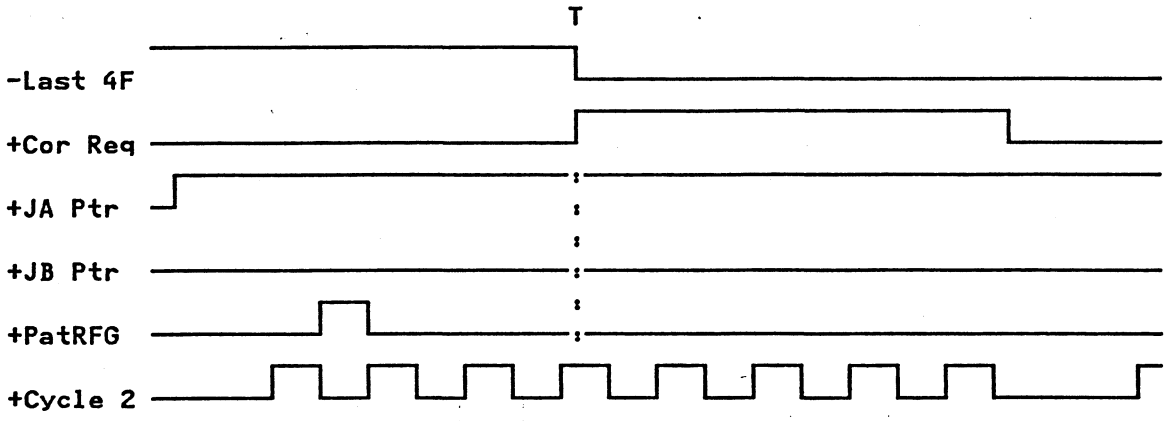
Following procedure shows which track needs to be corrected by the ECC circuitry by hooking up a BIO (or any Logical Analyzer) to the following signals:

A1R2Y12 -Last four frames
A1R2Y13 +Cycle 2
A1R2Z26 +Patt. Reg Funnel Gate
A1R2X22 +Correction Required
A1R2X04 -Backward/+Forward
A1R2Z28 +JA Pointer
A1R2Z32 +JB Pointer

Trk.	A2R2	A2S2	A2T2
1	1A	2A	3A
2	4A	5A	6A
3	7A	8A	9A
4	1B	2B	3B
5	4B	5B	6B
6	7B	8B	9B

And setting it up as follows:
TRIGGER: -Last four frames and +Correction required
DELAY : Depends on the BIO. About 200 CLOCKS.
CLOCK : 50 ns or less.

The following figure illustrates what can be seen for track 4A (in FORWARD) being needing correction.



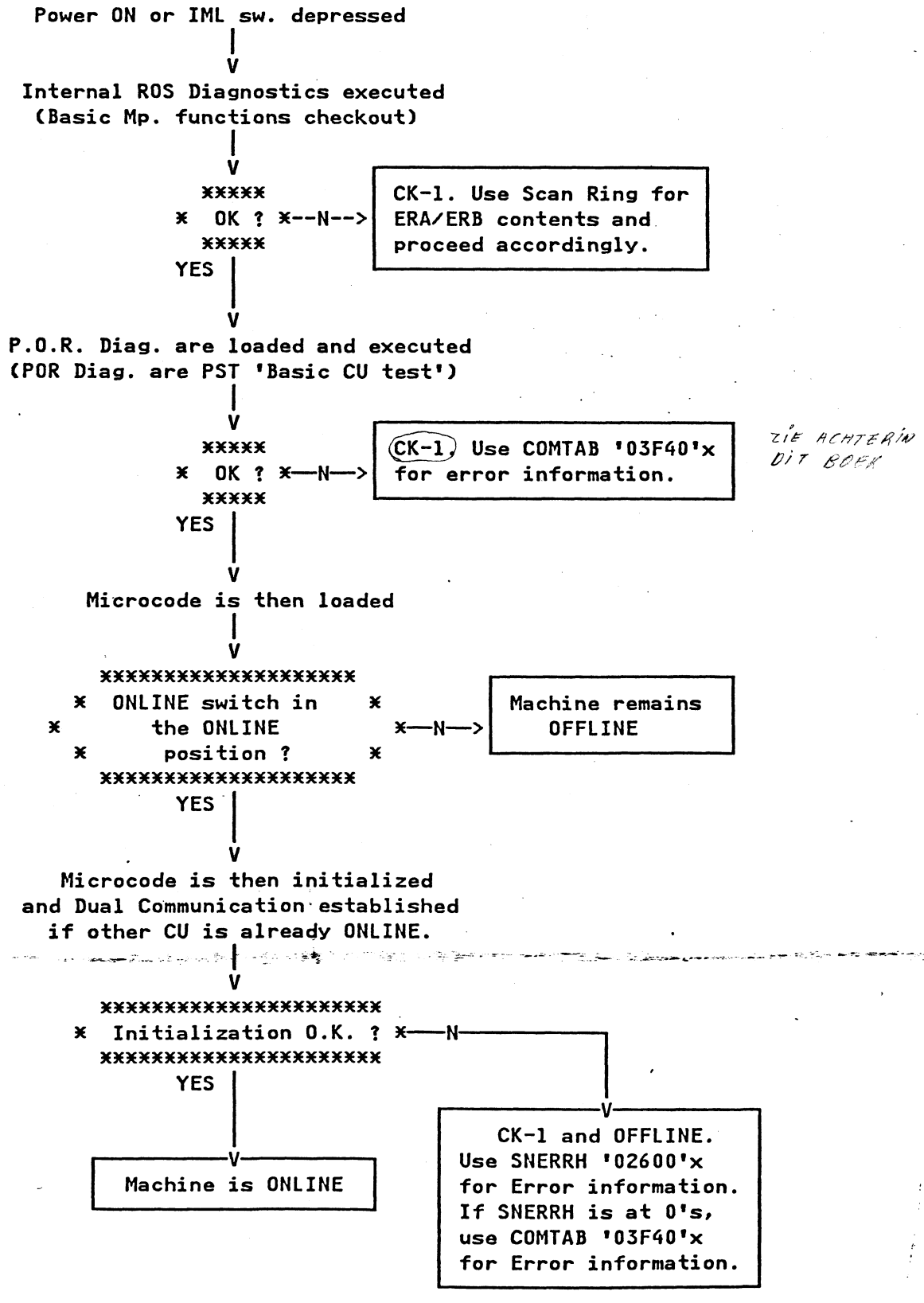
Track FWD: 1A 2A 3A 4A 5A 6A 7A 8A 9A 1B 2B 3B 4B 5B 6B 7B 8B 9B 1A 2A..
Track BWD: 7B 6B 5B 4B 3B 2B 1B 8B 9B 7A 6A 5A 4A 3A 2A 1A 8A 9A 7B 6B..

Note: a) Tracks 9A and 9B are not corrected by the ECC. If Corr. Req. is ON, but PatRFG is OFF within the next four frames, it is one of these tracks which is failing. JA and JB will resolve which of them is failing.

b) When in FORWARD; JA Ptr. is UP for failing tracks belonging to Group A and JB Ptr. is UP for failing tracks in Group B.

b) When in BACKWARD; JA Ptr. is UP for failing tracks belonging to Group B and JB Ptr. is UP for failing tracks in Group A.

2.0 IML STEPS AND ACTIONS ON ERROR



ZIE ACHTERIN DIT BOEK

3.0 KUDI SWITCHES SETTING

The following is the KUDI switch setting according to PTN 84-09, PTN 84-29, PTN 84-32 and PTN 84-33.

DSL & DSH = Control Unit serial number in binary.
DLR 1-3 = Language group
DLR 4 = KDRC being used (see PTN 84-26 for more details)
DLR 5 = KGBC being used (see PTN 84-32 for more details)
DLR 6 = SAG I/SAG II
DLR 7-8 = EC Level

The following is a picture of the switch disposition on the card and their assignment:

```
                          1
                    1 3 6 2
      1 2 4 8 6 2 4 8
    +---------------+
    | 1 2 3 4 5 6 7 8 | on
    +---------------+ off
            DSL
```

```
D D D
L S S
R H L U
      N
P P P S
+-------+
| 1 2 3 4 | on
+-------+ off
(ODD Parity)
```

(These SW's set the Parity bit of the corresponding Reg.)

```
                    1 3
              1 2 4 8 6 2
      2 5 0 0 0 1 3 7
      5 1 2 4 9 9 8 6
      6 2 4 8 6 2 4 8
    +---------------+
    | 1 2 3 4 5 6 7 8 | on
    +---------------+ off
            DSH
```

```
                S
                A
          K K   G
          D G   I
  L.G.    R B / EC
 .----. C C II.--.
    +---------------+
    | 1 2 3 4 5 6 7 8 | on
    +---------------+ off
            DLR
```

Note: 0 = off
1 = on

Language Group	
1 2 3	Lang.
1 0 0	- French
0 1 0	- German
1 1 0	- Spanish
1 0 0	- English
1 0 1	- Italian
0 1 1	- English
1 1 1	- English
0 0 0	- English

DLR EC Level Bits meaning:

Sw's 7, 8		SNB 27 bits 0,1	C.A. Hardware
ON	off	0 1	KUCJ
ON	ON	1 1	KUCH

Note: All the field should have been populated now with KUCJ.

DLR KDRC Bit meaning:

sw 4 - off = KDRC P/N-4451651 installed.
- on = KDRC other than P/N-4451651 installed.

Note: Mcode 991858 will only accept it to be ON.

DLR KGBC Bit meaning:

sw 5 - off = Old KGBC installed (P/N 4853970)
- on = New KGBC installed (P/N 6390118) (either KETCH OR SLOOP)

Note: All the field should have now KGBC at P/N 6390118.

SAG MODEL Bit meaning:

sw 6 - off = Model A11 Subsystem
- on = Model A22 Subsystem

LANG GROUP Bit meaning:

Sw's 1-3 - See Table on previous page.

NOTE: Bits order on XR's are the opposite to the one on switches.

switches: 1 2 3 4 5 6 7 8
XR bits: 7 6 5 4 3 2 1 0

4.0 3480 SENSE BYTES DESCRIPTION

4.1 COMMON BYTES (Formats 19,20 & 21):

SENSE BYTE 0: UNIT CHECK

bit 0: Command reject
1: Intervention required
2: Bus out check
3: Equipment check
4: Data Check
5: Overrun
6: Unit check timing
7: Assigned elsewhere

SENSE BYTE 1:

bit 0: Locate block function failed
1: On-line
2: Reserved
3: Out of sequence record
4: Beginning of tape
5: Write status
6: File protected
7: Not capable

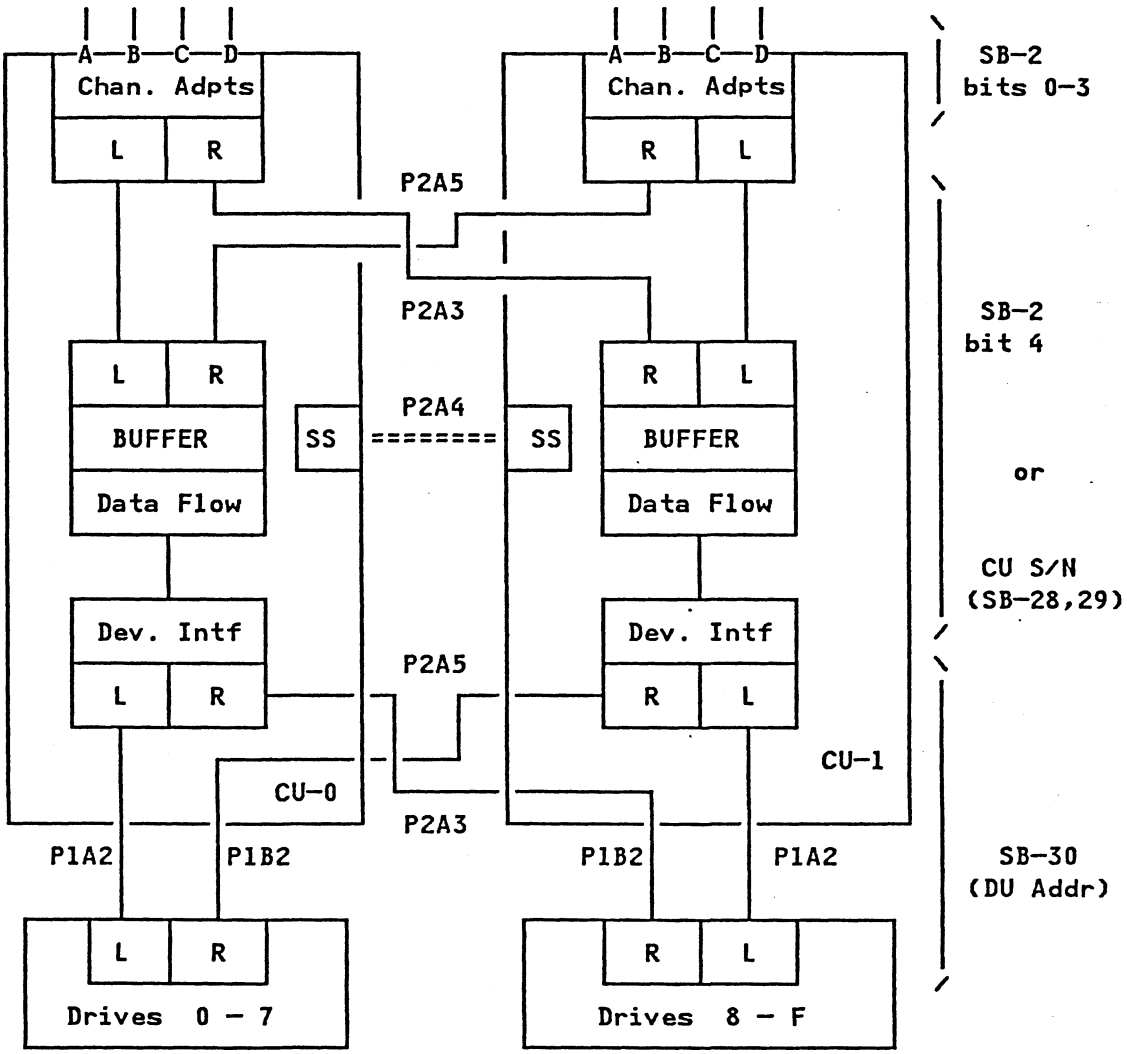
SENSE BYTE 2: DATA PATH AND ERROR POSITIONING

