DIAGNOSTIC PROGRAM MANUAL

SIGMA 5 THROUGH 9 DIAGNOSTIC PROGRAM MONITOR (DPM)

PROGRAM NO. 705682C

SUBJECT MODEL -- This program is used as the operating monitor program for DPM peripheral test programs. Refer to the individual test programs for further information.

REQUIRED EQUIPMENT -- Minimum Memory Size: 16k; Input Device: Card Reader, Paper Tape Reader or Magnetic Tape Unit; Output Device: Keyboard Printer or Line Printer

PROGRAM LOADING INSTRUCTIONS

From Magnetic Tape Library
- Mount tape on unit 0 (without write-ring) and set its address on the control panel
- Reset all sense switches
  Exception: Set sense switch 1 if the upper core protection is desired
- Execute a LOAD from the control panel:
  1. If sense switch 1 is reset, the loader is loaded to the upper end of memory.
  2. If sense switch 1 is set, the following occurs:
     a. If the keyboard printer is not on IOP 0, device address 1, the program will come to a wait. Enter the correct address into register 2 and clear the wait.
     b. If the keyboard printer is at the standard address or the correct address has been entered, the following three messages will be printed: (Reset sense switch 1 once printing has begun)
        - RELOCATION BIAS FOR RESIDENT LOADER IN HEX; Type in the hexadecimal memory address of the first location the resident loader is to occupy in memory, followed by a carriage return. Minimum address is 400 and the maximum address is IFE00 or maximum memory size less 200.
        - RELOCATION BIAS FOR DIAGNOSTIC PROGRAM IN HEX; DPM programs may not be relocated, therefore type in only a carriage return.
        - ALTERNATE INPUT DEVICE ADDRESS; To continue loading, type in only a carriage return.
        - Loading will continue following the third entry
  A message giving the tape library title and revision letter should be typed out from the keyboard
- Type in the program name desired and a N/L
  1. If a listing of all programs on tape is desired, type: !LIST, ADR, N/L N/L where ADR = output device address in hex. Default is to the keyboard printer.
  2. If the full name cannot be remembered, type in the partial name and a N/L. Complete the partial name by selecting the desired name from the suggested names typed out by program.
- To make a copy of the MTL, mount MTL on unit 0 and execute a LOAD. Mount scratch tape on unit 1 and make ready. Type: !COPY. The MTL tape will be copied to the scratch tape and verified.

From Card Deck (same for Paper Tape)
- Place card deck in Card Reader and set its address on the control panel
- Reset all sense switches
  Exceptions: Set sense switch 1 if the upper core protection is desired or sense switch 2 if register control

is desired by the keyboard printer (ASR DPM) test, program no. 705651

- Execute a LOAD from the control panel:
  1. If sense switch 1 is reset, no wait will occur unless sense switch 2 is set (see 3.)
  2. If sense switch 1 is set, the following occurs:
     a. If the keyboard printer is not on IOP 0, device address 1, the program will come to a wait. Enter the correct address into register 2 and clear the wait.
     b. If the keyboard printer is at the standard address or the correct address has been entered, the following three messages will be printed: (Reset sense switch 1 once printing has begun)
        - RELOCATION BIAS FOR RESIDENT LOADER IN HEX; Type in the hexadecimal memory address of the first location the resident loader is to occupy in memory, followed by a carriage return. Minimum address is 400 and the maximum address is IFE00 or maximum memory size less 200.
        - RELOCATION BIAS FOR DIAGNOSTIC PROGRAM IN HEX; DPM programs may not be relocated, therefore type in only a carriage return.
        - ALTERNATE INPUT DEVICE ADDRESS; To continue loading, type in only a carriage return.
        - Loading will continue following the third entry
  3. If sense switch 2 is set, the program comes to a wait:
  - Clear the wait, the program will come to a second wait
  - Enter X'FFFFFFFF' into register 0
  - Reset sense switch 2
  - Clear the wait
  - "!" should be typed out from the keyboard

  Exceptions: Sense switch 2 option was used or the keyboard is not on IOP 0, device address 001.

