FAIRCHILD

A Schlumberger Company

Fairchild Digital Test Systems

Quick Reference Handbook

Fairchild Digital Test Systems Quick-Reference Handbook

NOTICE

This handbook is a quick reference guide intended for use by licensed operators of Fairchild Digital Test Systems. The information provided is complete in terms of user interactions with system hardware and software but explanations are condensed to ease reader access to specific data.

The information presented in this handbook may not contain important details or current software changes and is subject to change without notice.

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The applicability of information to specific user systems and software packages has not been noted.

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APPENDIXES

1 Loading Software

LOADING SOFTWARE without PROM loader

1. At the tape unit:
   a) Mount the tape containing the operating system.
   b) Press Load to advance tape to beginning of tape (BOT).
   c) Press ON-LINE to place tape on-line.

2. On the FST-2 control panel:
   a) Set switch register to 01000100.
   b) Press STOP, RESET, LDP, LDC, and LDMT switches in that order.
   c) Press START to start reading tape.

   NOTE: Console switch (CS1), when placed in the up position, activates an error-override condition that allows disk back-up operations, such as this one, to continue without interruption by disk or tape errors.

LOADING SOFTWARE with PROM loader

1. Load the magtape as in the above procedure.

2. On the FST-2 control panel:
   a) Set switch register to 06760000.
   b) Press STOP, RESET, LDP, and LDC switches in that order.
   c) Press START to run the program in the PROM.
   d) The system responds by displaying a menu of options on the VKT screen.

Function Code and Option	Description
ENTER FUNCTION CODE	
0 COMPUTER SELF-TEST	Executes the condensed computer self-test diagnostic program.
1 DISK	Reloads CPU memory from disk memory unit.
2 MAG TAPE	Reloads CPU memory from magnetic tape unit.
3 CARD READER	Not used with the Series 20 test system.
4 FLOPPY DISK	Not used with the Series 20 test system.
5 RESTART	Restarts the system without reloading the CPU memory.

ERROR RECOVERY

1. Press STOP, RESET, LDP, LDC, and START
2. The system will display a menu of options on the VKT screen.
3. Choose the Function Code that best suits the error.

2 MASTR Modular Monitor Command Language

Datakind:

CO = Created object. File with a one-to-one correspondence to executable CPU instructions.
DD = Datalog Data. File containing fixed or variable length data.
DR = Directory.
DS = Dopsy Source. DOPSY/MASTR format string file.
MD = Module. A FACTOR language module compiled by M3 compiler or a result of LMSAVE utility.
OA = Object of Assembler. An assembly language object file.
OF = Object of FACTOR. Result of modular FACTOR compilation.
OM = Object of FACTOR main module. Result of modular FACTOR compilation.
RS = Runtime Stack. System data.
SC = Source Code. Standard M3 string file.
TP = Test Program or Plan. A FACTOR test program compiled by the M3 compiler.
ØØ = Unused memory.
-Ø = Working storage or scratch file.
-- = Working storage or scratch file.
TD = TAM/TFM Datalog Data
TC = TAM/TFM Current activity buffer

Record format:

U = Undefined. Assembly language file that does not correspond to any M3 file type.
V = Variable length record. Used by datakinds SC and DS.
W = Word. Used by datakind CO.

Parameter definitions:

'jjjj'	Job name or number. Maximum of 4 characters. In some cases single quotes are not required.
'ffffff'	File name. Up to 6 characters enclosed in single quotes.
STATn	Test station where n = 1,2,3, or 4. The default station may be specified by the STATn command. This is also true if (STATn) appears in a command stream.

Prompting Characters:

*	-	M^3 prompt.
?	-	FACTOR READ.
>	-	First level input (DEBUG, EDIT, COMPILE)
=	-	Second level input (EDITor insert directive, HELPER)
:	-	COPY prompt.
&	-	Phantom prompt.
#	-	CCP prompt.
@	-	FXFR prompt.

Default Devices:

Disk (DIF/DOF) is the default resident device for disk based systems and memory (MIF/MOF) is the default resident device for memory based systems and either mag tape (MTR/MTW) or floppy (FL1/FL2) is the default load and dump devices on memory based systems depending on which drive the system was loaded.

Input Devices:

PID	=	Primary/Principal Input Device. System PID
TTK/VK1	=	Video Keyboard Terminal 1
VK2	=	Video Keyboard Terminal 2
CR/CRD	=	Card Reader
MTR/MTR1	=	Magnetic Tape Reader unit 1
MTR2	=	Magnetic Tape Reader unit 2
MIF	=	Memory Input File. Usually followed by a filename.
DIF	=	Disk Input File. Usually followed by a filename.
CLI	=	Com Link Input. Usually followed by a filename.
CID	=	Command Input Device.
FLR1	=	Floppy Reader Unit 1
FLR2	=	Floppy Reader Unit 2

Output Devices:

POD	=	Primary/Principal Output Device. System POD (POD1 or POD1 depending on VKT usage.)
TTP/VP1	=	Video Printer (screen) 1
VP2	=	Video Printer (screen) 2
LP/LPT	=	Line Printer
MTW/MTW1	=	Magnetic Tape Write unit 1
MTW2	=	Magnetic Tape Write unit 2
MOF	=	Memory Output File. Usually followed by a filename.
DOF	=	Disk Output File. Usually followed by a filename.
CLO	=	Com Link Output. Usually followed by a filename.
WOM	=	Write Only Memory. (dummy output device.)
COD	=	Command Output Device.
FLW1	=	Floppy Write Unit 1
FLW2	=	Floppy Write Unit 2

M³ COMMANDS:

Some commands may be truncated to 4 characters.

ALTER n1 n2 (STATn)
ALTER [n1/ALL] OFF (STATn)
ALTER LIST (STATn) (output)

Alters statements or displays altered statements of the test program currently assigned to STATn. Maximum of 40 alters allowed.

n1	statement number to alter.
n2	value to be assigned to the variable used in that statement number.
ALL OFF	Cancels all ALTERs.
OFF	Cancels alter made on the statement number.
output	VP1, VP2, LP, or station POD

ARR variable-number (element-number) (STATn) (output)
ARR variable-number element-number = ['string'/value] (STATn) (output)

Displays or modifies contents of a variable or specified array element.

variable-number	unique number assigned by the compiler (symbol table) to an array or variable. Must be included to specify which variable or array to change or display.
element-number	element number of the array to be displayed or updated. If none is specified, the whole array is displayed. Element number 2 must be larger than element number 1 if there is no comma, since this implies a continuous display between these 2 elements. If there is a comma, it implies discrete elements display.
'string'	the variable or array element specified is updated with the string.
value	the variable specified by the variable-number or the array element specified is updated with this value.
output	Any display device. (VP1, VP2, or LP)

ASM source input (object output) (list device) (options)

Translates assembly language source programs into FST-1 or FST-2 hardware instruction codes using selector file names and devices as input and output.

source input	(TTK/VK1/VK2/CR/CLI/DIF/MIF) 'input filename'	
object output	(DOF/MOF) 'output filename'. If no filename is entered, no object code is generated.	
list device	(TTP/VP1/VP2/LP/CLO/POD)	
options	(SYM)	requests symbol table output
	(LIST)	requests listing of assembler output.
	(XREF)	outputs cross-reference table.
	(CTRL)	allows symbol definition from command stream.

ASSIGN (device) 'ffffff' (datakind) (n)

Creates a file in memory or disk by assigning n words.

device	may be DIF/DOF or MIF/MOF
'ffffff'	name of file being created or expanded.
datakind	2-character file type identifier.
n	number of words assigned. (n ≤ 393,168)

Note: n is in integral of 48-word sectors for DIF/DOF. This number n expands or shrinks a memory file. If MACTAB is being changed, n specifies number of files in MACTAB.

BIAS (n)

Assigns a priority number to the tester task. As the number increases, priority is biased toward the tester task.

n	Number used as bias factor. A decimal integer between 0 and 23.

[BTRAC/LIST] input dataid (listing dataid) (n1) (n2) (HALT) (SUMM/ALL)

Converts a binary file (type DD) created by Datalog or FACTOR writes to ASCII and prints it on the listing device.

input dataid	Any legal input device. The filename specified must be a binary file (type DD) created by Datalog or FACTOR writes.
listing dataid	Any legal output device. Defaults to POD if not specified. If output is to a file which does not exist, the file will be created. If the file does not exist, it will be deleted. The output file must be SC.
n1	Serial number of the first device to be output. If n1 is omitted, it reads and converts records to end of file.
n2	Serial number of last device to output. If n2 is omitted, only the serial number indicated by n1 is output. Do not specify n2 without n1.
HALT	If SUMM is undefined record ID is encountered, display the appropriate error message and terminate. If not specified, conversion continues.
SUMM/ALL	If specified, TT summary, TRIP summary, pin summary and yield summary are output without any test results. The default is ALL which prints test results and summaries.

CHANGE 'fffff1' (datakind) 'fffff2' (datakind)

Changes a filename and/or its datakind in the directory.

fffff1	includes the device and the name of the file to be changed.
fffff2	device and name of the new file.
datakind	2 character file identifier

CHECK (file dataid) (listing dataid)

Verifies the compatibility of a coreimage file with the resident operating system.

file dataid	name of a file on a random access device.
listing dataid	VKT or LP

CHGDKD jjjj odk ndk (ALL/'ffffff')

Current datakind is replaced with the new datakind for the file(s) in the job specified.

jjjj	jobname assigned to the file(s)
odk	current datakind of file(s)
ndk	new datakind for the file(s)
ALL	changes the datakind from the old datakind to new datakind for all files; default to ALL if not specified and no filename.
ffffff	includes the device DIF/MIF and the name of the file to change its datakind.

CHGJOB oj# nj# (ALL/'ffffff')

Changes the current jobname assigned to the file(s) to the new jobname on the disk. CHGJOB is independent of the current job.

oj#	jobname assigned to the file(s)
nj#	new jobname to be assigned to the file(s)
ALL	assigns all files to the new jobname. Defaults to ALL if no filename is specified.
'ffffff'	name of the disk file on which the jobname is changed.

CLEAR (STATn)

Resets all altered conditions established by DATALOG, TITLE, MANUAL, STEP, PAUSE, MODIFY, SYNC, LOOP, STOP, READ, WRITE, MEASURE, DISPLAY, OVERRIDE, and ALTER. Also, zeros the globals GLOB1 to GLOB40, SWITCH, VALUE and DATALOG. SN is set to 1. PID and POD are set to CID and COD.

CLOSE [input/output] (STATn)

Closes a file previously opened and used for binary I/O.

input	may be DIF, MIF, MTR1, or MTR2
output	may be DOF, MOF, CLO, MTW1, or MTW2

CNVFIL input source (new source) (NT)

Converts the source file format from DOPSY/MASTR to M^3 or M^3 to DOPSY/MASTR, depending on the input source.

input source	MIF/DIF 'ffffff'. May be M^3/DOPSY/MASTR source file.
new source	MOF/DOF 'ffffff'. This is the new source name. If not specified, the first character of the input source is replaced with an (&) and the converted file is created with the same name (input source).
NT	specifies that trailing blanks are not to be truncated. If not specified, trailing blanks are truncated.

COMPILE input dataid (output dataid) (list output) (options)

Converts a FACTOR source file into a program file of object codes.

input dataid	source file dataid (DIF/MIF) 'ffffff'. The device must precede the filename.
output dataid	object code destination file (DOF/MOF) 'ffffff'
list output	POD/VP1/VP2/LP/MTW1/MTW2/(MOF/DOF/CLO) 'ffffff'

options	OBJ	generate object code. Default case.
	NOBJ	do not generate object code.
	LIST	Lists source statements.
	LOBJ	Lists statements and object codes.
	LMAC	Generate listing and expand macros.
	LCON	Generate listing and include all conditional compile statements.
	NSEQ	Disable sequence number checking.
	XREF	Generate cross-reference listing.
	SYM	Generate symbol table listing.
	Cn	n is between 1 and 24. Sets conditional compile switch.
	Sn	S5/S7/S8/S10/S10B/S20. Specifies tester type.
	MVn	MV1/MV2. Specifies 1MV or 2MV option.
	PMUn	PMU4/PMU6. Specifies number of PMU ranges.
	CTRL	Specifies multi-line command. Requires// or $$ to exit.

CONT(INUE) (STATn)

Clears the single step and manual start modes and initiates a test start at the station specified. Continues the test program that is in a single step mode from where it is paused.

COPY input output (options)

Performs file transfers from the input device to the output device.

input	VK1/VK2/CR/MTR/(DIF/MIF/CLI) 'ffffff'
output	VP1/VP2/LP/MTW/(DOF/MOF/CLO) 'ffffff'

options

CLMI	Convert from TOPSY LMI file to M^3 LMI file
CDOF xx	Convert from TOPSY FDOF file to M^3 FDOF file where xx specifies the record length. (defaults to 18)
REW	Rewind tape before transfer
SKIP xx	Skip xx files on input tape
UO	Unblocked output (DOPSY FDUMP compatible)
UI	Unblocked input
NHI	No header on tape input
NHO	No header on tape output
OVLY	Overlay existng output file
W1	Blocked transfer for source file
VAR	Variable length (source) records transfer mode.
BOOT	Allows file on floppy to be bootable from the CPU panel.

CREATE 'created object' 'M3REF' 'OBJ1' .... 'OBJn' (options)

Links an assembly language program and its subroutines, or links several assembly language programs that are to be run as a single program.

created object	(DOF/MOF) 'ffffff'. Name of created object file.
M3REF	M^3 Operating System reference file
OBJ1-OBJn	Names of object input files. OBJ1 must contain the M^3 overlay header. Can also be (DIF/MIF) 'OBJn'
options	
OS	Specifies creating an operating system.
SYM	Generate alphabetically ordered symbol table.
SYMN	Generate numerically ordered symbol table (address-oriented).
XREF	Generate list of all object files used.
CTRL	Permit multi-line command. Requires//or $$ to exit.

CSPLOT id# suffix (output)

Generates composite Shmoo plots from SPLOT generated by FACTOR.

id#	SPLOT identification number used for a particular SPLOT during file generation in the FACTOR program.
suffix	Data file suffix number, integer from 01 to 99.
output	Any legal output device, default to POD if not specified.

CYCLE j k (saddr spin)
CYCLE OFF

Establishes a continuous loop between two specified addresses in local memory.

j	Loop start address
k	Loop end address
saddr	Address in local memory at which sync pulse in generated tester pin on which sync pulse generated at location saddr is to appear.
OFF	Terminates cycle loop. Restores affected registers.

DATA(LOG) (DCT) (MEAS) (LOG) (TRIP) (EOT) (FRQm) (FCT) (COUNT) (IFM) (n) (output) (STATn)
DATA OFF (STATn)

Logs the following data:

DCT	Logs all dc parametric test failures
MEAS	Logs measurements whenever a MEASURE statement is executed.
LOG	Logs all 'MEASURE , LOG;' statements
FCT (n)	Logs up to n+1 functional test failures by address
COUNT (n)	Logs up to n+1 functional test failures by count
IFM (n)	Logs up to n+1 functional test failures by addr or count
TRIP	Logs all DPS trips
EOT	Logs PASS/FAIL and EIR information
FRQm	Logs data for every mth device
output	VP1, VP2, LP, CLO, POD
OFF	Turns off DATALOG requests
STATn	STAT1, STAT2, STAT3, STAT4

DATE 'mm/dd/yy'

Sets the date to string entered. Single quotes are optional. A maximum of 8 characters can be in the string.

DBUP (VERIFY/CHECK) (OVERRIDE) (MT1/MT2) ('text')

Transfers the entire contents of the disk to the magnetic tape.

VERIFY	Verifies that the tape is readable and correct. Data is first transferred and verified.
CHECK	Checks that the DBUP tape is readable and correct. No data transfer is done.
OVERRIDE	Overrides tester busy and operating system busy conditon by resetting the tester hardware and setting single tasking mode.
MT1/MT2	Defines which magtape is to be used. MT1 is default
'test'	Comments up to 60 characters maximum.

DEBUG ('ffffff')

Used to debug coreimage files. If no filename is specified, DEBUG will access absolute addresses in memory.

A	Decrement current address
DEL	Delete entered line
LF	Advance current address
n1 ± n2/B =	Add or subtract. B is base address value
A	Display all breakpoints
n1(,n2)A	Set breakpoint to n1 to execute n2 times before halting
nB	Relative addressing
CTRL-B	Delete entered character
C	Continue
D	Exite from Debug
nG	Goto address n
nI	Insert at address I
L	Display contents of current address
n1(,n2)L	Display address contents n1 thru n2
nMA	Modify the A register to n (Accumulator)
nME	Modify the E register to n (Extension)
nMR	Modify the R register to n (Relocation)
n1, n2MX	Modify index register n1 to n2
N text	Enter a note of any length. Terminate with CTRL-L
Q	Display state switches and indicators.
nR(CT)	Read tester register n. CT = continuous. CS6 up to stop.
T	Return to monitor
V	Delete all breakpoints
nV	Delete breakpoint n
n1,n2W(CT)	Modify tester register n1 to n2. CT = continuous. CS6 up to stop.
X	Display A, E, and X register. (X -index)
Y	Start program at background entry point
Z	Start program at foreground entry point
P	Turn on or off the line printer

DELETE (device) 'fffff1' (device) 'fffff2' (device) .... 'fffffn'

Changes the first character of the filename to '&' which flags the file for deletion.

device	DOF/MOF/CLO from which to delete files. Applies to the following filenames until respecified.
fffff1..fffffn	Name of the file(s) to be deleted.

DELJOB jjjj [datakind/ALL] (NOVER) (listing device)

Deletes all disk files in a specified job with a specified datakind.

jjjj	jobname containing the files to be deleted. No quotes allowed.
datakind	2-character datakind of the files to be deleted. ALL may be used instead to delete all files in the specified job. A % sign may be used as a wild card, i.e. %% = ALL.
NOVER	Suppresses the verification query.
listing device	VP1/VP2/LP/WOM where the files will be listed as they are deleted.

DELTA 'fffff1' 'fffff2' ('limit file') (ALL) (n1) (n2) (output)

Generates a measurement delta report from datalog measure files. Compares two sets of device measurement.

fffff1	File containing data from first test performed.
fffff2	File containing data from second test performed.
limit file	File containing valid data limits
ALL	Outputs all measurements and computed deltas for all measurements.
n1	Serial number of the first device to be output.
n2	Serial number of the last device to be output.
output	listing device other than the sytem POD. (LP, VP1, VP2)

DEVICE (n/ALL) (OFF) (output)

Displays or closes the IOATAB entry for the devices specified.

n	number of the device to be closed; corresponds to the number displayed by IOATAB.
ALL	Indicates all devices currently active.
OFF	Closes device specified.
output	Any legal output device.

DFDV (load device (dump device (resident device)))

Sets the default LOAD, DUMP, and resident devices.

load device	Input device for LOAD commands.
dump device	Output device for DUMP commands
resident device	Device used for all functions other than LOAD and DUMP. Default is disk for all systems except Sentry V, Sentinel, and Series 10 for which the default is the memory.
device	Can be DSK, MEM, MT1, MT2, FL1, FL2.

DIRECT (output) (SOURCE/DATA/OBJECT/CO) (ALL/WS) ('ffffff') (n)
DIRECT [MTR1/MTR2] (n/ALL)

Displays disk or magnetic tape directories.

output	May be POD/TTP/VP1/VP2/CLO
n	Displays a directory listing of a number of files in all jobs
ALL	Displays a directory listing of all files in all jobs.
SOURCE/DATA/OBJECT/CO	Causes all source, object, data, or created object Files to be specified
WS	Displays disk working storage size
'ffffff'	Displays directory entry of disk file specified.
MTR1/MTR2	Displays directory of TDX or MBUP on specified magnetic tape unit.

DISPLAY (options) (ON/OFF) (RANKn) (STATn)

Displays tester status and selected registers at each pause and EOT if 'ON' is specified, or displays the information immediately if 'ON' is not specified. Display is output to the POD.

ON	Display the selected option at every pause and EOT
OFF	Disable the specified displays.
RANKn	Define starting rank n (n = 1-5) for long register displays
STATn	STAT1, STAT2, STAT3, STAT4
options	
PMU	Displays PMU status
FCT	Display long registers: MM, M, D, I, S, R, F, C, Local Memory address, selected time set, set of TG's TG's and period. Data for 60 pins are displayed beginning with RANK n.
EIR	Display external interface register
PWR	Lists pins connected to DPS1, 2, 3, or TCOM
CLK	Lists pins connected to clock references (EA0/EA1/ EC0/EC1)
STRB	Lists pins strobed by TG8 (A/B/D)
TG	Lists pins connected to input TG's
ALL	Selects all of the above
TVn	Displays start/stop values for TG1A-TG8B for timing value n (n = 1-16). Defaults to 1 if n is omitted.
SCRAM	Display timing value/period to timing set correspondence
TR	Display all period values
TIME(n)	select options: STRB, TG, TVn, SCRAM, and TR for timing value n (n = 1-16). Defaults to 1 if n is omitted.
TGxx	Display start/stop values for TGxx where xx = 1A-8B for all timing values.
DIM	Selects D, I, and M options (series 20 only)
D	Displays the I/O pin definition registers
I	Displays the INVERT registers
M	Displays the mask registers

DIST CREATE [TTy/PINz] (SIZEw) (STATn)
DIST DELETE [TTy/PINz] (STATn)
DIST DELETE ALL (STATn)
DIST LIST [TTy/PINz] (STATn) (output)
DIST LIST ALL (STATn) (output)
DIST ZERO [TTy/PINz] (STATn) (output)
DIST ZERO ALL (STATn) (output)
DIST ON (FRQt) (STATn)
DIST OFF (STATn)

Generates and manages a histogram data base.

CREATE Allows space for the specified histogram. Also initializes the histogram and activates the data collection algorithm for the station.

DELETE Removes specified histogram or all histogram for the station and then reinitializes each histogram listed.

LIST Writes the contents of the specified histogram or all histograms for the station to the specified output device.
Note: CREATE, DELETE, and LIST must be followed by at least one parameter.

ZERO Firsts lists the specified histogram or all histogram for the station and then reinitializes each histogram listed.

OFF May be used to suspend data accumulation for all histograms assigned to the specified station.

ON may be used to reactivate data collection after an OFF command or a CLEAR command. May be used to specify the datacollection frequency. ON is used when it is desirable to collect data for every nth device rather than for all devices tested.

SIZEw Specifies the size of the CPU memory buffer assigned to the histogram when it is created. Default of 20 is assumed if size is not specified.

TTy Identifies the Test Type (TT) for the histogram. 1 is assumed as default if not specified. Limits are $1 \leqslant y \leqslant 16$.

PINz Identifies the pin(s) for the histogram. Default of 0 is assumed if not specified. Limits are $0 \leqslant z \leqslant 60$ or $128 \leqslant z \leqslant 145$.

FRQt Specifies the data collection frequency for all histogram created for the specified station. If frequency is zero or one, data is collected for every device.

output any legal output device.

DLREG (output) (spin lpin) (?)

Displays the contents of all long registers at any specified cycle count of local memory execution.

output	May be VP1, VP2, LP, (DOF/MOF/CLO) 'ffffff'
spin	Starting pin number to be displayed. Default is pin 1 to pin 60 for a Sentry V and VII and from pin 1 to pin 120 for Sentry VIII and Series 20.
lpin	Last pin to be displayed
?	Displays all the command format of DLREG.

DUMP 'fffff1' ('fffff2') ('fffff3') (output)

Transfers file(s) from memory to the specified output device.

fffff1	Names of memory files to be dumped
ffff2, fffff3	
output	Any legal output device.

EDIT (OVLY) (input file) (output file)

Used to edit or generate Sentry source language programs. Prompt is >.

File Handling Directives:

0 'ffffff'	Open File.
0 dev 'ffffff'	Open named file from DIF/MIF/MTR1/or MTR2.
I 'ffffff'	Insert named file into the output file.
I dev 'ffffff'	Insert specified DIF/MIF/MTR1/or MTR2 file into output buffer

Record Oriented Directives

A(n)	Delete next n records and enter insert mode.
A label(+n)	Delete through label +n records and enter insert mode.
C(n)	Copy next n records to the output file
C label (+n)	Copy through label +n records to the output file.
CEOF	Copy through the end of the file.
D(n)	Delete next n records.
D label(+n)	Delete through label +n records.
I	Enter insert mode. New prompter is '='.
Mn	Enters multiple insert mode and duplicates entries n time.
L(n)	List next n records.
L label (+n)	Lists through label +n records.
P	Display pending line.
V(n)	Copy n1 records and display nth record.
Vlabel(+n)	Copy through label +n-1 records and display the label +nth record

Backup Directives:

B(n)	Backup input and output files n records, changes are not saved
BO(n)	Backup input or old file n records
BN(n)	Backup output or new file n records
BS(n)	Backup output file n records and save changes
X(n)	Delete n previous records.

Non-Record Oriented Directives:

A's1''s2'(n)	Alter string 's1' to string 's2' through n records.
V's1'(n)	Copy (up to n1 records) to the record containing string 's1'
%	Suppress character compare for specific position on alter. Similar to a wild card.
←	Edit end of record codes (EOR).

Special Control Directives:

ABORT	Exit the editor. Scratch file not deleted.
CS1	Set to suppress the display of the last record copied or deleted as the file is processed.
E	Enter the character edit mode.
Ex	Enter the character edit mode and display the next line up to the first occurrence of x.
L	Overrides CS1. List output to VKT.
U	Turn off L request.
Tn1,n2,..n20	Redefine up to 20 tab stops. (default 10,16,26, 31,45,72)
CTRL-B	Deletes the last character of the line while in the insert mode.
CTRL-T	Tab marks in insert mode.
(LF)key	Same function as CTRL-T
CTRL-L	Delete entire line while in insert mode.
(DEL)key	Same function as CTRL-L.
SCID	Change input device for reading edit commands to the CID.
SCR	Change input device for reading edit commands to the card reader.
STTK	Change input device for reading edit commands to the VKT
//	Exit the insert mode when in that mode. If not in insert mode, EDIT will display a message asking if you want to ABORT or not.
//R	Repeat request. This copies the input file to the end of the file. Places the pointer at the top of the buffer.
//'ffffff'	Copy to end of the input file and exit editor. File is copied to 'ffffff'.
#	Indicates a comment or note line that is inserted in MIF or DIF edit files.

Character Edit Mode Directives:

E(x)	Enter character edit mode and copy to character x.
CTRL-B	Delete character.
CTRL-C	Copy current record and display next record.
CTRL-E	Copy current record and exit character edit mode.
CTRL-L	Erase changes in record and restart scan at beginning of record.
CTRL-N	Advance one character across current line and display.
CTRL-P	Keep changes in record and start scan at beginning of record.

CTRL-Rx(CR)	Set search character to x.
CTRL-S	Search for next occurrence of search character x.
CTRL-T	Tab.
CTRL-V	Enter verify mode and remain in character editor. '=' prompt is issued.
CTRL-X	Exit the character edit mode. Current record is not copied.
(CR)	Copy current line to working storage.
(LF)	Same as CTRL-T.

EOF (n) output

Writes n end-of-file marks to the tape unit specified.

n	Number of end of file marks to be written
output	MTR1 or MTR2

FANT (command)

Causes a phantom file to be interrupted and a new prompt is issued, '&'. To abort the file, the // is entered.

If FANT command is entered, the third command stream is in effect.

command	Any M3 command.

FCOMP (device) 'fffff1' (device) 'fffff2' (listing device) (NTOF) (ALL/count)

Compares two specified files, word by word, and displays the word number and the words that miscompare, in both octal and TRASCII.

device	DIF or MIF where the file is located.
fffff1, fffff2	Name of the files to be compared.
ALL	Will display all miscompares
count	Maximum number of miscompares to be printed. Can be any valid number.
NTOF	Suppresses top of form.
listing device	VP1/VP2/LP where the miscompares and miscompare summary are displayed.

FETCH (options) ((job)) (fffff1) (fffff2) ... (fffffn)

Retrieves files from a DBUP tape. May be used to retrieve the directory or user message from the tape. A maximum of 80 files may be loaded with one FETCH command.

fffff1..fffffn	Files to be fetched from tape. Fetching by filename results in those files being loaded into the current job.
(job)	Identifies a job to be fetched. Parenthesis are required. All files from that job will be loaded into the same job unless NOJOB option is entered into place files in current job.
Options:	
ADD	Load only those files not currently on the disk. Must be used with filenames and job specification.
CLEAR	Deletes any corresponding files from the disk prior to loading the requested file(s).
NOJOB	Files are loaded into the current job. Applicable only when fetching an entire job.
DIRECT	DBUP tape directory is output to the selected output device (POD/LP)
NOTE	User message from the DBUP tape is output to the selected device.

FLINK (SYM) (XREF) output-dataid input-dataid

Links FACTOR external subroutines and functions to a FACTOR main module.

SYM	Generates symbol table for external symbols only.
XREF	Generates a symbol table and a cross reference table for external symbols only.
output-dataid	Destination file for resulting test program.
input-dataid	Main module of a modular FACTOR program. The datakind must be OM.

FLOP options (FLm1/FLm2) (output)

Used to manipulate files on floppy. Input default is the floppy #1 and the output is the VKT.

output — VP1 or LP

FLm1/FLm2 — Selects floppy #1 or #2. m is either R or W (read or write)

options

- INIT — Initialize floppy to M3 format. Must use FLW1 or FLW2.
- LIST — Prints out floppy files on selected output device. Uses FLR1 or FLR2.
- DELE — Delete specified files. The first character is changed to an ampersand (&). FLW1 or FLW2 is used.
- COPY — Copy contents of floppy #1 or floppy #2.
- PACK — Remove all files whose names begin with the &. Uses FLW1 or FLW2.
- LOCK ON — Prevents writing to floppy. Uses FLW1 or FLW2.
- LOCK OFF — Permits writing to floppy. Uses FLW1 or FLW2.
- HEAD REVxxxx DATE nmddyy 'comments...' — Writes the floppy header. Uses FLW1 or FLW2.
- UPDA 'ffffff' REVxxxx DATE nmddyy — Writes the revision number and date to the specified file. REV and DATE can be in any order. FLW1 or FLW2 used.
- HELP — Prints out a list of available FLOP commands.
- RENA 'offfff' 'nffffff' — Changes old file 'offfff' to new file 'nffffff'. Uses FLW1 or FLW2.
- LOAD 'fffff1' 'fffff2' 'ffffn' (DOF/MOF) — 'fffff1''fffff2''ffffn' are the files to be loaded to memory or disk. If no files are specified, all files on floppy will be loaded. DOF/MOF selects where the files are to be loaded. Uses FLR1 or FLR2.

FST (output device) ('ffffff') (CL) (?) (STATn)

Used for documentation and analysis of functional test patterns using the sequence processor module (SPM) by displaying a trace of functional data in the order in which it is programmed to execute.

output device	Any legal output device, default to POD.
'ffffff'	Filename is specified if output device is DOF or MOF.
CL	Clears all pin numbers. If not specified on subsequent calls, FST will not ask for pin numbers and instead use the pin numbers from the previous call.
?	Displays command format, responses, and error messages

FST uses a menu to ask the user for the necessary information.

FXFR

Module used to manipulate files on FXFR formatted diskettes. Enter this command and a new prompt is issued, '@'.

From this prompt, FXFR directives are entered:

LIST Provides a list of the contents of the floppy and directory.

LOAD ((ALL/'fffff1''fffffn')) CTRL

Transfers all files or specific files from floppy to memory.

ALL	Transfers all files from floppy to memory
'fffff'	Transfer specific files only
CTRL	Allows continuation to next line

SAVE "descriptive text" mm/dd/yy REVxxxxxxxx floppy-id CTRL

Creates a floppy header which includes data following the word SAVE. After the header, memory from zero to the first unused word is copied. The result is a bootable floppy. Maximum memory size that can be copied to floppy is 83K words.

descriptive text	Must be in double quotes and less than 72 characters in length.
mm/dd/yy	Specifies a valid date.
REVxxxxxxxx	Specifies revision using any eight characters.
floppy-id	Can be any eight character name.
CTRL	Allows in/out to continue on another line.

END Ends floppy transfer and returns control to the system.

MAKE 'ffffff' mm/dd/yy/REVxxxxxxxx CTRL

Load specific file(s) on a floppy while creating and inserting a directory. Up to 50 files can be loaded on a single floppy.

'ffffff'	Specific file(s) to be loaded on floppy.
mm/dd/yy	Specifies a valid date.
REVxxxxxxxx	Specifies the revision using any eight characters
CTRL	Allows input to continue on another line.

ADD 'ffffff' mm/dd/yy REVxxxxxxxx CTRL

Adds specific file(s) to an existing floppy made with the MAKE command. Description of options are identical to MAKE.

LOCK ON/OFF

Activates (ON) or deactivates (OFF) a control word inserted in the header when the HEAD command is used. Floppy cannot be overlayed once lock is activated.