bits 0-3: Channel interface reporting this error
bits 0-2: 001 = Interface A
010 = Interface B
011 = Interface C
100 = Interface D
bit 3: 0 = Interface is in CU 0
1 = Interface is in CU 1
bit 4: MP/Data Flow detecting this error.
bit 4: 0 = CU0
1 = CU1
bit 5: Automatic Cartridge Loader Active
bit 6: Drive is in Synchronous Data Transfer mode.
bit 7: Block ID positioning indicator for error recovery.

see figure on next page.

FL 4

Data Path Identification on sense bytes:



NOTE: For Channel Adapter error codes, sense byte 9 will define the actual failing CA as follows:

'80'x = Interface A
'40'x = Interface B
'20'x = Interface C
'10'x = Interface D

For ERA=42, SB2 will indicate the path over which the Data transfer was successful (the error was detected in the other CU Buffer from the one indicated).

SENSE BYTE 3: ERROR RECOVERY PROCEDURE ACTION CODE

00:	Non Error Sense	Perm
01-20 :	RESERVED	
21:	Data Streaming Not Operational	Retry
22:	Path Equipment Check	DDR
23:	Read Data Check	DDR
24:	Load Display Failure	Perm
25:	Write Data Check	DDR
26:	Read Data Available in Opposite Direction	Retry
27:	Command Reject	Perm
28:	Write Density Mark Failure	DDR
2A:	Unsolicited Read Buffered Log or Counter Overflow	Retry
2B:	Buffered Log Data after Rewind Unload Command	Retry
2C:	Permanent Equipment Check	Perm
2D:	Data Security Erase Failure	Perm
2E:	Read Density Mark Failure	DDR
2F:	RESERVED	
30:	File Protected	Op Intv
31:	Tape Void	DDR
32:	Drive Tension Loss	Perm
33:	Drive Load Assistance Required	Op Intv
34:	Drive Unload Assistance Required	Op Intv
35:	Drive Equipment Check	Perm
36:	RESERVED	
37:	Short Cartridge	Perm
38:	Physical End of Tape Encountered	Perm
39:	Backwards Command at Beginning of Tape	Perm
3A:	Drive Made Not Ready by Operator	Op Intv
3B:	Manual Tape Rewind or Rewind Unload has occurred	DDR
3C-3F:	RESERVED	
40:	Overrun While in Tape Syncronous Mode	DDR
41:	Block ID Sequencing Error	Perm
42:	Degraded Mode	Retry
43:	Drive Intervention Required	Op Intv
44:	Locate Block Unsuccessful	Perm
45:	Drive is Assigned Elsewhere	Perm
46:	Drive is Not Online	Perm
47:	Unload Tape to Continue	Perm
48:	Environmental Data	Retry
49:	Bus Out Parity Error	DDR
4A:	Tape Positioning is Uncertain	Perm
4B:	No Valid Drive Patches	DDR
4C:	Control Unit Check 1 Error (Recovered)	Retry
4D-5F:	RESERVED	

Notes:

DDR = Dynamic Device Reconfiguration (Swap to another drive)
RETRY = Reissue the command
PERM = Permanent Error. Job Abend.
OP INT = Operator Intervention is required.

SENSE BYTE 4: BLOCK ID HIGH ORDER

bits 0-3: Reserved
4-7: High order bits of block ID

SENSE BYTES 5-6: BLOCK ID LOW ORDER

Note: The Block ID indicated by sense bytes 4,5 and 6 corresponds to the Logical Block position indicated by bits 12-31 of a Read Block ID command - x'22'.

SENSE BYTE 7: FORMAT

19	Forced error logging set on (use format 20)
20	Control unit and drive status
21	Environmental data and buffered log

4.2 BYTES 8-31 FORMATS 19 & 20:

SENSE BYTE 8: DRIVE ERP CODE

4D	Backspace and rewrite block
4F	Write: Reposition tape and reissue failing command Read: Do nothing unless CU failure
51	Reissue the last parallel command.
5B	Last command failed (REISSUE)
5F	Serial command not processed (REISSUE)
61	Issue 'RESETA' command (RESUME)
63	Re-attempt locate if BLKID (PERM) not equal 0
66	Load drive patch area from CU
69	Mid-tape load required using rewind unload (OPER INTER)
6B	Issue 'RESETB' command, locate failing block (RESUME)
6C	Equipment check bit set (OPER INTER)
6D	Re-try last command if DTP error. CU must re-establish position
6E	Issue locate command to sector 55, rewind to BOT
70	File protected tape (OPER INTER)
71	Tape at PEOT, rewind tape (OPER INTER)
72	DSE failed (EQUIPMENT CHK)
73	Unload or load tape (OPER INTER)
75	Load tape, disabled drive (OPER INTER)
76	Unload tape to prevent damage (OPER INTER)
78	Manual LOC/REW (OP. INITIATED)
79	CU requested to rewind-unload (DRIVE FAILING)
7D	Log temporary error to host (RESUME)
BF	Read one block to verify tape position (RESUME)
EF	Inhibit block auto-space operation if DPT error occurred otherwise no CU action is required

SENSE BYTE 9 CONTROL UNIT FLAGS BYTE

See CU error dictionary
Used with error code in sense bytes 10-11 FSI

SENSE BYTES 10-11 CONTROL UNIT FRU CODE 1

SENSE BYTES 12-13 CONTROL UNIT FRU CODE 2

SENSE BYTES 14-15 CONTROL UNIT LAST ERROR CODE

SENSE BYTES 16-17 CONTROL UNIT HDWR FRU CODES

Check 2 Errors (nn = Register contents)

error code	regi-ster	write mask	write priority	read mask	read priority
D0nn	RSR	07	8	06	6
D1nn	MTI	--	1	1E	1
D2nn	CER	FF	2	FF	5
D4nn	DSE	E0	6	E0	-
D5nn	BCSE	FF*	3	FF	4
D6nn	BDSE	FF*	4	FF	3
D7nn	WSE	1F	5	1F	-
D8nn	RER	FF	7	FF	2
D9nn	No errors indicated in the registers				

* MASK: bits 0-3 = BCSE or BDSE group 0 / bits 4-7
bits 4-7 = BCSE or BDSE group 1 / bits 4-7

XR OP related errors (NN = contents of XRA register)

F00D	-	Unresolved level 0
F1nn	Cxx	Channel
F2nn	Bxxx	Buffer
F3nn	Mxx	Maintenance
F4nn	Dxx	Device Interface
F5nn	Rxx	Read Data Flow
F6nn	-	Invalid Register Address
F7nn	Pxx	Microprocessor
F8nn	-	Microcode Error Code Match
F9nn	Wxx	Write Data Flow
FC80	-	No Apparent Reason

SENSE BYTE 18: DRIVE ERROR FLAG

SENSE BYTE 19: DRIVE MODEL no.

01 = B11 Drive Model
02 = B22 Drive Model

SENSE BYTE 20: DRIVE COMMAND CODE 1

00	TIO	Test I/O
02	RDF	Read Forward
03	RDB	Read Backward
04	SNS	Sense
05	PAT	Patch Load
06	CL	Clamp
07	UCL	Unclamp
08	RSTA	Reset A

09	RSTB	Reset B
0A	WRT	Write or Erase Gap
0C	DIA1	Set Diagnostic
0D	SVI	Load Display
0E	DIA2	T.B.D.
0F	CIN	Post CLEAN Message
10	RCS	Read Control Store
11	WCS	Write Control Store
12	DSE	Data Security Erase
15	ASB	Auto-space Backward
16	ASF	Auto-space Forward
18	REW	Rewind
19	RUN	Rewind Unload
1A	LOC	Locate
1B	RLSR	Read LSR's
1C	RDXR	Read X-Regs
1D	WRXR	Write X-Regs
1E	CSLLD	Load Stack Loader

SENSE BYTE 21: DRIVE ERROR CODE 1 (Check number) (DISPLAY 3480)

SENSE BYTE 22: DRIVE COMMAND CODE 2 (See SNS Byte 20)

SENSE BYTE 23: DRIVE ERROR CODE 2

SENSE BYTE 24: CU CHANNEL INTERFACES

bit 0: Interface A installed
bit 1: Interface B installed
bit 2: Interface C installed
bit 3: Interface D installed
bits 4-7: (0000) = DCI
(0001) = DCI 1.5 MB/s Throttled
(0101) = 2.0 MB/s Streaming
(0110) = 3.0 MB/s Streaming
(0111) = 4.5 MB/s Streaming

SENSE BYTE 25: 3480-CU FEATURES INSTALLED

bit 0: Dual CU Communications
bits 1-5: Reserved
bits 6: 4.5 MB/s Data Streaming Feature Installed
bits 7: A.C.L. installed.

SENSE BYTE 26: CU MCODE EC LEVEL (*=FBM)

08 = 991852	Rel.:	24...	*	Big Block Support
0C = 991854	Rel.:	24.11	*	
0D = 991855	Rel.:	24.12	*	C.A. fixes
0F = 991856	Rel.:	25.14	*	ACL G.A. (Rillito)
01 = 991857E	Rel.:	25.20		Pick-up Field patches
02 = 991857F	Rel.:	25.23		SAG-1 Support
03 = 991857	Rel.:	25.14	*	1 MB Buffer support
04 = 991858E	Rel.:	25.31		POR Diag, Multitag IFCC
05 = 991858	Rel.:	27.18	*	SARS support and ACL fixes
06 = xxx860E	Rel.:	29.07		4.5 MB/s support

SENSE BYTE 27: CU MODEL / HDWR EC / SERIAL no.

bits 0-1: Hardware EC level set on KUDI switches

01 = KUCJ CA cards installed (EC A06010).
11 = KUCH CA Cards (A06010 not installed yet).

bit 2: 0 = Model A11 , 1 = Model A22
bit 3: 0 = KGBC 4853970, 1 = new KGBC 6390118 (for Sloop or Ketch)

bits 4-7: 10,000's Digit of serial number in BCD

SENSE BYTES 28-29: CU SERIAL NUMBER

bits 0-3: 1,000's Digit of serial number in BCD
bits 4-7: 100's " " " " " "

bits 0-3: 10's " " " " " "
bits 4-7: 1's " " " " " "

SENSE BYTE 30: DRIVE CHARACTERISTICS

bits 0-3: Drive Logical Address
bits 4-7: Drive Physical Address

SENSE BYTE 31: DATA BYTE COUNT

Number of 4K bytes contained in buffer

4.2 BYTES 8-31 FORMAT 21:

SENSE BYTE 8: TEMP READ FORWARD DATA CHECKS (X1)

Only one count per ERP, retries within the ERP are recorded in sense byte 30.

SENSE BYTE 9: TEMP READ BACKWARD DATA CHECKS (X1)

Only one count per ERP, retries within the ERP are recorded in sense byte 30.