  1. If sense switch 2 option was used, "LOAD" directive will automatically be performed
  2. If keyboard is not address 001, the program will come to a wait:
     - Enter IOP and device address of the keyboard into register 2, i.e. X'105'
     - Clear the wait
     - "!" should be typed on keyboard
- Type in "LOAD" and a "Space Character" if sense switch 2 option was not used. A message giving the program name and revision letter should be typed out

DIRECTIVES –directives are entered after a "!" is typed out

Name	Format	Parameter			
		ID	Definition	Value Range	Standard Value (default)
Monitor Directives					
Message Output Device	MOD, A, IXX	A	Device type	TY (KSR/ASR) LP (Line Printer)	TY
		I	IOP number	0 ~ 1FF	0
		XX	Device controller address	00 ~ 7F	01
Message Input Device	MID, A, IXX	A	Device type	TY (KSR/ASR) CR (Card Reader) PR (Paper Tape Reader)	TY
		I	IOP number	0 ~ 1FF	0
		XX	Device controller address	00 ~ 7F	01
Dump Memory	DMP, H1, H2 [,C]	H1 H2 C	Starting address Ending address Relative address flag (displacement from the starting address)	0 ~ FFFFF 0 ~ FFFFF C ≠ 0	0
Alter Memory	ALT, H1, X1 [,...,XN]	H1 X1 . . . XN	Memory address ⎱ Values to be inserted ⎰ into memory starting ⎰ from H1	0 ~ FFFFF N ≤ 254	
Load Program (from object deck)	LOAD				
Program Directives – Environmental Directives					
System Environment	SYST, D1, D2, H3, H4,...,HN	D1 D2 H3 H4 . . . HN	Device or controller model number	The 'SYST directive interpretation and value ranges are supplied by the program loaded by the 'LOAD' directive. Refer to the applicable diagnostic program reference manual. Also, the diagnostic program will generally print its 'SYST' format following the 'LOAD' operation.	
Program Directives – Testing Directives					
Test Directives (used to test a device or to modify test data)	Determined by Diagnostic Program		Supplied by the Diagnostic Program. Refer to the applicable Diagnostic Program Reference Manual.		

Note: Parameter of any directive beginning with a D means decimal, with an H means hexadecimal.

LOADER ERROR MESSAGES

Error Message	Description of Error
Sequence Error Job Aborted	The last record read was out of sequence (if reading cards, the deck may be missing a card) and loading has been aborted
Checksum Error Job Aborted	The last record read had a checksum error (the input media may be damaged) and loading has been aborted
Dev Not Redy	The input device failed to come 'READY' following the last read operation and loading has been aborted
Illegal Load ITM	The last record read contained an illegal load item type and loading has been aborted

1. If any loader error message is printed, loading has been aborted
2. Retry entire loading procedure:
   a. If identical error occurs, obtain a new copy of the program
   b. If loading still fails, check input device for correct operation

MONITOR ERROR MESSAGES

All monitor error messages are output to the keyboard, KSR, and have the following format:

   MONITOR ERROR XXXX where XXXX is a four-digit
                        number.

The four-digit error numbers have the following interpretation:

ERROR NO.	DESCRIPTION OF ERROR
0700	Illegal address (ALT directive, DMP directive, message print routine)
1000	Illegal device mnemonic, parameter A1, MOD directive
1100	Illegal device mnemonic, parameter A1, MID directive
1200	Illegal character in a hexadecimal parameter
1201	Illegal character in a decimal parameter
1202	No termination or continuation character in first 72 characters of a record containing a directive input from a device other than the keyboard/printer
1203	First character of a continuation line is not an exclamation
1301	First character of a record is not an exclamation
1302	Illegal directive
1303	More parameters indicated for a directive than authorized
1800	No parameters with SYST directive

ERROR NO.	DESCRIPTION OF ERROR
1801	Diagnostic program does not show the model number specified in a SYST directive that is executed while diagnostic program is loaded
1802	Context data block in diagnostic program is not long enough
1804	Context data table in diagnostic program shows zero model numbers to which a context data block applies
2201	SIO yielded IOP halt
2202	SIO yielded incorrect length indication
2203	SIO yielded IOP memory error indication
2204	SIO yielded memory address error indication
2205	SIO yielded transmission memory error indication
2206	SIO yielded transmission data error
2301	SIO not accepted after maximum delay
2302	I/O address not recognized
2303	I/O interrupt fails to reset
2304	Device not operational
2305	Controller not operational
2306	SIO rejected after operational status byte obtained
2307	Manual mode