HEAD "descriptive text" mm/dd/yy REVxxxxxxxx floppy-id CTRL

This header is created and inserted in the first floppy sector. The data following the HEAD command is placed in the header to identify the floppy. Option descriptions are identical to SAVE.

CHECK (ALL/'ffffff')

Checksums are recalculated and compared to the values in the directory. An error message is displayed if they do not match.

ALL	Selects all files on floppy
'ffffff'	Specifies an individual file on floppy.

COPY

Contents of floppy #1 is copied to floppy #2.

UNIT 1/2

Designates floppy #1 or floppy #2 as the primary input.

GLOB(AL) number value/'string' (STATn) (output)
GLOB(AL) number (STATn) (output)
GLOB(AL) (STATn) (output)

Displays or modifies a test station's global variables. If no value is entered, then that global variable number is displayed. If GLOB is simply entered, then the entire global variables are displayed.

number	Number of the global variable, a decimal integer between 1 and 40
value	Octal or decimal integer or floating point number to be stored in the global.
'string'	4 character string to be stored in the global variable.
output	Display device LP,VP1,VP2,MTW1,MTW2

GO

A null command that is used to read the next command from a command file, DIF, MIF, or procedure file that has been interrupted using the ESC key or with the FANT command.

HELPER

Invokes the enhanced Command Line Processor for a particular command stream and attaches syntax control files to that stream. New prompt will be issued, '='.

Command Summary:

ACTI
Activate command line processing

DEC (OVRD)
Deactivate command line processing
OVRD overrides any enabled command stream.

ENAB (VK1/VK2/FANT)
Enable CLP for VK1, VK2, or the phantom (FANT)

DISA (VK1/VK2/FANT)
Disable CLP for VK1, VK2 or the phantom (FANT)

ATTA 'ffffff' (VK1/VK2/FANT)
Attach a syntax control file 'ffffff' to VK1, VK2 or the FANT (phantom).

DETA (VK1/VK2/FANT)
Detaches the syntax control file from VK1, VK2 or the FANT.

List of HELP commands:

#CLEAR Clears the screen of the command input device (COD) if it is a VKT.

#SHOW Any text between #SHOW and #NOSHOW commands is displayed

#TYPE (token list)
The tokens which follow the #TYPE are displayed on the COD.

#RCSV (token list)
Displays the token list on the COD and then reads up to nine tokens from the COD.

#READ (token list)
Displays the token list on the COD and then reads an M^3 command or HELP command.

#STATE 'ffffff'
Searches for a file. #1 is set to blanks if not found.

- #1 filename
- #2 datakind
- #3 resident device (MEM, DSK)
- #4 job
- #5 data format
- #6 number of words in file
- #7 device type (DIF, MIF)

#STACK (STUFF) Lines of tokens between #STACK and #NOSTACK commands are copied to the file opened by the #OPEN help command file, or to the POD if not file is opened. If STUFF is not specified, tokens are copied exactly as they appear.

#NOSTACK

#OPEN 'ffffff' Opens a memory file and positions the file to EOF.

#CLOSE Closes the file opened by #OPEN

#SCSV (token list)
Causes the token list to be copied to CSV #1 through #9, #0 is set to the number of tokens in the list. CSV stands for Command Stream Variables.

#SLEEP (n) Causes the command file to wait until the ESC key is pressed on the CID. If n is entered, #SLEEP will time out corresponding to the value of n.

#BREAK Causes the M^3 BREAK message to be issued to the COD and allows a command to be input.

#CASE case character
Sets the case character which permits conditional execution of any M^3 or HELP command which begins with the characters '//' or '/.'

#NOCASE Sets the case character to a blank. Only command without the case character are executed.

-label # (command)
A command may be referenced by a label.

#GOTO -label Used for branching within the current command file.

#TR 'ffffff' (argument list)

#TR Transfer control to the command file specified by 'ffffff'. The argument list is passed in CSV #1 to #9.
#TR causes a transfer to the command file which called it.

#IF term relation term command:
Compares CSVs for conditional execution of commands

term — CSV or a constant. The special token ## is a null token which can be used to test for a blank token.

relation — may be EQ, NE, GT, LT, GE, and LE.

command — any M^3 or HELP command

#LOCK Places a system lock on tester tasks.

#NOLOCK Removes the lock placed by #LOCK.

#RESET Sets all CSVs to blank, turns off all echo options, closes any file opened by #OPEN, unlocks the tester task, and sets the HELP case character to blank.

#ECHO (ALL) (EDIT) (#) (COMD) (END) (COD) (STUFF) (HELP)
Causes various output to the POD or COD depending on the options selected.

ALL — Enables all of the options

EDIT — Causes syntax file processing to be echoed to the POD

— Causes each HELP command to be echoed to the POD

COMD — Causes each command not executed by HELP to be echoed to the POD

END — Causes an "END OF TASK" message to be echoed to the POD

COD — Causes each command not executed by HELP to be echoed to the COD

STUFF — Evaluations of CSVs references are echoed to the POD before and after stuffing

HELP — Everytime HELP is called, "HELP WAS CALLED" is echoed to the POD

#NOECHO (ALL) (EDIT) (#) (COMD) (END) (COD) (STUFF) (HELP)
Selectively turns off any or all echoes which may have been selected previously by the #ECHO command.

The description is the opposite of the above.

Command Stream Variables (CSV)

#0 to #9 and #A to #Z — total of 36 variables.

Special tokens

##	Blank spaces
#?	Command stream number
#JOB	Current job
#STAT	Current station number
#TP	Current test program

Syntax Definition Directives:

P	Command Prohibit mode
K list	Keep directive defines the commands in the list which the user wishes to be valid. Used with P directive.
D list	Delete directive defines the commands in the list which the user wishes not to be valid
V 'os' 'ns'	Verify directive is used for string replacement. When the old string 'os' matches a string in the keyboard command it is replaced by the new string 'ns'.
F ot nt	First directive replaces old token (ot) with the new token (nt) when a command is entered on the keyboard. nt can be any number of words.

HPLOT (input) 'ffffff' (output)

A histogram plotting routine that is used in conjunction with the datalogger in order to perform statistical analysis on measurements made by the tester. HPLOT will prompt with '=' and wait for HPLOT commands to be entered.

LIM MIN MAX	This command does not cause a plot to be generated but defines the limit for the commands that follow.
MIN	Lower limit for the histogram
MAX	Upper limit for the histogram
MEAS N1 (n2) (COMP) (output)	Define start and end measurement numbers.
n1	Starting measurement number
n2	Ending measurement number
COMP	Invokes composite histogram
output	Listing device may be changed

T n1 (COMP) (output)

Define test type numbers

n1 — Test type from the FACTOR program. All measurements made with TT = n1 are included in the histogram.

INST n1 (pin) (COMP) (output)

Defines instruction number of measurement to plot.

n1 — FACTOR instruction number of the measurement to be plotted (corresponding to datalog listing)

pin — Pin number requested. If no pin number is specified, then all measurements at the specified INST are plotted.

UNIT [SEC/VOLT/AMP] Defines units for plotting. This option is needed prior to entering the ARR option, as array records in data files do not specify units.

ARR n1 (n2) (COMP) (output)

Define start and end array element numbers

n1 — Starting array element number

n2 — Ending array element number (optional)

PLOT (output) Generates another plot and optionally allows the output device to be specified.

// Terminates the HPLOT program

IB command

Controls the tester's IEEE-488 bus interface.

command — Any IB command. Numbers can be decimal, octal (terminated by a B), or binary (with an *).

IB FORMAT (options)

options:

ASCII — Defines the format as 7-bit ASCII for read and write. This is the default state.

delimiter — Special character (except $) which terminates the data in the write statement. This only applies to WSPACE ; default state is @.

WSPACE — Sends all imbedded spaces in the data.

WOSPACE — Eliminates all imbedded spaces. This is the default.

VAR — Converts and display the data in the read mode.

terminator — Defines the string termination character for read. Defaults to linefeed (ASCII 12B).

BINARY — Defines the data for read/write in binary and is to be displayed/decoded in OCT/HEX/DECIMAL. OCT is the default.

IB CMD n Send command to instrument, n = 8-bit command.

IB DCL Issues the universal command device clear on the bus.

IB GET Issues the addressed command group execute trigger. Initiates a simulataneous preprogrammed action by responding devices-

IB GTL Issues the addressed command to go to local.

IB GTS Force the ibus interface to controller stand-by state.

IB IFC Bus control command. Set talkers, listeners, active controllers to inactive state.

IB LLO Issues the universal command local lockout.

IB PPC [PPE/PPD] Clear line for ready/busy/? for instruments that implement the PP1 subset of the 488 bus.

PPE is parallel poll enable
PPD is parallel poll disable
PPC is parallel poll configure command

IB PPOLL Command to clear the line for ready/busy/?. Goes through parallel poll sequence.

IB PPU Universal command: parallel poll unconfigure.

IB RDA Bus control command that returns control of the instrument to its front panel.

IB READ Reads data from instrument specified by the IB UNIT command and display on POD.

IB REN Permits instruments to operate under remote control.

IB SDC Issue addressed command: selective device clear to the device which is specified in the IB UNIT command.

IB SPOLL (number list)
Clears the line for ready/busy/?. Performs a serial poll of the 488 bus. Number list is for list of unit numbers.

IB STUS (n) Display status of unit n

IB TCA Forces the ibus controller to controller active state.

IB UNIT n1 (n2) Defines unit number for addressed commands.
n1 = primary address
n2 = secondary address

IB UTUL Issues universal command: UNTALK and UNLISTEN, thereby unaddressing all instruments on the bus.

IB WRITE data Write data to instrument specified by IB UNIT command — where data = ASCII/binary data

IB WSRQ Clear line ready/busy/? and cause test program to wait for a service request (SRQ).

JOB (jjjj/77777777B)
JOB?

Changes the current job to the name specified (4 characters max). If no name is specified, job is changed to the system job '----' or the same as JOB 77777777B. If JOB? is entered, current job is displayed.

KILL command

Initiates a controlled termination of a single, selected task.

command An M3 command

LABEL 'msg1' ('msg2'....'msgn') (ASM) (output device) ('ffffff')

Prints message(s) in large block letters on the specified output device.

msg1 One line user defined message.

msg2....msgn Second to the nth line of a user defined message

ASM causes an '*' to be placed in column 1 of each label record for use when outputting to a MOF/DOF file which is going to be inserted in an assembly language source file.

output device COD, VP1, VP2, LP

MOF Memory output file. A file named '!LABL!' is automatically assigned.

DOF Disk output file. A file named '!LABL!' is automatically assigned.

ffffff Optional filename for DOF/MOF file. Default filename is '!LABL!'.

LINK (options)

Displays com link status on the VKT. Establishes or disconnects communication with the Integrator. Also allows the user to set com link options.

Options:

UP Establishes line connection with the Integrator.

DOWN Disconnects the com link.

BLOCK n Establishes a blocking threshold of n word when reading or writing data. n > 0 integer.

NOBLOCK Eliminates blocking of data.

DIAG	Allows diagnostic error messages to be displayed on VKT.
NODIAG	Prevents the diagnostic error messages from being displayed.
HSL	Switches to High Speed Data Link. All CPU console switches should be in the down position or HSL will activate a diagnostic program that may halt the CPU.
LSL	Switches to Low Speed Com Link.
DSO	Turns data spool option on.
NODSO	Turns data spool option off.
MOD	Turns modem on.
NOMD	Turns modem off.
NOBGBLK	Disables blocking of background files. Only foreground data is blocked.
CLWR	Sends a fixed operator note "TESTFILE" to the Integrator.

LMIO CLEAR
LMIO LOAD [page/'ffffff'] (addr) [DIF/MIF]
LMIO (DATA/STRING/DEBUG (output)

Clears, loads, or dumps local memory contents. LMIO will ask the user for the information required to perform the selected operation.

CLEAR	Clears local memory contents to zero. Clears 8 ranks by 4096. Clears the D rank also on Series 20.
LOAD	Loads local memory with the contents of the file defined by page or 'ffffff'. Data is loaded starting at the address specified by addr. page 3-digit suffix (000 — 999) from the LMI file. (LMIxxx)
'ffffff'	User name of the file to be loaded.
addr	Starting address of the local memory load.
DIF/MIF	Device of the LMI file or 'ffffff'.
DATA	Dumps local memory in executable form to an output file
STRING	Dumps local memory in original source format
DEBUG	Default form. Output is similar to string form, but condensed so that each line of output contains all programmed data relating to the current local memory locations.
output	Any legal output device. If STRING or DEBUG is specified, COD is default. If DATA is specified, only DOF or MOF is allowed.

LOAD (n) (KEEP) 'fffff1' 'fffff2' 'fffff3' input
LOAD (KEEP) (SAVE) (STATn) 'tp1' 'tp2' 'tp3' input

Loads a file or test program into CPU memory from the specified input device. If a test program is loaded, it is attached to the station specified.

input	May be DIF, MIF, CLI, FLR1, FLR2, MTR1, or MTR2. The default input device is the disk.
tp1, tp2, tp3	Name of the test program to be loaded.
KEEP	May not be released from the memory until released by operator command. If a test program, prevents paging.
SAVE	Retains all operated-requested conditions, values of globals, and requests in use for the station. Retains Alters and Manual Analysis modes too.
n	Expansion buffer size for assembly language programs that collect data.

LOOP [ON n/OFF] (STATn)

Enables or disables PPM microprogram looping between control RAM address 0 and address n.

ON n	Turns on loop control where n is the control RAM address. n is an integer from 0 to 77B.
OFF	Disables PPM looping.

MANU(AL) (OFF) (STATn)

Invokes manual start for the station specified. Typing a (CR), carriage return, then initiates a test start. Entering the commands: CLEAR, MANU OFF, STEP, or CONT to the same station or entering the commands STEP or MANU to another station nullifies the manual start for the first station.

OFF	Turns off manual mode for default station or station specified.

MBUP (MTW1/MTW2)

Copies the contents of CPU memory to the tape unit specified.

MTW1/MTW2	Magnetic tape write unit one or two. MTW1 is default.

MEAS(URE) (node/node number/pin number) (ON) (STATn) (output)

Causes the PMU to make a measurement on the node or pin specified and displays the result to the output device. The PMU is disconnected and is forcing zero current in RNG1.

MODIFY [ON n/OFF] (DC/TO) (STATn)

Overrides the 'SET DELAY' and 'SET TIMEOUT' FACTOR statements with the new value specified. Remains in effect until MODIFY OFF or the CLEAR command is entered.

ON n	Overrides the FACTOR statements 'SET DELAY' and 'SET TIMEOUT' with the value n where: n is between 350E-6 and 5.734 sec for DC and n is between 350E-6 and 366 sec for TO (6 min and 6 sec).
DC	Specifies programmed time delay (SET DELAY). default is DC if DC is not specified.
TO	Specifies programmed time-out count. (SET TIMEOUT).

MPACK

Packs CPU memory in contiguous blocks.

NAME (ALL) (output/POD)

Displays the files in CPU memory in the current job or in all jobs.

output	any legal output device. POD is default.
ALL	Lists all files in all jobs. Default is current job only.

NOTE 'msg' (output)

Types a message to the specifed output device. If CLO is specified, message is sent to the Integrator.

'msg'	Message to be displayed enclosed by single or double quotation marks.
output	Any standard output device.

OPEN [input/output] 'ffffff' (ADD) (ASC) (STATn)

Opens a file for FACTOR I/O or datalog output. For binary data, the file must be datakind DD and SC for ASCII data.

input	May be DIF/MIF/MTR1/MTR2
output	May be DOF/MOF/MTW1/MTW2
ffffff	Name of the file to be opened
ADD	Appends data to an existing file
ASC	Designates the file format is ASCII

OVERRIDE [ON/OFF] (RESET) (FCT) (DCT) (TRIP) (ALL) (STATn)

Override the FACTOR statement ON [FCT/DCT/TRIP/RESET], label;

ON	Disables the branch and program continues as though no failures occur.
OFF	Turns OFF the override request and returns control to the test program. CLEAR resets the request.
FCT	Allows overriding of program control for functional failures.
DCT	Allows overriding of program control for parametric failures.
TRIP	Allows overriding of program control for trip failures.
ALL	Allows overriding of program control for functional, DC, and trip failures.
RESET	Allows overriding of program control for reset.

PACK

Purges all disk files whose names begin with the ampersand (&) and makes the space on disk available for working storage.

PATCH ('ffffff') (listing device)

Used to examine or modify disk files. Available only for disk based systems. If a file is specified, PATCH automatically opens the file. If no filename is specified, the open directive (O) opens the file. PATCH issues a new prompt, .

ffffff	file to be examined or modified.
listing device	any legal output device.

PATCH directives:

B n	Set relative addressing relative to n. Useful for patching assembly language programs which have been created from seperate source files.
C n1 n2	Calculate the value of n1 +/− n2. n1, n2 and the result are all in octal.
I (a) (n1,n2,...nm)	Insert the octal values (n1,n2,...nm) beginning at address (a). If a is omitted, insertion starts at the current address.
L (,+n)	List contents of current address through current address + n
L a(,+n)	List contents of the address specified by a through a + n
L a1,a2	List contents of address a1 through a2
L ,a	List contents of current address through a
O'ffffff'	Open the file specified.
*	Comments if PATCH is in a DIF/MIF file.
(CR)	Carriage Return. Increment current address and display the contents.
//or $$	Exit from PATCH.
	Decrement the current location and display the contents.

PAUSE ON FAIL (STATn)
PAUSE ON n (STATn)
PAUSE OFF (STATn)

Causes testing to stop at each failure or each time a specified statement number is executed.

ON FAIL	Indicates a pause request at each failure.
ON n	Statement number where testing is to stop. n must be between 1 and 65,535.
OFF	Turns off the pause request.

PID (VK1/VK2/CR/MTR1/MTR2/(DIF/MIF/CLI) 'ffffff') (PID)

Specifies the primary input device for a command stream. If no device is specified, the PID is reset to the command input device (CID). If PID is specified as the device, the current PID file is restarted at the beginning.

POD (VP1/VP2/LP/MTW1/MTW2/(DOF/MOF/CLO) 'ffffff') (POD)

Specifies the primary output device for a command stream. If no device is specified, the POD is reset to the command output device (COD). If POD is specified as the device, the current POD file is restarted at the beginning.

PPLOG [ROW n/COL m/STEP w/WALK x/FAIL y/TOPO/z] (output)

Datalogger overlay which produces a fail matrix map of the RAM test pattern being executed by the Pattern Processor Module (PPM).

ROW n	Maximum rows. n± 64. If omitted, automatically computed with increase in processing time.
COL m	Maximum columns. m± 256. If omitted, automatically computed with increase in processing time.
STEP w	For walking type patterns only, where w defines PPM test step (count) encompassed within the read portion of iteration to be plotted. Must be calculated properly or results are unpredictable.
WALK x	Computes step count for walking patterns, where x is the walk number desired.
FAIL y	Suppresses printing of background pattern in fail map and allows status of only failing device cells through step y to be logged. This reduces processing type by 60%. If y is omitted, all fails through the last PPM step are logged.
TOPO	Used with topological scrambler to cause failmap display of unscrambled pattern (i.e. a diagonal looks like diagonal)
z	Cycle count (integer) of the number of read/write cycles per cell
output	Any legal output device.

PPLOG TRACE (start) (stop) (XRn) (FAIL) (output)

Traces th PPM pattern sequence and logs results to specified output device.

start/ stop	Beginning and ending step count to be included in the trace output. Both may be omitted. Start default at 0 and end to the end of the program.
XR n	Number of PPM index register to be included in the trace output. n is between 1 to 3. Number 1 is the default condition.
FAIL	Causes only failing tests to be included in trace output.

PSCAN p1 (-p2) (clk1,clk2,...clkn) DBL) (MEAS) (output)

Scans the tester pins specified and prints the status of each pin to the specified output.

p1 – p2	Range of pins to be displayed. p1 may be 1 – 120. If p2 is not specified, pins 1 through p1 are displayed.
clkn	clk1,clk2,...clkn apply only to high speed test head and defines all clock pin numbers. Otherwise EA0/EA1, EC0/EC1 will not be reported correctly.
DBL	Double spaced output for readability.
MEAS	Output pins measured and results printed as with input pins.
output	Any legal output device.

PXLOG (RW/WR) (n1/n2) (VP1/VP2)

Displays to the VKT the sequential event execution of a PPM program.

RW/WR	Displays Read/Write cycles or Write/Read cycles. If both omitted, only read cycles are displayed.
n1/n2	Positive numbers specifying start and stop count. Default is 1 for start and the PPM program for stop.

RASM (input) 'sfffff' ('coffff') (list output) (LIST)

Assembles a PPM microprogram by (1) source translation, (2) listing, and (3) generating an executable PPM microprogram.

input	Any legal input device. PID is default.
sfffff	Source file name to be assembled.
coffff	Created object filename. May be DOF 'ffffff', or just 'ffffff'. Defaults to disk on disk based system, and memory for memory based systems.
list	Any valid output device. POD is default. May be
output	DOF 'ffffff', or MOF 'ffffff'.
LIST	List the source instructions. Default is no list even if a list output is specified.
NC	Stops RASM from producing an executable PPM microprogram. NC takes precedence even if a created object file is specified.

READ register name (ON) (RANK n) (STATn) (VP1/VP2/LP)

Displays the contents of any tester register. The following registers may not return correct data if read during a continuous Enable Test: Dn, Mn, In, DA, DB, MA, MB, MM, J, K, ST, and RZ. Register contents are displayed in binary, octal, decimal, engineering format or functional formats as shown in Table 2.1. Functional format displays 60 pins of data. The starting rank of the display may be specified by using the RANK N6n option. The register list is in Table 2.3.

ON	Causes the register to be read at the next station pause. Otherwise the register is read and displayed immediately.
RANK n	First rank of pins ranks to be read. Where n is between 1 and 5. (RNK n may also be used.)

REBOOT

Loads the M3 Operating System (XZM3) from disk to memory and turns control over to it.

RELEASE ['fffff1' ('fffff2') ('fffff3')/ALL/STATn/TP/OVLY/MOD]

Releases files, test programs, and modules from memory. Test programs are released and detached from the station.

ffffff	name of file in current or system job to be released from memory. Up to three filenames may be released.
ALL	Releases all files in the current and system job that are not busy.
TP	Releases all test programs from memory in the current job.
OVLY	Releases all CO modules from memory in the current job.
MOD	Releases all MD modules from memory in the current job.

RENAME 'fffff1' 'fffff2'

Changes the name of a file in memory.

fffff1	existing filename in current job in memory.
fffff2	new name; must not already exist in the current job.

RENAME JOBNUM(BER) 'jjjj' ('ffffff')

Changes the jobname of all the files or a file if specified in the current job to the jobname specified.

jjjj	name of the job to which the file or files are to be transferred.
ffffff	name of the file to be transferred. Single quotes are required.

RESET (STATn)

Initiates a test program reset for the station specified.

RESTART CLO

Purges all data from the file which is currently open for STATn at the Integrator and then re-opens the file for data collection. When the OPEN routine is entered, the LOT, DEVICE, and CATEGORY questions are asked and new data is entered.

RESTORE ('ffffff'/'M3SAVE')

Returns the operating system to the configuration that existed when the SAVE utility was last invoked. All the files that were in memory at the time of the SAVE are reloaded from the disk. A save file must be a disk file with datakind DA and must be in the system job. If no filename is entered, the default save file is 'M3SAVE'. The system parameters that are restored are: MACTAB, TVT, ALTBUF, TAT, and GLOVAR.

REW (device)

Rewinds the magnetic tape to the BOT position. If no device is specified, REW defaults to MT1.

device	May be MTR, MTR1, MTR2, MTW, MTW1, MTW2, MT1, MT2, or ALL.

RUN 'ffffff1' ('ffffff2') ('ffffff3') (TRACE/HOLD)

A RUN file is made up of source commands and is processed by RUN. It then generates an M^3 command file '.RUN' in memory. Control then passes to '.RUN' unless the HOLD option is used.

ffffff	filename(s) of the RUN files to be executed. A maximum of 3 is allowed. Run files will be executed in the order in which they are entered.
TRACE	Allows debugging of newly generated RUN files. If selected, all command records processed by RUN are echoed to the system POD and are processed by a plus (+) sign. Comments and non-executable records are not displayed. All commands placed in the MIF file. 'RUN' are echoed to the system POD preceded by a minus (−) sign.
HOLD	Generates the MIF file '.RUN' but is not set. May be used if a listing is required.

Command Language Description:

LABxxx	Label identifier.
SUBxxx	Subroutine identifier
END	End statement designating the end of a subroutine of the end of a RUN file.

where xxx represents the 3-character identifier.

In the commands that follow, xxx represents the conditional execution characters.

Rxxx &var Read from system PID and store in &var.
Wxxx message Write message to the system POD.
Dxxx (zzz/&var)
Define conditional execution word. May be absolutely defined using zzz or recall the variable &var.
Vxxx &var = string
Equate &var to the string which can be up to 8 characters.
Cxxx SUBxxx Call to the subroutine and xxx is the identifier.
Jxxx (SUBxxx/LABxxx)
Jump to the label specified. Note that a subroutine designator may be used but no return is possible.
Ixxx Initialize all program variables and the conditional execution word to blanks or zero. Predefined variables such as &var are reset to their initial values.

SAVE

Captures the state of the operating system and places it in the disk file 'M3SAVE'. If 'M3SAVE' is already on disk, it is deleted and a new file is created. This command is used with RESTORE.

SCOPE

Loops on functional test patterns in order to provide an oscilloscope display. It allows fast looping on various types of ENABLE TEST statements. SCOPE displays a menu of available options and will request the necessary data for the options selected. SCOPE may be terminated by toggling console switch CS6 or by using the KILL command. If KILL is used to terminate SCOPE, the scope sync bit is not reset.

SKIP (BACK) (n) input

Positions the magnetic tape at the beginning of a file by skipping n filemarks forward or backward. If n is omitted, 1 is assumed.

BACK Skip backward.
n number of file marks to be skipped. Defaults to 1.
input may be MTR1 or MTR2.

SM

Displays the system configuration or the contents of the status and mode registers. SM contains 5 options to aid in diagnostic and program debugging.

SN (value) (STATn) (output)

Changes or displays the global variable serial number (SN). If a value is specified, SN is changed to the value and displayed.

value	decimal integer.
output	any legal output device.

SPLOT (STATn) (LP) (n) (EDGE) (ftm)
SPLOT AGAIN

Generates Schmoo plots for various tester parameters. SPLOT will ask the user for the parameters to be plotted. The results is displayed on the VKT or the LP. If EDGE is selected, only the Pass/Fail boundary of the plot is displayed.

n	Local memory start address. Defaults to 0. Must not exceed the page size declared in the FACTOR program.
EDGE	Invokes the edge mode feature.
ftm	Functional Test Modes available are:
	NORMAL Tests in normal mode. Default condition.
	MATCH Match mode.
	AMATCH Alternate match mode.
	LOOP Loop modifier for the match modes.
	SEQ Match tests are in sequential mode. SPLOT uses last SET Q statement executed in FACTOR.
	EXT External sync mode.
	EXTA External alternate sync mode.
	PPM Use the pattern processer module instead of local memory for functional test.
AGAIN	Repeats the condition and parameters used the last time SPLOT was executed.

START (STATn)

Initiates a test start for the station specified.

STATn

Establishes the default station number. Defaults to 1.

n	station number between 1 to 4.

STEP (OFF) (STATn)

Initiates the single step mode. In step mode, test program instructions are executed one at a time, followed by a pause. STEP also initiates the manual start mode wherein the (CR) carriage return can initiate a test start. The commands CLEAR, STEP OFF, MANUAL, or CONTINUE to the same station, or entering the command STEP, or MANUAL to any other station nullifies the single-step mode for that station.

OFF Turns off the single-step mode.

SWIT(CH) (value/'string') (STATn) (output)

Change or display the global variable SWITCH. If value or 'string' is omitted, the current value of SWITCH is displayed.

value Decimal, octal, or floating point numbers, to which the variable will be set.
'string' string up to 4 characters that are to be stored in SWITCH.
output any legal output device.

SYNC [ON/OFF] stn
SYNC [ON/OFF] [lma/tsc] [ADDR/COUNT]

Generates a sync pulse at a specified statement number, local memory address or a test sequence. These three options are mutually exclusive. The sync pulse is available at the test station sync connector for a statement sync, or at the test station jack labeled 'EXT SYNC'. If ADDR or COUNT is specified, SYNC resets all pause requests. The IGNORE FAIL mode may not be used with 'SYNC ON ADDR' or 'SYNC ON COUNT'. The CLEAR command resets all sync requests.

stn Statement number in the range of 1 to 65,536.
lma Local memory address in the range of 0 to 4095. Used with ADDR.
tsc Test sequence count in the range of 0 to 37777777B. Used with COUNT.
OFF Resets all sync requests.

TDX command (DIRECT [n/L]) (options) (MTR1/MTR2/MTW1/MTW2)

This is the general form of the TDX command where command and options will are explained in detail below. TDX transfers a file or group of files between disk, memory or magtape. A TDX tape is structured as a series of directory and files. Thus remaking a directory results in the loss of subsequent directories and files.

DIRECT [n/L] Indicates directory n or L for last on tape.

TDX Command Summary:

TDX CHECK (DIRECT [n/L]) (options) (MTR1/MTR2)
TDX INIT (MTR1/MTR2)
TDX LIST (DIRECT [n/L]) (VP1/VP2/LP) (MTR1/MTR2)
TDX [LOAD/LOAD M] (DIRECT [n/L]) (options) (MTR1/MTR2)
TDX [MAKE/MAKE M] (DIRECT [n/L]) (options) (MTW1/MTW2)
TDX VALL (DIRECT [n/L]) (options) (MTR1/MTR2)
TDX VERIFY (DIRECT [n/L]) (options) (MTR1/MTR2)
TDX REV

where:

CHECK	Checks that files on tape match those on disk.
INIT	Initializes a tape in a TDX format.
LIST	Lists a specified directory. Defaults to LP.
LOAD	Loads specified jobs, file types, or files on disk.
LOAD M	Loads specified jobs, file types, or files in memory.
MAKE	Writes specified jobs, file types, or files on disk.
MAKE M	Writes specified jobs, file types, or files im memory.
VALL	Creates MIF '.VRALL' which contains the verify output records. No files are transferred.
VERIFY	Verifies the validity of files previously written to tape.
REV	Displays the revision date of the TDX utility.

TDX options are:

ALL	Transfer all files in/from specified job or directory. ALL is default option when none is entered.
CLEAR	Delete duplicate file prior to loading from tape.
CTRL	Enter multi-line command mode.//or $$ to exit.
'filnam'	Transfer file(s) 'fffff1' 'fffff2' ... 'fffffn'
HOLD	Inhibit the setting of PID to '.TDX'. TDX terminates following the creation of MIF file '.TDX'.
(jjjj)	Enclosed in parentheses, the jobname to be transferred. Multiple jobs can be tranferred.
NOJOB	Defeats writing of JOB records to tape during a MAKE operation. During a LOAD, permits files to be loaded into the current job, suppressing any JOB records written to tape.
NOVER	Disables automatic file verification during a LOAD operation ONLY.
OVLY	Permits LOADed file to overlay any pre-existing file with the same name.
PRFX 'x'	MAKE or LOAD accepts all file names with a first character matching x.
(SOURCE/S)	Transfer all source files.
(DATA/D)	Transfer all data files.
(OBJECT/O)	Transfer all object files.
(CO)	Transfer all createdobject files.
"text"	Inserts comments into a directory. Double quotes required.

TE (n) (output)

Outputs a description of any or all terminal error(s). If n is omitted, the terminal error table is printed out.

n	Terminal error number.
output	may be VP1, VP2, CLO, or LP

TEST (NORM/CONT/MATCH/MOMENT) (STATn)

Starts local memory test execution in normal, continuous, match, or momentary mode. Test start and stop addresses must be set up prior to executing TEST.

NORM	Specifies testing in normal mode. Default condition.
CONT	Specifies testing in continuous mode.
MATCH	Specifies testing in match mode.
MOMENT	Specifies testing in momentary mode.

TFX6

Initializes tester configuration for diagnostic testing so that patching TFX6 is no longer necessary.

TIME hh:mm

Sets the system's clock.

hh:mm	Hours:minutes based on a 24-hour clock.

TITLE 'string' (TOF) (STATn)

Specifies a title to be included in the test program header for the station specified. TITLE is cleared by the CLEAR command or whenever a test program is loaded to the same station without the SAVE option.

string	Up to 64 -character text string enclosed by single quotes or double quotes. Entering '' clears TITLE.
TOF	Requests a top-of-form whenever the test program header is output on the line printer.

TOF (n)

Executes n form feeds on the line printer. If n is omitted, 1 is assumed.

n	number of pages to eject.