SENSE BYTE 10: TEMP WRITE DATA CHECKS (X1)

Only one count per ERP, retries within the ERP are recorded in sense byte 24.

SENSE BYTE 11: READ BLOCKS CORRECTED (X1)

Number of read blocks having AXP correction (no ERP involved)

SENSE BYTE 12: WRITE BLOCKS CORRECTED (X1)

Number of write blocks having AXP correction (no ERP involved)

SENSE BYTE 13: TEMP CONTROL UNIT EQUIPMENT CHECKS (X1)

CU errors detected and recovered

SENSE BYTES 14-15: READ BYTES PROCESSED (X4096)

Count includes: Data/Block ID Bytes/Pad Bytes/CRC

SENSE BYTES 16-17: WRITE BYTES PROCESSED (X4096)

Count includes: Data/Block ID Bytes/CRC/Round out unused bytes mod 32

SENSE BYTE 18: READ BLOCKS PROCESSED (X16)

Count of blocks read forward and backward, used with the 4 high order bits of byte 26, SNS byte 18 is the high order 8 bits count.

SENSE BYTE 19: WRITE BLOCKS PROCESSED (X16)

Count of blocks written, used with the 4 low order bits of byte 26, SNS byte 19 is the high order 8 bits count.

SENSE BYTE 20: WRITE TRANSIENT CONDITIONS COUNT (X1)

SENSE BYTE 21: READ TRANSIENT CONDITIONS COUNT (X1)

SENSE BYTE 22: CRITERIA WRITE DATA CHECKS (X1)

Temp. WR DCHK with no HDWR FRU indicators, subset of SNS byte 10

SENSE BYTE 23: CRITERIA READ DATA CHECKS (X1)

Temp. RD DCHK with no HDWR FRU indicators, subset of SNS bytes 8 & 9

SENSE BYTE 24: ERASE GAP COUNTS (X1)

Count of ERG's during ERP's

SENSE BYTE 25: DRIVE DETECTED ERRORS (X1)

Count of Unit Checks set by the drive

SENSE BYTE 26: READ AND WRITE BLOCKS PROCESSED (X16)

bits 0-3: Four low order positions of Read Blocks Processed Counter (used with SNS byte 18)
bits 4-7: Four low order positions of Write Blocks Processed Counter (used with SNS byte 19)

SENSE BYTE 27: CU MODEL / HDWR EC / SERIAL no.

Same as SNS byte 27 formats 19/20

SENSE BYTES 28-29: CU SERIAL NUMBER

Same as SNS byte 28-29 formats 19/20

SENSE BYTE 30: READ RECOVERY RETRY COUNTS

Count of RD errors during internal RD ERP.

SENSE BYTE 31: DRIVE ADDRESS

bits 0-3: Logical Address
bits 4-7: Physical Address

FORMAT 21 COUNTERS, EXPLANATION NOTES:

1.- All the counters but the Data Check counters are totals of events encountered. They count on each occurrence: permanent, first retry, or following retries. The Data Check counters increment when the first error is encountered, before it is permanent or temporary. Permanent Data Check errors do increment buffered log counters.

2.- An error is a Data Check if it would cause Data Check bit in Sense Byte 0 to be set.

3.- Transient Data Checks have the acceleration bit on in the RER reg. and recover with a single retry, they are not counted in the total counters or the criteria counters.

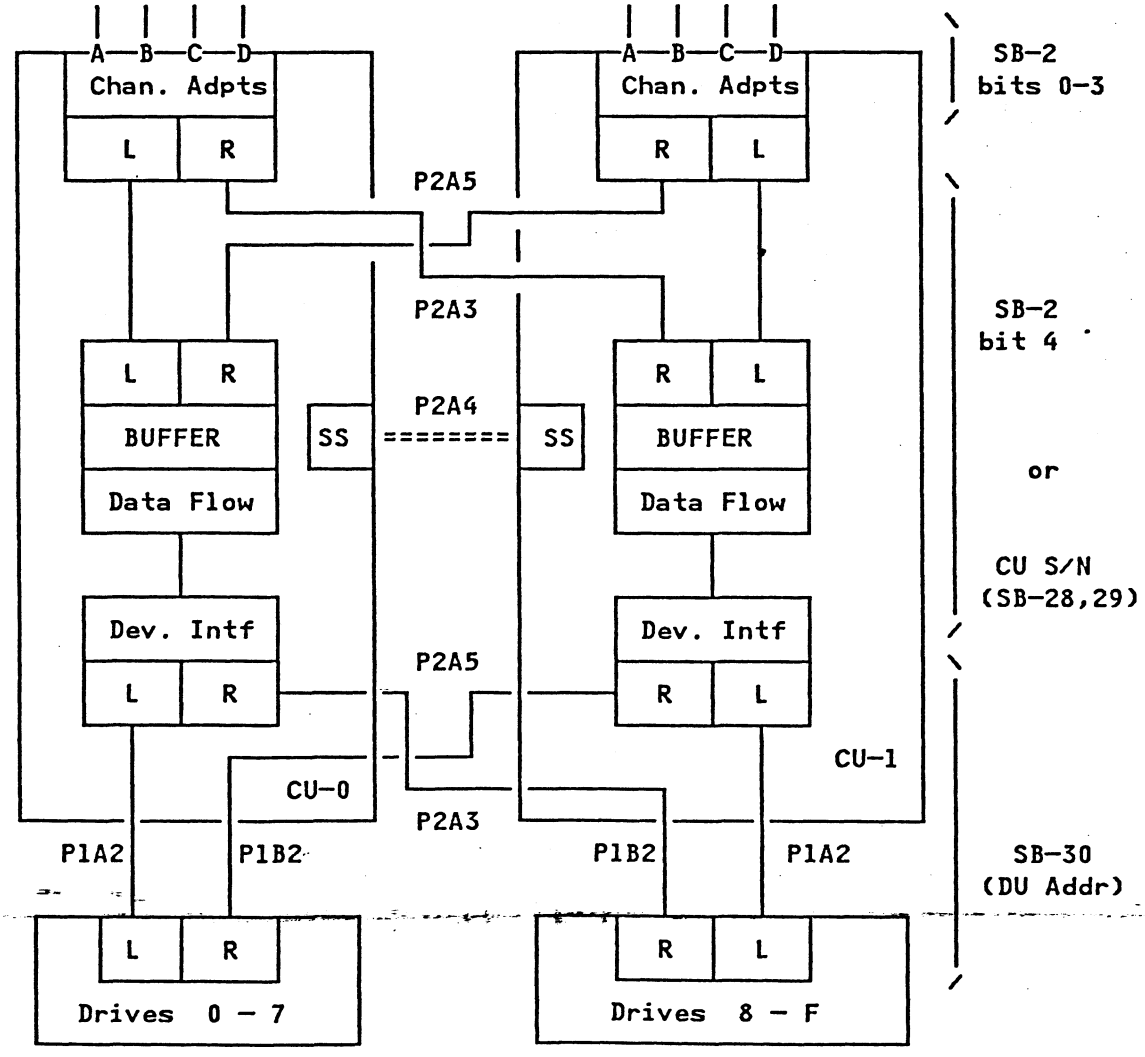
4.- Criteria Data Checks have one or more bits but not hardware bits in the NN portion of the 74NN or 76NN error codes. They are a proper subset of total data checks and will occur in both counters.

5.- Data check counters only increment on the first error received when transfering a block of data. Forcelog entries are only lost if there are multiple records successfully transfered between the buffer and the drive while only one record is in progress on the channel side.

5.0 DATA PATH ANALYSIS FROM SENSE INFORMATION.

Following is full explanation of Path analysis from Sense information. Sense Byte 2 deep analysis is also given. If the main concept of SB2 meaning is clear enough, then no troubles should appear on path analysis and sense interpretation.

Picture below is a good reference for Sense byte 2 analysis and data path determination.



As showed above, SB2 bits 0-3 identify the CA and the CU having it, over which the sense data was sent to the host, I mean, through which the error was reported.

SB2 bit 4 identifies the CU number (0 or 1) whose MCODE detected the error. The S/N of this CU is given in SB's 1/2x27, 28 and 29.

FLS

SB 2 bits 5, 6 and 7 has no meaning for path determination (bits 5-6 are reserved and bit 7 is the Block ID positioning used by Error recovery procedures).

This is the basic meaning of SB2, since the problem is bit 4 interpretation, let's go deeper in it:

By "the CU detecting the error", I mean:

1. The CU MCODE is the heart of the subsystem. It will be monitoring every operation, and therefore detecting the error if produced. If so, it will assemble the 32 bytes of the error, send the UC to receive the SENSE command and send the sense info to the host.

2. Buffer, Data Flow and Device Interface operations are controlled by the CU MCODE and therefore, they have to be located in the same CU, the one indicated by SB2 bit 4.

Some points to be used as a rule about path determination are:

1. Channel adapter errors are always reported by the CU housing the failing CA (which is indicated in SB9)

   a. It doesn't matter which CU was managing the Channel Command process. Control of a CA is always by the CU Mcode housing it.

   b. It doesn't matter if it is an Ending sequence, Data transfer, etc.. Mcode of both CU's communicate between them thru SS-SS comm., but MP orders to CA's are always generated by the Mcode of the CU housing the CA (may be as a result of previous SS-SS communication and by a requirement of the other CU).

   c. If a CA error is detected, of course it will be his own CU Mcode which will assemble and report the error if an alternate path is available.

2. Ck-1 errors can be reported by the failing CU (if successfully recovered) or by the other CU if ck-1 was unrecoverable.

3. Remainder errors are always reported by the CU having the buffer, MP, etc, etc. and thru the Channel path that was currently being used.

Let's see now some examples:

a. Channel Adapter Problems (5BB1, 5CC1, etc.):

   SB2 bits 0-3 indicates the path over which the error has been reported. SB2 bit 4 and SB's 27-29 indicate the CU where the 'failing' CA indicated in SB9 is located. The MCODE of this CU has detected, assembled and sent the sense info over the path indicated by SB2 bits 0-3.

b. Channel to Buffer communication problems 38E2, 38E4 :

FL6

SB2 bit 4 indicates the CU buffer that had the successful transfer while using the same channel adapter path indicated by SB9. Failing buffer is therefore the OPPOSITE of the indicated by SB2 bit 4.

SB9 format is 80,40,20,10 for CU-0 Ch. Adps A,B,C,D and 08,04,02,01 for CU-1 Ch. Adps A,B,C,D respectively.

Failing data path has to be determined by using above information and as much sense sample as possible due to its normal intermittent way of presentation (with ERA=48).

c. CK-1 errors (20x0 yyyyy):

SB2 bits 0-3 indicates the path over which the error has been reported. SB2 bit 4 and SB's 27-29 indicate the CU that is reporting the error. If it is the same as the X of FSC 20x0 it is because the CK-1 was successfully recovered and the same CU is able to generate the sense info.

Usually the CU reporting the error is the CU NOT having the CK-1 condition, anyway the CU having the CK-1 is indicated by the X of FSC 20X0.

FSC yyyy is the one passed by the failing CU thru the SS-SS communication (if the CK-1 was forced by its MCODE).
If the CK-1 was a hardware PB not allowing Mcode to assemble a FSC, then, yyyy is 2020/2021 or zeroes.

d. Read/write or drive interface errors. (74nn, 76nn, 8xxx, etc..):

SB2 bits 0-3 indicates the path over which the error has been reported.

SB2 bit 4 and SB's 27-29 indicate the CU where the Buffer, Data Flow and Device Interface is located. Using SB2 bit 4 and SB30 (Drive No.) we are able to know whether Local or Remote Drive interfacing is in use.

Think that above information is clear enough to avoid in the future any sense byte misinterpretation regarding paths.

FC7

6.0 3480 CHANNEL COMMANDS

6.1 STANDARD TAPE COMMANDS

TIO x'00' TEST I/O (no arguments/data)

NOP x'03' NO-OPERATION (no arguments/data)

WRT x'01' WRITE

Buffered mode/Write immediate mode depending on a previous Mode Set.
Tape Synchronous Mode, depending on block length.