START PROCEDURE

1. Sense Switch Options

Sense Switch	Position	Function
1	Reset	Continuous operation, no looping
1	Set	Loop on failing test or selected test if SSW3 is set
2	–	Not used *
3	Reset	Wait on error or successful completion of tests. (Clearing the wait causes looping on the error or selected test. PCP instruction address increment before clearing the wait continues the program without looping.)
3	Set	No wait after error or successful completion of test. See SSW1 for looping
4	Reset	Print all message(s)
4	Set	No message printout except from the monitor

*Note: Sense switch 2 may be used during the loading of the Diagnostic Program Monitor, see Program Loading Instructions.
2. Monitor Directive Options – Desired Monitor Directive(s) entered
3. Environmental Directives – SYST directive is entered for test environment (Diagnostic Program Dependent)
4. Test Strategy Selection (Diagnostic Program Dependent)
5. Repeat 1, 2 and 4 when the program terminates. Repeat 3 only if system environment is to be changed
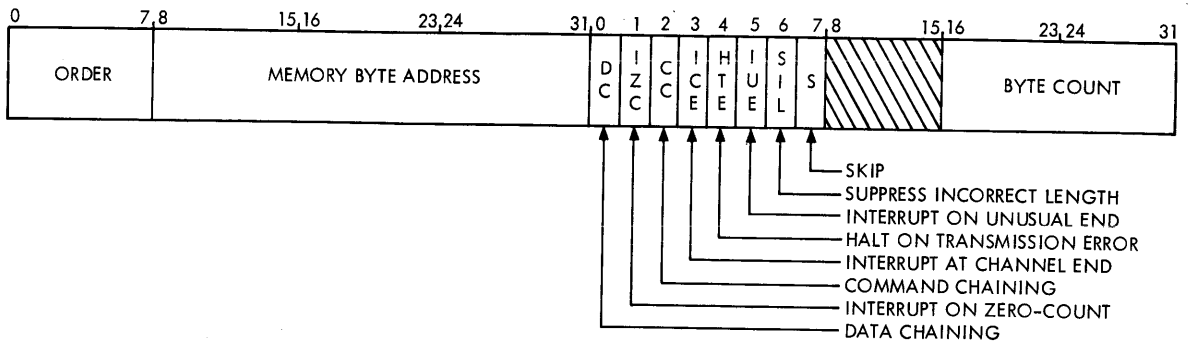
TERMINATION INDICATION

1. Completion of a directive – Control returns to the message input device or loops on an instruction sequence
2. Error indication – Error message printout or looping on an instruction sequence
3. PCP interrupt – Control returns to the message input device and the current operation is aborted
4. Watchdog timer trap – WAIT without message (if no jumper for I/O reset)
   – Looping with message (if no jumper is connected, Sigma 5: 4C17 to 6C15,
   Sigma 7: 27G21 to Ground)
5. Other traps or interrupts – The following type-out will occur:
   TRAP/INTER = XX   TCC = YYYY   REGSAVE = AAAAAAAA
   PSW1 = TTTTTTTT   PSW2 = RRRRRRRR
   where: XX   Denotes the trap or interrupt location
   YYYY   Denotes the trap condition codes
   AAAAAAAA   Denotes the location in memory where the register contents at the time of the trap or interrupt are stored
   TTTTTTTT and RRRRRRRR are the contents of the Program Status Doubleword saved by the LPSD instruction executed as a result of the Trap or Interrupt
   a. Memory Fault Trap or Interrupt only – The program will
   Type-Out: (Sigma 8 and 9 only)
   MSW0 = WWWWWW   MSW1 = EEEEE   MSW2 = RRRRRR
   Giving the status of the faulted memory
   b. Processor Fault Interrupt only – The program will type-out:(Sigma 8 and 9 only)
   PROC. NO.   SS   F/STAT = C
   Giving the faulted processor address and the fault status