TPEDIT command (STATn)

Test program debugging tool that permits modification of TP files without the need for recompilation. The test program to be modified must be in memory.

TPEDIT Command Summary:

ARR n1 n2	Causes the elements of array n2 to be displayed following the execution of statement n1. A FACTOR WRITE statement is inserted into the test program following statement n1.
GOTO n1 n2	Inserts a GOTO instruction to transfer control from statement n1 to statement n2. Statement n2 must be in the same block (or subroutine) or an outer block (or subroutine).

INSERT 'ffffff' n1 Causes the specified filename 'ffffff' to be inserted into the test program following statement n1. The file to be inserted must also be a test program or test program module file located in the current job.

LIST (n1) (n2) (DMA) (output)
Lists the FACTOR test program in a "source-like" format. n1 is the statement number of the first statement to list. If omitted, the entire program will be listed. n2 is the statement number of the last statement to list. If n2 is not entered, then only one statement n1 will be listed. DMA lists all transitions from interpretive to DMA and DMA to interpretive. (output) is any legal output device.

LIST PATCH (output) Lists all patches that have been made to the FACTOR test program. Patch is generated for the following TPEDIT commands: INSERT, GOTO, PAUSE, VAR, ARR, WRITE, and NOP.

MODIFY n1 (n2) Allows the statements n1 through n2 to be modified, if they were originally programmed as constants. If only n1 is specified then only statement n1 may be modified.

[MV1/MV2] Allows conversion of test program from 2V/2MV to 1V/1MV (MV1) or from 1V/1MV to 2V/2MV (MV2) without requiring a recompilation. FACTOR statements that are affected by this operation are:

FORCE VOLTAGE
FORCE CURRENT
SET DCT
FORCE E0/E1/EA0/EA1/EB0/EB1/EC0/EC1
SET S0/S1/SA0/SA1

NOP n1 (n2) Generates a jump in place of the statement n1. This jump is to statement n1 + 1 if only n1 is entered, or to n2 + 1 if n2 is also entered where n2 is the last statement to jump around. This effectively bypasses the execution of statements n1 through n2 inclusive.

PAUSE n1 (n2) Inserts a PAUSE statement in the test program following statement n1. If n2 is entered, this number is displayed by the pause output. If omitted the statement number n1 is displayed.

PMU4	Converts 6-range PMU statements to 4-range PMU statements.
RESTORE (n1) (n2)	Allows patches to be removed from the test program. If no numbers are specified, then all patches are restored. If only n1 is specified, then a patch at statement n1 will be restored. If n2 is also specified, then all patched from statement n1 through n2 will be restored.
SEARCH (output)	Allows a search and display to be performed for all occurrences of a specified FACTOR statement. A prompting message is output: ENTER STATEMENT TO SEARCH
VAR n1 n2	Inserts a WRITE statement to display the value of variable n2 after execution of statement n1.
WRITE n1 'text'	Inserts a WRITE 'text' statement in the test program following statement n1.

List of FACTOR statements that may be modified by TPEDIT MODIFY:

```
FORCE VOLTAGE n (, RNGy)
FORCE CURRENT n (, RNGy)
FORCE PMU n
FORCE [E0/E1/....EC1] n (, RNGy)
SET [S0/S1/SA0/SA1] n (, RNGy)
SET DCT [LT/GT] n (, RNGy)
SET DELAY n, DC
SET TGx [DELAY/WIDTH] n (, RNGy)
SET PERIOD n (, RNGy)
SET MAJOR 1,n
SET START n
SET IFAIL n
ENABLE [DCT0/DCT1] [LT/GT] n
WRITE (EIR) n
var = n
DCL var1/n1/, var2/n2/,....
SET PERIOD1 per1,per2,....per16
SET TV1 TGxx nst:nsp, nst:nsp,.....
```

VAR n1 (=) (n2/'string') (output) (STATn)

Displays or modifies the contents of a variable in a FACTOR program. If (n2/'string') is omitted, then the value of the variable n1 will be displayed. If the variable is modified, the modification is valid only until the next FACTOR 'DCL' or arithmetic assignment statement that changes the variable in question.

n1	FACTOR variable number taken from the compiler's cross reference listing.
n2	Value to be placed in variable n1.
string	String to be placed in variable n1.
=	Optional.

VERIFY input (datakind) ((checksum no.)) (output)

Checks the validity of a disk or memory file. Computes a verify or checksum number for the filename and datakind in the current job. If checksum is omitted, the generated checksum is output to the POD.

input	File to be verified. Must be DIF 'ffffff' or MIF 'ffffff'.
datakind	May be a filetype or 2-character identifier for datakind. S,SC-source O,OA-object D,TP,MD,DD - data, test program, module, datalog data C,CO -coreimage, created object DC -DOPSY coreimage

WAIT

Inhibits the acceptance of commands from the command stream until all test program activity is completed.

WRITE register name data (ON) (RANK n) (STATn)

Writes to a tester register. The data must be in binary, octal, decimal, engineering or functional format as shown in Table 2.1. The data must be the last numeric value entered in a write command. The register list is in Table 2.3.

ON	Causes the register to be written at the next station pause. If omitted, write immediately.
RANK n	Rank of 60 pins to be written, where n is 1 – 8.

XMIT

Dumps the contents of the VKT screen to the line printer.

TABLE 2.1 Register data format summary:

FORMAT	DESCRIPTION	EXAMPLE
(BIN) binary format	1 to 16 bits followed by an *, where bit 0 is right justified.	100111*
(OCT) octal format	1 to 8 digits followed by a B	257B
(2 OCT) octal format	2 three digit octal number	331B 255B
(DEC) decimal format	integer from 0 to 8388607	1389
(ENGR) eng'g format	1 to 4 digits plus power of 10	3.141E-3
(FUNC) func'l format	1 to 15 bits followed by an *, where bit 0 is left justified.	111001*

TABLE 2.2 Special characters list for registers displayed.

REGISTERS	LETTER	DESCRIPTION
DPS1,2,3, E0,E1,..etc.	V	Value is in voltage.
DPT1,2,3 DPS4,5,6	L	Trip is less than
	G	Trip is greater than
	V	Current force, voltage trip
PSL/PPS	I	Current sense mode
	V	Voltage sense mode
PA	R	ENABLE RELAY condition set
SPSL (CLAMP)	S	SYM
	+	POS
	-	NEG
	V	Voltage (for CLAMP OFF value = 0)
DCT	I	Current sense mode (read from PSL)
	V	Voltage sense mode (read from PSL)
	L	Fail if less than
	G	Fail if greater than
	P	Pass
	F	Fail
TD,TR,PW,PD,PWV,PDV,etc.	S	Value in seconds

TABLE 2.3 Register List

FUNCTIONAL REGISTER CODE SUMMARY

REG	SPECIAL INPUT	TESTER	DESCRIPTION	RD/WR	FORMAT
C	(RANK n)		Functional Compare	R	FUNC
	(RANK n)		Invert	W	FUNC
CH	(RANK n)		Chaining	R/W	BIN
D#	(RANK n)	S20	I/O pin definition # = 1-16	R/W	FUNC
DA/DB	(RANK n)		I/O pin definition (A/B)	R/W	FUNC
DIM		S20	Addr. reg. for D#,I#,M#	R/W	FUNC
F	(RANK n)(#)		Funct. test pattern at LM #	R/W	FUNC
I#	(RANK n)	S20	Invert, # = 1-16	R/W	FUNC
IF			Ignore Fail	R/W	OCT
IOEN		S20	I/O Mode enable	R/W	BIN
J			Minor loop start address	R/W	DEC
K			Major loop start address	R/W	DEC
L			Major loop end address	R/W	DEC
M			Minor loop count	R/W	DEC
M#	(RANK n)	S20	Mask, # = 1-16	R/W	FUNC
MA/MB	(RANK n)		Mask (A/B)	R/W	FUNC
MAD			Test start address	W	DEC
			Test fail address	R	DEC
MCS			Local memory pointer	W	DEC
MM	(RANK n)	S20	Master mask	R/W	FUNC
MUX1		S20	Extended Mux Mode	R/W	BIN
MUX2		S20	Extended Mux Mode A	R/W	BIN
N			Major loop count	R/W	DEC
R			Utility relay	R/W	FUNC
RZ	(RANK n)		Return to zero	R/W	FUNC
S	(RANK n)		Data/Clock RVS select	R/W	FUNC
SA			Start address	R/W	DEC
ST	(RANK n)		Strobe select	R/W	FUNC
XOR	(RANK n)		Exclusive or	W	FUNC
		S20 only	Exclusive or	R	FUNC
XIOEN		S20	Extended I/O enable (61-120)	R/W	BIN

SUPPLY REGISTER CODE SUMMARY

REG	SPECIAL INPUT	DESCRIPTION	RD/WR	FORMAT
DPS1	(RNG n)	Power supply 1	R/W	ENGR
DPS2	(RNG n)	Power Supply 2	R/W	ENGR
DPS3	(RNG n)	Power Supple 3	R/W	ENGR
DPT1	(I) (G) (RNG n)	DPS Trip 1	R/W	ENGR
DPT2	(I) (G) (RNG n)	DPS Trip 2	R/W	ENGR
DPT3	(I) (G) (RNG n)	DPS Trip 3	R/W	ENGR
E0	(RNG n)	Data RVS E0	R/W	ENGR
E1	(RNG n)	Data RVS E1	R/W	ENGR
EA0	(RNG n)	Clock RVS EA0	R/W	ENGR
EA1	(RNG n)	Clock RVS EA1	R/W	ENGR
EB0	(RNG n)	Data RVS EB0	R/W	ENGR
EB1	(RNG n)	Data RVS EB1	R/W	ENGR
EC0	(RNG n)	Clock RVS EC0	R/W	ENGR
EC1	(RNG n)	Clock RVS EC1	R/W	ENGR
S0	(RNG n)	Comparator RVS S0	R/W	ENGR
S1	(RNG n)	Comparator RVS S1	R/W	ENGR
SA0	(RNG n)	Comparator RVS SA0	R/W	ENGR
SA1	(RNG n)	Comparator RVS SA1	R/W	ENGR

MISCELLANEOUS REGISTER CODE SUMMARY

REG	SPECIAL INPUT TESTER	DESCRIPTION	RD/WR	FORMAT
CNF1	S2Ø	Configuration no. 1	R	BIN
CNF2	S2Ø	Configuration no. 2	R	BIN
EIR		External Interface	R/W	BIN
INC		Inst. number compare	R/W	DEC
IND		Inst. number display	R/W	DEC
IR		Instruction	R/W	BIN
LRAX		Long register address extended	R/W	BIN
MAR		Memory address	R/W	OCT
MODE		Mode	R/W	BIN
PPA	(PIN n)	Power Pin Address	R/W	BIN
SAMA	(see Table 2.4)	Status and Mode (A)	R/W	BIN
SAMB	(see Table 2.4)	Status and Mode (B)	R/W	BIN
SAMC	(see Table 2.4)	Status and Mode (C)	R/W	BIN
SAMD	(see Table 2.4)	Status and Mode (D)	W	BIN
SR		Status	R/W	BIN
STSC		Mux slave test station control	R/W	BIN
TSC		Test station control	R/W	BIN

PARAMETRIC REGISTER CODE SUMMARY

REG	SPECIAL INPUT	DESCRIPTION	RD/WR	FORMAT
CRO	(RANK n)	Comparator relay open	R/W	FUNC
DCT	(G) (STRB) (RNG n) (U1/U10/U100/M1/M10/M100)	PMU hardware compare	R/W	ENGR
PA	(ER) (DR)	Pin address	R/W	DEC
PPS	(V) (RNG n) (U1/U10/U100/M1/M10/M100)	Precision power supply	R/W	ENGR
PSL	(RNG n) (U1/U10/U100/M1/M10/M100)	Precision sense level	R/W	ENGR
SPSL	(SYM/+/-)	Special precision sense level (clamp)	R/W	ENGR
TD		Time delay	R/W	ENGR

SPM REGISTER CODE SUMMARY

REG	SPECIAL INPUT	TESTER	DESCRIPTION	RD/WR	FORMAT
CRNK	(n)	S20	LM inst. Rank 8 at n	R/W	OCT
DRNK	(n)	S20	LM inst. Rank D at n	R/W	BIN
FC			Clock burst	R	DEC
IF2			Ignore fail 2	R/W	OCT
LC			Loop count	R	DEC
LCS	(n)		Loop count stack at n	R	DEC
LMI	(n)		LM inst. Rank 8 at n	R/W	OCT
PFSQ			Pass/fail sequence	R	BIN
Q			Sequential pattern	R/W	BIN
QL			Sequential length	R/W	DEC
RA			Return address	R	DEC
STAM			Stack address and mode	R/W	OCT
SZLC			Subroutine 0 loop count	R/W	DEC

PPM REGISTER CODE SUMMARY

REG	SPECIAL INPUT	DESCRIPTION	RD/WR	FORMAT
CA		Control RAM	R/W	BIN
CD1		Control RAM #1	R/W	BIN
CD2		Control RAM #2	R/W	BIN
CMP		Compare address	R	2 OCT
CRA		Control RAM address	R	OCT
CSMD		Chip select and address mask	W	BIN
DEL1		Delta #1	W	2 OCT
DEL2		Delta #2	W	2 OCT
DEL3		DELTA #3	W	2 OCT
DRAM		Data RAM	R/W	BIN
DR1		Data readout #1	R	BIN
DR2		Data readout #2	R	BIN
HLD1		Hold register #1	W	2 OCT
HLD2		Hold register #2	W	2 OCT
HLD3		Hold register #3	W	2 OCT
IR1		Index register #1	R	2 OCT
IR2		Index register #2	R	2 OCT
IR3		Index register #3	R	2 OCT
MAX		Maximum	W	2 OCT
RFC		Refresh count	W	OCT
SD		Shift data	W	OCT
SSA		Stop address and storage address	R/W	2 OCT
TOPO		Topological scrambler	R/W	2 OCT

TIMING REGISTER CODE SUMMARY

REG	SPECIAL INPUT	TESTER	DESCRIPTION	RD/WR	FORMAT
APD	# (RNG n)		Alternate TG# delay	R/W	ENGR
APDV	# (RNG n)		Alternate TG# delay vernier	R	ENGR
APW	# (RNG n)		Alternate TG# width	R/W	ENGR
APWV	# (RNG n)		Alternate TG# width vernier	R	ENGR
PD	# (RNG n)		TG# pulse delay	R/W	ENGR
PDV	# (RNG n)		TG# pulse delay vernier	R	ENGR
PW	# (RNG n)		TG# pulse width	R/W	ENGR
PWV	# (RNG n)		TG# pulse width vernier	R	ENGR
REP		S20	TG repeat mode	R/W	BIN
RTD			Round trip delay	R	ENGR
SBP			Scrambler bypass	R/W	BIN
SCRAM n			Scram RAM at loc. n	R/W	BIN
TB1	#		Timing buffer 1 for TG#	R/W	BIN

REG	SPECIAL INPUT	TESTER	DESCRIPTION	RD/WR	FORMAT
TB2	#		Timing buffer 2 for TG#	R/W	BIN
TG1	(RANK n)		TG pin address 1	R/W	FUNC
TG2	(RANK n)		TG pin address 2	R/W	FUNC
TG3	(RANK n)		TG pin address 3	R/W	FUNC
TG#A	(START/STOP) (n)		TG#A (# = 1-8), TV n	R/W	ENGR
TG#B	(START/STOP) (n)		TG#B (# = 1-8), TV n	R/W	ENGR
TR	(RNG n)		Test rate	R/W	ENGR
TR#	(RNG n)	S20	Test rate # (# = 1-16)	R/W	ENGR
TIMA			Timing address	R/W	BIN
TIMR			Timing range	R/W	BIN
XTB1	#		Ext. timing buf 1,TG#	R/W	BIN
XTB2	#		Ext. timing buf 2,TG#	R/W	BIN

TABLE 2.4 STATUS AND MODE REGISTER BIT MODE SUMMARY

SAMA bit	FUNCTION	RD/WR
0	R Local Memory busy W Start local memory	R/W
1	R No match W Match mode	R/W
2	Momemtary mode	R/W
3	Continuous loop state	R
4	Functional fail	R
5	Parametric fail	R
6	Functional fail enable	R/W
7	Parametric fail enable	R/W
8	Enable ignore fail	R/W
9	Rank load mode	R/W
10-11	Memory size	R
12	Enable fail in continuous loop	R/W
13	Continuous loop mode	R/W

SAMB bit	FUNCTION	RD/WR
0	I/O mode	R/W
1	Sync mode	R/W
2	Page 2K	R/W
3	Ext. sync	R/W
4	Double strobe	R/W
5	Chain 2 mode	R/W
6	Chain 4 mode	R/W
7	D/L measure	R/W
8	DA/DB select (1 = DB) (rank 1)	R
9	MA/MB select (1 = MB) (rank 2)	R
10	MDOR3 memory data out (rank 3)	R
11	MDOR4 memory data out (rank 4)	R

SAMC bit	FUNCTION	RD/WR
0	28V swing clamp	R/W
1	SII/S610 flag	R
2	4K local memory	R
3	Timing Module Option (ETM)	R
4	1 ns option	R
5	S610 -10 Mhz controller	R
6	10 Mhz head	R
7	PPM	R
8	SPM	R
9	Fail match clock	R
10	Fail loop	R/W
11	Count enable	R/W

SAMD bit	FUNCTION	RD/WR
0	Data	W
1	PPM normal mode, SET PPM ON	W
2	PPM programmed stop	W
3	PPM programmed loop	W
4	Split cycle mode	W
5	Load alternate timing registers	W
6	PPM local memory address mode	R/W
7	PPM data bit extension	R/W
10	Disable return to one	W
11	Enable multiplexing of F data	W
12	1 conditioning pin vs 3 controlled pins	W
13	Mask input pins	W
14	SPM	W
15	Alternate match mode	W
16	P4K (SAMD 71)	W
17	SPM momentary	W
20	APS interrupt (high speed sync (APM))	W

LRAX bit	FUNCTION	RD/WR
0	Spare	W
1	Alternate register bank 1	W
2	Alternate register bank 2	W
5	Alternate bank 2 available	W
11	Alternate register banks 1 and 2 reset by a single write and execute	W

3 M³ FACTOR PROGRAMMING LANGUAGE

Parameter Definitions:

[array]	Must be declared before used. Brackets required to designate array size.
binary-pin-pattern	Each bit of the pattern specified or the following operators: [n] Pin originator where n is an integer. (m:bpp) Binary pin pattern replicator, where m is an integer and bpp is binary pin pattern.
decimal-pin-list	One or more decimal pin numbers separated by blanks or commas. A sequential group of pins can be separated with the start pin numbers and end pin numbers separated by a dash.
expression	Any floating point number, variable, or arithmetic combination of numbers and variables.
integer	User must select appropriate number or expression.
LOG	Allows datalog measurements specified with LOG.
number	Any floating point number but may not be a variable.
statement	May be a single statement, or a compound statement designated by BEGIN...END.
pin-list	List of pins (separated by spaces or commas) that may be connected to a device.

Arithmetic/Boolean/Relational Operators:

Symbol	Operation	Precedence Value
NEG	Unary negate	1 (highest precedence)
NOT	Not	
Λ	Exponentiation	2
/	Division	3
.	Multiplication	
+	Addition	4
–	subtraction	
LT	Less than	
LEQ	Less than or equal	
EQ	Equal to	5
GEQ	Greater than or equal	
GT	Greater than	
NEQ	Not equal	
AND	Logical and	6
EOR	Exclusive or	
OR	Inclusive or	7 (lowest precedence)

Globals:

DATALOG	Used to control datalog requests
GLOB1-40	Global values for user data storage or conditional branching
RTD	Round trip delay to support ETM option. Not to be altered.
SN	Serial number of devices being tested. Initialized to 1.
SWITCH	Used for conditional branch operations.
TT	Test type.
VALUE	Contains last value obtained from MEASURE statement execution.

Reserved words:

AND	CONN	EOR	IFC	NEQ	REM	WRITE
ASSIGN	CPMU	EQ	INSERT	NOISE	RESET	XCON
AT	DCL	EXEC	LCGEN	NOT	REXEC	XPMU
BEGIN	DISABLE	FOR	LEQ	ON	SET	
BLOCK	DO	FORCE	LSET	OR	SPEC	
BRANCH	ELSE	FUNCT	LSUBR	PAUSE	SUBR	
BY	ENABLE	GE	LT	PGEN	THEN	
CALL	END	GOTO	MACRO	PGM	THRU	
CGEN	ENDC	GET	MEASURE	RD	UPDATE	
CLEAR	ENDM	IF	NEG	HEAD	WR	

FACTOR STATEMENT FORMS

AT [label/label +/- expression/expression];

Designates a local memory address at which modification is desired.

BLOCK...END;

Allows grouping of program statements. Nesting is legal up to 8 levels. Local variable storage and local labels cannot be referenced outside the parent block.

CALL identifier (expression 1, expression 2,...,expression n);

Executes subroutine specified and returns control to the calling routine.

CGEN [TGØ/TG1/G2/TG3/TG4/TG5/TG6/TG12] decimal-pin-list;

Connects listed pin(s) to specified timing generator.

TG0	Reference time TØ.
TG1-6	Functional testing data and clock timing.
TG12	Logical OR of TG1 and TG2 for double pulse.

CGEN TGn [A/B/D] (A) (B) (D).....;

Designates timing generator groups and their associated pin groups.

Pin groupings for Series 20/Sentry 21 Systems

Pin Group	Pin Numbers	Pin Group*	Pin Numbers*
1	1 to 8	9	61 to 68
2	9 to 15	10	69 to 75
3	16 to 23	11	76 to 83
4	24 to 30	12	84 to 90
5	31 to 38	13	91 to 98
6	39 to 45	14	99 to 105
7	46 to 53	15	106 to 113
8	54 to 60	16	114 to 120

* Pins 61 to 120 for Series 20/Model 120 and Sentry 21/Model 120 systems only.

A	To select TGnA.
B	To select TGnB
D	To select TGnD, where D is the logical OR of TGnA and TGnB for double pulse.

CLEAR [DCT/FCT/TRIP/RESET];
Cancel the effect of a previously executed ON FCT/DCT/TRIP or ON RESET CALL statement.

CLEAR FAIL [FCT/DCT/TRIP] (,FCT/,DCT/,TRIP);
Clears the system software fail flags.

CLEAR RESET;
Terminates the ON RESET CALL statement request.

CLEAR TIME;
Clears programmed timing conditions. (May be used with either Series 20/Sentry 21 timing statements or the compatibility mode.)

COMMON;
Causes implicitly declared variables to be placed in block0 and to share physical cell locations with variables in the main module.

CMUX TGn [A/B/D] (A/B/D)....(A/B/D);
Makes timing generators available to groups of tester pins. (Series 10 MTM option).

Pin Groupings for Series 10 (TG1 - TG6) systems

Pin Group	Pin Numbers
1	1 to 30
2	31 to 60
3	61 to 90
4	91 to 120

Pin Groupings for Series 10 TG7 -TG8) systems

Pin Groups	Pin Numbers	Pin Groups	Pin Numbers
1	1 to 15	5	61 to 75
2	16 to 30	6	76 to 90
3	31 to 45	7	91 to 105
4	46 to 60	8	106 to 120

A	To select TGnA.
B	To select TGnB
D	To select TGnD, where D is the logical OR of TGnA and TGnB for double pulse.

CONN CLK decimal-pin-list;

Defines listed pins as clock pins (for a high-voltage test station only.)

CONN [DPS1/DPS2/DPS3/TCOM] decimal-pin-list;

Defines the listed pins to specified power supply or tester common via the PE card. (for high-voltage test station only.)

CONN SYNC 1;
CONN SYNCA [1/43];

Allows selection of external sync modes that are compatible with either Sentry or Sentinel systems.

CPMU PIN expression;

Connects the (E)PMU to the pin specified.

DCL identifier ([array-size]) (/value-list/) ...;

Single or arrayed (one dimensional) variable declaration to reserve storage for variables, assign initial values, or make a variable local to the block which it is declared.

[array-size]	size of array, if identifier specified as array variable.
/value-list/	Initial value of identifier, or values if identifier is an array.

DCL,EXT, [SUB/FUN] name 1, name 2, ... name n;

Identifies the modules to be linked by the modular compiler.

DISABLE [DCT0/DCT1];

Disables the comparison of limits set by the ENABLE DCT0/DCT1 statement.

DISABLE REPEAT;

Takes all timing generators out of the repeat mode.

DISABLE TRIPS;

Clears all voltage and current trip limits set up with ENABLE.

ENABLE ACCESS;

Forces a disk access to reload memory buffer if test program does not fit.

ENABLE [DA/DB/Dn] (MA/MB/Mn);

Selects I/O definition register and, optionally, a pin mask register. If not programmed, DA and MA are enabled by default.

ENABLE [DCT0/DCT1/DCT1] [LT/GT] expression;

Forms a pass/fail threshold or, if both DCT0 and DCT1 are specified, a pass/fail window. This is done with 2 statements.

[ENABLE/DISABLE] DOUBLE STROBE;

Allows strobing of pins by both TG7 and TG8.

[ENABLE/DISABLE] [(FRCLKA) (FRCLKB)];

Enables TG6A and/or TG6B for free-running clock mode operation.

ENABLE [ILO/IHI/VLO/VHI] [LT/GT] number;

Enables software limit comparison to be made on all programmed current/voltage operands prior to statement execution.

[ENABLE/DISABLE] IMASK;

Provides automatic masking of comparators on all input pins.

ENABLE [INVERT/I/In];

Selects active invert register.

[ENABLE/DISABLE] LATCHES;

Determines if C register is to be cleared prior to strobing functional test comparators.

[ENABLE/DISABLE MUXMODE;

Enables the logical OR of functional forcing gate: pin 16 ORed with pin 1, pin 1 driver surviving (17 ORed with 2 etc.); first 8 pins of rank 1 ORed with first 8 of rank 2; first 8 pins of rank 3 ORed with first 8 of rank 4.

ENABLE PPM;

Causes the current microprogram in the control RAM to be executed once, if SET PPM ON is active. Otherwise, this statement will execute like ENABLE TEST;

[ENABLE/DISABLE] RELAY;

Allows pin electronics voltage conditioner to remain connected to a pin when the (E)PMU is connected.

ENABLE REPEAT (TG1A) (TG1B) (TG2A) ..... (TG8B);

Selects one or more timing generators to be in repeat mode.

[ENABLE/DISABLE] RTO;

Inverts the entire waveform produced when RZ mode and INVERTed data has been programmed for a particular pin.

[ENABLE/DISABLE] SCRAM;

Enables or disables the scrambler for period and timing generator selection.

[ENABLE/DISABLE] SPLIT;

Allows selection of the alternate test rate and timing generator during PPM RAM testing.

ENABLE TEST (test-mode);

Determines test mode and initiates execution of test program loaded into local memory. Test modes are as follows:

NORMAL	Between test start/end addresses. Default case Need not be specified.
IFAIL	Functional fails ignored until IFAIL address or count reached.
EXT/EXTA/EXTB/	System test rate generator replaced with DUTs internal clock.
XCCM/XCFCM	acting as a sync for starting functional test and timing generators.
MATCH/AMATCH	In minor loop or SPM match loop until pass occurs.
CONTIN(UOUS)	In minor loop or SPM continuous loop until mode changed.
MOMENT(ARY)	Allows exit from CONTINUOUS mode.
IMMEDIATE	Compiler directive to produce DMA code instead of interpretive. DMA has the least overhead, but no fail timeout protection provided.

ENABLE [TRIPI1/TRIPI2/TRIPI3] [LT/GT] expression (,RNG2/,RNG3);

Enables current trip detector of the corresponding voltage forcing unit.

ENABLE [TRIPV1/TRIPV2/TRIPV3] [LT/GT] expression (,RNG2/,RNG3;

Enables voltage-trip detector of the corresponding DPS current forcing unit.

ENABLE TSn;

Selects one of 16 sets of timing values and period.

END;

Closes BEGIN, BLOCK, FUNCT, SUBR, or a FACTOR string file.

ENDC;

Defines end of conditional compile. (see IFC)

ENDM;

Defines end of macro definition. (see MACRO)

EXEC ffffff (parameter 1, ...parameter 63);

Executes an assembly language program.

ffffff	FACTOR identifier which is also the name of a coreimage file on disk or in memory.
parameter	Global variable, variable, array name, array element, or expression.

FOR variable = expression THRU expression BY expression DO (BEGIN) statement (END);

Allows looping under control of a variable.

FORCE CURRENT expression (,RNG0/,RNG1/,RNG2/,RNG3); (for PMU4)
FORCE CURRENT expression (,U1/,U10/,U100/,M1/,M10/,M100); (for PMU6)

Forces (E)PMU to current specified. See Table 5.5 to 5.8.

FORCE DELAY;

Force the time delay to occur and to wait until tester is not busy.

FORCE [E0/E1/EA0/EA1/EB0/EB1/EC0/EC1] expression (,RNG1/,RNG2/,RNG3);

Forces the indicated RVS unit to the value specified. See Table 5.5 to 5.8.

FORCE [IF1/IF2/IF3] expression (,RNG2/,RNG3);

Sets the indicated DPS unit to force current specified. See Table 5.5 to 5.8.

FORCE PMU expression;

Forces (E)PMU output to the value specified in the mode and range specified by a prior SET PMU statement.

FORCE RESET;

Clears all programmable test conditions and causes a hardware reset.

FORCE [VF1/VF2/VF3/VF4/VF5/VF6] expression (,RNG1/,RNG2/,RNG3);

Force DPS supply voltage to value specified. See Table 5.5 to 5.8.

FORCE VOLTAGE expression (,RNG1/,RNG2/,RNG3/,RNG4);

Forces (E)PMU to the voltage level specified.

FORCE WAIT;

Forces tester to wait until "tester-not-busy" before processing the next statement.

FORMAT format-id specification field;

Allows precise formatting of input and output data. See Table 5.18.

FUNCT identifier (parameters);

Begins a functions which is terminated by END. The identifier is used in expressions to cause execution of the function's statements and use of the value returned by the function.

GOTO label;

Causes unconditional branch.

GOTO (label 1, label 2,.... label n) expression;

Branch to appropriate label if expression rounds off to a value between 1 and n, inclusive, otherwise no branch.

IF [relation/boolean expression] THEN (BEGIN) statement(s) (END);
IF [relation/boolean expression] THEN statement1 ELSE statement2;

Statements are executed if the IF condition is met. Second form executes statement2 if condition is not met.

IFC (NOT) option ([EQ/NEQ] [1/0]) THEN (BEGIN) statement(s) (ENDC);

Allows compilation of FACTOR statements if the IFC condition is met.

Options are:

PMU4 (4 range PMU)	S5 (Sentry V or VII)
PMU6 (6 range PMU)	S7 (Sentry V or VII)
MV1 (1V/1MV option)	S8 (Sentry VIII)
MV2 (2V/2MV option)	S10 (Series 10)
S20 (Series 20)	S120 (Series 20/120-pin)

INSERT string-filename;

Allows inclusion and compilation of the named source file at point specified. String file must not start with '*'.

label:

An address is assigned to label to allow branching to label.

label@

Designates a local memory address label. Must be defined before reference and must not be used as objects of GOTO or ON FCT statements.

LCGEN TGn decimal-pin-list;

Assigns timing generators from local memory. Special timing considerations and pipeline compensation required. (SPM required.)

[LIST/NOLIST] (remarks);

Controls compiler listing.

LSET [DA/DB/D1/D2] (*) binary pattern;

Sets I/O pin definition register from local memory during functional testing. (SPM required.)

LSET [INVERT/I/I1/...I16] (*) binary pattern;

Inverts the functional data on any specified pin but is written from local memory. (SPM required.)

LSET [IX/IX1/.....IX16] (*) binary pattern (,binary pattern, ...);

Inverts the functional data of the lst SET F statement executed and executes that inverted data. Inverts remain active until SET I, LSET I, or LSET IX redefine them. (SPM required.)

LSET [IX/IX1/.....IX16] (*) binary pattern - LCALL identifier;

Causes inversion of F data and execution followed by a call to local memory subroutine. (SPM required.)

LSET LC integer (-LCALL identifier);

Loads local memory subroutine loop counter and, optionally, calls a local memory subroutine. (SPM required.)

LSET [MA/MB/M1/M2] (*) binary pattern;

Sets specified pin mask register from local memory. (SPM required.)

LSET MM (*) binary pattern;

Sets the master mask register from local memory. (SPM required.)

LSET NOOP - LCALL identifier;

Causes a call to the loop or local memory subroutine specified. (SPM required.)

LSET register (*) - LCALL identifier;

Causes a call to the loop or local memory subroutine specified following the loading of the indicated register. (SPM required.)

Register is one of the following:

D1, DA, D2, DB, M1, MA, M2, MB, I1 to I16, I, INVERT, IX1 to IX16, IX, MM, LC, NOOP, RZ, ZOR, ST, STROBE.