RDF x'02' READ FORWARD

RDB x'0C' READ BACKWARD

WTM x'1F' WRITE TAPE MARK (no arguments/data)

ERG x'17' ERASE GAP (no arguments/data)

DSE x'97' DATA SECURITY ERASE (no arguments/data)

FSB x'37' FORWARD SPACE BLOCK (no arguments/data)

FSF x'3F' FORWARD SPACE FILE (no arguments/data)

BSB x'27' BACKSPACE BLOCK (no arguments/data)

BSF x'2F' BACKSPACE FILE (no arguments/data)

REW x'07' REWIND (no arguments/data)

RUN x'0F' REWIND-UNLOAD (no arguments/data)

SNS x'04' SENSE (32 bytes read)

6.2 DEL ORO SPECIAL COMMANDS

=3480

LOC x'4F' LOCATE BLOCK (4 bytes write)

bit 0: Reserved (must be 0)
bits 1-7: Sector (Physical ref. val. used for high speed search)
bits 8-11: Reserved (must be 0)
bits 12-31: Logical block position

RBID x'22' READ BLOCK ID (8 bytes read)

The 8 bytes returned make up two 4-byte block ID's:

1st BLK ID: A/ buffer in RD or WR mode is data block about to be passed between host and subsystem.
B/ buffer in RD BKD mode is block sent to the host by a prior RD BKD CMD.

2nd BLK ID: A/ buffer in WR mode, is the next to be written to the drive from the buffer.
B/ buffer in RD mode, is the next to be read from drive to the buffer.
C/ buffer in RD BKD mode, is the last read into the buffer from the drive.

Note: If not anticipatory buffering then 2nd BLK ID = 1st BLK ID.

For each four bytes block ID's, meaning is:

bit 0: Reserved (should be 0)
bits 1-7: Sector (Physical reference value)
bits 8-11: Reserved (should be 0)
bits 12-31: Logical block position

RBF x'12' READ BUFFER (data read)

RBL x'24' READ BUFFERED LOG (32 bytes read)

SID x'E4' SENSE ID (7 bytes read)

byte 0: Hex 'FF'
bytes 1-2: 3480 CU Type number
byte 3: 11 or 22 CU model no. (SAG I or II)
bytes 4-5: 3480 Drive type number
byte 6: 11 or 22 Drive model no. (SAG I or II)

LDD x'9F' LOAD DISPLAY (17 bytes write)

1st of 17 bytes transferred is control byte, meaning as follows:

bits 0-2: New message overlay
000 = General Status msg (overlays when tape starts)
001 = Dismount msg (cannot be overlaid until tape removed)
010 = Mount msg w. imm action indicator
111 = Dismount/Mount w. imm action indicator
bit 3: Alternate messages
0 = Dsply only msg specif. setting of bit 5
1 = Dsply both msg's bytes 1-8 & 9-16 alternating
bit 4: Blink message
0 = no blinking
1 = blinking
bit 5: Display LO/HI Message
0 = only bytes 1-8 to be displayed (1st msg)
1 = only bytes 9-16 to be displayed (2nd msg)
bits 6-7: Reserved, not to be used by the host

MDS x'DB' DEL ORO MODE SET (1 byte write)

bits 0-1: Tape format
00 = Write in 18-track format (this is the default)
01 = Reserved
10 = Reserved
11 = Reserved
bit 2: Write mode
0 = Execute WR in buffered write mode (default)
1 = Execute WR in Tape write immediate mode
bit 3: Inhibit Supervisor Commands
0 = Allow supervisor commands. (default)
1 = Inhibit supervisor commands after this one.
bits 4-6: Reserved must be 0, else UCK
bits 7: Inhibit Control Unit recovery (if on).

Note: See Control Access cmd. for a set of hidden functions.

TWM x'C3' TAPE WRITE MODE SET (no arguments/data)

SYNC x'43' SYNCHRONIZE (no arguments/data)

CTL x'E3' CONTROL ACCESS (12 bytes write)

Standard use:

byte 0: x'00' = Set-password function
x'80' = Request-temporary-unassignment Function
x'40' = Generalized-unassign Function
bytes 1-11: Password

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Engineering use (hidden):

byte 0: Function Control Byte
x'01' = Allow CU or drive function
x'02' = Inhibit CU or drive function
byte 1: Implementation Byte
x'01' = Implement CU functions
x'02' = Implement drive functions
bytes 2-3: Control Unit functions (if byte 1 = x'01')
x'8000' = Read in Readahead Mode
x'4000' = Write in buffer write mode
x'2000' = Load Balance drives
x'1000' = CU controlled ERP's
x'0800' = Reconnect (Early)
x'0200' = Force Error Logging
x'0100' = Serial Start drive
x'0010' = Select drive
x'0002' = Report Read CRC errors
x'0001' = Report block ID errors
bytes 2-3: Drive functions (if byte 1 = x'02')
x'8000' = Drive write operations
x'4000' = Read in Readahead mode
x'2000' = Reconnect (Early)
x'1000' = Serial start drive
x'0800' = CU controlled ERP's
bytes 4-11: Not used (must be 0's).

SPG x'AF' SET PATH GROUP ID (12 bytes write)

byte 0: Function Control Byte, meaning follows:

bit 0: Path mode -
0 = Single path mode
1 = Do not use, command reject
bits 1-2: Group Code
00 = Establish group
01 = Disband group
10 = Resign from group
11 = Reserved (do not use)
bits 3-7: Reserved (must be 0's)

bytes 1-11: Path Group ID

SPID x'34' SENSE PATH GROUP ID (12 bytes read)

byte 0: Path-state byte, meaning as follows:

bits 0-1: Grouping status:
00 = Reset
10 = Ungrouped
11 = Grouped

01 = Reserved
bits 2-3: Assign/unassign status:
00 = No Allegiance
10 = Assigned Elsewhere
11 = Assigned
01 = Allegiance to Issuing Host
bit 4: Mode
0 = Channel path operating in single-path mode
1 = Not valid for 3480
bits 5-7: Reserved, will allways be zero

SMR x'5B' SUSPEND MULTIPATH RECONNECTION (no arguments/data)

ASN x'B7' ASSIGN (11 bytes write)

UNA x'C7' UNASSIGN (11 bytes write)

7.0 STATUS STORE RAM LAYOUT

RAM Page	RAM Address	CONTENTS
0	00-0F	Device Assignments (Index by Device)
1	10-1F	Device and Buffer Status (Index by Device)
2	20-2F	Device Assignment Mask (Index by Device)
3	30-3F	Program Flags Part II (Index by Device)
4	40	CU-0 Buffer Assignment
	41	CU-0 Reset Information
	42	System Reset Acknowledge
	43	Buffer Switch Interlock Flag
	44	CU-1 Buffer Assignment
	45	CU-1 Reset Information
	46,47	"CE" Storage
	48	Serial Interface Assignments
	49,4A	CU SS Interlock
	4B-4F	CHK-1 Information
5	50-5F	Temporary SS Assignment Mask (by Device)
6	60-6F	Active Channel Path Group Mask (by Device)
7	70-7F	Program Flags Part I (Index by Device)
8 . . B	80 . . BF	CU-0 READ Message Buffer CU-1 WRITE Message Buffer
C . . F	C0 . . FF	CU-0 WRITE Message Buffer CU-1 READ Message Buffer

STATUS STORE RAM CONTENTS

STATUS STORE DEVICE ASSIGNMENTS ('0X') (DSN: SSDEVASG)

X = Drive Address

Constant	value
ACU0CHA	'80'x - Assigned to CU-0 Intf A
ACU0CHB	'40'x - Assigned to CU-0 Intf B
ACU0CHC	'20'x - Assigned to CU-0 Intf C
ACU0CHD	'10'x - Assigned to CU-0 Intf D
ACU1CHA	'08'x - Assigned to CU-1 Intf A
ACU1CHB	'04'x - Assigned to CU-1 Intf B
ACU1CHC	'02'x - Assigned to CU-1 Intf C
ACU1CHD	'01'x - Assigned to CU-1 Intf D

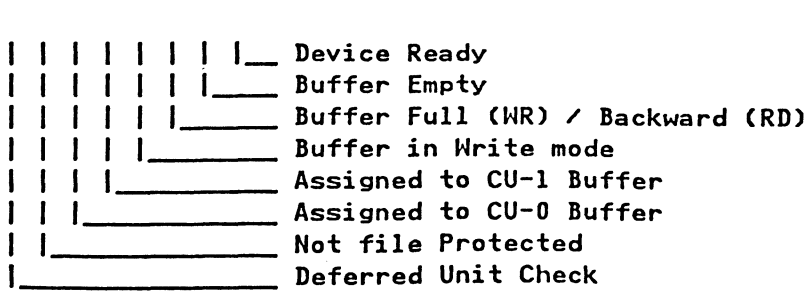
ESPECIAL DEVICE ASSIGNMENT VALUE

One or a combination of following constants can be found in the DEVICE ASSIGNMENT Byte if Multiple Functional Areas are trying to process the device at the same time.

'E0' - Assigned to MP for System Reset
'D0' - Assigned to MP for Selective Reset
'C8' - Assigned to MP for HALTIO (Intfc. Disc.)
'C4' - Assigned to MP for Buffer Management
'C2' - Assigned to MP for Supervisor
'C1' - Assigned to MP for Maintenance Device

STATUS STORE DEVICE STATUS ('1X') (DSN: SSBUFFST)

X = Drive Address



Constant	value
DUC	'80'x - Deferred Unit Check
NFP	'40'x - Not File Protected
ACU0	'20'x - Buffer Assigned to CU-0
ACU1	'10'x - Buffer Assigned to CU-1
CUA	(ACU0+ACU1) - C.U. Assignment bits
BWRT	'08'x - Buffer Writing
BFULL	'04'x - Buffer Full
BBKWD	'04'x - Buffer Backward
BEMPTY	'02'x - Buffer Empty
BNALLOC	(BWRT+BFULL+BEMPTY) - Buffer not Allocated
DRDY	'01'x - Device Ready

STATUS STORE ASSIGNMENT MASK ('2X') (DSN: SSALLINF)

X = Drive Address

Constant	value
ALCU0IFA	'80'x - Allow CU-0 Interface A
ALCU0IFB	'40'x - Allow CU-0 Interface B
ALCU0IFC	'20'x - Allow CU-0 Interface C
ALCU0IFD	'10'x - Allow CU-0 Interface D
ALCU1IFA	'08'x - Allow CU-1 Interface A
ALCU1IFB	'04'x - Allow CU-1 Interface B
ALCU1IFC	'02'x - Allow CU-1 Interface C
ALCU1IFD	'01'x - Allow CU-1 Interface D

Note: This page has another meaning when bit 4 of page 7 is ON or when bit 7 of page 3 is ON

STATUS STORE PROGRAM FLAGS PART II ('3X') (DSN: SSRAMPG3)

X = Drive Address

Constant	value
LCLRST	'80'x - Local System Reset processing
RMTRST	'40'x - Remote System Reset processing
INTERLK0	'20'x - CU-0 CMP device Interlock
INTERLK1	'10'x - CU-1 CMP device Interlock
DVDEADLK	'30'x - CMP Device Deadlock State
ACPASND	'08'x - All Channel Paths assigned
BEOHTEE	'04'x - Device at Beginning-of-Tape
INITXXC	'02'x - Initiate Extended Contingent connection
XCCBUSY	'01'x - Give Busy for Ext. Cont. Connection

STATUS STORE CU-0 BUFFER ASSIGNMENT ('40') (DSN: SSCUBUFF)

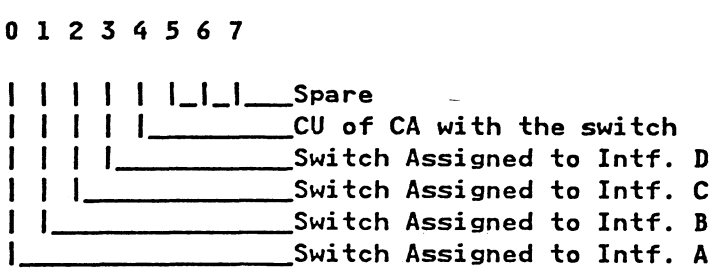
Constant	value
C0BA0IFA	'80'x - CU-0 Buffer assigned to CU-0 Intf. A
C0BA0IFB	'40'x - CU-0 Buffer assigned to CU-0 Intf. B
C0BA0IFC	'20'x - CU-0 Buffer assigned to CU-0 Intf. C
C0BA0IFD	'10'x - CU-0 Buffer assigned to CU-0 Intf. D
C0BA1IFA	'08'x - CU-0 Buffer assigned to CU-1 Intf. A
C0BA1IFB	'04'x - CU-0 Buffer assigned to CU-1 Intf. B
C0BA1IFC	'02'x - CU-0 Buffer assigned to CU-1 Intf. C
C0BA1IFD	'01'x - CU-0 Buffer assigned to CU-1 Intf. D

SPECIAL BUFFER SWITCH ASSIGNMENT VALUES

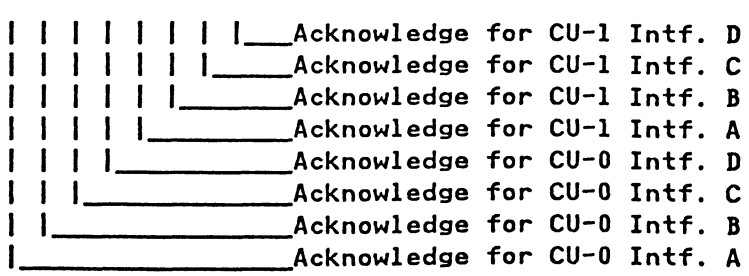
One or a combination of following constants can be found in the BUFFER SWITCH ASSIGNMENT Byte if Multiple Functional Areas are trying to process the switch at the same time.