RESTART PROCEDURE

1. Perform applicable steps under Start Procedure
2. Depress System or CPU reset switches and return the system to a RUN condition. Control returns to the message input device and the current operation (if any) is aborted
3. PCP Interrupt – Control returns to the message input device and the current operation (if any) is aborted
4. If program fails to restart correctly, reload the program
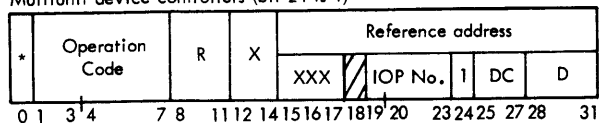
COMMAND DOUBLEWORD FORMAT

```
 0        7,8        15,16      23,24       31,0  1  2  3  4  5  6  7,8        15,16    23,24      31
┌──────────┬────────────────────────────────┬──┬──┬──┬──┬──┬──┬──┬──┬─────────┬───────────────────┐
│          │                                │D │I │C │I │H │I │S │  │/////////│                   │
│  ORDER   │      MEMORY BYTE ADDRESS        │C │Z │C │C │T │U │I │S │/////////│    BYTE COUNT     │
│          │                                │  │C │  │E │E │E │L │  │/////////│                   │
└──────────┴────────────────────────────────┴──┴──┴──┴──┴──┴──┴──┴──┴─────────┴───────────────────┘
```

SKIP
SUPPRESS INCORRECT LENGTH
INTERRUPT ON UNUSUAL END
HALT ON TRANSMISSION ERROR
INTERRUPT AT CHANNEL END
COMMAND CHAINING
INTERRUPT ON ZERO-COUNT
DATA CHAINING

INPUT/OUTPUT INSTRUCTIONS

I/O ADDRESS

I/O STATUS RESPONSE

SIO, HIO, TIO, AND TDV

Multiunit device controllers (bit 24 is 1)
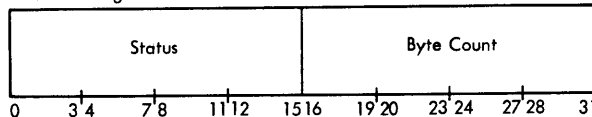
*	Operation Code	R	X	Reference address
				XXX / IOP No. 1 DC D

0 1 3 4 7 8 11 12 14 15 16 17 18 19 20 23 24 25 27 28 31

Sigma 8/9 systems only
000 = HIO
001 = RIO
010 = POLP
011 = POLR

Word into register R

Sigma 8/9 Subchannel Status	000	Current command address

0 3 4 7 8 10 11 12 19 20 23 24 27 28 31

Word into register Rul

Status	Byte Count

0 3 4 7 8 11 12 15 16 19 20 23 24 27 28 31

AIO

*	6E	R	X	Reference address
				/// 0 0000 ///

0 1 3 4 7 8 11 12 14 15 16 18 19 20 23 24 27 28 31

Status	000	I/O address

0 3 4 7 8 11 12 15 16 18 19 20 23 24 27 28 31
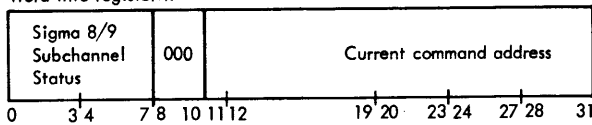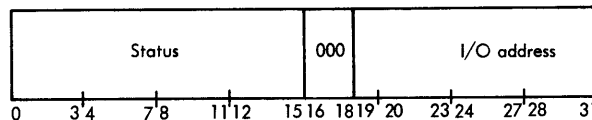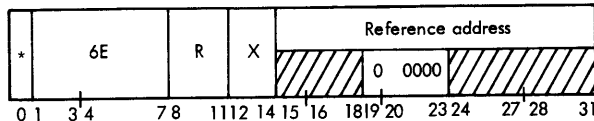
GENERAL CONDITION CODES

Note: These condition codes apply to most devices but they may differ. Refer to the individual device reference manual for correct condition code.

The condition code settings are:

1	2	3*	4	Result of SIO
0	0	–	–	I/O address recognized and SIO accepted
0	1	–	–	I/O address recognized but SIO not accepted
1	0	–	–	device controller is attached to a "busy" selector IOP or Sigma 8/9 MIOP operating in Burst Mode
1	1	–	–	I/O address not recognized

1	2	3*	4	Result of TIO
0	0	–	–	I/O address recognized and acceptable SIO is currently possible
0	1	–	–	I/O address recognized but acceptable SIO is not currently possible
1	0	–	–	device controller is attached to "busy" selector IOP or Sigma 8/9 MIOP operating in Burst Mode
1	1	–	–	I/O address not recognized

1	2	3*	4	Result of HIO
0	0	–	–	I/O address recognized and device controller is not "busy"
0	1	–	–	I/O address recognized but device controller was "busy" at the time of the halt
1	1	–	–	I/O address not recognized