LSET [RZ/XOR/STROBE/ST] (*) binary pattern;

Allows loading of long register from local memory. Special timing considerations and pipeline compensation required. (SPM required.)

LSET TGAn binary pattern;

Provides dynamic TG selection via the timing generator pin address (TGA) registers (TGA0, TGA1, TGA2). This statement and the LCGEN TGn statement are similar in purpose but different in execution. (SPM required.)

LSUBR identifier (NORMAL/MATCH) integer;
LSUBR identifier CONTIN (integer);

Defines loop start address, number of times of loop execution, and the test mode for local memory subroutine loops. (SPM required.)

MACRO name;

Begins definition of user defined macro, terminated by ENDM.

MAIN (options);

Identifies the beginning of a main module for the modular compiler.

MODULE (options);

Identifies the beginning of an external module for the modular compiler.

MEASURE [FREQ/FREQA];

Measures frequency of external sync signal. (Series 10 MTM option.)

MEASURE NODE number (,LOG);

Causes the (E)PMU to measure DPS voltage or current or RVS voltage at internal tester monitor node. See Table 5.16.

MEASURE PIN;

Allows fast go/no-go dc prametric tests. Similar to MEASURE VALUE except comparisons are made against SET DCT limit and no floating point conversion takes place. Cannot be used in CONTINUOUS mode.

MEASURE PIN number (,LOG);

Initiates dc measurement sequence for SET TEST. Used with dc macro-instructions.

MEASURE VALUE (,LOG);

Initiates a measurement within the (E)PMU and stores the resulting value in the system global VALUE. Compares VALUE with ENABLE DCT0/DCT1 limits.

MEASURE VARIABLE variable (,LOG);

Stores the values of the specified variable identifier or array element in the system global VALUE. Compares VALUE with ENABLE DCT0/DCT1 limits.

NOISE word1 (,word2,...wordn);

Defines words (ignored by compiler) that make statements read like English sentences. Reserved words and user declared identifiers are not allowed.

ON [DCT/FCT/TRIP/] CALL subroutine-name;

Calls specified FACTOR subroutine on dc test, functional test or DPS trip failures.

ON [DCT/FCT/TRIP], label;

Established branch control on dc test, functional test, or DPS trip failure.

ON [DIFEOF/EOF], label;

Provides a branch to a label when the end of an input file is reached. Used with READ statement to cause program branch.

ON RESET CALL subroutine-name;

Branches to subroutine on encounter of FORCE RESET statement, normal EOT, terminal error, or RESET button pressed.

PAGE (text);

Causes ejection of paper to top-of-form if output is being listed on the line printer, where text is any alphanumeric or special character except a semicolon.

PAUSE expression;

Stops statement execution until the tester is restarted. The statement number and expression value are output to the POD.

READ [(CR)/(CLI)/(TTK)/(VK1)/(VK2)/(PID)] [v1/&v1];
READ [(MTR)/(MTR1)/(MTR2)/(MIF)/(DIF)] ("char") [v1/&v1];

Reads data from specified device and assigns to variables without concern for specific format.

READ ((dev,) format-id)) ("char") (input list);

Allows reading data from a peripheral device in a precisely defined order.

NOTE:

1. Parenthesis required around device mnemomic.
2. Not all data types applicable to every peripheral device.

"char"	File identifier.
v1	Numerical variable or arrayed numerical variable.
&v1	Literal variable or arrayed literal variable.
dev	may be TTK, VK1, VK2, DIF, MIF, MTR, MTR1, MTR2, CR
format-id	Derived from the FORMAT statement.
input-list	variable names to where inputs will be stored.

READ (EIR) variable;

Read external interface register.

READ (AxxxB) variable;
READ (xxxB) variable;
READ (xxxxB L) variable;

Reads short and long registers. See Table 5.1 and 5.2.

REM (text);

Allows comments to be added to a program listing. The commentary is ignored by the compiler.

RESET [DIF/IFILE];

Resets the file pointer to the beginning of the file and reopens the file.

REXEC ffffff (parameter 1, ... parameter 13);

Causes the load and execution of a PPM microprogram.

ffffff — maximum 6 characters and a value (module number) in parameter 1. Module may be a constant or a variable.

PARAMETER	FUNCTION	PARAMETER	FUNCTION
1	module number	8	X1 HOLD
2	XMAX	9	Y1 HOLD
3	YMAX	10	X2 HOLD
4	refresh time	11	Y2 HOLD
5	chip select	12	X3 HOLD
6	MASKX	13	Y3 HOLD
7	MASKY		

SET APERIOD expression (,RNG0/,RNG1/,RNG2/,RNG3);

Defines the functional test rate for DUT read test cycle during execution of a PPM microprogram when using compatibility mode timing.

SET ATG4 [DELAY/WIDTH] expression (,RNG0/,RNG1/,RNG2/,RNG3);

Programs delay and width values for alternate timing generator 4. Used with ENABLE SPLIT statement.

SET CHAIN [TWO/FOUR] surviving-pin-list;
SET CHAIN OFF;

Allows 2 or 4 patterns to be generated for each SET F statement. Not allowed with SPM.

SET CLAMP [SYM/POS/NEG] number;
SET CLAMP OFF;

Sets limit on voltage allowed when (E)PMU current is forced.

POS	No voltages less than -0.7 and above number.
NEG	No voltage greater than 0.7 and lower than number.
SYM	Both positive and negative voltages.

SET CRO (*) binary-pin-pattern;

Opens or closes comparator relays as defined in the binary pattern.

1	Opens relay.
0	Closes relay, except when the (E)PMU is on the pin.

SET [DA/DB/Dn] (*) binary-pin-pattern;

Sets one of the I/O pin definition registers. 1 defines input and 0 defines output.

SET DCT [LT/GT] expresson (,RNG0/,RNG1/,RNG2/,RNG3/,RNG4);
SET DCT [LT/GT] expression (,U1/,U10/,U100/,M1/,M10/,M100); (For PMU6)

Forms hardware pass/fail limit for DCT threshold for MEASURE PIN.

SET DELAY expression, DC;

Loads value into the tester time delay register.

SET DESKEW ([pin#]) (repetition) definition1 (,definition2,...);

Defines input TG#, mode, strobe TG# for auto deskew of each pin on Sentry 21 systems. (Exclusively for Sentry 21 only.)

SET DWi [TGnn] d:w, d''w, ... d''w;

Sets timing generator delay and width values. (Series 10 MTM option)

SET F (*) binary-pin-pattern (,binary-pin-pattern,....);

Loads functional test pattern into local memory.

SET F (*) binary-pin-pattern - LCALL identifier;

Causes a call to the local memory subroutine specified following execution of functional data. (SPM is required.)

SET F (*) binary-pin-pattern - LEND;

Defines the end of a local memory subroutine. (SPM is required.)

SET F (*) binary-pin-pattern - LGOTO label/integer;

Allows unconditional branching in local memory. (SPM is required.)

SET FC (NORMAL/MATCH) integer (*) binary-pin-pattern;
SET FC CONTIN (*) binary-pin-pattern;

Loads a binary functional test pattern into local memory and arms a clock burst so the pattern is repeated. In CONTIN mode the pattern is repeated until execution of ENABLE TEST MOMENT. In NORMAL mode, the pattern is repeated ''integer'' number of times. In MATCH mode, the pattern executes until a match occurs. If MATCH LOOP is specified in the ENABLE TEST, the nth iteration of SET FC MATCH n forces a failure.

SET FI binary-pin-pattern;

Modifies one or more bits of data at a local memory address location. Must be used with the AT statement.

SET FAIL [DCT/FCT/TRIP] (,DCT/,FCT/,TRIP);

Sets system software flags that control the pass/fail indicators.

SET [FRCLKA/FRCLKB] period,width;

Sets start and stop values for TG6A and TG6B in free-running clock mode operation; values are stored in TV16.

SET IFAIL [label/constant/label +/-expression];
SET IFAIL expression, COUNT;

Sets local memory address or step count through which fails are ignored.

SET [INVERT/I/In] binary-pin-pattern;

Inverts the functional data on any specified pin.

SET IOMODE [OFF/surviving-pin-list];
SET IOM3 [OFF/surviving-pin-list];
SET IOM8 [OFF/surviving-pin-list];

Selects I/O definition pins independent of the definition specified by a SET D statement. See Table 5.3 and 5.4 for list.

SET LOGIC [POS/NEG];

Initializes functional test comparator logic pass conditions for either positive or negative logic.

SET [MA/MB/Mn] (*) binary-pin-pattern;

Sets one of the pin mask registers specified.

SET MAJOR expression [,label/,constant/,label +/- expression/,expression];
SET MAJOR n,l;

Defines the major loop within local memory.

n	major loop count where n is between 1 and 4096
l	major loop end address.

SET MINOR expression ([,label/,constant/,label +/- constant/,expression]);
SET MINOR m,(j,k);

Defines the minor loop within local memory. Not allowed with SPM.

m	Minor loop count where m is between 1 and 4096.
j	Minor loop start address. Default isØ.
k	Minor loop end address. Default isØ.

SET MM binary-pin-pattern;

Sets the master mask register.

SET MODE TGnn [N/A] (N/A) .... (N/A);

Defines operating mode of one or more timing generators. (Series 10 MTM option.)

SET MPIN number;

Defines the maximum pin count allowed.

SET PAGE integer (,SPM) (,HS) (,PDMA);

Identifies required local memory size and hardware options.

SET [PERIOD/APERIOD] expression (,RNG0/,RNG1/,RNG2/,RNG3);
SET PERIODi expression1 (,expression2,....expression16);

Defines functional test rates prior to ENABLE TEST, or defines alternate functional test rate for read test cycle during execution of a PPM microprogram.

SET PMU FORCEV (,RNG1/,RNG2/,RNG3/,RNG4/,AUTO);
SET PMU FORCEI (,U1/,U10/,U100/,M1/,M10/,M100/,AUTO); (For PMU6)

Initializes the (E)PMU forcing range before force (E)PMU statements are used.

SET PMU SENSE [,RNG1/,RNG2/,RNG3/,RNG4/,AUTO];
SET PMU SENSE [,U1/,U10/,U100/,M1/,M10/,M100/,AUTO); (For PMU6)

Initilizes the (E)PMU sensing range.

SET PPM [ON/OFF];

Allows the ENABLE PPM statement to start the pattern processor. Should be turned off when not in use.

SET Q binary-pattern;

Loads Q and QL registers prior to a test sequence initiated in MATCH or AMATCH mode (12 bits maximum length.)

SET R (*) binary-pin-pattern;

Controls the opening and closing of utility relays.

1	closes relay.
0	opens relay.

SET RANGE TGnn dr:wr, dr:wr, ... dr:wr;

Sets timing generator delay and width ranges. (Series 10 MTM option).

SET REG n (,n, n, ..., n);

Inserts user-defined data code, bypassing compiler code generation.

CAUTION: Use with care. No error checking is done by the compiler.

SET REL 'xxxxxxxxxxx';

Assigns program release number and date displayed in the VERIFY output record. (12 characters maximum for xxxxxxxxxxx)

SET RZ (*) binary-pin-pattern;

Programs any tester pin to either Return-to-Zero or Non-Return-to-zero, RZ or NRZ, mode respectively.

1	RZ mode (default condition for clock pins.)
0	NRZ mode (default condition for data pins.)

SET S (*) binary-pin-pattern;

Load the S register with selected alternate reference supplies.

0	Data pins: E1/E0	S1/S0	Clock pins: EA1/EA0
1	Data pins: EB1/EB0	SA1/SA0	Clock pins: EC1/EC0

SET SCRAM [n/LM/NOP/RD/WR/RMW] TVi,PERp, (TVi,PERp,....TVi,PERp);

Specifies as many as 16 pairs of timing sets.

SET SI binary-pin-pattern;

Generates interpretive code for modifying the S register.

SET [S0/S1/SA0/SA1] expression (,RNG1/,RNG2/,RNG3);

Sets the comparator reference supplies to value specified. See Table 5.5 to 5.8.

SET START [label/constant/label +/- constant/expression/label +/- expression];

Specifies the start address for the next functional test execution. Defaults to local memory location0.

SET [STROBE/ST] (*) binary-pin-pattern;

Selects one or both of two possible strobe times for each tester pin.

0	Connects TG7 to the pin.
1	Connects TG8 to the pin.

SET TEST number;

Selects the dc macro test type. The dc macro measurement sequence is initiated with the statement: MEASURE PIN number.

Number is:

1 = VOH	4 = ICEX	7 = ISC
2 = VOL	5 = IIL (IF)	9 = IOL
3 = IIH (IR)	6 = VCD	10 = VBD

SET [TGx/ATGx/BTGx] [DELAY/WIDTH] expression (,RNG0/,RNG1/,RNG2/,RNG3);

Sets delay and width of timing generators 1 to 8 (lower 60 pins), or alternate TGs (upper 60 pins), or both. See Table

TGx	Lower 60 pins.
ATGx	Upper 60 pins (Sentry VIII)
BTGx	TGx and ATGx set to same value.

SET TIMEOUT expression;

Defines value for timeout of local memory tests when ENABLE TEST MATCH or EXT options are used. If not programmed, the value in SET DELAY expression, DC is used.

SET TIMRNG [0/1/2/3];

Selects the range for the period and timing generators.

SET TVi [TGnn] start:stop, start:stop, ... start:stop;

Sets timing generator start and stop values.

SET VOFFSET number;

Specifies an offset voltage to be added to all subsequent voltage or sensing statements.

SET XOR (*) binary-pin-pattern;

Sets return-to-complement format. Establishes exclusive NOR condition of F -data and the timing generator assigned to the pin.

SPEC v1, v2, ... vn;

Declares external specification variables. (Series 10 system.)

SUBR identifier ((parameters...));

Begins a subroutine terminating with END. The identifier must be used in call statements to specify the execution of the subroutine.

variable = expression;

Assigns value of the expression to the variable.

WRITE [(LP)/(TTP)/(VP1)/(VP2)/(POD)] output list;
WRITE [(MTW)/(MTW1)/(MTW2)/(DOF)/(MOF)/(CLO)] "char" output list;

Writes data from variables to specified device.

READ ((dev,) format-id)) ("char") (output list);

Allows writing data to a peripheral device in a precisely defined order.

NOTE:

1. Parenthesis required around device mnemonic.
2. Not all data types apply to every peripheral device.

"char"	File identifier
output-list	may be: numeric data or array or string of character in single quotes. Any of above preceded by column number enclosed in slashes represents tabulation.
format-id	Derived from the FORMAT statement.

WRITE (EIR) expression;

Writes to the EIR register.

WRITE (AxxxB) expression;
WRITE (xxxB) expression;
WRITE (xxxxB L) expression;

Writes to short and long registers. See Table 5.1 and 5.2.

XCON PIN decimal-pin-list;

Disconnects power or clock and reconnects pin to selected data reference.

XCON [VF1/VF2/VF3];

Disconnects specified DPS unit from the load board (when using direct load board connection.)

XPMU PIN;

Disconnects (E)PMU from the present pin connection.

4 FACTOR EXEC Commands:

EXEC DATAIO (opcode, ioflag, buffer, device):

Performs I/O to disk in variable or fixed length records

opcode	Constant, variable, or member of any array: 0 Open file. 1 Read one record from DEVICE into BUFFER. 2 Write one record from BUFFER to DEVICE. 3 Close file. 4 Skip N records (+ = forward; - = backward). 5 Position to record N. 6 Skip n file marks (tape only). 7 Position after file mark n (tape only).
ioflag	Filled in by DATAIO 0 or + Successful completion of operation. −1 End of file (Read); End of file space (Write); File can't be accessed (Open or Close). −2 Error, needs operator attention or maintenance. −3 Error in calling sequence. −4 Data overflow. −5 Parameter error
buffer	User array of data to be read/written; or variable constant, or array member containing record length when opening fixed-record file; or variable, constant, or array member containing N for Opcode 0, or 4-5.

device	Constant, variable, or member of an array or arrays; 0 Working storage file (Use DOF PMF header). 1 Disk file (DIF PMF, open and close via MASTR commands). 2 Disk file (DOF PMF, open and close via MASTR commands).
PMF	Array of 70 words or more (70 + 1*48, 1=0,1,2...) PMF [1], [2] -Contains file name. PMF [3] -Contains job number (0 = current job). PMF [4] - [22] -Reserved for DATAIO use. PMF [23] - [70] -Disk buffer (DATAIO use only).

EXEC EUNIC (value, unit, result):

Converts values in floating point format into engineering notation in TRASCII format.

value	Floating point value to be converted (number range 1E-15 to 999.9 E+12).
unit	Any single character units suffix (such as 'S' or 'V') previously defined in a DCL statement.
result	2 or 3 word array containing the TRASCII conversion result.

EXEC EXCCSV (flag);

Allows data to be passed from the test program to CLP. CSV #1 is set to the value of the flag. The flag may be a flag for conditional execution of commands or an error code.

flag	constant, variable, or array element containing a flag to be stored into CSV #1.

EXEC FEXEC (command);

FACTOR test program may issue a command to the phantom using this statement. One command per call is allowed.

command	Previously declared literal array containing any standard M[3] or HELP command.

EXEC GETXY (x,y,step);

Used with PPM or SPM to return information concerning functional fails.

x,y	Coordinates of failing memory cell returned to caller following a PPM test execution.
step	Following an SPM test execution (the step count at which the fail occurred.)

EXEC GLOBS (gnum,op,val,fnum);

Makes available any desired additional number of globals.

gnum	Reference number of global variable (constant or variable).
op = 0	Resets the specified global variable to zero.
1	Increments the specified global by 1.
2	Decrements the specified global by 1.
3	Copies variable or constant val into global variable gnum.
4	Copies contents of global variable gnum into variable val.
val	Variable used to read back value of given global, or place given value into given global.
fnum	Optional two digit file name suffix used only when a memory file name GFILxx has been assigned.

EXEC HPLOT (0);

Initializes histogram and clears it to zero.

EXEC HPLOT (0, llim, ulim);

Initializes the histogram with defined limits.

EXEC HPLOT (1, value);

Contents of the variable named in second parameter are added to the histogram.

EXEC HPLOT (2);

Histogram is output to current station output device.

EXEC HPLOT (2, units);

Outputs histogram with units defined along the X-axis in engineering units.

EXEC IBUS (function code, unit, array, error-flag);
EXEC IBUS (function code, command);
EXEC IBUS (function code, unit, command);

Allows communication with instruments in ASCII via the IEEE 488 Standard Bus. Any instrument may be controlled via a FACTOR test program or by an M^3 command.

Function code	= 0	Reset.
	= 1	Write ASCII.
	= 2	Read ASCII.
	= 3	Write variable.
	= 4	Read variable.
	= 5	Wait for SRQ (service request).
	= 6	Addressed or universal command.
	= 7	Bus control.
	= 8	User defined bus command.
	= 9	Write variable (integer).
unit		Address of the instrument on the 488 bus.
array		Arrayname of the data transferred to the instrument or the area defined to receive data from the instrument
error-flag		Error returned when function code is 5 and no SRQ is received from the instrument. 0 = no error; 2 = error.
command		Special code or command is passed to IBUS from the test progrm (Contents depend on the function).

EXEC IBUS (10, A);

This function replaces the standard delimiter (@) with any TRASCII character the user selects. If there is more than one nonzero character in the variable presented to IBUS, the right-most character is used.

A	Is a literal scalar variable or an element of a literal array.

EXEC IBUS (11, unit, array);

This function performs a serial poll of the 488 bus. The serial poll is the mechanism of the 488 bus that allows ascertaining which instrument on the 488 bus has generated an SRQ. The serial poll also may provide information on the status of the instrument. This information is in the instruments user manual under serial polling, or under the description of the SRI subset.

EXEC LABEL (output,msg1,msg2,...,msgn);

output	= 0	Users VP	
	= 1	VP1 (TTP)	Video display 1
	= 7	VP2	Video display 2
	= 4	LP	Line Printer
	= 2	MTW1	Magnetic tape unit 1
	= 3	MTW2	Magnetic tape unit 2
	= 5	DOF	Disk output file. A file named '!LABL!' is automatically assigned.
	= 8	MOF	Memory output file
	= 6	CLO	Integrator line printer
	= 11	System POD	
	= 12	Station POD	
msg1...msgn		Array identifiers of previously declared arrays that contain the label text to be displayed.	

EXEC LITOP...

Performs a variety of operations of literal variables and arrays. The forms are as follows:

EXEC LITOP (1,n1,n2,n3);

Performs literal AND.

n1	Number from 0 to 15 (4 bits) that specifies which characters to mask. 1 = leave character undisturbed. 0 = mask character.
n2	4 TRASCII characters to be masked.
n3	Optional. If absent, n2 contains mask result that destroys original contents. If present, contains masked result and leaves contents of n2 undisturbed.

EXEC LITOP (2,n1,n2,n3);

Performs literal SHIFT.

n1	Number of bits to shift right. A negative value shifts N1 bits to the left.
n2	Where the result of shifting operation is placed.
n3	Optional. If present, filled with shift operation overflow.

EXEC LITOP (3,n1,n2,n3);

Performs literal OR.

n1,n2	The values ORed together.
n3	Optional. If present contains the result, if absent the result is in N2.

EXEC LITOP (n1,n2,n3,n4);

Converts literal to floating point.

Format of n2,n3

n1 = 4	Octal.
6	Hexadecimal.
8	Decimal.
n2,n3	Contains a left justified literal integer as read from the keyboard.
n4	Contains the floating point result.

EXEC LITOP (n1,n2,n3,n4,n5);

Converts floating point to literal.

Format of n3,n4

n1 = 5	Octal.
7	Hexadecimal.
9	Decimal.
n2	Floating point input.
n3,n4	Contains a right justified number with leading TRASCII zeroes.
n5	If non-zero specifies the number of digits returned (optional).

EXEC LITOP (12,n1,n2,f1,f2,...fn);

Performs array parsing.

n1	Delimiter.
n2	Input string.
f1,f2,fn	First field, second field, nth field.

EXEC LITOP (10,n1,n2,n3);

Performs array searching.

n1	Reference string to be searched for.

n2	4 element array defining the table structure of n3, search region and pointer to n3: n2 [1]-pointer to n3. Returned to 0 if no match found. n2 [2]-table width (number of n3 elements per line). n2 [3]-starting column of search field (element of array n3). n2 [4]-ending column of search field (element of array n4).
n3	FACTOR array to be searched.

EXEC LITOP (13,n1);

Returns date and raw number time maintained by the system in number of seconds elapsed since midnight.

n1	The time (a scalar floating point number described above).

EXEC LITOP (14,n1);

Returns date and the literal TRASCII form of time.

n1	Four element array. Elements 1 and 2 contain the 8 character literal string entered in the MASTR command DATE 'string'. Elements 3 and 4 contain the time (element 3 blank, blank, blank H; Element 4 H:mm.)

EXEC LITOP [(15, p1, p2)/(16, p3, p4 (,p5))];

This function allows number conversion from literal binary to floating point, or from floating point to literal binary.

15	Represents literal binary to floating point conversion.
p1	Is an array of length 1-6 containing left-justified literal binary data.
p2	Contains the floating point result.
16	Represents floating point to literal biary converversion.
p3	Is the floating point number to be converted.
p4	Is an array of length 1-6 contaning the right-justified result.
p5	Is an optional parameter specifying the number of characters to return. If p5 is 0, or is omitted, the array will be filled with leading 0's.

EXEC LMLOAD (page,n,stop,fileid);

Allows functional test data to be transferred between local memory and files on the disk at run time.

page	Three digit file name suffix between 000 and 999 for use in filename 'LMInnn'. Files must be assigned type MOD.
n = 1	Save local memory contents in the disk file defined by page.
= 2	Load the contents of the disk file defined by page into local memory.
stop	Highest local memory address to be saved in file. Optional
field	identifier defined in DCL statement to specify optional three character file name prefix. (DCL FILEID/'XYZ'/;)

LMLRN

Used to generate (learn) a functional test pattern in local memory, scramble data from FACTOR variables to specific pins of local memory, unscramble data from local memory to the FACTOR program, alter the contents of a specified local memory location to pattern required by the device, and allow the FACTOR program to read/write the bits in local memory that are used for mask enable, input enable, time set enable, LMI code.

EXEC LMLRN (1, field1, field2, ...);

DCL field 1 [8]/5, 6, 7, 8, 15, 14, 13, 12/;
DCL field 2 [8]/1, 3, 9, 11, 2, 4, 10, 16/;

Defines pin fields. The first pin of the declaration represents the LSB to the associated array. Pins may be defined when pins are in sequential ascending order and the LSB corresponds to the lowest number pin of a rank. Maximum number of pins per field is 16. If the field definition is a scalar, then the associated element of the data arrays corresponds to a predefined field as follows:

1	ENABLE MA/MB (bit 16 of rank 1)
2	ENABLE DAB (bit 16 of rank 2)
3	ENABLE TS1 .. TS16 (bit 16 of ranks 3 and 4, and bit 10 and 11 of Rank D)
4	LMI OPCODE (bits 13 to 16 of rank C)
5	LMI OPERAND (bits 1 to 12 of rank C)

EXEC LMLRN (2, addr, array);
EXEC LMLRN (3, mad, array);

Read local memory.

2	Unscramble data in local memory location ADDR into the ARRAY.
3	Performs a read and gets the local memory address from the tester MAD register.

EXEC LMLRN (4,addr,array);
EXEC LMLRN (5,mad,array);
EXEC LMLRN (4,addr,array,n1,n2,...);
EXEC LMLRN (5,mad,array,n1,n2,...);

Writes to local memory.

4	Write to local memory location specified by ADDR.
5.	Read MAD register to determine local memory address.

EXEC LMLRN (7);
EXEC LMLRN (6,addr);
EXEC LMLRN (7,mad);
EXEC LMLRN (6,addr,array);
EXEC LMLRN (7,mad,array);

Read/Fix local memory.

6	Read contents of location ADDR in local memory.
7	Read MAD register to determine local memory address.

EXEC LMLRN (8,addr,array);
EXEC LMLRN (9,mad,array);

Read/Fix to user array.

8	Read contents of location ADDR in local memory. Exclusive or with C register and pass result in the ARRAY.
9	MAD register to determine the local memory address.

EXEC LMLRN (10,addr,array);

Read C Register.

10	Read C register and unscramble in the ARRAY.

EXEC LMMOD (0);
EXEC LMMOD (1,p1,p2,...,pn);
EXEC LMMOD (2,p1,p2);
EXEC LMMOD (3/4, line, rept, ab1,n1,ab2,n2,...,abn,nn);
EXEC LMMOD (5,disp,from,to,p1,p2,...,pn)
EXEC LMMOD (6,p1,p2,...,pn);

LMMOD allows manipulation of data in local memory from a FACTOR program, but more quickly and flexibly than with FACTOR statements. LMMOD assists the FACTOR programmer in modifying locations in local memory. LMMOD modifies only local memory. If a string file of the functional pattern is required, the user may create one with the command, LMIO STRING (output device).

0	Clears local memory.
1	Complements the designated pins (p1,p2,...,pn) in alllocations from 0 to SET PAGE SIZE. If p = 0, or is missing, complements all pins.

2	Overlays the data on the first pin (p1) with the data from the second pin (p2), in all locations from 0 to SET PAGE SIZE. This does not change the condition of the second pin.
3	Inserts ENABLE DA/DB
4	Inserts ENABLE MA/MB
line	Is the local memory location to start first ENABLE. line can be 0-4095.
rept	Is the number of times to repeat the following ab pattern. rept can be 1-4096.
ab1,ab2, ...,abn	is set to 0 to ENABLE DA/MA, or is set to 1 to ENABLE DB/MB.
n1,n2 ...,n	Is the number of times to set preceding ab. These can be 1-4096. There can be a total of 30 ab-n combinations.
5	Shifts designated pins (p1, p2,...,pn) in channel by the following displacement factor (disp).
disp	Is the number of local memory locations to shift designated pins (p1,p2,...,pn). If disp is negative, the direction of shift is from lower local memory address to higher. If disp is positive, the direction of shift is from higher local memory address to lower.
from	Is the first local memory address to change.
to	Is the last local memory address to change.
6	Clears the channel for designated pins (p1,p2,...,pn).

EXEC LMSAVE ...

Similar to LMLOAD but additonally designed for use with microprocessor test generation programs. Currently supports 8 separate functions as follows:

EXEC LMSAVE (page, n,stop,fileid);

Transfers functional test data between local memory and an 'LMI' file. See EXEC LMLOAD parameter descriptions.

EXEC LMSAVE (0,n2,n3,n4,n5,n6);

Transfers single data items between the FACTOR program and file LMI000.

NOTE: User must first ASSIGN file: 'LMI000' 66528 MOD

n2 = 1	Place data into LMI000.
= 2	Fetch data from LMI000.
n3	Random word address within LMI000 of data being accessed; 0≤n3≤65535.
n4	Data in (floating point format) put to or fetched from LMI000. Accesses bits 0 to 15 of word addressed by n3. Must be positive integer 32767.
n5 = 0	Normal use of n3 defined above.
= 1	LMI000 use as destination for peripheral ID data. Utilizes LMI000 addresses beyond 65535.

n6	Data (floating poing format) put to or fetched from LMI000. Accesses bits 16 to 23 of word addressed by n3. Must be a positive integer 255. n6 is optional and may be omitted.

EXEC LMSAVE (0,n2,n3);
EXEC LMSAVE (0,8,n3,fn 1, fn 2);

Loads file LMI000 with user generated data from an input device.

n2 = 3	Data input from cards.
= 7	Data input from magnetic tape.
= 8	Data input from a disk file.
n3 = 0	Data in octal.
= 1	Data in hexadecimal.
fn 1, fn 2	Two word literal array containing disk file name. Used when n2 = 8.

EXEC LMSAVE (0,9);

Closes file LMI000.

EXEC LMSAVE (0,4,n3,n4,n5,n6);

Converts numbers from floating point to octal or hexadecimal format.

n3 = 0	Conversion to octal.
= 1	Conversion to hexadecimal.
= 2	Reads test count into n5 and n6.
n4	Floating point number to be converted.
n5	Upper 4 characters of result in TRASCII.
n6	Lower 4 characters of result in TRASCII.

EXEC LMSAVE (0,5,n3,n4,n5);

Converts microprocessor opcodes into their corresponding mnemonics.

n3	Opcode in floating point format.
n4	Upper 4 characters of mnemonic.
n5	Lower 4 characters of mnemonic.

EXEC LMSAVE (0,6,n3,n4,n5,n6);

Transfers data from input device to FACTOR program.

n3 = 0	Data input in octal.
= 1	Data input in hexadecimal.
n4	First data item in floating point format received from input device.

n5	Second data item in floating point format received from input device.
n6 = 0	Data input from keyboard.
= 1	Data input from card reader.
= 2	Data input from magnetic tape.

EXEC LMSAVE (0);

Performs a line printer top of form.

EXEC LPLF (numsp, numt);

Performs line printer top of form and line feed functions.

numsp	Number of lines to space. If missing or equal to 0, paper is positioned at top of form.
numt	Number of top of forms to issue.

EXEC PSCAN (n);

Displays the status of all programmed tester pins.

p1-p2	Range of pins to be displayed.
clkn	clk1, clkn apply only to low voltage test head and define all clock pin numbers.
DBL	Double spaced output.
MEAS	Output pins measured and results printed as with input pins.
n	Highest pin number to be displayed.

EXEC RAFER (0);

This call creates a data file in memory working storage where data and coordinates from test data calls will be stored. The data file is originally assigned an 861 word block and the file size will be increased by similar size blocks as needed. The data file is a temporary file and exists in memory only while the tester is executing a test plan.

EXEC RAFER (1, mapchar);

The Sentry interface to the E98P is a custom product. Users desiring to use this method of passing wafer coordinates to the tester should contact their Fairchild sales representative for more information.It is not supported in this release.

EXEC RAFER (2);

This call causes the contents of the working storage data file to be formatted into a wafer map which is printed on the line printer. The map character is positioned in the print buffer in the location corresponding to its coordinates.

EXEC RAFER (3);

This call resets the data pointer to the working storage data file to the top of the file. Attempting to clear a data file that has not been initialized will result in a terminal error.

EXEC RAFER (4, mapchar, X, Y);

The literal variables X and Y contain the X coordinate and Y coordinate, respectively, of the wafer prober which have been determined by the FACTOR program. Exclusive use of this call eliminates the need for the E98P Interface entirely or can be used with other probers requiring a user designed interface. The coordinate values and the contents of mapchar are stored in the working storage data file currently being used by RAFER.

4	Is the op code for the test data call to a FACTOR program.
mapchar	Is a scalar, literal variable which contains a one or two character representation of the die pass/fail condition.
X	Is a constant or scalar, literal variable containing the X coordinate of the die under examination on the wafer.
Y	Is a constant of scalar, literal variable containing the Y coordinate of the die under examination of the wafer.