'E0' - Assigned to MP for System Reset
'D0' - Assigned to MP for Selective Reset
'C8' - Assigned to MP for HALTIO (Intfc. Disc.)
'C4' - Assigned to MP for Buffer Management
'C2' - Assigned to MP for Supervisor
'C1' - Assigned to MP for Maintenance Device

CU-0 RESET INFORMATION ('41')



SYSTEM RESET ACKNOWLEDGE ('42')



BUFFER SWITCH INTERLOCK FLAGS ('43') (DSN: SSRAM43)

Constant	value
DEADLOK0	'80'x - Buffer Switch 0 Deadlock
CU0BS0	'40'x - CU-0 is requesting for Switch 0
CU1BS0	'20'x - CU-1 is requesting for Switch 0
FBSTOMP0	'10'x - Force Buffer Switch 0 to MP CU-0
FBSTOMP1	'08'x - Force Buffer Switch 1 to MP CU-1
DEADLOK1	'04'x - Buffer Switch 1 Deadlock
CU0BS1	'02'x - CU-0 is requesting for Switch 1
CU1BS1	'01'x - CU-1 is requesting for Switch 1
TILTCU	'0C'x - Tilted CU Flag
PROUL6	'0A'x - Processing Unusual Level 6

STATUS STORE CU-1 BUFFER ASSIGNMENT ('44') (DSN: SSCUBUFF)

Constant	value
C1BA0IFA	'80'x - CU-1 Buffer assigned to CU-0 Intf. A
C1BA0IFB	'40'x - CU-1 Buffer assigned to CU-0 Intf. B
C1BA0IFC	'20'x - CU-1 Buffer assigned to CU-0 Intf. C
C1BA0IFD	'10'x - CU-1 Buffer assigned to CU-0 Intf. D
C1BA1IFA	'08'x - CU-1 Buffer assigned to CU-1 Intf. A
C1BA1IFB	'04'x - CU-1 Buffer assigned to CU-1 Intf. B
C1BA1IFC	'02'x - CU-1 Buffer assigned to CU-1 Intf. C
C1BA1IFD	'01'x - CU-1 Buffer assigned to CU-1 Intf. D

SPECIAL BUFFER SWITCH ASSIGNMENT VALUES

One or a combination of following constants can be found in the BUFFER SWITCH ASSIGNMENT Byte if Multiple Functional Areas are trying to process the switch at the same time.

'E0' - Assigned to MP for System Reset
'D0' - Assigned to MP for Selective Reset
'C8' - Assigned to MP for HALTIO (Intfc. Disc.)
'C4' - Assigned to MP for Buffer Management
'C2' - Assigned to MP for Supervisor
'C1' - Assigned to MP for Maintenance Device

CU-1 RESET INFORMATION ('45')

```
  0 1 2 3 4 5 6 7

  | | | | | |_|_|___Spare
  | | | | |_________CU of CA with the switch
  | | | |___________Switch Assigned to Intf. D
  | | |_____________Switch Assigned to Intf. C
  | |_______________Switch Assigned to Intf. B
  |_________________Switch Assigned to Intf. A
```

'CE' STORAGE ('46-47')

SERIAL INTERFACE ASSIGNMENTS ('48') (DSN: SSSERINF)

Constant	value
	'00'x - Serial Interface not Assigned
SIFCU0	'80'x - Serial Interface Assigned to CU-1
SIFCU1	'40'x - Serial Interface Assigned to CU-0

CUSS INTERLOCK ('49-4A')

CHECK-1 ERROR INFORMATION ('4B-4F')

Addr.	Contents
4B	MP Check 1 error code
4C	MP Check 1 error code
4D	Drive address / flags
4E	C.U.F. data
4F	ERA Code

Note: The contents of these locations is a copy of the SNERRH entry corresponding to the Error.

TEMP STATUS STORE ASSIGNMENT MASK ('5x')

X = Drive Address

Constant	value
ALCU0IFA	'80'x - Allow CU-0 Interface A
ALCU0IFB	'40'x - Allow CU-0 Interface B
ALCU0IFC	'20'x - Allow CU-0 Interface C
ALCU0IFD	'10'x - Allow CU-0 Interface D
ALCU1IFA	'08'x - Allow CU-1 Interface A
ALCU1IFB	'04'x - Allow CU-1 Interface B
ALCU1IFC	'02'x - Allow CU-1 Interface C
ALCU1IFD	'01'x - Allow CU-1 Interface D

Note: See bit 4 of Page 7.

ACTIVE CHANNEL PATH GROUP MASK ('6x') (DSN:SSRAMPG6)

X = Drive Address

Constant	value
APGM0	'80'x - Active Group for CU-0 Intf A (bit 0 of APGM in CST)
APGM1	'40'x - Active Group for CU-0 Intf B (bit 1 of APGM in CST)
APGM2	'20'x - Active Group for CU-0 Intf C (bit 2 of APGM in CST)
APGM3	'10'x - Active Group for CU-0 Intf D (bit 3 of APGM in CST)
APGM4	'08'x - Active Group for CU-1 Intf A (bit 4 of APGM in CST)
APGM5	'04'x - Active Group for CU-1 Intf B (bit 5 of APGM in CST)
APGM6	'02'x - Active Group for CU-1 Intf C (bit 6 of APGM in CST)
APGM7	'01'x - Active Group for CU-1 Intf D (bit 7 of APGM in CST)

(not longer used)

STATUS STORE PROGRAM FLAG ('7x') (DSN: SSPGMFLG)

X = Drive Address

Constant	value
ONLIN0	'80'x - Device is Online to CU 0
ONLIN1	'40'x - Device is Online to CU 1
VDPATH0	'20'x - Valid Data Path to CU 0 exists
VDPATH1	'10'x - Valid Data Path to CU 1 exists
ASNSTOR	'08'x - Assign Mask Stored in SS Page 5
DFREE0	'04'x - Device Freed in CU-0
DFREE1	'02'x - Device Freed in CU-1
TAPEMNT	'01'x - Tape Volume mounted

CU-0/CU-1 MESSAGES BUFFER ('80-FF')

Used by the CU Mcode to communicate between the two Control Units.

8.0 CONTROL UNIT CARDS.

NAME LOC. PNAME LP.P/N LP.EC REA	On-coming replacement / Notes
BOARD 01A-A1	
KAA1 6272321 A06010 12-15179	SLOOP & KUCJ Support (S/N 7711259)
WESTPORT MEMORY (128 Kwords)	
A1B2 WSPT 8282169 997309	
CONTROL STORE (S/N 77-47461)	Support for 3.5 inches IML drive.
A1C2 KUFG 13F2207 A58287	
MICROPROCESSOR	
A1D2 KUPR 6390093 333302 12-25770	
MAINTENANCE ADAPTER	
A1E2 KUMI 6460300 A06020 12-25600	
STATUS STORE FEATURE	NPL drivers change.
A1F2 KUSM 68X8149 A46520 12-25282	
STATUS STORE	
A1G2 KUST 6460283 A06020 12-25598	
BUFFER ADAPTER (S/N 77-47461)	4.5 MB/S Data Streaming support
A1K2 KGBB 13F2194 A57601	
BUFFER CONTROL	KETCH & SLOOP support
A1L2 KGBC 6390118 A06013	DLR sw 5 to ON
BUFFER MEMORY (S/N 77-47461)	2 MB Buffer Memory for A22
A1M2 KFSA 13F5671 A46539	0.5 MB for All models (S/N 77-58242)
WRITE DATA FLOW (S/N 77-11761)	FBM 6179012 may be ordered.
A1P2 KDWD 6384583 A29042 12-15191	(not sent to Field)
DEVICE INTERFACE	NPL drivers change.
A1Q2 KUDI 68X8148 A46520 12-25281	
ERROR CORRECTION	
A1R2 KDEC 6050647 991718 12-18422	
READ CLOCK AND FORMAT	All/A22 support
A1S2 KDRC 6272316 A29011	DLR sw 4 to ON
VOLTAGE REGULATOR	
A1T2 KREG 82X4222 A46528	

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NAME LOC. PNAME LP.P/N LP.EC REA	On-coming replacement / Notes
BOARD 01A-A2	Bisbee Support (NCRD Card)
KAA3 13F3757 A57689	S/N 77-47137 (WK24/88)
CHANNEL ADAPTERS A,B,C,D	(CI 4049 on EE64 intermittently)
A2C2 KUCJ 68X8152 A46521	Replace pull-up resistors
(1 x Ch. Adp.)	to fix the problem
POWER ON RESET	
A2H4 KRST 8576411 A06011 12-25591	
SKEW BUFFER CARDS 1,2,3	(BISBEE-I)
A2K2 SBCR 56X4626 A29044 (x3)	
READ DETECTION CARD	Fix DC offset Pb detected with ICGT
A2Q2 NCRD 13F4258	Replaces 3 x ICDC cards
TAG SHOE CARDS (1 x Ch. Adp.)	4.5 MB/S support
CH.A-D ITAG 6178704 A56006	
BUS SHOE CARDS (1 x Ch. Adp.)	4.5 MB/S support
CH.A-D IBUS 13F2193 A56006	

*** 3480-A11 ONLY ***

BOARD 01A-A2	
KAA2 6272322 A06010	
READ DETECTION CARDS 1,2,3	
A2R2 ICDE 6460357 (x3)	

*** MIM's, MCODE & RAS PKG ***

MI's : A57721 (WK 45/88)	PDT Diskette: A57725 (WK 45/88)
Mcode: xxx860E (WK 45/88)	PST Diskette: A57729 (WK 45/88)

Notes...: W45/88 ==> S/N 77-47461 (A22) & 77-58242 (A11)

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9.0 EMC SETTING

EMC Brief explanation.

CU Mcode allows us to set up to three different Error Match Codes (EMC), so that they are compared to the Fault Symptom Codes (FSC) generated each time an error occurs and Sense Bytes are reported to Host. Also a Match value can be entered, so that Mcode uses it as an AND function to the FSC and therefore several type of FSC can be matched (i.e: 76nn, 74nn, etc..).

If a Match is found, the selected Match action is done by CU Mcode (i.e: Stop trace, Force a CK-1, etc..).

EMC utilities also allow us to specify different Trace options and to limit them to single drives. We may trace for example, Drive activity, Channel activity, Module activity, etc..

PST Steps to set EMC options:

Use SDISK page 145 on MI Vol.4 as reference an proceed as follows:

1. From MAIN MENU, select option ..... 3 = SUPP UTILITIES

2. Then select option ..... 1 = CU TRACE/MATCH CTL

3. Then select option ..... 1 = ERROR MATCH CNTRL

4. Enter ERROR MATCH VALUES when requested by depressing ENTER after each value (up to three different values can be entered, for example 8E05 8007 8007). Should you want to enter only one EMC, type it in, and then depress ENTER three times.

5. Enter ERROR IGNORE MASK values in the same way as the EMC before. This is used as a Mask by MCode, so that various types of errors can be matched .Normal value to be entered is 0000 when only the given FSC is wanted. It could be 00FF if you for example wanted to get a Match on any 74nn error.

6. Message 2730 and its associated questions are received now for each one of the EMC being entered above. Its questions are:

   - WANT TO LIMIT THIS MATCH FOR A SINGLE DRIVE? Depress Y or N.

   - If answer to above is YES, you will be prompted by the DRIVE ADDRESS. (Enter the drive you only want to validate the EMC).

   - * SELECT MATCH ACTION:

     A menu is presented here with different options and none or both of them can be selected. Enter the number of the options you want (i.e: 3 = STOP TRACE). An asterisk (*) is placed after the number of the option selected. Depress ENTER when you have finished.

7. Above loop is repeated up to three times depending on how many EMC's have been entered. When you are through, you get back to the **TRACE MATCH MENU screen just by depressing ENTER key.