1	2	3	4	Result of RIO (Sigma 8/9 only)
0	0	–	–	I/O address recognized
1	1	–	–	I/O address not recognized

1	2	3	4	Result of POLP or POLR (Sigma 8/9 only)
0	0	–	–	processor fault interrupt not pending
0	1	–	–	processor fault interrupt pending
1	1	–	–	processor address not recognized

1	2	3*	4	Result of TDV
0	0	–	–	I/O address recognized
0	1	–	–	I/O address recognized and device-dependent condition is present
1	0	–	–	device controller is attached to "busy" selector IOP or Sigma 8/9 MIOP operating in Burst Mode
1	1	–	–	I/O address not recognized

1	2	3*	4	Result of AIO
0	0	–	–	normal interrupt recognition
0	1	–	–	previous operations ended with unusual end or transmission error
1	0	–	–	AIO is accepted
1	1	–	–	no interrupt recognition

*On Sigma 8/9 systems only
CC 3 = 0 Status information in general registers is correct
CC 3 = 1 Status information in general registers is incorrect

STATUS BITS FOR I/O INSTRUCTIONS

Position and State in Register Ru1

Device Status Byte								Operational Status Byte								Significance for SIO, HIO, and TIO	Significance for TDV
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Dev Interrupt Pending	*
-	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	Dev Ready	*
-	0	1	-	-	-	-	-	-	-	-	-	-	-	-	-	Dev Not Oper	*
-	1	0	-	-	-	-	-	-	-	-	-	-	-	-	-	Dev Unavailable	*
-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	Dev Busy	*
-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	Dev Manual	Unique
-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	Dev Automatic	to the device
-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	Dev Unusual End	and the
-	-	-	-	-	0	0	-	-	-	-	-	-	-	-	-	Dev Cntr Ready	device
-	-	-	-	-	0	1	-	-	-	-	-	-	-	-	-	Dev Cntr Not Oper	device
-	-	-	-	-	1	0	-	-	-	-	-	-	-	-	-	Dev Cntr Unavail	cntr
-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	Dev Cntr Busy	*
-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	Unassigned	*
-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	Incorrect Length	*
-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	Trans Data Error	*
-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	Trans Mem Error	Same
-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	Mem Addr Error	as for SIO, HIO,
-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	IOP Mem Error	TIO
-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	IOP Contl Error	*
-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	IOP Halt	*
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	Selector IOP Busy	*

Position and State in Register R

Device Status Byte								Operational Status Byte								Significance for AIO
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*
-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*
-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	*
-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	*
																Unique to the device and device controller
-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	*
-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	*
-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	*
-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	
-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	Incorrect Length
-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	Trans Data Error
-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	Zero BC Interrupt
-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	Channel End Intrpt
-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	Unusual End Intrpt
-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	Unassigned
-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	Unassigned
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	Unassigned

MONITOR LINK TABLE (MLT)

The MLT table allows the interfaced diagnostic program access to subroutines with the DPM and allows for data/information exchange between the DPM and the interfaced program.