EXEC RAFER (5, arraysize);
EXEC RAFER (6, arrayname);

The contents of the working storage data file being used by RAFER can be transferred to the calling FACTOR program by using RAFER options 5 and 6. First an option 5 call is made to get the number of words written to the working storage data file (3 words per test data call). The file size is returned to the FACTOR program in the 'arraysize' variable and should be used to declare an array of the correct size to receive the contents of the data file. Next an option 6 call is made to complete the transfer. The data file contents are transferred to the array named in the transfer call. The data transferred is the unformatted map data collected during the test data calls and must be formatted in FACTOR if a map output is desired.

5 Is the op code to transfer the number of data words used in the data file to the FACTOR program.

arraysize Is a scalar, literal variable when returned from RAFER contains the number of words written in RAFER's data file.

6 Is the op code to transfer the contents of the data file to an array in the FACTOR program.

arrayname Is the name of the FACTOR array whose size has been declared by 'arraysize' and which is to hold the contents of data file.

EXEC RLREG (reg,val);

Reads tester long registers with four digit addresses in either the main or alternate register bank.

reg Four digit register address expressed as assigned octal constant. Plus = primary bank; minus = alternate bank.

val Contents of the referenced register returned as a floating point number.

EXEC RUN 'fffff1' (fffff2') ('fffff3');

Command file generator from Factor.

EXEC SPLOT (yunit,ystart,ystop,xunit,xstart,xstop,result,lstart,topt);

yunit Scalar or array that defines tester unit to be varied on the SHMOO Y axis.

ystart,ystop Start and stop values over which tester unit is varied for Y axis.

xunit,xstart,xstop Same as above but for X axis.

result Optional 96 word array returned by SPLOT to allow SHMOO results to be logged to a disk file for later processing by a FACTOR program.

lstart Optional parameter to define test start address (default = 0)

topt Optional parameter to select one of all available Enable Test forms for SPLOTs go/no-go testing:

100000B Standard Enable Test.
100001B EDGE mode test.
100002B MATCH mode test.
100004B AMATCH mode test.
100010B LOOP option for MATCH mode test.
100020B SEQUENTIAL MATCH mode test.
100040B EXTERNAL SYNC test mode.
100100B EXTERNAL ALTERNATE sync mode test.
100200B HPG test. Do ENABLE PGEN 0,ON; first.
100400B PPM test SET PPM ON; first.

NOTE: Bit 15 must always be set. If permitted by the system, more than one option may be enabled at one time by setting more than one bit in the control word.

TESTER UNIT NAME VS UNIT NUMBER

E0 = 1	EC0 = 7	DPS1 = 11	PMU= 14
E1 = 2	EC1 = 8	DPS2 = 12	DCT = 15
EA0 = 3	S0 = 9	DPS3 = 13	TR = 16
EA1 = 4	S1 = 10	DPS4 = 69	ATR = 65
EB0 = 5	SA0 = 66	DPS5 = 70	RFC = 68
EB1 = 6	SA1 = 67	DPS6 = 71	

SENTRY TIMING GENERATORS[1]

PD 1 = 17	APD 1 = 33	BPD 1 = 49
PD 2 = 18	APD 2 = 34	BPD 2 = 50
PD 3 = 19	APD 3 = 35	BPD 3 = 51
PD 4 = 20	APD 4 = 36	BPD 4 = 52
PD 5 = 21	APD 5 = 37	BPD 5 = 53
PD 6 = 22	APD 6 = 38	BPD 6 = 54
PD 7 = 23	APD 7 = 39	BPD 7 = 55
PD 8 = 24	APD 8 = 40	BPD 8 = 56
PW 1 = 25	APW 1 = 41	BPW 1 = 57
PW 2 = 26	APW 2 = 42	BPW 2 = 58
PW 3 = 27	APW 3 = 43	BPW 3 = 59
PW 4 = 28	APW 4 = 44	BPW 4 = 60
PW 5 = 29	APW 5 = 45	BPW 5 = 61
PW 6 = 30	APW 6 = 46	BPW 6 = 62
PW 7 = 31	APW 7 = 47	BPW 7 = 63
PW 8 = 32	APW 8 = 48	BPW 8 = 64

ENHANCED TIMING MODULE (ETM) TIMING GENERATORS[2]

TG1A START = 17	TG1B START = 33
TG2A START = 18	TG2B START = 34
TG3A START = 19	TG3B START = 35
TG4A START = 20	TG4B START = 36
TG5A START = 21	TG5B START = 37
TG6A START = 22	TG6B START = 38
TG7A START = 23	TG7B START = 39
TG8A START = 24	TG8B START = 40

TG1A STOP = 25	TG1B STOP = 41
TG2A STOP = 26	TG2B STOP = 42
TG3A STOP = 27	TG3B STOP = 43
TG4A STOP = 28	TG4B STOP = 44
TG5A STOP = 29	TG5B STOP = 45
TG6A STOP = 30	TG6B STOP = 46
TG7A STOP = 31	TG7B STOP = 47
TG8A STOP = 32	TG8B STOP = 48

1. APD/W and BPD/W on the Sentry VIII only, except APD/W4.

2. ETM unit numbers are the same as standard timing generators. For ETM timing value (TV) definition, the desired TV is batched with the desired x/y unit as follows:

   For unit 19, TV12, x/y unit = 1219.

EXEC TFX6 (0, P2, P3, P4, ... P22) or E EC TFX6 (0, PARRAY);

This option returns hardware configuration data to the calling program.

0 Is option number.

Pn Is a parameter as described below:

Parameter	Description
P1	Always zero
P2	SAMC bit 4-5 MHz controller, 1 ns option, 0 for no, 1 for yes.
P3	SAMC bit 5 - controller, 0 for 5 MHz, 1 for 10 MHz.
P4	SAMC bit 6 - test head, 0 for 5 Mhz, 1 for 10 MHz.
P5	SAMC bit 3 - ETM installed, 0 for no, 1 for yes.
P6	SAMC bit 7 - PPM installed, 0 for no, 1 for yes.
P7	SAMC bit 8 -SPM installed, 0 for no, 1 for yes.
P8	Number of tester pins (1-120).
P9	Number of TGS (for ETM 1-12, for non-ETM 1-6).
P10	Number of Strobe TGS (ETM 1-4, non-ETM (1-6).
P11	EB0/EB1 RVS pair installed, 0 for no, 1 for yes.
P12	EC0/EB1 RVS pair installed, 0 for no, 1 for yes.
P13	Number of DPS units installed (1-6).
P14	SA0/SA1 RVS pair installed, 0 for no, 1 for yes.
P15	Always 1.
P16	Local memory size.
P17	Always 1.
P18	MR bit 17 - test head, 0 for high voltage (HV), 1 for high speed.
P19	MR bt 16 - S7, new M1/M2, 0 for no, 1 for yes.
P20	CRO installed - 0 for no, 1 for yes.
P21	MR bit 18 - 28 V option, 0 for no, 1 for yes.
P22	PMV type installed 0 for +10 V 4 range 1 for +40 V 4 range 2 for +100 V 4 range 3 for +100 V 6 range

PARRAY Is an array

EXEC TFX6 (1, RANK, ACTUAL, EXPECTED, REGISTER);

This option prints one line of data for each execution of TFX6. The rank, actual data, and expected data are converted, formatted, and printed. No hardware register are read during execution.

1	Is option number.	
RANK	Is rank of register data (1-8)	
ACTUAL	Is actual read data from register, passed by user.	
EXPECTED	Is expected data for register, passed by user.	
REGISTER	0	prints CREG name
	1	prints FDATA name
	2	prints SAMM name
	OTHER	prints TRASCII name passed in register.

EXEC TFX6 (2, ERROR, PF, DL, EXP, ACT, NAME);

Compare expected data against C register data with:

EXEC TFX6 (2, ERROR, PF, DL, EXP)

C register read data is zeroed out before compare, if SAMA bit 4 is not on. Compare MA register to C register with:

EXEC TFX6 (2, ERROR, PF, DL)

2	Is option number.
ERROR	0 returned for no error and 1 returned for an error. Possible errors are as follows: (1) Parameter error on DL, outside range (2) EXP of ACT is not at least an eight deep array
PF	0 returned for pass, 1 returned for fail.
DL	0 for datalog on fail only, 1 for datalog on all tests, or 2 for check for fail without datalog.
EXP	An eight deep array (minimum) containing expected values. EXP[1] corresponds to Rank 1, EXP[2] corresponds to Rank 2, etc.
ACT	An eight-deep array (minimum) containing octual values. ACT[1] corresponds to Rank 1, ACT[2] corresponds to Rank 2, etc.
NAME	TRASCII name for register.

EXEC TFX6 (3, LADDR);

This option results in local memory being written to zeros. All locations from zero to the last address (passed parameter) will be cleared to zero. Available memory check or other hardware status checks are not performed during execution of this option.

3	Is option number.
LADDR	Is upper limit of local memory to be cleared.

EXEC TFX6 (4, MAD, IF, SAMA4);

Read MAD and IF Registers and Bit 4 of SAMA Register.

4	Is the option number.
MAD	Is the MAD register. Its value is read and returned in this variable.
IF	Is the IF register. Is value is read and returned in this variable.
SAMA4	Is bit 4 of the SAMA register. Bit 4 is checked for an FC fail.

EXEC TFX6 (5, LMSIZE);

This option is for controlling the set page size of a FACTOR program while inside that program. The INTPR page size is also changed to this value.

5	Is option
LMSIZE	Is new set page size.

EXEC TFX6 (6, ARRAY);

This option is used by diagnostics as part of an error or datalog printout.

6	Is the option number.
ARRAY	Is a three (or more) word array containing floating point numbers in cells 1 and 2 on call and the TRASCII conversion of those numbers are returned in cells 1 and 3.

Passed To TFX6
ARRAY[1] = Integer 1
ARRAY[2] = Integer 2
ARRAY[3] = Don't Care

Returned From TFX6
ARRAY[1] = TRASCII of Integer 1
ARRAY[2] = Blanks
ARRAY[3] = TRASCII of Integer 3

EXEC TFX6 (7, TEST, PF);

This option is used in PPOD tests (PPM Diagnostic). An error results in a datalog being output. Limits are as follows:

7	Is the option number
TEST	Is the test number passed to TFX6 for PPM refresh counter time out tests.
PF	Is the pass/fail flag returned to caller. 0 indicates a pass and 1 indicates a fail.

EXEC TFX6 (8, CLMP);

Read 28 V Bits, Verify -16 V Clamp

8	Is the option number.
CLMP	Bit 0 of SAMC is read to determine if the −16 V clamp has been exceeded. CLMP = 0 indicates no CLMP = 1 indicates yes.

EXEC TFX6 (9, ERROR/DPIN, MOPT, SPIN, LPIN, CLK, MAARRAY);

Mask MA for specified pins

9	Is option number.
ERROR/DPIN	For MOPT = 1, 2, or 3, 0 returned for no error and 1 returned for error. Errors may be: a) SPIN, LPIN, or CLK element out of limits. b) LPIN = SPIN. c) Due to pin limits all of MA masked to 0. For MOPT = 4, 0 returned for error, driving pin is returned for no error. Compare pin is DPIN + 1.
MOPT	1 for all pins, 2 for odd drive even (so even pins set), 3 for even drive odd (so odd pins set), 4 for single pin pair.
SPIN	Is starting pin (1-120).
LPIN	Is last pin (1-120).
CLK	Is the clock pin array. The array may be any size with 0 values ignored.
MAARRAY	Array wth 8 or more elements, filled with values written to MA register and passed back to caller.

EXEC TFX6 (10, DMAD, FC, RA, DRA, LC, LCS, STAM, QL, Q, SZLC, PFSQ)

Read Registers

10	Is option number		
Register	**Address**	**Mask**	**Special Considerations**
MAD	D-166B	177777B	For Series 20 and Sentry 21 only.
FC	B-1703B	377B	
RA	B-1701B	7777B	
RA	D-156B	177777B	For Series 20 and Sentry 21 only.
LC	B-1705B	7777B	
LCS	B-1704B	7777B	
STAM	B-1706B	7777B	Right justify, mask to 17B.
QL	B-1710B	17B	
Q	B-1711B	7777B	
SZLC	B-1701B	7777B	For Series 20 and Sentry 21 only.
PFSQ	B-1712B	7777B	For Series 20 and Sentry 21 only.

EXEC TFX6 (11, D, M, I, TR);

Clean selected memories, Ranks 1 thru 8

D	Is D1 through D16, not DA or DB. 0 = Skip Clear, 1 = Clear
M	Is M1 through M16, includes MA or MB. 0 = Skip Clear, 1 = Clear
I	Is I1 through I16, 0 = Skip Clear, 1 = Clear
TR	Is TR1 through TR16, cleared to default of 200 ns.

NOTE: This option is for Series 20 and Sentry 21 systems only.

EXEC TFX6 (12, P2, P3, P4, P5, ..., P25); or
EXEC TFX6 (12, CNF1);

This option returns the CNF1 register configuration bits as shown below.

12	Is the option number.
Pn	Is a parameter (see description below).
CNF1	Is an array.

Parameter	**Returned to Caller**
1	Always 12
2	Bit 0 of CNF1, 1 for S20 system, 0 otherwise
3	Bit 1 of CNF1, STAT1 1 For 120 Pin Test Head, 0 For 60 Pin (S20)
4	Bit 2 of CNF1, STAT2 1 For 120 Pin Test Head, 0 for 60 Pin (S20)
5	Bit 3 of CNF1, STAT3 1 For 120 Pin Test Head, 0 For 60 Pin (S20)
6	Bit 4 of CNF1, STAT4 1 For 120 Pin Test Head, 0 For 60 Pin (S20)
7	Bit 5 of CNF1
8	Bit 6 of CNF1
/	/ / //
25	Bit 23 of CNF1

EXEC TFX6 (13, P2, P3, P4, P5, ..., P25); or
EXEC TFX6 (13, CNF2);

This option returns the CNF2 register configuration bits as shown below.

13	Is the option number.
Pn	Is a parameter (see description below).
CNF2	Is an array.

Parameter	Returned to Caller
1	Always 13
2	Bit 0 of CNF2
3	Bit 1 of CNF2
4	Bit 2 of CNF2
5	Bit 3 of CNF2
6	Bit 4 of CNF2
7	Bit 5 of CNF2
8	Bit 6 of CNF2
/	/ / //
25	Bit 23 of CNF2

EXEC TTIME (tpass, tfail, start, stop, tgn, rslt, topt, tv);

Provides fast, convenient time measurement capability.

tpass	Passing pulse delay or width (pulse start or stop for ETM).
tfail	Failing pulse delay or width (pulse start or stop for ETM.
start	Local memory start address.
stop	Local memory stop address.
tgn	Timing generator manipulated during binary search.
rslt	Floating point time measurement result of search procedure.
topt	100000B Standard ENABLE TEST. 100001B Enable the 'both' TG mode for Sentry VIII (120 pin system). 100002B MATCH mode test. 100004B AMATCH mode test. 100010B LOOP option for MATCH mode test. 100020B SEQUENTIAL MATCH mode test. 100040B EXTERNAL SYNC test mode. 100100B EXTERNAL ALTERNATE SYNC mode test. 100200B HPG test. Do ENABLE PGEN 0, ON; first. 100400B PPM test. Do SET PPM ON; first. 101000B With ETM allos the programmed pulse stop to remain constant when doing a search with pulse start.
tv	ETM TG timing value.

TTIME Console Switch Options:

CS1	Slows down each search step.
CS2	Defeats restoration of TGs on return, to allow examination by analysis commands.
CS3	Halts CPU within continuous loop mode. Used with CS1 to allow detailed scope observation of the scope at each position as it converges upon the final result.
CS4	Allows repeat of previous search.
CS6	Dumps (to station POD) timing values, delta and PASS/FAIL indications during binary search procedure. Values are integers in 80 ps units.

EXEC VPLOT...

Allows point and vector plotting and cursor manipulation on the system VKT terminal. The forms are as follows:

EXEC VPLOT (0);
EXEC VPLOT (0,0);

Clears all characters from the screen; returns cursor to home position.

EXEC VPLOT (0,1);

Clears foreground only; returns cursor to home position.

EXEC VPLOT (0,2);

Clears the window, returns cursor to home position.

EXEC VPLOT (3);
EXEC VPLOT (3,0); Set Foreground
EXEC VPLOT (3,1); Set Background

Sets foreground or background.

EXEC VPLOT (4,x,y);

Moves the cursor to position X, Y.

EXEC VPLOT (6,char);

Writes ASCII

EXEC VPLOT (6,xright,xleft,yupper,ylower);

Sets window.

EXEC VPLOT (7,xmax,xmin,ymax,ymin);

Sets scale.

EXEC VPLOT (8,x,y,char);

Plots point.

EXEC VPLOT (,x,y,char);

Plots vector.

EXEC XGRAPH ...

Allows test results and other data to be plotted graphically on line printer or VKT. The following six forms are available:

EXEC XGRAPH (op, x, tpas, ind);

Outputs SHMOO plot results from FACTOR program.

op = 10	Conventional SHMOO plots with Xs in Shmoo field.
= 11	Plot where SHMOO field contains TRASCII codes that the user has placed in the TPAS array.
x	Numerical value to be printed to the left of the SHMOO line on the vertical axis.
tpas	51 element array containing pass (1)/fail (0) pattern for current SHMOO line to be plotted.
ind = 0	Standard plot with every fifth location on the horizontal axis delineated by a column of periods, ('.').
= 3	Suppress printing of any X value (even 0) on the vertical axis and the '*' which follows it.
= 4	Suppress printing of columns of periods which delineate every fifth location on the horizontal axis.
= 5	Produces combined result of both 3 and 4.

EXEC XGRAPH (0);

Perform line printer top of form:

EXEC XGRAPH (3,loc,val,ind);

Uses XGRAPHS internal buffer for auxiliary data storage by the FACTOR program:

loc	Buffer address (0 to 1250) to be accessed.
val	Data fetced from or stored in buffer location LOC.
ind = 0	Place VAL in buffer location LOC.
= 1	Returns data from buffer location LOC to VAL.

EXEC XGRAPH (12,x,tpas,ind,tpact,xrows);

Performs Composite SHMOO Plot.

x	Numerical value to be printed to the left of the SHMOO Line of the vertical (ordinate) axis.
tpas	51 word array containing the pass (1)/fail(0) pattern to be composited upon the previously collected data.
ind = 1	Overlay the current pass/fail pattern in TPAS upon area of previously collected data specified by TPASCT.
= 2	Output a line of composited SHMOO data according to area of data specified by TPASCT.
= 20	Clear contents of internal memory buffer and file specified by TPASCT.
tpasct = 00 to 9	Two digit number used as last 2 characters of file name during open and clear function, or a number (50 to 2500) in increments of 50 during compositing and printing composite results.
xrows = 1 to 50	Determines the number of rows or lines of SHMOO data that are composited and printed along the x (vertical) axis.

EXEC XGRAPH (op, x, y);

Performs X-Y plots and bar graphs:

op = 1	For X=Y plots, where X is printed on plot at location X, T.
= 2	Block graphs, where a row of Xs of length Y is printed at location X
x	X axis coordinate (printed on left hand margin of plot). A constant, variable, or expression. See description of Y.
y	Y axis coordinate that must be normalized to a value between YMIN and YMAX. A constant, variable, or expression.

EXEC XMIT;

Dumps the foreground contents of the VKT screen to the line printer.

5 TABLES

TABLE 5.1 Reading and Writing Codes for Short Registers

Statement format: [READ/WRITE] (AxxxB) [variable/expression];
A = 1 = SPECIAL
A = 2 = WRITE
A = 3 = READ

Register Number	Register	xxxx	SPECIAL Function
1	Mode	A002	Clear mode register
2	Status	A004	Clear status register
3	Instruction	A006	
4	Memory Address	A010	
6	CNF1	A014	
7	CNF2	A016	
10	Clock Burst Count	A020	
11	Time Delay	A022	Start dc delay
14	Instruction Number Compare	A030	
15	Instruction Number Display	A032	

TABLE 5.1 Reading and Writing Codes for Short Registers (Continued)

Register Number	Register	xxxx	SPECIAL Function
21	DPS1	A042	Disconnect DPS1
22	DPS2	A044	Disconnect DPS2
23	DPT3	A046	
24	DPS3	A050	Disconnect DPS3
25	DPT2	A052	
26	DPT1	A054	
32	E1	A064	
33	E0	A066	
34	S1	A070	
35	S0	A072	
36	EA1	A074	
37	EA0	A076	
42	EB1	A104	
43	EB0	A106	
44	EC1	A110	
45	EC0	A112	
46	SA1	A114	
47	SA0	A116	

TABLE 5.2 Reading and Writing Codes for Long Registers

Statement format: [READ/WRITE] (xxxB) [variable/expression];
(for 3 digit codes)
[READ/WRITE] (xxxxB L) [variable/expression];
(for 4 digit codes)

Register	Pins	Register No.	Write XXX	Read XXX
RZ	1 to 15	000	200	400
RZ	16 to 30	001	201	401
RZ	31 to 45	002	202	402
RZ	46 to 60	003	203	403
RZ	61 to 75	004	204	404
RZ	76 to 90	005	205	405
RZ	91 to 105	006	206	406
RZ	106 to 120	007	207	407
ST	1 to 15	010	210	410
ST	16 to 30	011	211	411
ST	31 to 45	012	212	412
ST	46 to 60	013	213	413
ST	61 to 75	014	214	414
ST	76 to 90	015	215	415
ST	91 to 105	016	216	416
ST	106 to 120	017	217	417
D/DA/D1	1 to 15	020	220	420
D/DA/D1	16 to 30	021	221	421
D/DA/D1	31 to 45	022	222	422
D/DA/D1	46 to 60	023	223	423
D/DA/D1	61 to 75	024	224	424
D/DA/D1	76 to 90	025	225	425
D/DA/D1	91 to 105	026	226	426
D/DA/D1	106 to 120	027	227	427

TABLE 5.2 Reading and Writing Codes for Long Registers (Continued)

Register	Pins	Register No.	Write XXX	Read XXX
DB/D2	1 to 15	030	230	430
DB/D2	16 to 30	031	231	431
DB/D2	31 to 45	032	232	432
DB/D2	46 to 60	033	233	433
DB/D2	61 to 75	034	234	434
DB/D2	76 to 90	035	235	435
DB/D2	91 to 105	036	236	436
DB/D2	106 to 120	037	237	437
M/MA/M1	1 to 15	040	240	440
M/MA/M1	16 to 30	041	241	441
M/MA/M1	31 to 45	042	242	442
M/MA/M1	46 to 60	043	243	443
M/MA/M1	61 to 75	044	244	444
M/MA/M1	76 to 90	045	245	445
M/MA/M1	91 to 105	046	246	446
M/MA/M1	106 to 120	047	247	447
MB/M2	1 to 15	050	250	450
MB/M2	16 to 30	051	251	451
MB/M2	31 to 45	052	252	452
MB/M2	46 to 60	053	253	453
MB/M2	61 to 75	054	254	454
MB/M2	76 to 90	055	255	455
MB/M2	91 to 105	056	256	456
MB/M2	106 to 120	057	257	457
F	1 to 15	060 (070)*	260 (270)*	460
F	16 to 30	061 (071)*	261 (271)*	461
F	31 to 45	062 (072)*	262 (272)*	462
F	46 to 60	063 (073)*	263 (273)*	463
F	61 to 75	064	264	464
F	76 to 90	065	265	465
F	91 to 105	066	266	466
F	106 to 120	067	267	467

TABLE 5.2 Reading and Writing Codes for Long Registers (Continued)

Register	Pins	Register No.	Write XXX	Read XXX
S	1 to 15	100	300	500
S	16 to 30	101	301	501
S	31 to 45	102	302	502
S	46 to 60	103	303	503
S	61 to 75	104	304	504
S	76 to 90	105	305	505
S	91 to 105	106	306	506
S	106 to 120	107	307	507
TGA0	1 to 15	110	310	510
TGA0	16 to 30	111	311	511
TGA0	31 to 45	112	312	512
TGA0	46 to 60	113	313	513
TGA0	61 to 75	114	314	514
TGA0	76 to 90	115	315	515
TGA0	91 to 105	116	316	516
TGA0	106 to 120	117	317	517
C/INVERT	1 to 15	120	320**	520**
C/INVERT	16 to 30	121	321**	521**
C/INVERT	31 to 45	122	322**	522**

*F register rank 1: bit 18 = low-order bit of Dn selection.
F register rank 2: bit 18 = low-order bit of Mn selection.
F register rank 3 and 4: bit 18 = two low-order bits of TSn selection.

**Read: C register/Write: invert register

C/INVERT	46 to 60	123	323*	523*
C/INVERT	61 to 75	124	324*	524*
C/INVERT	76 to 90	125	325*	525*
C/INVERT	91 to 105	126	326*	526*
C/INVERT	106 to 120	127	327*	527*

TABLE 5.2 Reading and Writing Codes for Long Registers (Continued)

Register	Pins	Register No.	Write XXX	Read XXX
TGA1	1 to 15	130	330	530
TGA1	16 to 30	131	331	531
TGA1	31 to 45	132	332	532
TGA1	46 to 60	133	333	533
TGA1	61 to 75	134	334	534
TGA1	76 to 90	135	335	535
TGA1	91 to 105	136	336	536
TGA1	106 to 120	137	337	537
R	1 to 15	140	340	540
R	16 to 30	141	341	541
R	31 to 45	142	342	542
R	46 to 60	143	343	543
R	61 to 75	144	344	544
R	76 to 90	145	345	545
R	91 to 105	146	346	546
R	106 to 120	147	347	547
TGA2	1 to 15	150	350	550
TGA2	16 to 30	151	351	551
TGA2	31 to 45	152	352	552
TGA2	46 to 60	153	353	553
TGA2	61 to 75	154	354	554
TGA2	76 to 90	155	355	555
TGA2	91 to 105	156	356	556
TGA2	106 to 120	157	357	557
Pin Address (PA)		160	360	560
Statement Number				
Delay (IND)		162	362	562
Test Rate (TR)		163	363	563
Precision Power Source (PPS)		164	364	564
Precision Sense Level (PSL)		165	365	565
External Interface				
Register (EIR)		166	366	566
Slave Test Station (STSC)		167	367	567
Control				
Test Start/Delayed (MAD)		170	370	570

**Read: C register/Write: invert register

TABLE 5.2 Reading and Writing Codes for Long Registers (Continued)

READ: Delayed Memory Address/WRITE: Test Start.

Register	Register No.	Write XXX	Read XXX
Minor Loop Count (M)	1701	1701	1701
Major Loop Count (N)	1702	1702	1702
Main Frame Access (MCS)	1703	1703	1703
Minor Loop Start Address (J)	1704	1704	1704
Minor Loop End Address (K)	1705	1705	1705
Major Loop End Address (L)	1706	1706	1706
Ignore Fail (IF)	1707	1707	1707
DC Trip (DCT)	171	371	571
Chaining (IDEN)	172	372	572
Status Mode A (SAMA)	173	373	573
Status Mode B (SAMB)	1734	1734	1734
Status Mode C (SAMC)	1735	1735	1735
Status Mode D (SAMD)	1736	1736	1736
Status Mode E (LRAX)	1737	1737	1737
Pulse Width TG1	1751	1751	1751
Pulse Width TG2	1752	1752	1752
Pulse Width TG3	1753	1753	1753
Pulse Width TG4	1754	1754	1754
Pulse Width TG5	1755	1755	1755
Pulse Width TG6	1756	1756	1756
Pulse Width TG7	1757	1757	1757
Pulse Width TG8 (TB1)	175	375	575
Pulse Delay TG1	1761	1761	1761
Pulse Delay TG2	1762	1762	1762
Pulse Delay TG3	1763	1763	1763
Pulse Delay TG4	1764	1764	1764
Pulse Delay TG5	1765	1765	1765
Pulse Delay TG6	1766	1766	1766
Pulse Delay TG7	1767	1767	1767
Pulse Delay TG8 (TB2)	176	376	576
Power Pin Address (PPA)	177	377	577
Timing Generator Vernier	17704	Cannot be read/written from FACTOR	
DIM	1745	3745	5745
MUX1	1746	3746	5746
MUX2	1747	3747	5747

TABLE 5.2 Alternate Bank Long Register (LRAX = 1) Read/Write Codes

Register	(Pins)	Register	Write	Read
XOR	1 to 15	000	200	NA
XOR	16 to 30	001	201	NA
XOR	31 to 45	002	202	NA
XOR	46 to 60	003	203	NA
XOR	61 to 75	004	204	NA
XOR	76 to 90	005	205	NA
XOR	91 to 105	006	206	NA
XOR	106 to 120	007	207	NA
CRO	1 to 15	020	220	420
CRO	16 to 30	021	221	421
CRO	31 to 45	022	222	422
CRO	46 to 60	023	223	423
CRO	61 to 75	024	224	424
CRO	76 to 90	025	225	425
CRO	91 to 105	026	226	426
CRO	106 to 120	027	227	427
Data Readout 1		060	NA	460
Data Readout 2		062	NA	462
Topological Scrambler		100	300	500
Hold Register 1		102	302	NA
Index Register 1		102	NA	502
Hold Register 2		104	304	NA
Index Register 2		104	NA	504
Hold Register 3		106	306	NA
Index Register 3		106	NA	506

TABLE 5.2 Alternate Bank Long Register (LRAX = 1) Read/Write Codes (Continued)

Register (Pins)	Register	Write	Read
Maximum Register	110	310	NA
Compare Address Register	110	NA	510
Delta Register 1	112	312	NA
Delta Register 2	114	314	NA
Delta Register 3	116	316	NA
Control RAM 1	120	320	520
Control RAM 2	122	322	522
Control RAM	124	324	524
Shift Data	126	326	NA
Execute Address	126	NA	526
Data RAM	130	330	530
Chip Select and Mask	132	332	NA
Stop and Storage Address	134	334	534
Refresh Count	136	336	NA
Start Address	1700	NA	2100
Return Address	1701	NA	2101
Clock Burst	1703	NA	2103
Loop Count Stack	1704	NA	2104
Loop Count	1705	NA	2105
Stack Address	1706	1906	2106
Ignore Fail 2	1707	1907	2107
Sequential Length	1710	1910	2110
Dequential Pattern	1711	1911	2111
Local Memory Instruction	1740	NA	2140

TABLE 5.3 Surviving Pin Lists

TESTER SURVIVING AND CONDITIONING PINS FOR IOMODE

Surviving pins	1	5	9	13	16	20	24	28	31	35	39	43	46	50	54
Conditioning Pins	2	6	10	14	17	21	25	29	32	36	40	44	47	51	55
SVIII Surviving Pins	61	65	69	73	76	80	84	88	91	95	99	103	106	110	114
SVIII Conditioning Pins	62	66	70	74	77	81	85	89	92	96	100	104	107	111	115

IOM3 EXTENDED PIN LIST

Sentry V,VII Surviving Pins (Series 20/Sentry 21 Model 60)

1	5	9	13	16	20	24	28	31	35	39	43	46	50	54
3	7	11	15	18	22	26	30	33	37	41	45	48	52	56
4	8	12	—	19	23	27	—	34	38	42	—	49	53	57

Sentry V,VII Conditioning Pins (Series 20/Sentry 21 Model 60)

2	6	10	14	17	21	25	29	32	36	40	44	47	51	55

Sentry VIII Surviving Pins (Series 20/Sentry 21 Model 120)

61	65	69	73	76	80	84	88	91	95	99	193	196	110	114
63	67	71	75	78	82	86	90	93	97	101	105	108	112	116
64	68	72	—	79	83	87	—	94	98	102	—	107	113	117

Sentry VIII Conditioning Pins (Series 20/Sentry 21 Model 120)

62	66	70	72	77	81	85	89	92	96	100	104	107	111	115

TABLE 5.4 IOM8 Pin Groups

Surviving Pin in Pin Lists*	1 5	16 20	31 35	46 50	61 65	76 80	91 95	106 110
Conditioning Pin for Group*	14	15	44	45	74	75	104	105
Groups of Pins*	1-8	16-23	31-38	46-53	61-68	76-83	91-98	106-113

* Pins 61-120 for Series 20/Model 120 test systems only.