8. At this menu you may now want to select any of its options as 2 = TRACE OPTIONS or 3 = MCODE CONTROL. Follow SDISK 145 where right flow is represented for this options.

   Default TRACE OPTIONS for 3480 are:

   MD TRACING
   DRIVE TRACING
   CHANNEL TRACING

   If you have changed the trace options (set force error logging) and use the reset option to turn off the trace options it will reset all trace options. If the CU was offline when you reset the trace options the microcode will check the other cu for the same microcode level before coming online. It will find a different check sum and tilt the CU with FSC1601.

   Do not use the reset option to reset trace options. Instead set MD, drive and channel tracing.

9. Get back to previous menus just by depressing ENTER when everything is done.

You may want to check that the EMC you have just set is OK. This can be done by displaying CU Storage by entering EMC as the table name.

If you have set for example EMC to 8E05 8007 8007 with the match action being set to STOP THE TRACE and only for drive 0, what you should see at the display is:

24E5	8E05 0000 9000
24E8	8007 0000 9000
24EB	8007 0000 9000
24EE	1900 xxxx xxxx

EMC table description:

24E5	EMC1 ING1 OPT1
24E8	EMC2 ING2 OPT2
24EB	EMC3 ING3 OPT3
24EE	TOT N/A N/A

EMC = ERROR MATCH CODE value (The FSC).

ING = IGNORE MASK value (Usually = 0000).

OPT = DUMP/MATCH OPTIONS :

BIT 0 -- MATCH A SINGLE DRIVE ADDRESS.
BIT 1 -- WRITE DGHELO LOG.
BIT 2 -- WRITE DGOVLY LOG.
BIT 3 -- STOP TRACE.
BIT 4 -- RESET MATCH CODE.
BIT 5 -- FCODE HANG (7001).
BIT 6 -- NOTIFY MD.
BIT 7 -- FORCE CHK1 DUMP.

TOT = TRACE OPTION TABLE :

BYTE 0
BIT 0 -- TRACE MODULE ACTIVITY.
BIT 1 -- UNUSED.
BIT 2 -- ALLOW LEVEL 7 MODULE ACTIVITY.
BIT 3 -- TRACE CHANNEL ACTIVITY.
BIT 4 -- TRACE DRIVE ACTIVITY.
BIT 5 -- ALLOW UCODE CHK1 HANG (7002).
BIT 6 -- CHK1 RECOVERY HANG (7005).
BIT 7 -- TRACE SINGLE DRIVE.

BYTE 1
BIT 0 -- TRACE MD ACTIVITY.
BIT 1 -- SPARE.
BIT 2 -- SPARE.
BIT 3 -- SPARE.
BIT 4 -- DRIVE ADDRESS.
BIT 5 -- DRIVE ADDRESS.
BIT 6 -- DRIVE ADDRESS.
BIT 7 -- DRIVE ADDRESS.

10.0 GTF CCW TRACE SETTING PROCEDURE

370 MODE:

```
S GTF.ASP,TIME=Y              /* Init.  GTF with Time stamp   */

....after the message AHL100A SPECIFY TRACE OPTIONS, enter:

R XX,TRACE=SIOP,IOP,CCWP          /* I/O Interrp, SSCH and CCW    */

....after the message AHL101A SPECIFY TRACE EVENT KEYWORDS, enter:

R XX,IO=SIO=(dev1,dev2,etc),CCW=(SI,DATA=32,IOSB),END  /*trace def.*/

R XX,U                                /* STARTS THE TRACE           */

.... to stop it later on:

P ASP                                 /*  STOPS THE TRACE  ASP      */

.... and to print it:

S GTFPRT                              /* PRINTS THE TRACE DATA       */
```

* NOTE: GTF/CCW DOES NOT TRACE AF (SPID) COMMANDS IN 370 MODE.

* NOTE: FOR OPTION "IO=SIO=(1A0,2A0" 1A0 = PRIMARY CHANNEL
2A0 = ALTERNATE CHANNEL

==========

XA MODE:

```
S GTF.ASP,TIME=Y
R XX,TRACE=SSCHP,IOP,CCWP,CSCH,HSCH,MSCH
R XX,IO=SSCH=(1A0,1A1,ETC),CCW=(SI,DATA=32,IOSB),END
R XX,U          /*  STARTS THE TRACE            */

P ASP           /*  STOPS THE TRACE             */

S GTFPRT        /*  PRINTS THE TRACE DATA       */
```

NOTE: TIME ON GTF TRACE IS NUMBER OF SECONDS SINCE MIDNIGHT.

11.0 SENSE ERROR HISTORY TABLE DISPLAY

SNERRH table use and display.

The Sense Error History Table (SNERRH) contents and description is explained on MI Vol.4 DF 145, but it will only work when functional code is running.

When ucode is hang in a CHK1 condition (WAIT light off and ERROR light on), PST "Storage Display/Alter-CU Tables" function doesn't work and following procedure has to be use in order to know the latest FSC's stored by ucode in this table.

1. Refer to SDISK 110 for Storage Display/Alter descriptions.
2. Select opt 2 = SUBSYS DSPLY/ALTER
3. Select opt 2 = STORAGE DSPLY/ALTER
4. Select opt 2 = CU STG
5. Select opt 1 = DISPLAY
6. Enter address 024F0 : You are displaying the Sense Error History Pointer (SNERHPTR) that indicates the next entry point in SNERRH table. This table starts at address 02600 and is a 256 byte wrap-around.
7. Write down the contents of address 024F0 displayed in previous step.
8. Subtract 4 from this address and use the result to display control storage again.
9. Locate the letters 'ABCD' in the display, immediately after the ABCD is the FSC of 4 hex digits.

   You have now located the latest FSC stored in the table.

12.0 MCODE EC 991858

EC 991858 contains several changes that will be of interest to both the Customer Engineer (CE) and the customer. These changes are discussed below and include the following items:

- Real Time Statistical Analysis & Reporting System
- Enhancements to Automatic Cartridge Loader operation when in in SYSTEM mode and operating in an MVS/JES2 environment.
- Changes to functional microcode diskette serialization.

REAL TIME STATISTICAL ANALYSIS & REPORTING SYSTEM (RTSARS)

Real Time Statistical Analysis and Reporting System is an algorithm controlled by 3480 Control Unit microcode. Real Time Statistical Analysis performs real time or near real time predictive maintenance and problem determination on 3480 subsystem hardware.

PURPOSE

Real Time Statistical Analysis gathers performance information (statistics or counts of specified events) every time a cartridge is mounted. These statistics are then combined with the past history of the device to produce measures of level of performance and performance trends for the device.

These single cartridge mount statistics are combined with the device condensed statistical history (saved on the control unit diskette) to develop device dependent performance trends for generating alert messages for the device. There is one record for each device attached to a control unit. The device condensed statistical history is saved on the control unit diskette and is available for further processing when the next cartridge is mounted.

These hardware performance measures are used to identify:

- When a device requires cleaning.
- When a device, string of devices, or control unit have degraded in performance and should be repaired.

BENEFITS

Real Time Statistical Analysis provides the following benefits:

- Identifies degraded hardware. This allows you to schedule maintenance before hardware causes permanent errors, high criteria error counts, and unscheduled interrupts.
- Saves rerun time by decreasing the number of ABENDs caused by degraded hardware.
- Tells you when a device should be cleaned.

MESSAGES

Messages are provided on both the 3480 device pod and the EREP Permanent/Recovered Error Summary Report.

Device Messages: The CLEAN message is displayed on the 3480 device pod. The CLEAN message indicates that the cleaning cartridge should be inserted in the device in order to clean the drive. This message will appear every time a cartridge is demounted until the device has been cleaned. This message can be overlaid by a system message.

EREP Messages: Messages directed to the Customer Engineer are shown in the EREP Permanent/Recovered Error Summary Report. These errors have a FSC in sense byte 10 and 11 that start with a "B" and have an ERPA code of 48 (recoverable error) in sense byte 3. (THE REAL TIME STATISTICAL ANALYSIS FSC'S WILL ONLY APPEAR IN THE "RECOVERED ERROR" SECTION OF THE PERMANENT/RECOVERED ERROR SUMMARY REPORT.)

These errors should be treated by the Customer Engineer as serious and require a repair action. The action to be taken is specified by the maintenance package.

OBTAINING MAXIMUM REAL TIME STATISTICAL ANALYSIS BENEFITS

The following suggestions allow you to receive the maximum benefit from the Real Time Statistical Analysis algorithm:

- Clean a drive as soon as possible after the CLEAN message appears on the display pod.
- Have the customer spread work across all devices. Do not use only the low order devices or those that are the closest.

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- Run EREP daily and review for Real Time Statistical Analysis temporary errors. (Sense byte 3 to 48 and bytes 10 and 11 set to Bxxx.) Again, these errors will only appear in the "RECOVERED ERROR" section of the PERMANENT/RECOVERED ERROR SUMMARY REPORT of EREP.

- Take action on any Real Time Statistical Analysis error code presented.

FL14

AUTOMATIC CARTRIDGE LOADER CHANGES

PURPOSE

This microcode enhances the use of SYSTEM mode on a loader in an MVS/JES2 operating system environment. It provides smoother and faster operation by providing timely updates of loader active status to the host. It includes four changes that were part of a list of changes to loader operations requested by customers. The installation of this microcode is transparent to JES3, VM, and VSE.

This change refers to a loader being used in SYSTEM mode only, unless noted otherwise. Additionally, all fixes apply to MVS/XA, but not all apply to MVS/370 mode. Each change notes which software applies.

CHANGES

CONTROL UNIT SENSE BYTE 2 BIT 5: The meaning of this bit has been changed to:
Automatic Cartridge Loader Active

The bit is set to a one if all of the following conditions apply:

1. The automatic cartridge loader is installed and operational.

2. The automatic cartridge loader is in system mode.

3. The automatic cartridge loader is capable of indexing a cartridge into the device as the result of a Load Display command which specifies the index function.

   In order to index a cartridge, there must one or more cartridges available in the input stack and there must be room for any cartridge in the deck or feed position to be indexed into the output stack.

   The bit is set to zero when any of the above conditions do not apply.

   This bit is valid for Formats 19, 20, and 21.

Previously:

- The loader could also be in AUTO mode for this bit to be active.
- The status of the output stack had no effect on this bit.
- This bit was only valid in Format 21. It was reserved in Formats 19 and 20.

This bit only affects JES2. JES3, VM, and VSE do not presently use this bit.

SYSTEM IPL (370 AND XA): Part one affects system IPL. It allows JES2 to be IPLed and, in the process, retrieve loader active status from each loader that is attached to that host. In addition, any VARY ON operation to a loader will post current loader active status to that host.

INPUT STACK GOING EMPTY (XA ONLY): Part two affects operation when the input stack on the loader is allowed to empty. Loading the empty input stack with more cartridges and pressing the START button on the loader will normally cause the first cartridge in the stack to be fed into the drive. The process of the drive becoming ready updates the active status of the loader in the host that is owed status by that loader. In the case of a multi-host environment, no other hosts are notified of the status change. This change will not affect the operation of JES2/370 mode. In this case, the operator must still unload the drive by a command at the system console to allow JES2/370 to receive the latest loader status.

AUTOMATIC CARTRIDGE LOADER ATTENTION INDICATOR (370 AND XA) .: Part three concerns the loader Attention indicator in both SYSTEM and AUTO mode. When the input stack is empty, the Attention indicator flashes, indicating that the operator needs to add cartridges to the input stack. This indication can help the operator avoid a loader becoming inactive. An empty input stack will cause the indicator to flash whether there is a cartridge in the drive or not unless the mode switch is moved to MANUAL. Note that the indicator will also flash if the output stack is full (no change).

CONTROL UNIT IML (370 AND XA): Part four helps operators by not requiring that the START button on the loader be pressed under the following conditions:

1. The loader is in SYSTEM mode
2. The loader input stack is not empty
3. The output stack is not full
4. There is no cartridge in the drive or in the feed position of the loader
5. The above conditions are met at the time that the 3480 control unit is IMLed

If the conditions are met, the host may begin using the loaders as soon as control unit IML is complete without the operator needing to go to each loader

to press the START button. This is the only case where the loader may begin feeding without the operator having to press the START button and could surprise operators, if they are not informed.

INSTALLATION SEQUENCE

There are three levels of operational loader changes that can be added to a customers installation.

1. 3 Tiered Allocation - to prefer loaders for scratch cartridges
2. 3480 Microcode - part of the loader Active changes and fixes
3. DFP - the other part of the loader Active changes

The 3 Tiered Allocation changes may be applied independently of the microcode and DFP changes and vice versa. The microcode may be applied before the DFP changes. Installing only the microcode will cause some operational changes with the loader, but will not solve the loader Active problem without the DFP changes.