Name	Definition	Memory Location	
		Program Location	Core Location
MLT	Absolute program recovery address	MLT+0	X'200'
MLT01	Parameter 1	MLT+1	X'201'
MLT02	Parameter 2	MLT+2	X'202'
MLT03	Parameter 3	MLT+3	X'203'
MLT04	Parameter 4	MLT+4	X'204'
MLT05 · · · MLT14	Unassigned	MLT+5 · · · MLT+14	X'205' · · · X'20E'
MLT15	'DMP' directive routine call location for interfaced programs	MLT+15	X'20F'
MLT16	Unassigned	MLT+16	X'210'
MLT17	Parameter status word	MLT+17	X'211'
MLT18	Unassigned	MLT+18	X'212'
MLT19	Binary coded decimal (BCD) to binary, conversion subroutine interface location	MLT+19	X'213'
MLT20	Directive return address – returns control to the DPM	MLT+20	X'214'
MLT21	Unassigned	MLT+21	X'215'
MLT22	Binary to EBCDIC conversion subroutine interface location	MLT+22	X'216'
MLT23	Decimal to EBCDIC conversion subroutine interface location	MLT+23	X'217'
MLT24	Hexadecimal to EBCDIC conversion subroutine interface location	MLT+24	X'218'
MLT25	One-byte input subroutine interface location	MLT+25	X'219'
MLT26	Current character counter for one-byte input routine	MLT+26	X'21A'
MLT27	Error report subroutine interface location	MLT+27	X'21B'
MLT28	Message print subroutine interface location	MLT+28	X'21C'
MLT29	Sense switch check subroutine interface location	MLT+29	X'21D'
MLT30	'WAIT' instruction, after I/O failure of 'MOD/MID' device	MLT+30	X'21E'
MLT31	Branch instruction – retry after I/O failure	MLT+31	X'21F'
MLT32	I/O address of current 'MOD' device (branch instruction)	MLT+32	X'220'
MLT33	I/O address of current 'MID' device	MLT+33	X'221'
MLT34	I/O address of initial loading device	MLT+34	X'222'
MLT35	Teletype print routine location	MLT+35	X'223'
MLT36	I/O address of default 'MOD/MID' device	MLT+36	X'224'
MLT37	Computer type code storage, 0 = Sigma 5/7, 9 = Sigma 8/9	MLT+37	X'225'
MLT38	Relocation bias of DPM program	MLT+38	X'226'
MLT39	Resident loader base address	MLT+39	X'227'
MLT40	Unassigned	MLT40	X'228'
MLT41	Parameter error report subroutine interface location	MLT+41	X'229'

(Continued)

MONITOR LINK TABLE (MLT) (Continued)

Name	Definition	Memory Location	
		Program Location	Core Location
MLT42	Unassigned	MLT+42	X'22A'
MLT43	Unassigned	MLT+43	X'22B'
MLT44	DPM directive dictionary base address	MLT+44	X'22C'
MLT45	Length of DPM directive dictionary	MLT+45	X'22D'
MLT46	Address of last memory location	MLT+46	X'22E'
MLT47	Address of last memory location interfaced program may use	MLT+47	X'22F'
MLT48	Base address of 120 byte input buffer	MLT+48	X'230'
MLT49	Base address of 40 ward parameter input buffer	MLT+49	X'231'
MLT50	'LOAD' directive memory location	MLT+50	X'232'
MLT51 . . . MLT63	Unassigned	MLT+51 . . . MLT+63	X'233' . . . X'23F'

PROGRAM INTERFACE TABLE (PIT)

The PIT table is established by the user program at 'LOAD' time and provides the DPM with information describing the user diagnostic program

Name	Definition	Memory Location	
		Program Location	Core Location
PIT	Unassigned	PIT+0	X'300'
PIT01	Address of the user program's title message	PIT+1	X'301'
PIT02	Address of the user program's directive dictionary	PIT+2	X'302'
PIT03	The count of the number of words in the user program's directive dictionary	PIT+3	X'303'
PIT04	Address of the user program's absolute recovery routine	PIT+4	X'304'
PIT05	Address of the user program's context description table	PIT+5	X'305'
PIT06	The count of the number of words in the user program's context description table	PIT+6	X'306'
PIT07	Unassigned	PIT+7	X'307'
PIT08	Address of the user program's initializer routine	PIT+8	X'308'
PIT09	Contains the last device model number input via 'SYST' directive transferred to a context data block	PIT+9	X'309'
PIT10	Specifies the number of the faulty parameter in a parameter error message	PIT+10	X'30A'
PIT11	The DPM stores a zero in PIT11 prior to branching to the user program's initialization routine. If this location is non zero upon returning to the DPM, the contents are assumed to be a message address and the message is printed	PIT+11	X'30B'
PIT12	The user program's RUN switch. This location must be non zero to execute a user directive. If zero when a user directive is called, the error message: 'ENTER SYST DIRECTIVE' is printed	PIT+12	X'30C'
PIT13 PIT14	Unassigned	PIT+13 PIT+14	X'30D' X'30E'
PIT15	Address of the user program's trap and fault interrupt handling routine	PIT+15	X'30F'
PIT16 . . . PIT31	Unassigned	PIT+16 . . . PIT+31	X'310 . . . X'31F'

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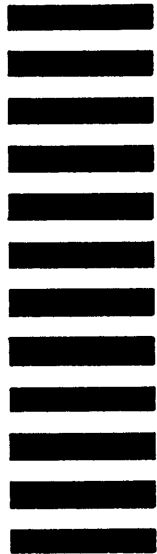
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