MODULE STATEMENT	PROGRAMMABLE VALUE/RESOLUTION			
	Range 2	**Range 3**		
DPS FORCE VF	10.23 V/10 mV	40.92 V/40 mV		
DPS FORCE IF	102.3 mA/0.1 mA	1.023 A/1 mA		
DPS ENABLE TRIPI	102.3 mA/0.1 mA	1.023 A/1 mA		
DPS ENABLE TRIPV	10.23 V/10 mV	40.92 V/40 mV		
	Range 2	**Range 3**		
RVS SET (S0/S1)	+6.0 V to -10.23 V/10 mV	+6.0 V to -30.72/40 mV*		
RVS FORCE E	+6.0 V to -10.23 V/10 mV	+6.0 V to -30.72/40 mV*		
	Range 0, U1	**Range U10****	**Range 1, U100**	**Range M1****
PMU FORCE VOLTAGE			1.023 V/1 mV	
PMU SET PMU FORCEV			1.023 V/1 mV	
PMU FORCE CURRENT	1.023 uA/1 nA	10.23 uA/10 nA	102.3 uA/0.1 uA	1.023 mA/1uA
PMU SET PMU FORCE I	1.023 uA/1 nA	10.23 uA/10 nA	102.3 uA/0.1 uA	1.023 mA/1uA
PMU SET PMU SENSE VOLTAGE			1.023 V/1 mV	
PMU SET PMU SENSE CURRENT	1.023 uA/1 nA	10.23 uA/10 nA	102.3 uA/0.1 uA	1.023 mA/1uA
	Range 2, M10	**Range 3, M100**	**Range 4**	
PMU FORCE VOLTAGE	10.23 V/10 mV	+10.23 V to -40.92 V/40 mV	+10.23 to -102.3 V/100 mV	
PMU SET PMU FORCEV	10.23 V/10 mV	+10.23 V to -40.92 V/40 mV	+10.23 to -102.3 V/100 mV	
PMU FORCE CURRENT	10.23 mA/10 uA	102.3 mA/0.1 mA		
PMU SET PMU FORCEI	10.23.mA/10 uA	102.3 mA/0.1 mA		
PMU SET PMU SENSE VOLTAGE	10.23 V/10mV	40.92 V/40 mV	102.3 V/100 mV	
PMU SET PMU SENSE CURRENT	10.23 mA/10 uA	102.3 mA/0.1 mA		

* Max limit is -30.72 V for a 5 MHz pin electronics board, -16.00 V for a 10 MHz pin electronics board.

** 6 Range PMU only. For 4 range PMU, if U10 is specified the value is scaled in the RNG1-U100 range, and if M1 is specified the value is scaled in the RNG2-M10 range.

TABLE 5.5 Normal Force and Measure Ranges (Series 20/Sentry 21 Test Systems)

MODULE STATEMENT	PROGRAMMABLE VALUE/RESOLUTION			
	Range 1	**Range 2**	**Range 3**	
DPS FORCE VF	2.046 V/2 mV	10.23 V/10 mV	40.92 V/40 mV	
DPS FORCE IF		102.3 mA/0.1 mA	1.023 A/1 mA	
DPS ENABLE TRIPI		102.3 mA/0.1 mA	1.023 A/1 mA	
DPS ENABLE TRIPV		10.23 V/10 mV	40.92 V/40 mV	
	Range 1	**Range 2**	**Range 3**	
RVS SET (S0/S1)	2.046 V/2 mV	+6.0 V to -10.23 V/10 mV	+6.0 V to -30.72/40 mV*	
RVS FORCE E		+6.0 V to -10.23 V/10 mV	+6.0 V to -30.72/40 mV*	
	Range 0, U1	**Range U10****	**Range 1, U100**	**Range M1****
PMU FORCE VOLTAGE		2.046 V/2 mV		
PMU SET PMU FORCEV		2.046 V/2 mV		
PMU FORCE CURRENT	1.023 uA/1 nA	10.23 uA/10 nA	102.3 uA/0.1 uA	1.023 mA/1uA
PMU SET PMU FORCE I	1.023 uA/1 nA	10.23 uA/10 nA	102.3 uA/0.1 uA	1.023 mA/1uA
PMU SET PMU SENSE VOLTAGE		2.046 V/2 mV		
PMU SET PMU SENSE CURRENT	1.023 uA/1 nA	10.23 uA/10 nA	102.3 uA/0.1 uA	1.023 mA/1uA
	Range 2, M10	**Range 3, M100**	**Range 4**	
PMU FORCE VOLTAGE	10.23 V/10 mV	+10.23 V to -40.92 V/40 mV	+10.23 to -102.3 V/100 mV	
PMU SET PMU FORCEV	10.23 V/10 mV	+10.23 V to -40.92 V/40 mV	+10.23 to -102.3 V/100 mV	
PMU FORCE CURRENT	10.23 mA/10 uA	102.3 mA/0.1 mA		
PMU SET PMU FORCEI	1.23.mA/10 uA	102.3 mA/0.1 mA		
PMU SET PMU SENSE VOLTAGE	10.23 V/10 mV	40.92 V/40 mV	102.3 V/100 mV	
PMU SET PMU SENSE CURRENT	10.23 mA/10 uA	102.3 mA/0.1 mA		

* Max limit is -30.72 V for a 5 MHz pin electronics board.

** 6 Range PMU only. For 4 range PMU, if U10 is specified the value is scaled in the RNG1-U100 range, as if M1 is specified the value i scaled in the RNG2-M10 range.

TABLE 5.6 Normal Force and Measure Ranges with 2 V/2 mV Option (Series 20/Sentry 21 Test Systems)

MODULE STATEMENT	PROGRAMMABLE VALUE/RESOLUTION			
	Range 1	**Range 2**		
DPS FORCE [VF1/VF2/VF3]	±2.046 V/2 mV	+2.0 V to -10.0 V/20 mV		
	Range 1	**Range 2***		
RVS SET (S0/S1)	±2.046 V/2 mV	+12.0 V to -4.0 V/20 mV		
RVS FORCE E	+2.046 V to -1.0 V/2 mV	+12.0 V to -1.0 V/20 mV		
	Range 0, U1	**Range U10****	**Range 1, U100**	**Range M1****
PMU FORCE VOLTAGE		2.046 V/2 mV		
PMU SET PMU FORCEV		2.046 V/2 mV		
PMU FORCE CURRENT	1.023 uA/1 nA	10.23 uA/10 nA	102.3 uA/0.1 uA	1.023 mA/1uA
PMU SET PMU FORCE1	1.023 uA/1 nA	10.23 uA/10 nA	102.3 uA/0.1 uA	1.023 mA/1uA
PMU SET PMU SENSE VOLTAGE		2.046 V/2 mV		
PMU SET PMU SENSE CURRENT	1.023 uA/1 nA	10.23 uA/10 nA	102.3 uA/0.1 uA	1.023 mA/1 uA
	Range 2, M10	**Rnge 3, M100**	**Range 4**	
PMU FORCE VOLTAGE	10.23 V/10 mV	+10.23 V to -40.92 V/40 mV	+10.23 to -102.3 V/100 mV	
PMU SET PMU FORCEV	10.23 V/10 mV	+10.23 V to -40.92 V/40 mV	+10.23 to -102.3 V/100 mV	
PMU FORCE CURRENT	1.23 mA/10 uA	102.3 mA/0.1 mA		
PMU SET PMU FORCE1	10.23.mA/10 uA	102.3 mA/0.1 mA		
PMU SET PMU SENSE VOLTAGE	10.23 V/10 mV	40.92 V/40 mV	102.3 V/100 mV	
PMU SET PMU SENSE CURRENT	10.23 mA/10 uA	102.3 mA/0.1 mA		

* Range 2 values for RVSs and DPSs that are above 10.023 V must be programmed in Range 3 via FACTOR statements. The values are rescaled to Range 2 at run time.

** 6 Range PMU only. For 4 range PMU, if U10 is specified the value is scaled in the RNG1-U100 range, and if M1 is specified the value is scaled in the RNG2-M10 range.

TABLE 5.7 Force and Measure for Series 10 DLSI Test System

MODULE STATEMENT	PROGRAMMABLE VALUE/RESOLUTION			
	Range 1	**Range 2***		
DPS FORCE [VF1/VF2/VF3]	±2.046 V/2 mV	+20.0 V to -10.0 V/20 mV		
DPS FORCE [VF4/VF5]* **	±6.0 V/8 mV			
DPS ENABLE [TRIP4/TRIP5]* **		±3.0 A/4 mA		
	Range 1	**Range 2***		
RVS SET (S0/S1)	+2.046 V to -1.0 V/2 mV	+12.0 V to -1.0 V/20 mV		
RVS FORCE (E0/E1)	+2.046 V to -1.0 V/2 mV	+6.0 V to -1.0 V/20 mV		
RVS FORCE (EA0/EA1)	+2.046 V to -1.0 V/2 mV	+16.0 V to -1.0 V/20 mV		
	Range 0, U1	**Range U10****	**Range 1, U100**	**Range M1****
PMU FORCE VOLTAGE		2.046 V/2 mV		
PMU SET PMU FORCEV		2.046 V/2 mV		
PMU FORCE CURRENT	1.023 uA/1 nA	10.23 uA/10 nA	102.3 uA/0.1 uA	1.023 mA/1
PMU SET PMU FORCE1	1.023 uA/1 nA	10.23 uA/10 nA	102.3 uA/0.1 uA	1.023 mA/1uA
PMU SET PMU SENSE VOLTAGE		2.046 V/2 mV		
PMU SET PMU SENSE CURRENT	1.023 uA/1 nA	10.23 uA/10 nA	102.3 uA/0.1 uA	1.023 mA/1uA
	Range 2, M10	**Range 3, M100**	**Range 4**	
PMU FORCE VOLTAGE	10.23 V/10 mV	+10.23 V to -40.92 V/40 mV	+10.23 to -102.3 V/100 mV	
PMU SET PMU FORCEV	10.23 V/10 mV	+1.23 V to -40.92 V/40 mV	+10.23 to -102.3 V/100 mV	
PMU FORCE CURRENT	10.23 mA/10 uA	102.3 mA/0.1 mA		
PMU SET PMU FORCE1	10.23.mA/10 uA	102.3 mA/0.1 mA		
PMU SET PMU SENSE VOLTAGE	10.23 V/10 mV	40.92 V/40 mV	102.3 V/100 mV	
PMU SET PMU SENSE CURRENT	10.23 mA/10 uA	102.3 mA/0.1 mA		

* Range 2 values for RVSs and DPSs that are above 10.023 V must be programmed in Range 3 via FACTOR statements. The values are rescaled to Range 2 at run time.

** 6 Range PMU only. For 4 range PMU, if U10 is specified the value is scaled in the RNG1-U100 range, and if M1 is specified the value is scaled in the RNG2-M10 range.

*** Available with 120-pin option only.

TABLE 5.8 Force and Measure for Series 10 High-Speed Test System

TABLE 5.9 Timing Generator Specifications (Series 20/Sentry 21)

Time Base	100 MHz, crystal-controlled		
Periods	Range	Period Range	Resolution
	0	50 ns to 40.95 us	5 ns
	1	1 us to 409.5 us	100 ns
	2	10 us to 4.095 ms	1 us
	3	100 us to 40.94 ms	10 us
Timing Generator Outputs	Range		
	0	0 to (10.24 us less 156 ps) or 0 to (2 periods-20 ns), whichever is less.	
	1	0 to 102.3 us or 0 to (2 periods-100 ns), whichever is less.	
	2	0 to 1.023 ms or 0 50 (2 periods-1us), whichever is less.	
	3	0 to 10.23 ms or 0 to (2 periods-10 us), whichever is less.	
Resolution and Linearity	Range	Resolution	Linearity
	0	156 ps	±156 ps ±0.02%
	1	100 ns	±156 ps ±0.02%
	2	1 us	±156 ps ±0.02%
	3	10 us	±156 ps ±0.02%

TABLE 5.10 Sentry VII, VIII

DELAY/WIDTH GENERATOR

Range	Full Scale/ Auto Range	Resolution
0	10 us	160 ps
1	100 us	100 ns
2	1 ms	1 us
3	10 ms	10 us

PERIOD GENERATOR

		Auto Range	
Range	Full Scale	Maximum	Resolution
0	40 us	10 us	10 ns
1	400 us	100 us	100 ns
2	4 ms	1 ms	1 us
3	40 ms	10 ms	10 us

DMA MODE STATEMENTS

FACTOR statements that cause a value to be loaded in a tester long register are normally executed in direct memory access (DMA) mode. In this mode, the system software determines the start address of a sequence of these statements, loads the MAR register, and initiates DMA mode. The hardware then executes the test program directly until an instruction that cannot be processed in this mode is encountered. Such an instruction may require several operations to be performed; these instructions are executed interpretively by the system software Execution in DMA mode is more efficient, particularly if the programmer structures the program so that long DMA sequences are not broken by interpretive statements or statement lables.

TABLE 5.11 indicates which FACTOR instructions are executed in DMA mode and which long registers may be affected.

TABLE 5.11 Statements Executed in DMA Mode

Instruction	Long Register Number	
SET RZ	000 to 003	
SET ST	010 to 013	
SET D/DA	020 to 027	
SET DB	030 to 037	Functional test statements
SET M/MA	040 to 047	load from one to eight
SET MB	050 to 057	ranks per statement, depending
SET F	060 to 067	on the specified pins.
SET S	100 to 107	
SET INVERT	120 to 127	
SET R	140 to 147	
CPMU PIN[1]	160	
XPMU PIN	160	
ENABLE/DISABLE RELAY	160	
FORCE VOLTAGE/CURRENT[1]	164	
SET CLAMP number	165	
MEASURE PIN[2]	171, 173	
SET CHAIN	172 (not Sentry 7 and Series 20)	
SET IOMODE/IOM3	172	
ENABLE TEST[3]	1700, 1703, 1706, 1730	
CGEN TG(x)	110 to 117, 130 to 137, 150 to 157	
CONN DPS(x)/TCOM/CLK	177	
XCON PIN	177	
AT label[4]	1703	
SET START[4]	1700	
SET MAJOR[4]	1702, 1706	
SET MINOR[4]	1701, 1704, 1705	

NOTES:

1. Only when the expression is a simple constant. (If the expression must be evaluated at execution time, the statement is executed interpretively.)
2. Only when a SET DCT statement is programmed before the MEASURE PIN statement.
3. Any enable test except with a modifier EXT, EXTA, EXTB, XCCM, or MATCH without IMMED.
4. Only when the label or constant can be evaluated at compile time.
5. Does not generate code if using Series 20 test system (compiler directive only).
6. Also generates an interpretive code (544) if DISABLE CHECKS is not programmed.
7. Without an asterisk (*), statement is interpretive.

TABLE 5.11 Statements Executed in DMA Mode (Continued)

Instruction	Long Register Number
SET DCT[1]	171, 165
SET XOR	000 to 007 (bank B)
SET CRO	020 to 027 (bank B)
SPM	
LSET DA/DB/D1/D2	067
LSET MA/MB/M1/M2	067
LSET I/IX	067
SET FC	067
LSET RZ/XORST	067
PPM	
ENABLE/DISABLE SPLIT	1736
ENABLE PPM	1730
ENABLE/DISABLE RTO/MUXM/IMASK	1736
Series 20	
SET PERIOD[1]	012, 014, 163 (bank C)
SET TVn[1]	012, 014, 020 to 116 (bank C)
SET TIMRNG[5]	012 (bank C)
SET SCRAM[6]	012, 014 (bank C)
CGEN TGn letter list	175, 176
ENABLE SCRAM	1736
DISBLE SCRAM	1736
SET Q*	1710, 1711 (bank B)
SET IOMODE/IOM3	172
SET IOM8	1736, 172
SET MUX	1746, 1747
LSET LC/NOP/MM/IXn	067
SET Dn	1745, 150 to 157 (bank B)
SET MM	160 to 167 (bank B)
SET Mn	1745, 040 to 047
SET In	1745, 120 to 127
SET LC	
Series 21	
ENABLE FRCLKA/FRCLKB	1736
DISABLE FRCLKA/FRCLKB	1736

TIME DELAY RELATED STATEMENTS

TABLE 5.12 lists all statements that are time delay dependent; the execution of these statements, which generate time delays (a fixed number if hardware initiated or a variable if software initiated), is listed in TABLE 5.13. Note that x implies a DPS number 1 through 3 and y implies an RVS level of 0 or 1.

TABLE 5.12 Time Delay Dependent Statements

FORCE WAIT
SET DELAY
FORCE DELAY
ENABLE TRIPVx (if changing to current force mode)
ENABLE TRIPIX (if changing to voltage force mode)
FORCE VFx (after a FORCE IFx)
FORCE IFx (after a FORCE VFx or FORCE RESET)
FORCE VOLTAGE
FORCE CURRENT
FORCE PMU
SET PMU FORCEI/FORCEV/SENCE
SET D
SET M
SET R
SET S
CPMU PIN expression
XPMU PIN
MEASURE PIN
MEASURE VALUE/NODE/PIN number
Any statement at the start of DMA mode sequence (refer to TABLE 5.11).
SET DCT

TABLE 5.13 Time Delay Generating Statements

Statement	Description
FORCE DELAY	Programmed dc time delay
SET S	0.28 ms
SET D, SET CLAMP CPMU PIN, XPMU PIN, CONN CLOCK, CONN DPS, CONN TCOM ENABLE RELAY, DISABLE RELAY	0.56 ms
SET R	0.56 ms
SET PMU FORCEV, FORCEI FORCE VOLTAGE FORCE CURRENT FORCE PMU	Programmed dc time delay or 0.56 ms with no current range change or 4 ms (+1 ms) with current range change, whichever is greater.
SET PMU SENSE	0.56 ms with no current range change or 4 ms with current range change.
FORCE VFx, FORCE IFx ENABLE TRIPVx ENABLE TRIPIx XCON VFx, FORCE RESET	Programmed dc time delay or 5.37 ms, whichever is greater.
SET Sy, SET SAy, FORCE Ey FORCE EAy, FORCE EBy, FORCE ECy	Approximately .300 ms/V of change or 0.56 ms, whichever is greater.
SET DCT, MEASURE PIN	56 us

TABLE 5.14 TERMINAL ERROR DESCRIPTION LIST

Certain setup and programming errors cannot be detected at compilation time; these errors are discoverable only while testing.When one is detected, the error number is logged, both the parameter FAIL and parameter PASS lights are ON, and the EOT light is OFF. The error number is displayed (in binary format) in the EIR register bits 0 to 10, with the least significant bit (bit 0) to the left.

Terminal Error No.	Description
1	The user has not loaded a test program to the station that received the start request, or the file was released from the station.
2	There is no power for the station receiving the start request.
3	DMA did not start.
4	A data cell is fetched that has an opcode between 400 and 477. This is a hardware or system error.
5	A data cell is fetched with an illegal 500 opcode. This is a hardware or system error.
6	A data cell is fetched with an illegal 600 opcode. This is a hardware system, or programming error.
7	A data cell is fetched with an illegal 700 opcode. This is a hardware or system error.
8	The opcode for a macro statement is wrong. The error occurs on a MEASURE PIN statement, but the value comes from the SET TEST statement. This is a system error.
9	A system error has occured while the program is being paged from the disk into memory.
10	A system overlay, such as analysis, datalog, distribution, or dc fail, cannot be found in memory or on the disk.
11	User overlay executed by FACTOR EXEC or REXEC statement cannot be found in memory or disk, or insufficient memory space to allow a disk load.
12	There is not enough memory available to extend the stack or load test program as required for the requested operation.
13	The assembly language program called is not compatible with this release. Recreate the created-object file.
14	An error is detected on the stack in the block header area.

15 An arithmetic or interpretive opcode requires a certain number of entries on the stack that are not present.

16 An invalid parameter was passed from a diagnostic to SKWTAB, WDSK, or SKW21.

17 A data check error (potential data loss) occurred while generating the deskew file.

18 The test program is not being fetched properly, causing a FACTOR I/O operation to be initiated before a previous I/O operation is completed. This is usually a hardware or a system error.

19 The test program is not being fetched properly, causing a FACTOR I/O operation to be requested before the I/O operation is initialized. This is usually a hardware or a system error.

20 The test program created by FLINK contains a linking error.

21 The user has programmed ENABLE ILO/IHI limits and programmed a value outside these limits.

22 The user has programmed ENABLE VLO/VHI limits and programmed a value outside these limits.

23 The pin number programmed is negative or greater than 60 (for 60-pin stations) or 120-pin stations), or greater than the number specified by the SET MPIN statement.

24 The value for SET DELAY DC is greater than 5.734 seconds (14 bits), the value for SET TIMEOUT is greater than 6 minutes (20 bits), or either is negative.

25 The memory size requested on the SET PAGE statement exceeds the local memory size available.

26 The local memory address specified in a SET MAJOR/MINOR/START/IFAIL or AT statement exceeds the local memory size of the SET PAGE statement or is negative.

27 The local memory loop count specified is negative or exceeds 4096. This applies to loop counts set by SET LC and to major and minor loop counts set by SET MAJOR/MINOR.

29 The SMM address is less than zero or greater than 8K.

30 The magnitude programmed by the following commands exceeds the limit of 11 bits signed.

FORCE E0/E1/EA0/.../EC1
SET S0/S1/SA0/SA1
FORCE VF1/VF2/VF3
FORCE IF1/IF2/IF3
ENABLE TRIPI1/TRIPI2/TRIPI3
ENABLE TRIPV1/TRIPV2/TRIPV3
SET DCT
SET TG DELAY/WIDTH
FORCE PMU
FORCE VOLTAGE/CURRENT

31 The magnitude programmed for the RVS exceeds the hardware limit for the system option.

System	High Limit	Low Limit	Registers
5 MHz	6	-30	All
10 MHz	6	-16	All
28 V swing	6	-32	E0, E1, EA0, EA1, EB0, EB1, EC0, EC1
28 V swing	6	-19	S0, S1, SA0, SA1
High-speed	17	-2	EA0, EA1
High-speed	7	-2	E0, E1, EB0, EB1 EA0, EA1, S0, S1, SA0, SA1

32 The value programmed for the timing generator is less than 10 ns or exceeds 10 bits.

33 The value programmed for the period or alternate period is out of range or is less than 50 ns for 20 MHz, 100 ns for 10 MHz, or 200 ns for 5 MHz.

34 The value of the period or alternate period is less than or equal to the value of any programmed width or delay.

35 The range of the period or alternate period is less than any programmed width range. This is checked at the SET PERIOD/APERIOD statement.

36 The range of the period is less than any programmed delay range. This is checked at the SET PERIOD/APERIOD statement.

37 The width range is greater than the corresponding delay range for a timing generator. This is checked at the SET PERIOD/APERIOD statement.

38	The programmed PERIOD or APERIOD is less than 200 ns and an RVS is less than -16 V, checked in a 28 V swing system when the RVS is programmed and at the SET PERIOD statement.
39	RVS overvoltage trip; voltage exceeds value allowed by test rate. A hardware trip ocurred, indicating that an RVS value or swing is too high for the programmed frequency.
40	The system or a user overlay encountered an I/O error during a read or write operation.
41	The system or a user overlay encountered an I/O error during an open operation.
42	The user has not opened an input or output device (disk, memory, or magnetic tape).
43	A system or user overlay error occurred in the call to open or perform foreground I/O.
44	An I/O error occurred when the system attempted to page the test program from disk.
45	The system or a user overlay attempted to do foreground I/O (using the routine FGIO) before opening the file.
46	The end of an input file was detected and there was no ON [DIFEOF/EOF] statement programmed.
48	Binary output exceeds 4094 words.
49	The reset button was pressed during blocked or binary FACTOR output, which resulted in incomplete data, such as missing last blocks or trailing records. The file may be corrupt or unreadable.
50	The parameters passed to a FACTOR subroutine are not equal to the number of parameters expected by the routine.
51	An overflow condition occurred during FACTOR arithmetic.
52	The starting value of a FOR loop counter is greater than the limit.
53	The array size declared is zero, negative, or caused an overflow.
54	During array initialization, more elements have been assigned values than exist.

55 An attempt has been made in FACTOR to write an array to a register or read a register into an array.

56 A scaler variable passed to a subroutine as a parameter is referenced in a subroutine as an array.

57 An array passed to a subroutine as a parameter is referenced in the subroutine as a variable.

58 An array is referenced in the test program before the DCL statement was executed.

59 An array element referenced is greater than the array size or is negative. Element 0, the array size, may not be referenced on the left of an equal sign.

60 An attempt has been made to go to a label specified by an ON fail type or a DIFEOF statement. The label is in a block higher than the one executing at the time the condition occurred.

61 An overlay called by a FACTOR EXEC statement expects more or fewer parameters than passed.

62 A definition provided by the SET DESKEW statement did not have a corresponding definition in the master deskew file. Therefore, no deskewing value could be found.

63 A data check error (potential data loss) occurred during creation of a test station deskew file (SKWn) in memory.

65 A program executing in compatibility mode (pre-Series 20 timing statements) does not meet the range restrictions of the Series 20/Sentry 21 timing system.

66 ETM system and ETM program: All periods selected by the SET SCRAM statement are not in the same range as in the TIMR register.

67 The TG START or STOP value exceeds (2 x period) -20 ns in range 0 or (2 x period) -1LSB in range 1, 2, or 3. The TG values of a time set are compared with the period value with which they have been paired by the SET SCRAM or DISABLE SCRAM statement.

68 ENABLE SPLIT is illegal with periods of less than 70 ns. The error checks done by SET SCRAM or DISABLE SCRAM have detected a test rate less than 70 ns with the split mode enabled.

69 A high-speed program (strobe TGs in MA) is being run on a high-voltage test head. If HS is specified in the SET PAGE statement, the strobes can be DMA and no RTD is added. However, this program does not execute on a high-voltage test head, where the RTD must be added.

70 A program compiled for a six-range EPMU is being run on a tester with a four-range PMU.

71 The user has attempted to execute a FACTOR program compiled for a Sentry VII system on a Sentry VIII system.

72 An attempt has been made to run a Series 20 or Sentry 21 program on a Sentry VIII test system.

73 An attempt has been made to run a Series 20 or Sentry 21 program on a Sentry VII test system.

74 The user has attempted to execute a program containing ETM timing statements on a system set up for standard timing.

75 The user has attempted to execute a program containing a SET PAGE, PDMA statement on a system using a 5 MHz test head.

76 SPM is specified on the SET PAGE statement and the SPM option is not in the tester.

78 A program compiled for a 1 V/1 mV sytem is being run on a 2 V/2 mV system.

79 A program compiled for a 2 V/2 mV system is being run on a 1 V/1 mV system.

80 A PPM statement appears in the program on a system with-out the option. One of the following was encountered:

SET APERIOD
SET ATG4 [DELAY/WIDTH]
SET PPM
REXEC

81 The module of the PPM microprogram called by the REXEC statement contains assembly errors.

82 The module number passed to the microprogram by the REXEC statement is negative.

83	The module number passed to the microprogram by the REXEC statement is greater than the number of modules in the microprogram.
84	Error in DMA occurred when loading the control RAM, or in DMA when loading the PPM registers when a PPM micro- program is executed.
85	The user did not execute SKEW21 to create a master deskew file on disk for the respective test station.
86	With the free-running clock option in range 0, the period was less than 30 ns on a high-speed test head or 100 ns on a high-voltage test head, or the pulse width was below 8 ns on a high-speed test head or 20 ns on a high-voltage test head. In other ranges, the value is less than 1 LSB.
87	The opcode parameter passed to LITOP is less than 1 or greater than 16.
88	A parameter passed to LITOP is a scalar variable which must be changed to an array, or the parameter is an array which must be changed to a scalar variable.
89	The array specified by LITOP to receive the output is too short.
90	Too few arrays have been passed as parameters to LITOP.
91	A program using MTM capability is being run on a tester not equipped with MTM hardware.
95	The value of the expression of the SET [SD/SM] START or ATSTM statements exceeds the available hardware. That is, a value exceeds 8K-1 with the ST8 option, or 32K-1 with the ST32 option.
96	An STM program containing an ST8 or ST32 option in the SET PAGE statement was executed on a test system not equipped with STM hardware.
97	An STM program containing an ST32 option in the SET PAGE statement was executed on a test system equipped with only 8K of STM memory.
100	Parameter or calling sequence error.
101	File access error.
102	File not found.

104 Local memory busy.

105 Hardware not available.

106 Table overflow.

107 Tester register specification error.

108 An illegal combination of tester options specified.

110 An IBUS parameter is missing or is out of range.

111 IBUS hardware error.

112 The array specified for an IBUS read is too small.

113 An overflow of variables occurred during an IBUS read or write.

114 The value programmed for the DPS hardware is greater than 6 volts or less than -6 volts on a Series 10 120-pin system.

115 The value programmed for the DPS current trip is greater than 3 Amps or less than -3 Amps on a Series 10 120-pin system.

116 The value for symmetrical trips 4 and 5 must be negative if LT is used on a Series 10 120-pin system.

117 The value of symmetrical trips 4 and 5 must be positive if GT is used on a Series 10 120-pin system.

118 An attempt has been made to execute a Series 20 or Sentry 21 program on Series 10 hardware.

119 An attempt has been made to execute a Sentry VIII program on a Series 10 system with 60 pins.

120 An attempt has been made to execute a Series 10-120 pin program (S10B) on a Series 10 system with 60 pins and RANK C required to be in Bank A (S10 hardware).

122 An attempt has been made to execute a program using MTM timing statement on a system without MTM hard-ware.

123 An attempt has been made to execute a program using ETM timing statements on Series 10 hardware.

124 An attempt has been made to execute a program compiled with the "S10B" option or compiled on an S10 system with switchable RANK C. The program's RANK C data is in Bank B and will not execute on hardware which requires RANK C in Bank A.

140 An array containing a system command passed to FEXEC exceeds 20 words.

141 An optimized test program is being executed but its Assembly Test Program (ATP) file has not been installed.

142 A disk error occurred while paging an Assembly Test Program (ATP) file.

150 A formatted WRITE statement was encountered, but the FORMAT statement has not been executed.

151 The data cell fetched contains an invalid formatted I/O opcode. This is a hardware or system error.

152 A formatted READ or WRITE statement specifies variables or arrays, but the corresponding FORMAT statement contains only specifications controlling the line. There must be a specification to format the data if data exists.

153 No number was entered during a formatted READ. The FORMAT statement specified that a number was required.

154 The data input via formatted READ is illegal.

170 Chaining is not permitted on the Series 20 or Sentry 21 test system.

171 An attempt was made to change DRNK with SET FI when CRNK is LSET REG or LSET REG - LCALL.

200 All terminal error codes 200 and above are reserved for user overlays.

STATEMENT LIST, REGISTERS WRITTEN, CODE TYPE, AND TIME DELAY

See TABLE 5.15 for an explanation of time delay codes.