NOTE: THE 3480 MICROCODE IS A PREREQ TO THE DFP APARS.

Microcode required

- EC 991858 parent for 3480

Software required

- MVS/XA SP 2.1.2 or above
- MVS/XA DFP 1.1.2, 2.1.0, or 2.3.0
- DFP APAR for XA OY07024
- MVS/370 SP 1.3.3 or above
- MVS/370 DFP 1.1.1 or FMID JDQ1110
- DFP APAR for 370 OY07023
- 3 Tiered Allocation APAR for MVS OY06778

DIFFERENCES NOTICEABLE TO THE OPERATOR

The software changes are not a corequisite of the control unit microcode unless the loader Active changes are desired. Installation of the microcode causes certain changes in the loader operation, however, and these must be noted to all customers before they install the microcode. Essentially, these changes are:

- After a control unit IML, a loader in SYSTEM mode with cartridges in the input stack may begin feeding cartridges automatically without the operator pressing the START button. Before, the operator was required to press the START button to cause any motion on the loader to begin.

- After refilling an empty input stack, removing cartridges from the output stack, if it is full, and pressing the START button, the loader may automatically feed the first cartridge from the stack into the drive if the loader is in SYSTEM mode and a mount private has not been called for. Previously, a cartridge would not have been loaded before the mount request.

- The loader Attention indicator is used to alert the operator in one additional case. If the loader is in SYSTEM or AUTO mode and the input stack is empty at any time, the Attention indicator flashes. This is to aid the operator by calling his attention to a condition that could cause the host to wait while more cartridges are loaded. There are times when a loader may not be in use and the flashing indicator is not wanted. The indicator can be made to stop flashing by placing the loader in MANUAL mode. Previously, the flashing Attention indicator was not related to the condition of the input stack.

CHANGES TO MVS ALLOCATION

MVS has been changed to allocate to 3480 devices in a three tiered approach. The concept can be seen by looking at mount requests for both specific and non-specific cartridges.

- If a mount request is for a non-specific cartridge, allocation will look for available drives in the following order:

  1. A 3480 drive with a loader attached that is active where active means that the loader is in SYSTEM mode and can index cartridges into the drive on command

  2. Next, a 3480 drive with a loader attached that is not active

  3. Finally, a 3480 drive without a loader attached

- If a mount request is for a specific cartridge, allocation will look for available drives in exactly the opposite order:

1. A 3480 drive without a loader attached
2. Next, a 3480 drive with a loader attached that is not active
3. Finally, a 3480 drive with a loader attached that is active

CHANGES TO DFP

The changes to DFP allow software to interrogate the status of the loaders on the 3480 and update the appropriate active/inactive bit in the host UCB.

SERIALIZATION OF FUNCTIONAL MICROCODE DISKETTES

CURRENT IMPLEMENTATION

During Initial Microcode Load (IML) the diskette is checked to determine if the machine serial number has been written. If the diskette has not been IML'd in any machine, the serial number will be blank and as a result the switches on the 01A-A1Q2 logic card are read and written on the diskette. This serial number is used to ensure that the diskette does not get used in another control unit. Additionally, microcode patches are sent for a specific microcode level and to a specific control unit.

Real Time Statistical Analysis and Reporting System (RTSARS) data must remain with the control unit that gathered the data. This requires that the RTSARS data also be serialized.

CHANGES

In an effort to streamline the IML and patching process, the following changes have been incorporated:

- bypass setting of an error on an IML sequence when a serial number mismatch is detected.
- read the serial number switches on the 01A-A1Q2 logic card and write them on the functional microcode diskette on each IML.
- ensure that the RTSARS history data is used only when the serial number associated with the history data matches the serial number of the control unit being IML'd.

Operational Results of Serialization Changes

The preceding changes will:

- allow moving the functional microcode between control units for problem diagnosis.
- prevent machine outage when the diskettes must be replaced due to damage and the microcode is not available locally.
- allow microcode patch updating of all diskettes on a single subsystem.

Note: Diskettes should be returned to their original location once the patch update process is complete. The most current RTSARS data can then be available for use in the control unit.

13.0 KNOWN PROBLEMS AND FIXES.

Following is a list of known problems detected either in the Field or in Manufacturing Plant. Along with them is the Date of Detection and the fix or circumvention (if any.)

Please review this list and see if there is anything you can add. If there is, please send a feedback to 3480 PE's in Valencia Plant.

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
DATE: 6/28/85
FROM: RICH FORD

LOTS OF TEMPORARY READ/WRITE ERRORS

When looking at a Forced Error logging report. If you see a lot of single 74nn's or 76nn's followed by a perm 74nn. The Maintenance Package may or may not fail. OLTS test C if run to EOT and P2 option (full sense) may fail even if the maintenance package doesn't. This could be a indication of bad compliant guides. it could also be isv if new tape cartridges are being used.
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
DATE: 7/02/85
FROM: BOB GENSLER

70E4 ERRORS

FSC70E4 70E4 are caused by a glitch on the interface cable (bus bits).

A/P : Replace interface cable. A 'window' in the Buffer allows a undetected 'CRC Error'.
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
DATE 7/18/85
FROM BOB GENSLER

Subject: FSC A170 WITH D5C1 OVERRUNS IN DATA CHAINING
In Dual Subsystems. Sense Bytes 10-17 = A170 A170 3941 D5C1

With Data Streaming, minimum byte count of 16 should be used. Overruns can occur when the CPU fetches the next CCW with a 'short' (<16) count. See "3081,3083 & 3084 Channel Characteristics Config. Guide GA22-7077"
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
FROM: J.D.JOHNSTON
DATE: 07/30/85

Subject: OLTS FAILURE - T3480B - ERROR MESSAGE CB0136

OLTS test T3480B 3.1 can fail with microcode release 24 or higher.

**** FIX **** T3480B 3.2 scheduled for release with OLTSEP 13.5

** TEMP FIX ** Use SOSPC Ext = ZAP
NAME = T3480B
VER 00093E = 4710,397C
REP 00093E = 47F0,397C

****

FROM: J.D.JOHNSTON
DATE: 07/31/85

Subject: MISSING DEVICE END/FSC 3030

Missing Device End and/or FSC 3030 are frequently the result of a loose cable in an upstream 3803 Control Unit. The 3803 must propagate "Mark In" even though it doesn't use it. The path for "Mark In" thru the 3803 is:

I/O TAILGATE 01S-A1A2J13 TO 01A-B2U2D13 LOGIC PAGE FC061 AJ3
I/O TAILGATE 01S-A1B2J13 TO 01A-B2V2D13

A problem on one path will affect all other paths to that subsystem.

****

FROM: J.D.JOHNSTON
DATE: 08/16/85

Subject: VARY PROBLEMS WITH OEM SOFTWARE INSTALLED (MSX)

FAILING SENARIO No.1:

Customer IPL's (tapes are GENNED to come up Off-line)
MSX is started
VARY XXX,ONLINE,SHARE

IEE444I DYNAMIC PATHING NOT OPERATIONAL ON PATH (XXX,YY)
IEE791I XXX VARY REJECTED - ASSIGN CONFLICTS WITH CURRENT DEVICE STATUS .

This is because the OEM Software (MSX) modifies the tape UCB's , then when the vary is done it finds the device is already assigned.

Other failures that may occur:

OLTEP:

IFD109I XXX ONLINE , ALLOCATED , WILL NOT BE TESTED

CE responds PROCEED

S0C4 ABEND (The component that had the drive was MSI)

CIRCUMVENTION:

Option 1: 1. Customer IPL'S
2. VARY Tapes ONLINE
3. Start OEM Software Package (MSX)

Option 2: 1. Remove 3480's from MSX control

****

FROM: J.D.JOHNSTON
DATE: 09/03/85

Subject: 237 ABENDS/STATUS = DEVICE BUSY & DEVICE END/ZERO SENSE

MSG IEA000I 000,**,IOE,02,1400,,**,VOLSER,JJJ,HH.MM.SS.

Failures with Device Busy and Device End together (Status = 1400) can be a result of having the 3480 defined as shared in the IOCDS or UCW. This can also result in zero sense and 237 abends.

FIX: Change the IOCDS to UNSHARED for the 3480's.

****

FROM: A. Sancho
DATE: 10/03/86

Subject: MOUNT PENDING PROBLEMS

After mounting a requested cartridge, drive display shows 'READY U', but system doesn't acknowledges the mounting and after a while, a MOUNT PENDING message appears on the console.

FIX: Install APAR's OZ89754, OZ91912 and OZ90399

****

FROM: A. Sancho
DATE: 10/03/86

Subject: FSC 5BB1 ON CHANNEL ADAPTERS IN CU-1.

Problem is caused by 5BB0 type errors (log sense with ERA=48) being reported as 5BB1 (Degr. mode ERA=42) if the Channel Adapter is an old style one (KUCH at P/N 6460337)

FIX: New C.A. card KUCJ at P/N 6272311 (EC A06010)
FBM 6178234 will be sent to the Field to update machines.

****

14.0 DYNAMIC PATHING ANALYSIS.

Dynamic Pathing facility controls host system access to 3480 subsystems operating in Full Function mode. This protects the drive from being inadvertently used by more than one host at the same time.

Drive assignments and channel paths are controlled by software using the VARY command.

This control is based upon five new channel commands: Set Path Group ID, Sense Path Group ID, Assign, Unassing and Control Access.

Explanation of the use of these commands follows.

14.1 Set Path Group ID (x'AF'):

- Establish identification of a host system via a particular channel path to the addressed drive. Each host will have a unique Path Group Identification (PGID).
- Used in conjunction with the ASSIGN command to provide drive assignment.
- Must not be in a chain of CCW with any other command. It will execute if the drive is not-ready, not installed and not assigned.
- CU will operate in single-path mode. Completion of an I/O operation will be made only to the channel path that originated the I/O.
- Until an ASSIGN command is successfully executed, a drive may accept commands from any channel path group.
- Once an ASSIGN command has been issued by one of the channel paths of an established Channel Path Group, then the assignment pertains to all members of the Channel Path Group.
- The PGID value can only be changed by POR or by a System Reset received on the channel path.
- SPGID command causes 12 bytes of information to be transferred from the host to the 3480 CU:

  Byte 0: Function Control Byte, meaning follows:

  bit 0: Path mode:
  0 = Single path mode
  1 = Do not use, command reject

bits 1-2: Group Code:
- 00 = Establish group: Places the drive in grouped state.
- 01 = Disband group: Each path in the path group, as recognized by the addressed drive only is placed in ungrouped state.
  If the addressed drive was assigned to the path group, then the drive remains assigned only to the path that issued the command.
- 10 = Resign from group: The path is removed from any path group for that drive and placed in the ungrouped state.
  If the addressed drive was assigned, remains with the remaining members of the group. If no other paths in the group, assignment remains with the path issuing the command.
- 11 = Reserved (do not use)

bits 3-7: Reserved (must be 0's)

Bytes 1-11: Path Group ID (may NOT be zero) CPU NMBR.

14.2 Sense Path Group ID ('34'x):

This command causes twelve bytes of information to be transferred from the CU to the Channel. It will execute even if the drive is not ready, not assigned or not installed.

The Sense PGID has to be the only command in the channel program. Chained from any other CCW will cause UCK with Command Reject.

Information provided is:-

Byte 0: Path-state byte, meaning as follows:

bits 0-1: Grouping status:
- 00 = Reset
- 10 = Ungrouped
- 11 = Grouped
- 01 = Reserved

bits 2-3: Assign/Unassign status:
- 00 = No Allegiance
- 10 = Assigned Elsewhere
- 11 = Assigned
- 01 = Allegiance to Issuing Host

bit 4: Mode
- 0 = Channel path operating in single-path mode
- 1 = Multipath mode (Not valid for 3480).

bits 5-7: Reserved, will always be zero.

Bytes 1-11: Path Group ID set by a previous Set PGID Cmd.
('0' if not Path Group ID was previously set).

14.3 Assign (x'B7'):

- Causes the addressed drive to be exclusive use-assigned to all the channel paths in the channel path group.
- Sense byte 0 bit 7 (ASE) and Unit Check will be posted to commands other than Sense, Set PGID, Sense PGID and Control Access issued to a drive not assigned to the path.
- If a previous Mode set inhibited Supervisor commands, then Assign will fail with UCK and Command Reject.
- Command will execute even if the drive is not-ready. If not installed or Off-line, the ERA 46 (Drive not On-line) will be presented in sense.
- Assign command passes 11 bytes of information. They may be all zero or a path group ID.
- The assignment of a drive may be cleared by:
  - POR in a the CU.
  - System reset on all assigned channel paths.
  - The '40' form of a Control Access command.
  - Unassign command.