Statement and Options	Registers Written	DMA/INTP	Time Delay Code
AT	MCS	D/I(503)	0
BRANCH UNLESS/TO/RESET	PG-MIL	D	
CGEN TGn	TGA0, TGA1, TGA2	D	0
CLEAR TIME	LRAX, TIMA, SBP, TG1A-TG8B (16 sets), TR1-16, SAMD	I(545)	
CONN CLK	PPA, RZ	D	2
CONN DPS1/DPS2/DPS3/TCOM	PPA	D	2
CPMU PIN	PA, SR	D/I(612)	2
DISABLE SCRAM			
With DISABLE CHECKS	SAMD	D	
Without DISABLE CHECKS	SAMD, TIMA, DBP	D, I(544)	
DISABLE TRIPS	SR	I(646)	0
ENABLE/DISABLE DCT0/DCT1	None	*(631,632)	0
ENABLE/DISABLE DOUBLE STROBE	SAMD	D	0
ENABLE/DISABLE LATCHES	MR	I(640/641)	0
ENABLE/DISABLE RELAY	PA	D	2
ENABLE/DISABLE SPLIT/RTO/ MUXMODE/IMASK	SAMB	D	
ENABLE DA/DB/Dn	F-RANK1, DRNK	0	
ENABLEDISABLE FRCLKA/ FRCLKB	SAMD	D	
ENABLE IL0/IHI/VLO/VHI	None	I(632,635)	0
ENABLE In	DRNK		
ENABLE MA/MB/Mn	F-RANK2, DRNK	0	
ENABLE PPM	SAMA	D	0
ENABLE SCRAM	SAMD	D	
ENABLE TSn	F-RANK3, F-RANK4, DRNK		
ENABLE TEST	D	0	
No SET START	S	D	
No SET MAJOR	L	D	
	MCS, SAMA	D	
	SAMA, IF, SR, SAMB, SAMC, SAMD	I(531)	
D/L additional failure	MCS, IF, LRAX, IF2 Q, QL, SR, SAMA		

Statement and Options	Registers Written	DMA/INTP	Time Delay Code
EXTA/EXT	SAMB, CBC	I	
LOOP	SAMC	I	
MATCH	CBC (if time out fail enabled)	I	
AMATCH	SAMD, CBC (if time out fail enabled)		
EXTB	SAMD	I(531)	
XCCM	SAMD	I(531)	
ENABLE TRIPI1/TRIPI2/TRIPI3	SR, DPT1/2/3,DPS1/2/3	I(601-603)	6
ENABLE TRIPV1/TRIPV2/TRIPV3	SR, DPT1/2/3,DPS1/2/3	I(613-615)	6
FORCE CURRENT/VOLTAGE	PPS, SR	D/I(605)	4
FORCE DELAY	TD (special)	I(642)	9
FORCE E0/E1/.../EC1	E0/E1/.../EC1, TD SAMC (28 V swing)	I(620-623)	7
FORCE IF1/IF2/IF3	SR, DPT1/2/3,DPS1/2/3	I(647-651)	6
FORCE PMU	PPS, SR	D/I(605)	4
FORCE RESET	DPS1/2/3, DPT1/2/3, PPS, RVSs, all registers on hardware reset line, MR, DA, DB, MA, MB, SR, SAMA, EIR, TD, RV-ETM. These registers are restored: bits 1, 2, 7, SAMB, all bits except 4 and 5 of MR, bits 0 and 12 of SR, bit 11 of SAMC, SPM mode bit in SAMD, and IND, INC, EIR, DIM, D, I, M	I(640)	6
FORCE VF1/VF2/VF3	SR, DPT1/2/3,DPS1/2/3	I(625-627)	6
FORCE WAIT	None	I(642)	10
label:	IND	I(645)	0
LCGEN TG1/TG2/TG3	F	D	0
LSET In/IXn/LC/NOP/ MM/Mn/Dn	F	D	0
LSET IX/STROBE/RZ/INVERT/ DA/DB/MA/MB	F	D	0
LSUBR	F	D	0
MEASURE NODE	SAMA, PA, PSL, DCT PPS, SR on failure	I(616)	

Statement and Options	Registers Written	DMA/INTP	Time Delay Code
MEASURE PIN			
No ENABLE DCT1/DCT0	DCT, SAMA	D	8
MEASURE VALUE/PIN			
ENABLE DCT1/DCT0	DCT, SAMA, PSL and TD if autoranging	I(616)	
MEASURE PIN # (SET TEST #)			
1, 2, 6, 10	PA, PPS, SAMA, DCT		
3, 4	PA, SAMA, DCT		
5, 7, 9	PA, PPS, SAMA, DCT		
MEASURE VARIABLE	SAMA	I(616)	0
PGEN LOAD	PG-PCNTR	D	
RD/WR ONE/ZERO/CHECK/NCHECK	PG-MIL	D	
SET APERIOD	SAMD, TR, SAMC (28 V swing)	I(507)	0
SET ATG	I(520-527		
DELAY	LRAX, PDV, PD, PWV, PW		
WIDTH	LRAX, PWV, PW		
SET ATG4	I(523)		0 *
DELAY	SAMD, PDV, PD, PWV, PW		
WIDTH	SAMD, PWV, PW		
SET BTG	I(550-557)		
DELAY	PDV, PD, PWV, PW, LRAX, PDV		
WIDTH	PWV, PW, LRAX, PWV, PW		
SET CLAMP	PSL (called SPSL in analysis)	D/I(624)	
SET CRO	LRAX, CRO	D	
SET Dn	LRAX, DIM, Dn	D	
SET DA	DA	D	2
SET DB	DB	D	2
SET DCT	PSL, DCT	D/I(652)	8
SET DELAY	TD	I(611)	0
SET DESKEW	FLEAD,FTRL,TGTE, IOS,LD	I	

Statement and Options	Registers Written	DMA/INTP	Time Delay Code
SET F	F	D	0
SET FC	F	D	0
SET FRCLKA/FRCLKB	LRAX,TIMA,SBP,TG	D/I(543)	
SET FI	SAMA, F	I(530)	0
SET In	DIM, In	D	
SET IFAIL	IF, SAMC	I(537)	0
COUNT	IF, LRAX, IF2, SAMC	I(540)	
SET INVERT	INVERT (W)	D	0
SET IOM3			
ON pin list	SAMD, SAMB, IOEN	I(535), D	0
OFF	SAMD, SAMB	I(535)	
SET IOM8			
ON pin list	SAMD, IOEN		
OFF	SAMD		
SET LOGIC	MR	I(640,641)	
SET M	MA	D	0
SET MAJOR			
Loop count	N	D/I(506)	0
Last address	L	D/I(504)	
SET MB	MB	D	0
SET MINOR			
Loop count	M	D/I(506)	0
Start and end	J, K	D/I(505)	
SET MUXMODE	MUX1, MUX2	D	
SET MM	LRAX, MM	D	
SET Mn	DIM, Mn	D	
SET PAGE	SAMB, SAMA, S, N, MCS, J, K, L, M, TR, F, DA, DB, MA, MG, IND, SAMD, LRAX, TIMA, SBP, TG1A-TG8B (16 sets), SCRAM, TR1-4	I(501)	0
	TR1-16, DRNK, DIM, D, I, M, SAMD	I(501)	0
SET PERIOD	TR, SAMC (28 V swing)	I(507)	0
SET PGEN1	PG-PS, PG-SIZE, PG-XSIZE	D	

Statement and Options	Registers Written	DMA/INTP	Time Delay Code
SET PGENA/PGENC/PGENCN/ PGEND/PGENDN	PG-PS	D	
SET PMU			
SENSE	PSL	I(607)	5
FORCEV	PPS, SR	4	
FORCEI	PPS, SR	4	
SET PPM	SAMD	I(534)	0
SET Q	LRAX, QL, Q, SAMD	I(533)	0
SET R	R	D	3
SET RZ	RZ	D	0
SET S1/S0/SA1/SA0	S1/S0/SA1/SA0, TD, SAMC, (28 V swing)	I(630,654)	7
SET S	S	D	1
SET SCRAM			
With DISABLE CHECKS	LRAX, TIMA, SCRAM	D	
Without DISABLE CHECKS	LRAX, TIMA, SCRAM, SBP	D,I(544)	
SET SI	SAMA, S	I(530)	0
SET START	S	D/I(502)	0
SET STOBE	ST	D	0
SET TG			
DELAY	PDV, PD, PWV, PW	I(510-517)	0
WIDTH	PWV, PW		
SET TEST #	PPS, PA	I(655)	
SET XOR	LRAX, XOR	D	
WRITE (register)	(register)	I(705)	0
XCON PIN	PPA	D	2
XCON VF1/VF2/VF3	DPT, DPS, SR	I(612)	6
XPMU PIN	PA	D	2
SET TVi	LRAX, TIMA, SBP, TG	D/I(543)	
SET PERIODi	LRAX, TIMA, SBP, TRn	D/I(542)	
SET TIMRNG	None		
SET PERIOD/APERIOD	LRAX, TIMA, SBP, TRn, SAMC (28 V swing)	I(507)	
SET TG DELAY/WIDTH	LRAX, TIMA, SBP, TG	I(510-517, 520-527, 550-557)	
SET TIMEOUT	None	I(610)	

TABLE 5.15 Time Delay Code Explanation

Time Delay Code	Description
0	No delay
1	0.28 ms
2	0.56 ms
3	1.75 ms
4	Programmed dc time delay or 0.56 ms with no current range change or 4 ms (+1 ms) with current range change, whichever is greater
5	0.56 ms with no current range change or 4 ms with current range change
6	Programmed dc time delay or 5.37 ms, whichever is greater
7	Approximately 300 us/V of change or 0.56 ms, whichever is greater
8	56 us
9	Programmed dc time delay
10	The time required for the tester to become not busy

INTERNAL NODE MEASUREMENT

Internal nodes are listed in TABLE 5.16. The PMU must be programmed to force zero current in range 2 before the PMU is connected to any internal node, including the load current nodes (143 to 145). The voltage sensing range and the limit are programmed according to the expected value.

On Series 20 and Sentry 21 systems, load currents are proportional to the voltage drop across an internally connected resistor chosen so that the full-scale measurement value is 1.023 V. If the power supply is in range 3, 1 mV of voltage drop corresponds to 1 ma of load current. If the power supply is in range 2, 1 mV of voltage drop corresponds to 0.1 mA of load current.

On Series 10 systems, load currents are proportional to the voltage drop across an internally connected resistor. For DPS1, DPS2, and DPS3, the resistor is chosen so that 5 mV of voltage corresponds to 1 mA of load current. For DPS4 and DPS5, 1 mV of voltage drop corresponds to 1 mA of load current.

When load currents are measured, the measured voltage is converted automatically into the corresponding current value by the FACTOR "MEASURE NODE" statement.

TABLE 5.16 Internal Node Measurement

Node Number Decimal	Octal	Name	Measured Parameter Description
128	200B	S1	Comparator S1 reference voltage
129	201B	S0	Comparator S0 reference voltage
130	202B	E1	Forcing level E1 reference voltage
131	203B	E0	Forcing level E0 reference voltage
132	204B	EA1	Forcing level EA1 reference voltage
133	205B	EA0	Forcing level EA0 reference voltage
134	206B	EB1	Forcing level EB1 reference voltage
135	207B	EB0	Forcing level EB0 reference voltage
136	210B	EC1	Forcing level EC1 reference voltage
137	211B	EC0	Forcing level EC0 reference voltage
138	212B	SA1	Comparator SA1 reference voltage
139	213B	SA0	Comparator SA0 reference voltage
140	214B	VF1	Voltage forcing unit 1 output voltage
141	215B	VF2	Voltage forcing unit 2 output voltage
142	216B	VF3	Voltage forcing unit 3 output voltage
143	217B	TRIP1	VF1 load current
144	220B	TRIP2	VF2 load current
145	221B	TRIP3	VF3 load current
146	222B	VF4	Voltage forcing unit 4 output voltage (S10/120)
147	223B	TRIP4	VF4 load current (S10/120)
148	224B	VF5	Voltage forcing unit 5 output voltage (S10/120)
149	225B	TRIP5	VF5 load current (S10/120)
150	226B	VF6	Reserved for voltage forcing unit 6 output voltage
151	227B	TRIP6	Reserved for VF6 load current

COMPILER ERROR MESSAGES

The error messages issued by te compiler are generally self-explanatory. They are listed in TABLE 5.17, with some comment for clarification. The error messages are accompanied by an up-arrow, ' ↑ ', where appropriate, to indicate the position in the statement text where the error was detected. Two parentheses or brackets may be used in the text of the error messages, since a single symbol might be obliterated by the up-arrow and make the messages illegible. The total number of errors is output to the POD at the end of compilation.

TABLE 5.17 FACTOR Error Messages Descriptions

Text	Description
(#) UNMATCHED IFC-BEGIN STATEMENTS	At the end of a compile, the number of unmatched BEGIN/END; statements are totaled, indicating incorrect programming procedure.
UNMATCHED BEGIN/END LABEL	END, ENDM, and ENDC are checked for labels that correspond to BEGIN, MACRO, IFC, SUBR, and FUNCT labels. Error messages indicates a mismatch.
ADDRESS OUT OF RANGE	Greater than local memory determined by SET PAGE statement.
COMMAND ERROR	Syntax error in compile command line.
COMPILER GENERATED "ENABLE TEST"	Number of SET F statements comprising a local memory load has exceeded local memory size defined by the SET PAGE statement. Compiler has generated code for an ENABLE TEST statement.
END OF FILE INPUT	Input file exhausted without finding an END; statement.
ERROR IN PARM	Error in command syntax.
EXCESS BLOCK--STOP OBJ	Allowable maximum number of nested blocks has been exceeded. Blocks may be nested to a depth of eight (including block 0).

TABLE 5.17 FACTOR Error Messages Descriptions (Continued)

Text	Description
EXCESS VARIABLES STOP	Allowable maximum number of variables per block has been exceeded, or too many parameters in an EXEC statement. (Maximum number of variables per block is 1019, except in block 0, which is 958. Maximum number of parameters in an EXEC statement is 63.)
EXPRESSION SYNTAX	Expression written incorrectly.
FATAL ERROR. CIRCULAR EXPANSION	Endless loop encountered in a macro expansion. (That is, macro A invokes macro B, which invokes macro A, etc.)
ILLEGAL WITH HS - THD	Statement not allowed if SET PAGE, HS statement is programmed.
ILLEGAL WITH SPM	Statement is illegal if SET PAGE, SPM statement is programmed.
INPUT FILETYPE ERROR IN MODULE: name	Input module is not OM datakind.
INSERT FILE NOT FOUND	Incorrect file used with INSERT statement.
INSUFFICIENT SPACE FOR OBJ FILE	Not enough space on disk for the data file to be built up in working storage.
INVALID OR CONFLICTING FILE/DEVICE SPECIFICATION	Illogical or inconsistent file or device in command line.
INVALID ON system configuration	Statement not allowed on this machine type.
INVALID PIN	Inappropriate pin number for this statement.
INVALID SOURCE FILE DATAKIND	Any datakind other than string file is invalid.
INVALID TERMINATOR	Expected terminator or delimiter incorrectly specified or missing.
I/O DEVICE ERROR	Invalid peripheral specified in a READ or WRITE statement.

TABLE 5.17 FACTOR Error Messages Descriptions (Continued)

Text	Description
I/O SPECIAL ERROR	Format used for READ or WRITE statement is incorrect.
LOAD ADDRESS NOT DEFINED	Missing this argument.
LOCAL MEMORY NOT LOADED	No last local memory address defined. (That is, no SET F statements appear before the ENABLE TEST statement.)
LOCAL MEMORY SIZE EXCEEDED	Maximum 4096 words of local memory available.
MACRO SOURCE ILLEGAL, ABORT	Macro definition not resident in a DIF.
MISSING]]	Left or right bracket left out.
MISSING))	Left or right parenthesis left out.
MISSING LEND	LSUBR statement needs LEND.
MISSING NAME	Identifier should have been specified in this syntactical position.
MISSING NUMBER	A number should have been specified.
MIXED TIMING STATEMENTS	Mixing Series 20/Sentry 21 and non-Series 20/Sentry 21 timing statements.
module name CONFIG ERROR: configuration	Hardware configuration specified in main module is in conflict with external module.
name FILE NOT FOUND IN JOB jobname OR SYSTEM JOB	External file not found in named job or system job.
NON-FATAL ERROR. DUPL. MACRO DEF, IGNORED	Same macro already defined; this duplicate is ignored.
NO SET PAGE	Statement is illegal if SET PAGE statement is not programmed.
NO SOURCE SPECIFIED	Source of file not specified.
NUMBER EXCEEDS LIMIT	Number used is greater than 16 bits (177777B).

TABLE 5.17 FACTOR Error Messages Descriptions (Continued)

Text	Description
NUMBER OUT OF RANGE	Value specified exceeds limit of the range used in the tester instruction.
NUMBER SYNTAX	Number specified incorrectly.
OBJECT FILE SIZE EXCEEDS 64K, CURRENT MODULE IS name	TP program object size over 64K while processing the named module
OBJ PROGRAM TOO LARGE TO EXECUTE	Object code generated exceeds 777777B.
PIN MISSNG	No pin list with CGEN TGX statement.
REQUIRES SENTRY 8	This statemet is illegal unless compiling on a Sentry VIII system or the option S8 is specified in the COMPILE command.
REQUIRES SPM	Statement not allowed unless SET PAGE, SPM statement is programmed.
RESERVED WORD USE ERROR	Reserved word used in place of an identifier.
SEQUENCE ERROR	A warning message. The sequence numbers punched in columns 73 to 80 of the source card deck are out of order.
SET PAGE ERROR	More than one SET PAGE statement appears in the program, or it is preceded by something other than PGMID or REM, or a CHAIN mode has been selected that is not compatible with the page size.
STACK OVERFLOW	Space in memory exceeded due to quantity of symbols or noise words in work area.
START ADDRESS NOT DEFINED	Missing this argument.
STATEMENT SYNTAX	Statement incorrectly written.
SYMBOL SUMMARY:	
UNDEFINED =	Total number of linkage errors undefined (fatal)
NOT USED =	Total number of linkage errors not used (non-fatal).

TABLE 5.17 FACTOR Error Messages Descriptions (Continued)

Text	Description
TOO MANY CHARACTERS	Number of characters in the argument string exceeds 72.
TOO MANY PINS	Number of pins exceeds 12.
USE ERROR--DEFINED usage	Incorrect use of variables, when usage is: • SCALAR for simple variable • FOR PAR for argument in CALL or FUNCT statement • ARRAY for array variable • FUNCT for function • SUBR for subroutine • LABEL for statement label • LM LABEL for local memory label
variable name ALREADY DEFINED	A duplicate definition of a variable within the same block.
xx-USE ERROR-NOT DECLARED	A variable used in an external module is not explicitly declared as a formal parameter or in a DCL statement.
WARNING - LOG IGNORED	LOG specified in MEASURE PIN instruction is ignored since it is a DMA instruction.
WARNING - NO STATEMENT INSIDE FOR LOOP	'FOR' loop contains no statement.
WARNING - STMT COUNTER OVERFLOW	Program exceeds 77777B statements.

TABLE 5.18 FORMAT Specification Elements

Element	Description
+	Used at the first token in a specification field in order to continue READ operation from the previous record; used as the last token in order to suppress a linefeed/carriage return when writing to the VKT.
C	Clears the VKT screen.
(n)X	Specifies skipping of n positions on input or inserting of n spaces on output.
(r)	Optional repeat count; specifies the number of times an element or group is to be used.
(r)/	Specifies the end of a record during input or output operations, or the end of a line to be printed during output; also used to skip r-1 records or lines.
(r)%(n)	Specifies input or output of hexadecimal integers; n is the number of characters, including the sign, represented in a field (n=7 is the default condition).
(r)A(n)	Specifies input or output of alphanumeric literals; n specifies the actual number of characters in a field (n=4 is the default condition).
(r)B(n)	Specifies input or output of octal integers; n is the number of characters, including the sign, represented in a field (n=7 is the default condition).
(r)F	Specifies input or output of floating-point numbers in decimal or exponential notation. The input field size and output field size are both fixed at 10 characters.
(r)I(n)	Specifies input or output of decimal integers; n is the number of characters, including the sign, represented in a field (n=7 is the default condition.
(r)P	Forces a top-of-form if the output device is a printer.
r'string'	Specifies that an output field is to contain the exact number of characters appearing within the single quotes.

TABLE 5.18 FORMAT Specification Elements (continued)

Element	Description
(r)U	Specifies input of floating-point numbers in decimal or exponential notation or output of values expressed in engineering notation. The input field size is fixed at 10 characters.
Tc	Specifies skipping to column c, which sets up the start of a field for input or output; the specifier c is mandatory (c = 1 denotes the first location on a record or line where 1 c 132).

6 FST-2 COMPUTER

Assembly Language Programs:

The following assembler directives, contained within the assembly language program, allows the operator to describe or select assembly options; define grous of data, character strings or storage areas; specify symbol values; or assign location values.

Assembler Directives

ABS

Indicates the object program is not to be relocated when loaded (i.e. assembly and execution address are the same). Must occur in source before any object code is produced.

(label) BSS expression

Saves a block of storage N words in size.

label	References the first word of the block.
expression	Must be reducible to an absolute value; cannot contain any forward reference.

(label) CALL (symbol)

Generates a BSM instruction and allows the CREATE procedure to link the BSM to the PROC whose label is the same as the symbol of the CALL.

label	Assigned current value of the location counter.

(label) DATA expression (,...,expression n)

Enters constants and data into the program. Each expression in the operand generates a 24-bit binary value.

label — References the first operand expression.

END

Indicates end of the source program has been reached.

label EQU (expression),(expression)

Assigns value to symbols. No object code is generated.

label — Assigned the value of the first operand expression.

second expression — Defines opcode and operand format as follows:

Bits	Meaning	
0 to 2	Operand Type	
	0	User operand expressions are ORed with opcode value
	1	(address)
	2	(address),(index)
	3	(index)
	4	(index),(address)
	5	(indicator/state),(address)
	6	(state) ....,(state)
3	0	Not Augmented
	1	Augmented
4 to 5	Opcode Type	
	1	No Operand Required
	2	Operand Required
6	0	No Indirection allowed
	1	Indirection allowed
8	0	No Memory Reference
	1	Memory Reference

LIST/NOLIST

Controls which portions of the program produce an assembly listing.

OBJ expression

Specifies the maximum number of expressions to be placed in each object record.

number 1 to 14 (default = 7)

(label) ORG expression

Sets the value of the current location counter to the value of the expression.

label Assigned value of the location counter before counter is assigned its new value.

special expression *
Forces location counter to an even location for double precision operands.

PAGE

Forces a top-of-form; i.e., the PAGE record will be the first line listed on the next page.

(label) PROC (expression)

Assigns the value of the current location counter to the symbol in the label field and allows the CREATE procedures to link the BSMs generated by CALL's to the symbols defined by PROC.

expression If present and not zero, its value (mut be less than 64) is an interrupted entry address that CREATE will use to link the interrupt to the PROC.

(label) PZE 0

Forces a word of zeroes in the output.

REL

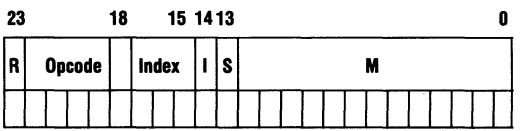
Indicates all relocatable memory reference instructions will have bit 23 set to 1 unless ABS is specified. Must appear before any instruction.

(label) TEXT 'character string ....'

Allows the program to define a literal character string (e.g. informative comments, operating instructions, error messages). Each 4 characters (maximum 64) generates one word.

string Must begin and end with single quote: Any character in TABLE 6.2 (except single quote) allowed.

FST-2 INSTRUCTION SET
Memory reference Instructions



R	Relocation field to specify absolute (0) or relocatable (1)
Opcode	Operand code field
Index	Index field
I	Direct (0) or indirect (1) address field
S	Sign field to specify positive (0) or negative (1) indexing
M	Memory field of instruction

Arithmetic Instructions

		Op	Equation
ADD	Addition	20	(A) + (Me)→A
SUB	Subtraction	22	(A) − (Me)→A
DADD	Double Addition	30	(A,E) + (Me,Me + 1)→A,E
DSUB	Double Subtraction	32	(A,E) − (Me,ME + 1)→ A,E
MUL	Multiply	34	(Me)*(A)→ A,E
DIV	Division	35	(A,E)/(Me)→ E, Remainder→ A
AOM	Add One to Memory	36	(Me) + 1→ Me
SOM	Subtract One from Memory	37	(Me) − 1→ Me

Data Transfer

		OP	Equation
STA	Store A	14	(A)→ Me
STE	Store E	15	(E)→ Me
LDA	Load A	24	(Me)→ A
LDE	Load E	25	(Me)→ E
DLD	Double Load A,E	31	(Me,Me + 1)→ A,E
DST	Double Store A,E	33	(A,E)→ Me, Me + 1

Index Instructions

		OP	Equation
LDX	Load Index	05	Me→ Xn
ATX	Add to Index	11	Me + (Xn)→ Xn
STX	Store Index	16	(Xn)→Me

Logical Instructions

		OP	Equation
RUM	Replace Under Mask	17	[(Me) AND (E)] EOR [(A) AND (E)]→A
EOR	Exclusive OR	21	(A) EOR (Me)→A
AND	Logical AND	26	(A) AND (Me)→A
OR	Logical OR	27	(A) OR (Me)→A
NOP	No Operation	10	No Operation

Compare Instruction

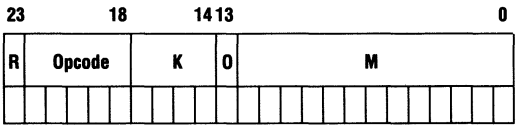
		OP	Equation
CAM	Compare A with Memory	23	(A) is compared with (ME) GT indicator set if (A) ≥ (Me) EQ indicator set if (A) = (Me) LT indicator set if (A) ≤ (Me) BE set if any corresponding bit positions of both A and Me contain a one.

Unconditional Branch/Branch Store Instructions

		OP	Equation
BAH	Branch after Halt	00	Halt and Branch to Me when CPU START is pressed
BRU	Branch Unconditionally	01	Branch Unconditionally to Me
BSM	Branch Store Return at M	12	Branch to Me + 1, Store Return at Me; store (>), (=), (<), (B), (Ov) in Me bits 22-18 respectively.

Conditional Branch/Branch Instructions

Format:



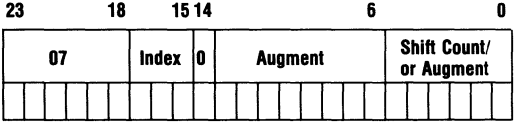
K = Condition

		Op	Equation
BAT	Branch A register Test	02	Branch to M on A Register Test
BP	Branch Positive		K = 1000
BPZ	Branch Positive or Zero		K = 1100
BZ	Branch Zero		K = 0100
BNZ	Branch Negative or Zero		K = 0110
BN	Branch Negative		K = 0010
BNEZ	Branch Not Equal to Zero		K = 1010
BO	Branch Odd		K = 0001
BIO	Branch on Indicator	03	Branch to M if Tested Indicator(s) Set
BG	Branch Greater		K = 1000
BGE	Branch Greater or Equal		K = 1100
BE	Branch Equal		K = 0100
BLE	Branch Less Than or Equal		K = 0110
BL	Branch Less Than		K = 0010
BNE	Branch Not Equal		K = 1010
BBC	Branch Bit Compare		K = 0001

BOS	Branch on State	04	Branch to M if State K Set
	K State Tested	K	State Tested
	0 Switch Flip-Flop 0	10	Interrupt Enable IE
	1 Switch Flip-Flop 1	11	Overflow indicator OV (reset after test)
	2 Switch Flip-Flop 2	12	Console Switch CS0
	3 Switch Flip-Flop 3	13	Console Switch CS1
	4 Switch Flip-Flop 4	14	Console Switch CS2
	5 Switch Flip-Flop 5	15	Console Switch CS3
	6 Switch Flip-Flop 6	16	Console Switch CS4
	7 Switch Flip-Flop 7	17	Console Switch CS5

Augmented Instructions

Format:



Arithmetic Instructions

		Opcode	Equation
TCA	Two's Complement	07002000	Two's Complement of (A)→ A
DTC	Double Two's Complemen	07014000	Two's Complement of (A,E)→ A,E

Data Transfer Instructions

		Opcode	Equation
RSR	Read Switch Register	07006000	(W)→A
EXC	Exchange A,E	07010000	(A)→E, (E)→A
LRA	Load RR from A	07000400	(A)→RR
LAR	Load A from RR	07000600	(RR)→A
CLA	Clear A	07000604	0→A

Index Instructions

		Opcode	Equation
LXA	Load Index from A	07000000	(A)→Xn
LAX	Load A from Index	07000200	(Xn)→A

Shift Instructions
Timing Equation: T = 2 + [(Je-9)/5] integer cycles

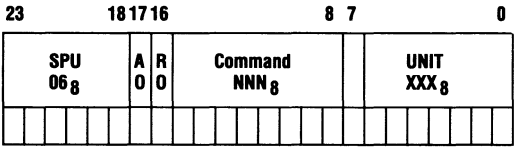
		Opcode	Equation
DSN	Double Shift Normalize	07016000	Normalize A and E
SR	Shift Right	07020000	Shift (A) Right Arithmetical
LS	Logical Shift	07022000	Shift (A) Right Logical
SA	Shift Around	07024000	Shift (A) Left Around
SL	Shift Left	07026000	Shift (A) Left End Off
DSR	Double Shift Right	07030000	Shift A,E Right Arithmetical
LDS	Logical Double Shift	07032000	Logical Shift A,E Right
DSA	Double Shift Around	07034000	Shift A,E Around Left
DSL	Double Shift Left	07036000	Shift A,E Left

State Control Instructions

		Opcode	Equation
SST	Set State	07004000	Set States Defined by C
RST	Reset State	07012000	Reset States Defined by C

Operand Address Bit	State F-F Affected	Operand Address Bit	State F-F Affected
OP0	SW0	OP5	SW5
OP1	SW1	OP6	SW6
OP2	SW2	OP7	SW7
OP3	SW3	OP8	IEN
OP4	SW4	OP9	OV
		OP14	PD

I/O Instructions
Format:



A=1 Accumulator Transfer.
R=1 Transfer from peripheral unit to Accumulator.
R=0 Transfer from ccumulator to peripheral unit.

		Opcode	Equation
SPU	Select Peripheral Unit	060000000	Select Peripheral Unit "U"

Multiply Device Instructions

Instruction	Opcode	Description	Devices
STST	060000XX	Status Test	All
ETST	060100XX	Error Test	Fixed Disk, Card Reader, Disk, Tape
RDS	066114XX	Read Status	VKT, Card Reader, Disk, Tape
PON	060130XX	Enable Interrupt	All
POFF	060110XX	Disable Interrupt	All
PCOMP	060010XX	Interrupt Complete	All
Specific Device Instructions			
VK1, VK2	0660142X	Read VK1 or VK2	
RD	0602042X	Feed paper tape	
VP1, VP2			
WRIT	0642143X	Write to VP1 or VP2	
CR			
RD	06401440	Read Card Binary	
RD	06403440	Read Card BCD	
LP			
WRIT	06421460	Write to line printer	

DISK

RD	06401470	Read from disk
ARD	06403470	Alternate read from disk (Parity Test)
ARDS	06613470	Alternate read status from disk (TASA)
WRIT	06421470	Write disk

MAGNETIC TAPE

RDT	0650140X	Read from tape
ART	0640150X	Alternate read from tape (Parity Test)
RSKIPF	0600150X	Skip record forward
RSKIPB	0601150X	Skip record backward
FSKIPF	0604150X	Skip file forward (advance past next tape mark)
FSKIPB	0605150X	Skip file backward (backspace to next tape mark or BOT)
WRIT	0642150X	Write tape
SKWR	0646150X	Skip and Write
WRITM	0606150X	Write Tape Mark
REWIND	0600050X	Rewind tape
REWC	0661170X	Read Excess Word Count

TESTER

RD	066XX120	Read
WRIT	064XX120	Write
SPECIAL	062XX120	Special
NOOP	060XX120	No Operation

COMM LINK

WDTD	0650013X	Write to Comm Link
RDTD	0670013X	Read from Comm Link
WDTC	0644013X	Write control function
LDTS	0601213X	Latch UART status
RDTS	0664013X	Read UART status
RDSS	0660413X	Read RS232 status
RSTI	0601013X	Reset interface
LOTB	0602013X	Control function load
RDSQ	0650053X	Read sequence register
SPAR	0602113X	Spare

IEEE-488 bus

SRE	0600214X	Send Remote Enable
RRE	0600314X	Reset Remote Enable
GTS	0600414X	Go to Standby
SIC	0600514X	Send Interface Clear
RPP	0600614X	Request Parallel Poll
TCON	0601014X	Take Control
RDD	0660154X	Read data
WRIT	0642154X	Write data
BCOM	0643154X	Bus command
LTN	0601600X	Local listen

Peripheral Device Characteristics

Peripheral Device	Unit Address	Interrupt Priority 1 is Lowest	Interrupt Address	Memory Priority 1 is Highest
VKT Keybd (VK1/2)	020/21	1	02	--
VKT Printer (VP1/2)	030/31	2	02	--
Card Reader (CR)	040	5	04	5
Line Printer (LP)	060	3	06	--
Disk (fixed)	070	8	07	12
Mag Tape (MTx)	10X	7	10	8
Tester	120	9	12 to 21	1
Comm Link	13X	11	30 to 37	--
488 Bus	14X	6	40 to 43	--
Status bit return (except ETST):			20 BE	Not available
			21 LT	Busy
			22 EQ	Idle with error
			23 GT	Idle no error

TABLE 6-1 CR Controller Code Conversions

Octal TRASCII	7-Bit ASCII	ALPHA	HOLLERITH	System Character	029 Equiv.
00	040	20	NO PUNCH	SPACE	
01	041	00	11-8-2		
02	042	17	8-7	"	
03	043	13	8-3		
04	044	53	11-8-3	$	
05	045	34	0-8-4	%	
06	046	60	12		
07	047	15	8-5	'	
10	050	75	12-8-5	(	
11	051	55	11-8-5	)	
12	052	54	11-8-4	*	
13	053	76	12-8-6	+	
14	054	33	0-8-3	,	
15	055	40	11	– (Minus)	
16	056	73	12-8-3	.	
17	057	21	0-1	/	
20	060	12	0	0	
21	061	01	1	1	
22	062	02	2	2	
23	063	03	3	3	
24	064	04	4	4	
25	065	05	5	5	
26	066	06	6	6	
27	067	07	7	7	
30	070	10	8	8	

TABLE 6-1 CR Controller Code Conversions (continued)

Octal TRASCII	7-Bit ASCII	ALPHA	HOLLERITH	System Character	029 Equiv.
31	071	11	9	9	
32	072	32	0-8-2	:	0-8-2
33	073	56	11-8-6	;	
34	074	72	12-0	<	12-0
35	075	16	8-6	=	
36	076	52	11-0	>	11-0
37	077	37	0-8-7	?	
40	100	14	8-4	@	
41	101	61	12-1	A	
42	102	62	12-2	B	
43	103	63	12-3	C	
44	104	64	12-4	D	
45	105	65	12-5	E	
46	106	66	12-6	F	
47	107	67	12-7	G	
50	110	70	12-8	H	
51	111	71	12-9	I	
52	112	41	11-1	J	
53	113	42	11-2	K	
54	114	43	11-3	L	
55	115	44	11-4	M	
56	116	45	11-5	N	
57	117	46	11-6	O	
60	120	47	11-7	P	
61	121	50	11-8	Q	
62	122	51	11-9	R	
63	123	22	0-2	S	
64	124	23	0-3	T	
65	125	24	0-4	U	
66	126	25	0-5	V	
67	127	26	0-6	W	
70	130	27	0-7	X	
71	131	30	0-8	Y	
72	132	31	0-9	Z	
73	133	74	12-8-4	[	
74	134	57	11-8-7	/	
75	135	36	0-8-6	]	
76	136	77	12-8-7	↑	
77	137	35	0-8-5	←	

All other hole punch combinations are illegal in the Read Alpha mode and will be flagged by "Validity Error, S11".