14.4 Unassign ('C7'x)

This command causes a prior assignment of the addressed drive to the exclusive use of the channel path or a collection of channel paths to be terminated. The command will be accepted whether the path is assigned or unassigned. Drives being not-ready or off-line do not prevent this command from execution.

UCK will be presented if drive is assigned to a collection of channel paths not including the path issuing the Unassign command.

Eleven bytes of information are passed from the host to the CU. If they are all zeros, then assignment will be cleared for the channel path group over which the Unassign command is received.

If the eleven bytes are not all zeros, then they are interpreted to be a Path Group ID and the drive becomes no longer assigned to those channel paths having that Path Group ID.

Unassign is a Supervisor command and therefore will be UCK'ed and Cmd Rejected if Supervisor Cmds were previously inhibited by a Mode Set.

Note: The Unassign cmd may by issued by any host along any assigned channel path, and can unassign that drive from any correctly-specified channel paths, even if those channel paths belong to a different host.

14.5 Control Access (x'E3'): PNEM

The Control Access command permits special exceptional access to a specific tape drive, even though that drive is assigned (by ASSIGN cmd) to another host processor. It also will perform a generalized Unassign function.

Function provided by this command are:

- Permits a host that already possesses assignment of a specific drive to establish a password.
- Can allow a host that not possess assignment of a drive to issue a channel program to that drive. In this case, Control Access command has to be either first in a CCW chain or immediately following a Sense Cmd which is first in the chain.
- Can cause the addressed drive to be unassigned from any and all channel paths.
- Can turn on/off Force Error logging for either a drive or all drives addressable by a CU.

It is a Supervisor command, which may be inhibited by a Mode Set.

This command will execute, even if the addressed drive is not installed.

Twelve bytes are passed to the CU with this command for the three different way of use:

Standard use:

Byte 0: x'00' = Set-password function
x'80' = Request-temporary-unassignment Function
x'40' = Generalized-unassign Function

Bytes 1-11: Password. PNEM?

Error Logging Control:

Byte 0: x'01' = Activate Forced Error Logging
x'02' = Deactivate Forced Error Logging

Byte 1: x'01' = For All Drives (both CU's if Dual)
x'02' = For the addressed drive only.

Bytes 2-3: x'0200' = Error Logging

Bytes 4-11: Ignored (must be 0's).

Engineering use (hidden):

Byte 0: x'01' = Allow CU or drive function
x'02' = Inhibit CU or drive function

Byte 1: x'01' = Implement CU functions
x'02' = Implement drive functions

Bytes 2-3: Control Unit functions (if Byte 1 = x'01')
x'8000' = Read in Readahead Mode
x'4000' = Write in buffer write mode
x'2000' = Load Balance drives
x'1000' = CU controlled ERP's
x'0800' = Reconnect (Early)
x'0100' = Serial Start drive
x'0010' = Select drive
x'0002' = Report Read CRC errors
x'0001' = Report block ID errors

Bytes 2-3: Drive Unit functions (if Byte 1 = x'02')
x'8000' = Drive write operations
x'4000' = Read in Readahead mode
x'2000' = Reconnect (Early)
x'1000' = Serial start drive
x'0800' = CU controlled ERP's

Bytes 4-11: Not used (must be 0's).

SET-PASSWORD FUCTION (00): When byte 0 has the value '00', then a Password is established for the addressed drive, whenever the host processor possesses assignment to it.

The password will remain until all assignments of that drive to any and all host processors are cleared.

REQUEST-TEMPORARY-UNASSIGNMENT FUCTION (80): When byte 0 has the value '80', then the command is requesting that assign protection (not the assignment itself) be suspended for the channel commands that follow Control Access in the individual Channel program.

This function operates for the single channel program for any path in the path group it is received over and it can be thought as "temporarily assign this drive to this channel path group" function.

An Assign command may follow the '80'x Control Access function which redefines the collection of hosts to which the addressed drive is assigned.

Note: Password in bytes 1-11 must match previous set password in order this function to work. Otherwise UCK and Command Reject will be presented.

GENERALIZED-UNASSIGN FUCTION (40):When byte 0 has the value '40', then under certain conditions the assignment of the addressed drive will be cleared for any and all channel paths.

Note: Password in bytes 1-11 must match previously set password in order this function to work. Otherwise UCK and Command Reject will be presented.

- If no password was previously established, then the drive is unconditionally unassigned from all channel paths that at that time possess assignment ot it. Bytes 1-11 are then ignored.
- If this function is received on a channel path that does not possess assignment of the addressed drive, then UCK and Cmd Reject will be presented.
- Control Access password (if any) is removed by this Generalized-Unassign function.

14.6 CU Mcode Tables.

Mcode is controlling dynamic pathing by keeping information relative to the paths groups and the drive assignments into several tables as well as in the Status Store RAM. Description of these tables and their use by Mcode for Dynamic Pathing control follows:

14.6.1 Path Group ID Table (PGT):

The Path Group ID table contains the PGID for each of the channel Adapters for both CU's. The table is affected by Set PGID commands addressed to drives on either CU, since in a Dual Subsystem, the PGT tables will be mirror images of each other after execution of a Set PGID command.

Each entry of the table contains 14 bytes:

Byte 0: Basic Pathing information

- bit 0: System reset due to C.A. CK2 or other error.
- bits 1-2: Reserved (not used)
- bit 3: A PGID has been received since last POR or Sys. Reset.
- bit 4: Path mode. Must be 0 (Single Path)
- bits 5-7: A PGID number (starting from 1) has been received since last POR or Sys. Reset.

Bytes 1-11: Path Group ID data

Byte 12: C.A. System Reset information

bit 0: The channel adapter is now disabled (CADIS).
bit 1: The C.A. is processing a C.A. Disable sequence.
bit 2: Disable-to-enable interrupt to CU Mcode.
bit 3: Off-line complete interrupt presented to CU Mcode.
bits 4-7: Number of device last addressed by the resetting C.A. and having buffered write data that has not yet been written to tape.

Byte 13: Channel Connection information

bit 0: C.A. is processing a System Reset.
bit 1: Processing a CK-1 condition.
bit 2: Two pass incomplete.
bit 3: Processing Go-Online.
bit 4: Bad Mode has been set in C.A. switches.
bit 5-7: C.A. Mode:
000 = DCI
001 = DCI 1.5 MB Throttled
101 = 2.0 MB Streaming
110 = 3.0 MB Streaming
111 = 4.5 MB Streaming

Note: When looking at this table by using the CU Table Display option of the PST, you are prompted to enter the drive address. Even though this is a device indexed table, contents pertains to C.A's and CU's, and PGT contents for device 0 is in fact for CU-0 CA-A, for device 1 is CU-0 CA-B,....., for device 4 is CU-1 CA-A, and for device 7 is CU-1 CA-D.

Information for devices 8-F should be disregarded and not used.

14.6.2 Path Group Map table (PGM): Vol. 4

The Path Group Map consists of 14 data bytes per entry with the following contents: "by drive!"

Byte 0: Path Group Mask: One bit set for all C.A. interfaces which are members of a Path Group. It is added to when a Set PGID 'Establish Group' is received and certain members removed by a Set PGID 'Resign from Group' or 'Disband Group' command.
Path Group Masks are mirror images in both CU's. (has to be the same for both CU's)

Byte 1: Control Bits.

bit 6: All Paths have assignment of the device: Used to differentiate between 'none-assigned' and 'all-assigned' states of Page 2 of Status Store (Assignment Mask).
bit 7: A valid Password has been set by a Control Access cmd.

Byte 2: Currently Unused

Bytes 3-13: Password set by the Control Access command (if any).

14.6.3 Command Status Table (CST): forget.

This table contains information about the current command that is being executed against the addressed drive and is arranged by drive. used by progr.

The only field of interest for Dynamic pathing in this table is Word 5, first byte (APGM) which contains the Active Path Group mask and indicates which channel Paths are members of the path group that have been WRITING data to the device.

Initial setting if 'FF'x. When channel are grouped for that drive, bits indicating the path are set to zero. Later, when a WRITE command is issued against the drive, the paths are indicating by the bits being at '1' and remaining bits set to zero (in fact it is a copy of Byte 0 of PGM).

Example: Channels A and B have access to drive 0 (a Set PGID to the drive has been sent over them, but each one belongs to a different PGID). Before any write operation, CST Word 5 will be '3F00'x, but after writing data through Channel Adapter A to the drive, this word will have '8000'x .

14.7 Status Store RAM

Information of interest on Dynamic Pathing analysis and contained in Status Store RAM will be given below. Detailed information can be found in the Status Store RAM section 7.0 of this Bulletin. Display during customer jobs.

each page is 16 bytes long.

Page 0: Indexed by drive address, indicates which channel adapter is using that drive at a given moment.

Page 2: Contains the Assignment Mask. It is indexed by drive address and indicates which channel adapters have assignment to that drive and therefore are allowed to work with it. cc = A/3 CU0 is working with A/3 CU1 that drive.

Page 3: Program Flags. It is indexed by drive address and indicates some conditions used by CU mcode operation.

Bit 0 = Local System Reset Processing
Bit 1 = Remote System Reset Processing
.
.
Bit 4 = All Channel Path assigned
.
Bit 6 = Initiate Extended Contingent Connection
Bit 7 = Give Busy for Ext. Contingent Connection

Page 5: Temporary Assignment Mask: Status Store Page 2 is copied into this page when a Control Access command with '80'x function is executed. During this Control Access command processing, Page 2 is set to 'FF'x.

14.8 Some Action Plans and hints

14.8.1 ACTION PLAN FOR ASE:

ASE's could be the result of a variety of situations: ESD, operation problems & Tape Management software as well as 3480 microcode have been the major causes to date.

3480 PE/microcode will no longer be the determining organization towards problem definition or ownership. When it is deemed the ASE is a microcode failure, Engineering will become involved.

There are approximately 30 ASE problems active in any given month. Any problems of this nature should be addressed with the following action plan which is intended to be a generic approach to an Assign Elsewhere problem that is normally not a hardware failure, but a operational condition where a path is not allowed to access a drive.

1. Get console logs from all systems attached to the 3480 subsystem having ASE's. The console logs should start from the last time that the first drive to fail was working correctly and run thru the occurrence of the ASE. Go back to the last time all the drives where VARY ONLINE, if possible.

2. Get EREP data for that same time span.

3. Take a concurrent dump of both CU's.

4. Use MD to display assignments (Status Store page 2. From Mcode release 991858 on, SB9 will have this information for FSC 33E4) and Dynamic Pathing Mcode tables (PGT and PGM).

5. Use above data to go-thru the console logs and find out what caused the Assigned Elsewhere.

14.8.2 ACTION PLAN FOR 'VARY ONLINE' UNDER VM:

When running MVS under VM the following is a situation that can be encountered:

1. After normal running, bring down the MVS signon.

2. Bring MVS back up under VM (VM was never brought down).

3. VARY ONLINE failed.

   IEA444I Dynamic pathing not on device
   IEE791I 185(Device Address) Vary Rej-Dyn Path not operational

   The passwords are different because MVS IPL'ed under VM and no System Reset was given the CU to reset the password.

Also Ref:
SE Guide to the IBM 3480 Magnetic Tape Subsystem
ZZ10-5008-01 page 107 (Full Function mode)

FSC4B22:

The Path Group ID in the argument of the Set Path Group ID command does not match the Path Group ID received in a prior Set Path Group ID command over the same channel interface.

4. This shows up after a re-IPL of MVS under VM:

The 3480 does not get a reset so the PGM still has the Password. (CPU + TOD clock). The new MVS IPL has a different TOD so the SPGID gets a Unit Check. The Sense has a 4B22, Cmd Reject in it. This causes the VARY to fail.

14.8.3 TIP H114814: 3480 COMMAND REJECT WITH A 'C7' COMMAND:

3480 Power down while still On-line to Host, then when trying to VARY OFF-LINE, will get Cmd Reject with FSC 4261.

Display of Device will show up 'OFF-LINE-R' as reserved status.

Solution: Change Assign Status to 'NOT RESERVED' by a 'VARY XXX.OFFLINE,FORCE' cmd, where XXX is the Device address.

14.8.4 OPERATOR GUIDE

PNEM. Refer to Appendix A of 3480 Operator's Guide for VARY Command procedures for MVS and recovery procedures for Dynamic Pathing Problems. Information contained there is very usefull and should be known and used by CE's.