TABLE 6-2 OPCODES (Alpha Sort)

OPCODE	Mnemonic	Code Description	Cycles
	ABS	Absolute Program Locator	
*20000000	ADD	Add	2
*26000000	AND	Logical AND	2
*36000000	AOM	Add One to Memory	4
064034XX	ARD	Alternate Read	1
066134XX	ARDS	Alternate Read Status	1
06422400	ASPAC	Alternate Space	1
06401500	ART	Alternate Read Record Tape	1
*11000000	ATX	Add To Index	2
07000000	AUG	Augment	
06423400	AWRIT	Alternate Write	1
*00000000	BAH	Branch After Halt	1
*02000000	BAT	Branch On A-Register Test	1
*03040000	BBC	Branch Bit Compare	1
*03200000	BE	Branch If Equal	1
*03400000	BG	Branch If Greater	1
*03600000	BGE	Branch If Greater Or Equal	1
*03100000	BL	Branch If Less	1
*03300000	BLE	Branch If Less Or Equal	1
*02100000	BN	Branch If Negative	1
*03500000	BNE	Branch Not Equal	1
*02500000	BNEZ	Branch If Not Equal To Zero	1
*02300000	BNZ	Branch If Negative Or Zero	1
*02040000	BO	Branch If Odd	1
*03000000	BOI	Branch On Indicator	1
*04000000	BOS	Branch On State	1
*04440000	BOV	Branch On Overflow	1
*02400000	BP	Branch If Positive	1
*02600000	BPZ	Branch If Positive Or Zero	1
*01000000	BRU	Branch Unconditional	1
*12000000	BSM	Branch Store Return At M	2
	BSS	Block Storage Size	
*02200000	BZ	Branch If Zero	1
12000000	CALL	Subroutine Call	
*23000000	CAM	Compare A With Memory	2
07000604	CLA	Clear Accumulator	1
*30000000	DADD	Double Add	3
*	DATA	Data Definition	
*35000000	DIV	Divide	26
*31000000	DLD	Double Load	3
07034000	DSA	Double Shift Around	
07036000	DSL	Double Shift Left	
07016000	DSN	Double Shift Normalized	
07030000	DSR	Double Shift Right	
*33000000	DST	Double Store	3
*32000000	DSUB	Double Subtract	3

TABLE 6-2 OPCODES (Alpha Sort) (Continued)

OPCODE	Mnemonic	Code Description	Cycles
07014000	DTC	Double Two's Complement	2
	END	Program Terminator	
*21000000	EOR	Exclusive OR	2
	EQU	Equivalence	
060100XX	ETST	Error Test	1
07010000	EXC	Exchange A And E	1
06051500	FSKIPB	Skip File Backward (Go Back To Tape Mark)	1
06041500	FSKIPF	Skip File Forward (Advance to (Tape Mark)	1
07012400	IDA	Interrupt Disable	1
07004400	IEN	Interrupt Enable	1
07000600	LAR	Load A From Relocation Register	1
07000200	LAX	Load A From Index	1
*24000000	LDA	Load A-Register	2
*25000000	LDE	Load E-Register	2
070320000	LDS	Logical Double Shift	
*050000000	LDX	Load Index	1
	LIST	Produce Assembly Listing	
07000400	LRA	Load Relocation Register From A	1
07022000	LS	Logical Shift A	
07000000	LXA	Load Index From A	1
*34000000	MUL	Multiply	25
	NOLIST	No Assembly Listing	
*10000000	NOP	No Operation	1
	OBJ	Produce Object Program	
*27000000	OR	OR(Inclusive)	2
	ORG	Origination Control	
	PAGE	Pagination Control	
060010XX	PCOMP	Priority Complete	1
060110XX	POFF	Priority Off (Interrupt Disable)	1
060130XX	PON	Priority On (Interrupt Enable)	1
00000000	PROC	Subroutine Entry Point	
00000000	PZE	Positive Zero (Entry Point)	
064014XX	RD	Read	1
066114XX	RDS	Read Status	1
06501500	RDT	Read (Magnetic) Tape	1
06601400	RDTT	Read Teletype	1
06611700	REWC	Read Excess Word Count	1
06000500	REWIND	Rewind Tape	1
06011500	RSKIPB	Skip Record Backward	1
06001500	RSKIPF	Skip Record Forward	1
07006000	RSR	Read Switch Register	1
07012000	RST	Reset State	1
*17000000	RUM	Replace Under Mask	2
07024000	SA	Shift A Around Left	

TABLE 6-2 OPCODES (Alpha Sort) (Continued)

OPCODE	Mnemonc	Code Description	Cycles
06461500	SKWR	Skip And Write	1
07026000	SL	Shift A Left	
*37000000	SOM	Subtract One From Memory	4
06420400	SPAC	Space	1
06000000	SPU	Select Peripheral Unit	1
07020000	SR	Shift A Right	
07004000	SST	Set State	1
*14000000	STA	Store A-Register	2
*15000000	STE	Store E-Register	2
07000611	STM1	Set FST-1 Mode	1
07000612	STM2	Set FST-2 Mode	1
060000XX	STST	Status Test	1
*16000000	STX	Store Index	2
*22000000	SUB	Subtract	2
07002000	TCA	Two's Complement A	1
06000400	TOF	Top-Of-Form	1
064214XX	WRIT	Write	1
06061500	WRITM	Write Tape Mark	1

*B23 = 0 for Absolute Memory Reference of Non-REL Program
= 1 for Relocaton Memory Reference with REL Program

TABLE 6-3 OPCODES (Octal Sort)

OPCODE	Mnemonic	Code Description	Cycles
	ABS	Absolute Program Locator	
00000000	BSS	Block Storage Size	
*00000000	DATA	Data Definition	
00000000	END	Program Terminator	
	EQU	Equivalence	
	LIST	Produce Assembly Listing	
	NOLIST	No Assembly Listing	
	OBJ	Specify Object Program Size	
	ORG	Origination Control	
	PAGE	Pagination Control	
*00000000	BAH	Branch After Halt	1
00000000	PROC	Subroutine Entry Point	
00000000	PZE	Positive Zero (Entry Point)	
*01000000	BRU	Branch Unconditional	1
*02000000	BAT	Branch On A-Register Test	1
*02040000	BO	Branch If Odd	1
*02100000	BN	Branch If Negative	1

TABLE 6-3 OPCODES (Octal Sort) (Continued)

OPCODE	Mnemonic	Code Description	Cycles
*02200000	BZ	Branch If Zero	1
*02300000	BNZ	Branch If Negative Or Zero	1
*02400000	BP	Branch If Positive	1
*02500000	BNEZ	Branch If Not Equal To Zero	1
*02600000	BPZ	Branch If Positive Or Zero	1
*03000000	BOI	Branch On Indicator	1
*03040000	BBC	Branch Bit Compare	1
*03100000	BL	Branch If Less	1
*03200000	BE	Branch If Equal	1
*03300000	BLE	Branch If Less Or Equal	1
*03400000	BG	Branch If Greater	1
*03500000	BNE	Branch Not Equal	1
*03600000	BGE	Branch If Greater Or Equal	1
*40000000	BOS	Branch On State	1
*04400000	BOV	Branch On Overflow	1
*05000000	LDX	Load Index	1
06000000	SPU	Select Peripheral Unit	1
060000XX	STST	Status Test	1
06000400	TOF	Top-Of-Form	1
06000500	REWIND	Rewind Tape	1
060010XX	PCOMP	Priority Complete	1
06001500	RSKIPF	Skip Record Forward	1
060100XX	ETST	Error Test	1
060110XX	POFF	Priority Off (Interrupt Disable)	1
06011500	RSKIPB	Skip Record Backward	1
060130XX	PON	Priority On (Interrupt Enable)	1
06020400	FEED	Character (Paper Tape) Feed	1
06041500	FSKIPF	Skip File Forward (Advance To Tape Mark)	1
06051500	FSKIPB	Skip File Backward (Go Back To Tape Mark)	1
06061500	WRITM	Write Tape Mark	1
064014XX	RD	Read	1
06401500	ART	Alternate Read Record Tape	1
064034XX	ARD	Alternate Read	1
06420400	SPAC	Space	1
064214XX	WRIT	Write	1
06422400	ASPAC	Alternate Space	1
06423400	AWRIT	Alternate Write	1
06461500	SKWR	Skip And Write	1
06501500	RDT	Read (Magnetic) Tape	1
06601400	RDTT	Read Teletype	1

TABLE 6-3 OPCODES (Octal Sort) (Continued)

OPCODE	Mnemonic	Code Description	Cycles
066114XX	RDS	Read Status	1
06611700	REWC	Read Excess Word Count	1
06613400	ARDS	Alternate Read Status	1
07000000	AUG	Augment	
07000000	LXA	Load Index From A	1
07000200	LAX	Load A From Index	1
07000400	LRA	Load Relocation Register From A	1
07000600	LAR	Load A From Relocation Register	1
07000604	CLA	Clear Accumulator	1
07000611	STM1	Set FST-1 Mode	1
07000612	STM2	Set FST-2 Mode	1
07002000	TCA	Two's Complement A	1
07004000	SST	Set State	1
07004400	IEN	Interrupt Enable	1
07006000	RSR	Read Switch Register	1
07010000	EXC	Exchange A and E	1
07012000	RST	Reset State	1
07012400	IDA	Interrupt Disable	1
07014000	DTC	Double Two's Complement	2
07016000	DSN	Double Shift Normalized	
07020000	SR	Shift A Right	
07022000	LS	Logical Shift A	
07024000	SA	Shift A Around Left	
07026000	SL	Shift A Left	
07030000	DSR	Double Shift Right	
07032000	LDS	Logical Double Shift	
07034000	DSA	Double Shift Around	
07036000	DSL	Double Shift Left	
*10000000	NOP	No Operation	1
*11000000	ATX	Add To Index	2
*12000000	BSM	Branch Store Return At M	2
12000000	CALL	Subroutine Call	
*14000000	STA	Store A-Register	2
*15000000	STE	Store E-Register	2
*16000000	STX	Store Index	2
*17000000	RUM	Replace Under Mask	2
*20000000	ADD	Add	2
*21000000	EOR	Exclusive OR	2
*22000000	SUB	Subtract	2

TABLE 6-3 OPCODES (Octal Sort) (Continued)

OPCODE	Mnemonic	Code Description	Cycles
*23000000	CAM	Compare A With Memory	2
*24000000	LDA	Load A-Register	2
*25000000	LDE	Load E-Register	2
*26000000	AND	Logical AND	2
*270000000	OR	OR (Inclusive)	2
*30000000	DADD	Double Add	3
*31000000	DLD	Double Load	3
*32000000	DSUB	Double Subtract	3
*33000000	DST	Double Strobe	3
*35000000	MUL	Multiply	25
*35000000	DIV	Divide	26
*36000000	AOM	Add One To Memory	4
*37000000	SOM	Subtract One From Memory	4

*Bit 23 = 0 for Absolute Reference of non-REL Program
= 1 for Relocation Memory Reference with REL Directive

A M³ COMMAND ERRORS

(job) 'filename' datakind LOADED

The indicated file has been loaded to the DFRD.

(job) - 'filename' - FILE ALREADY EXISTS DELETE OLD? Y/N =

A duplicate filename has been encountered.

(job) - 'filename' NOT FOUND

The job and/or filename indicated could not be found in the tape directory. FETCH proceeds to load any remaining files specified.

????

This will be output in place of the FACTOR statement if an unrecognizable opcode is found by TPEDIT.

#NOSHOW I/O ERROR

An error occurred while writing to the COD.

A FILE ALREADY OPEN

Only one file per command stream can be opened by #OPEN. If a file is already open, it will not open another unless you close the open file first.

A SYNFIL ALREADY ATTACHED

If already attached, the current syntax file must be detached before attaching a new one.

ADDR NOT FOUND IN TOPO RAM

The TOPO parameter was specified but the topological scrambler was not properly programmed. Some device addresses not specified.

ALREADY 1V/1MV

Attempt to convert a test program that is already 1V/1MV.

ALREADY 2V/2MV

Attempt to convert a test program that is already 2V/2MV.

ALREADY OPEN

A file is open for this device.

ALREADY OPEN FOR BINARY FORMAT

ASC was specified in the command but the file is already open for binary input.

ARITH COMPARE OF NON BINARY TOKEN IN #IF STMT

One term is a number and another term is alphanumeric so the comparison cannot take place.

ATTA COMMAND ERROR

Invalid syntax in ATTA directive.

BAD ASG STMT OPCODE

An illegal operator was entered on the right side of the = sign.

C TOO LARGE OR XMAX/YMAX ERROR

User specified an incorrect value of 'c' (cycles per cell per pass over RAM). Or incorrect value of XMAX/YMAX specified in PPM or FACTOR program.

BAD ASG STMT OPRAND AFTER "!"

An illegal string was entered after the ! substring operator.

CALLING PARAMETER ERROR

Illegal parameter which can be one of the following:
1. More than 2 numbers (EXEC/command). 2. Could not parse a parameter.
3. No calling parameter at all. 4. More than two paramters (EXEC only)
5. File suffix number not 01 to 99.

CAN'T GO TO HIGHER BLOCK

A GOTO or NOP command is attempting to transfer to a block that has not been initialized.

CANNOT DO AGAIN

AGAIN function invoked and SPLOT cannot comply. Possible reasons are: (a) SPLOT not loaded with KEEP option, or (b) last use of SPLOT was a test program of a different name.

CANT RESTORE MEMORY

The data required to reload memory with the files designated in the save file have been corrupted.

CHECKSUMS DO NOT MATCH!! INITIALIZING SYSTEM

A checksum miscompare has been detected. Depending upon the error, the system may or may not operate correctly.

CMND FORMAT ERR

An invalid command was entered.

COM LINK FAILURE: DSDOWN

Data set is down.

COM LINK FAILURE: INTG BUG

An Integrator problem.

COM LINK FAILURE: LINE HOG

Integrator didn't release the ownership.

COM LINK FAILURE: RECV ERR

Framing, parity or overrun error.

COM LINK FAILURE: RECV TO

A time-out in the receive cycle.

COM LINK FAILURE: SLEEPING

Integrator doesn't respond.

COM LINK FAILURE: XMIT TO

A time-out in the transmit cycle.

COMMAND ERROR

The command entered is not a legal TPEDIT command.

CONTROL RAM IS EMPTY

Not paused on an REXEC or ENABLE PPM statement.

COREIMAGE FILE PROBLEM

An M3IO data check occurred while closing a created object file.

CRAM EMPTY

PPLOG executed at statement other than REXEC statement. The PPM control RAM contains no program.

DATA FROM OLD TP

The ON or CREATE command was entered as a histogram is in memory for a previous test program. DELETE the old data and CREATE a new histogram.

DATA UNABLE TO BE SAVED

A system overlay is preventing the saving of system parameters.

DETA COMMAND ERROR

Invalid syntax in DETA directive.

DEVICE NOT AVAILABLE

Device is not on line.

DEVICE NOT READY

The line printer is off line. XMIT terminates.

DISA COMMAND ERROR

Invalid syntax in DISA directive.

DISK BUSY OR NOT AVAILABLE

Disk unit off line.

DISK ERROR

After 10 retries for disk read or write errors, DBUP ends. If CS1 is up, DBUP continues.

DISK OR TAPE OFFLINE

Disk or tape is inhibited. In load phase, boot in operating system, In make phase, DBUP ends unless CS1 is up, then DBUP continues.

DISK OVERFLOW

If disk is too small for tape to load properly DBUP ends.

DUPLICATE HISTOGRAM

An identical CREATE command has already been entered.

ELEMENT NUMBER EXCEEDS ARRAY SIZE

Element number outside of array size.

ENAB COMMAND ERROR

Invalid syntax in ENAB directive.

END OF FILE

EOF reached on an attempt to read data from the insert file.

END OF function

Specified task has completed its execution.

ERROR filename COULD NOT BE FOUND

Filename could not be found in current job. (open error.)

ERROR filename DOES NOT VERIFY CORRECTLY

The filename does not have the same verify number as the input number.

ERROR IN DIRECTORY AREA OR ERROR IN FILE XXXXXX JOB XXXX

An error occurred in data compare and the appropriate file and job is displayed.

ERROR IN FILE XZM3 JOB 7777

REBOOT tried 10 times to overcome disk read error and failed.

ERROR IN MOD: XXXX

Indicates the name of the FCOMP module where a system I/O error occurred. It is for use by system engineering personnel.

ERROR IN NUMB (BIAS)

Invalid number, not between 0 and 23

ERROR IN NUMB (BTRAC)

The number entered in the command is not a positive integer.

ERROR IN NUMB (DATALOG)

FRQ is not followed by a valid integer between 0 and 99.

ERROR IN NUMB (DIST)

A number in one of the parameters, such as TTy, is illegal or out of range. Correct the parameters and reenter the command.

ERROR IN NUMB (GLOBAL)

Number specified is not between 1 and 40.

ERROR IN PARM (FCOMP)

File not found or omitted.

ERROR IN PARM (FLINK)

Error in command syntax.

ERROR IN PIN DEFINITION

Starting pin number must be greater than zero; last pin number should be greater than starting pin number.

ERROR IN PIN NUMB

The pin number provided in input file is out of range.

ERROR IN STAT

The station number is missing in the command .

ERROR-2 OCTAL NUMBERS REQUIRED

Two values are required to write 2 octal format type registers.

ERROR-BINARY OR OCTAL NUMBER REQUIRED

WRITE functional format type registers require a binary or octal number.

ERROR-LOOP/STOP ADDRESS (1-63) REQUIRED

The number is missing or outside the range 1-63 in the STOP ON command.

ERROR-MISSING NUMBER

READ SAMD requires a mode address, which is missing.

ERROR-MISSING NUMBER

MODIFY ON requires a value.

ERROR-MISSING REGISTER NAME

No recognized name was entered on the READ command.

ERROR-NEGATIVE VALUE NOT ALLOWED

A negative value was entered in a WRITE timing register command.

ERROR-NO WRITE RING

If a TDX MAKE/INIT is issued from a PID file, a break is issued with its error message.

ERROR-NODE MUST BE 128-145

If a node number is entered in the MEASURE command, it must be in the range 128(200B) to 145 (221B).

ERROR-NUMBER MISSING

SYNC ON requires a number.

ERROR-PAUSE ON REQUIRES "FAIL" OR NUMBER (1-64K)

PAUSE ON was entered without either a statement number of "FAIL".

ERROR-PIN # MUST BE 1-120

The n of PIN n in the READ PPA command is outside the range 1-120.

ERROR-RANK # MUST 1-5

The n of the RANK n on the DISPLAY FCT/D/I/M RANK n command must be 1-5.

ERROR-RANK # MUST 1-8

The n of the RANK n on WRITE functional format type registers must be 1-8.

ERROR-SCRAM ADDRESS (1-16) REQUIRED

The n of the READ SCRAM command is missing or outside the range 1-16.

ERROR-TG # (1-8) REQUIRED

The TG # is missing or outside the range 1-8 in the command READ TB1/TB2/PD/PW/PDV/PWV/APD/APDV/APWV.

ERROR-TV # MUST BE 1-16

The n of DISPLAY TV n is zero or greater than 16 or the n of the READ TGxx n command is outside the range 1-16.

ERROR-U10 or M1 RANGE ALLOWED IN CURRENT MODE ONLY

U10 or M1 was specified in a WRITE command while in voltage mode.

ERROR-U10 or M1 RANGE REQUIRES 6 RANGE PMU

U10 or M1 was specified in a WRITE command using hardware with a 4-range PMU.

ERROR-VALUE EXCEEDS 366

MODIFY ON TO value may not exceed 366 seconds.

ERROR-VALUE EXCEEDS 4K

The n in SYNC ON ADDR exceeds 4095.

ERROR-VALUE EXCEEDS 5.734

MODIFY ON DC value may not exceed 5.734 seconds.

ERROR-VALUE EXCEEDS 64K

The number entered is greater than 65,535.

ERROR-VALUE TOO SMALL

A non-zero value was entered which scaled to zero on a register without a range.

ERROR. CONTIN LOOP IN SPM PROGRAM (TE107)

SPLOT will not do ENABLE TEST MOMENTARY on SPM programs. However, DCT tests while in a continuous loop are allowed.

ERROR. UNIT ALREADY USED (TE 116)

Attempt to use the same tester unit more than once.

ERROR: END-OF-TAPE

EOT mark encountered during tape write or read.

FGCM: ERROR IN NAME

No filename was entered.

FGCM: ERROR IN PARM

No device or CLI was specified.

FGCM: FILE NOT FOUND

The file is not as the device specified of datakind is not DD for binary or SC for ASCII.

FILE BUFFER OVERFLOW FETCHING 80 FILES

When fetching by jobname, more than 80 files were present on tape. Reexecuting FETCH with "ADD" loads remaining files.

FILE BUILDING ERROR

A write error occurred while generating the CO file.

FILE NOT FOUND

Insert file not found either in memory or on disk.

FILE NOT FOUND (HELPER)

The ACTI directive was entered but the program HELP is not available.

FILE NOT FOUND (TPEDIT)

Insert file not found in memory or on disk.

FILE TYPE WRONG

Filename was found, but had a different filetype than specified.

filename - NOT FOUND FOR RESTORE

The indicated file could not be located on the disk when RESTORE attempted to restore memory.

filename BAD DATAKIND

The file is not a created object file.

filename CHECKSUM MISMATCH: xxxxxxxxB

The file checksum does not match the operating system checksum.

filename IS BUSY

Program 'filename' is busy.

filename MISSING

The file could not be located.

filename NO CHECKSUM

The file has no checksum and therefore cannot be checked.

filename OK

The file checksum matches that of the operating system resident in memory.

FLOATING OUTPUT, STEP OR XMAX/YMAX ERROR

Open socket or load board not installed; output pin improperly terminated. Incorrect value of STEP or XMAX/YMAX specified in PPM or FACTOR program caused overlapping patterns.

function IS DEAD

The controlled termination of the victim task has begun.

function IS NOT ACTIVE

The task indicated was not busy at the time KILL was entered.

function SURVIVED

The victim task was not killable. KILL is one such task.

HARDWARE NOT AVAILABLE (TE 115)

A program on a high speed head requested use of EC0/EC1 RVS.

HELP ALREADY ACTIVE

The ACTI directive was entered when HELP was activated.

HELP FILE NOT FOUND

On an ATTA command, the specified syntax file was not found in the memory or disk.

HELP NOT ACTIVE

1. The DEAC directive was entered when HELP was not activated.
2. The ENAB and DISA directives are illegal unless ACTI has been entered.
3. The ATTA and DETA directives are illegal unless ACTI has been entered.

HELP: HRCSV I/O ERROR

A system error occurred while reading from CID.

HELP: I/O ERROR IN "#GOTO"

A system I/O error occurred during the #GOTO command.

HELP: LABEL NOT FOUND DURING "GOTO"

The label following the #GOTO statement is not found in the command file.

HISTOGRAM ERROR

A computational error in forming the histogram.

HISTOGRAM MISSING

The histogram identified in a LIST, ZERO, or DELETE request was not found. Correct the parameters and reenter.

HPLOT ERROR

An undefined datalog record ID code was encountered.

HSD LINK FAILURE: BUSY ECO

Link is busy in ECHO mode or link is performing the remote diagnostic.

HSD LINK FAILURE: HOST DOWN

Integrator just brought link down.

HSD LINK FAILURE: HOST ERR

Host error for sending us illegal protocol.

HSD LINK FAILURE: HWR ERR

Hardware error detected (when doing a local diagnostic)

HSD LINK FAILURE: MBX ERR

Just received an unrecognizable or illegal protocol in the mailbox.

HSD LINK FAILURE: NO HOST

Time-out for Integrator's response to our request to connect the link.

HSD LINK FAILURE: RDSQ ERR

Read sequence error-Integrator's violation of our protocol sequence.

HSD LINK FAILURE: RMBX TMO

Time-out for remote mailbox because Integrator does not read its mail.

HSD LINK FAILURE: SPUR INT

Undefined spurious interrupt occurred.

HSD LINK FAILURE: WRIT ERR

Write error detected when transferring data to the transmit buffer.

HSD LINK FAILURE: XMIT ERR

No response from Integrator to our transmission.

HSD LINK FAILURE: XMIT TWO

Time-out for Integrator's acknowledgement of receiving a message from us.

ILLEGAL #ECHO/#NOECHO OPTION

An option is entered on the #ECHO or #NOECHO command which is illegal.

ILLEGAL DEVICE CODE.

An illegal device code was specified in the dataid.

ILLEGAL RANGE

A range was entered in a WRITE engineering register command which is not valid for the register.

ILLEGAL RELATION IN #IF STMT

An invalid relation was entered in the IF command.

ILLEGAL SYNFIL

An ATTA command specifies a resident device other than memory or disk, or the datakind of the file was not SC.

ILLEGAL TEST OPTION COMBINATION (TE108)

The TOPT argument or the SPLOT command have invalid combinations. (e.g. MATCH and AMATCH together)

ILLEGAL TO CHANGE ARRAY SIZE

Element number 0 is array size. It cannot be changed.

ILLEGAL WITH ETM HARDWARE

A READ TR command was entered on a system with ETM hardware.

ILLEGAL WITHOUT ETM HARDWARE

A READ ETM register command was entered on a system without ETM hardward.

ILLEGAL WITHOUT PPM HARDWARE

The STOP command is entered on a system without PPM hardware.

INCOMPLETE CONDITION IN #IF STMT

The IF command is incomplete. Either one or more of the terms, relation, or command is missing.

INPUT DATA NOT 96 ELEMENT ARRAY, FILE %SHMXX

A data block found which is not 96 words in size.

INPUT FILE TYPE ERROR

Input module is not OM file type.

INVALID COMMAND

Wrong command parameter given.

INVALID HELPER COMMAND

A directive other than ACTI, DEAC, ENAB, DISA, ATTA, DETA,//or $$ was entered.

INVALID IDENTIFIER

The identifier returned by SCAN was not one of the valid identifiers.

INVALID OUTPUT DEVICE ASSIGNMENT

Device specified not a VKT.

KILL WHOM

Command was entered without function.

LAMP TEST ON - PROGAM ABORTED

Lamp test button has been depressed. Program aborts.

LETTER IN VERIFY NUMBER

A letter was found by SCAN while reading the verify number from input command.

LMIO: DEVICE CODE IS WRONG

The device specified in the command stream is incorrect.

LMIO: FILE CONTAINS NON-DMA CODE

An attempt was made to load to local memory an 'LMI' file which contains interpretive FACTOR object code.

LMIO: FILE EMPTY

User attempted to load local memory data from an empty disk or memory file.

LMIO: FILENAME NOT FOUND OR NOT IN PROPER TYPE

The specified file was not found on disk or memory. Possible error in specifying filename.

LMIO: INVALID LMI OPCODE: FUNCT/DATA = xxxxxxxxB

An invalid LMI opcode was encountered in the LMI file.

LMIO: LM BUSY

Local memory is being read/written to.

LMIO: NON SENTRY 7 SPM CODE

Using Series 20 SPM code on a Sentry VII system or Sentry VIII.

LMIO: NUMBER OF L/M LABELS EXCEEDS SIZE OF SYMBOL TABLE

Due to a large number of SPM local memory labels, the symbol table size requirements exceed available memory space. Release LMIO from memory and reexecute.

LMIO: OTHER OVERLAY OR TP USING HARDWARE

Tester is currently in use.

LMIO: PARAMETER ERROR

An unrecognizable parameter was detected in the input command.

LMIO: VVVV INVALID REF BY ERRONEOUS LCALL ADDR FIELD

Invalid LSUBR address occurred in LCALL, and consequently in the symbol table.

LOAD: LOAD ABORTED STATION BUSY

The test program is currently being executed on the station. The load did not take place.

LOCATE ERROR - PROGRAM ABORTED

File could not be found.

M3 OPERATING SYSTEM WRITTEN

The M3 operating system has been written to tape.

MBUP LOADER WRITTEN

The bootstrap loader has been written to the tape.

MBUP OF M3-INITIALIZING OPERATING SYSTEM

The operating system has been successfully loaded into memory.

MEMORY FILES WRITTEN

Files in memory have been written to the tape.

MISSING ASG STMT OPERAND

There is nothing to the right of the = sign in the assignment statement.

MISSING VAR NUMBER

Variable number not entered.

module name CONFIG ERROR:

Hardware configuration specified in main module in conflict with external module.

name FILE NOT FOUND IN NAME JOB OR SYSTEM JOB

File not found in the job or system job.

NO CHECKSUM IN O.S.

The operating system Release Match value is zero; checking cannot be performed.

NO DATA FOUND FOR SPLOT ID # X FILE %SHMXX

Indicates there is no data for the given SPLOT id # in the indicated file.

NO FILENAME

No filename was specified, or it did not precede the verify-number.

NO INPUT FILE SPECIFIED

BTRAC requires an input file name.

NO PATCH INSERTED

The requested patch could not be made. This may be due to the indicated statement numbers not being found or due to attempt to patch an illegal statement.

NO PPM HARDWARE OPTION

System does not have PPM hardware.

NO PROGRAM LOADED

No test program is associated with the current station number (or the station number specified in the TPEDIT commmand.)

NO SPACE AVAILABLE

Insufficient space was available for the histogram size as specified in the CREATE command. Delete one or more histograms.

NO STATION GIVEN

No STATn command issued.

NO WRITE RING

TDX INIT command is issued but tape does not have write ring.

NON-SPM HARDWARE - PROGRAM ABORTED

Self explanatory.

NOT A DD FILE

BTRAC or LIST only allows a DD file.

NOT A MEMORY FILE

MIF was not specified in the #OPEN command.

NOT AN ARRAY

Not really an array.

NOT OPENED

Trying to close a device that ins't open.

NUMBER ENCOUNTERED WHEN NOT LEGAL

A number was found before an open parenthesis was found.

O.S. BUSY--MBUP ABORTED

MBUP could not be performed due to other activity in the operating system.

O.S. CHECKSUM = xxxxxxxxB

The current operating system checksum is displayed when no filename is entered in the command.

OBJ FILE ERROR

An invalid record was encountered in an object file.

OBJECT FILE SIZE EXCEEDS 64K, CURRENT MODULE IS

TP program object size over 64K at the module.

ONLINE STATION IS RESET.

Current online station is reset.

OPEN ERROR - PROGRAM ABORTED

File could not be opened.

OVERFLOW WHILE COMPUTING SIGMA

The sum of the squares is too large for Standard Deviation Calcualtion.

PACK ABORTED- SYSTEM TOO BUSY

Command task active or disk file(s) open.

PARTIAL FILE IN MEMORY

VERIFY does not verify files which are only partially in memory, that is, when a test program is paging.

PAUSE ON COUNT NOT LEGAL

COUNT is not a legal modifier of the PAUSE command.

PID CALL STACK OVERFLOW

The transfer command is attempting to call another command file to nest beyond seven levels.

POD ERROR

Could not write to POD.

POTENTIAL DATA LOSS

Unable to read the next word of the insert file.

PROGRAM AT EOT

The FACTOR test program is at End of Test. It must be at a pause on the REXEC statement.

PROGRAM BUSY

Attempted to enter XMIT via a command during FACTOR EXEC of XMIT.

PROGRAM TOO BIG

Created object file exceeded 8192 words.

PSCA: OTHER OVLY OR TP USING HDW

Tester is currently in use.

PSCA: PARAMETER ERROR

Unrecognizable parameter entered.

PSCA: PIN COUNT EXCEEDS 120

Table will output for number of pins specified up to 120.

PSCA: PIN COUNT MISSING

No pin number was given in background call or EXEC statement.

PSCA: PINVEC OVERFLOW AT PIN XXX

Only four programmed tester elements (i.e., RELAY, TGn, E0, etc.) are stored for each pin scanned. If program finds a fifth element the pin vector table overflows. Pin data printed in the output table after the indicated pin number should be suspected.

PSCA: PSCAN ABORT FROM PREVIOUS RESET

Reset button has been depressed. Program aborts.

PSCA: PSCAN BUSY IN F.G.

PSCAN was invoked from keyboard while it was servicing a FACTOR program call.

REF FILE PROBLEM

An M3IO data check occurred while opening, renaming, or moving the reference file.

RESET ON - PROGRAM ABORTED

Reset button has been depressed. Program aborts.

SAVE FILE READ ERROR

The file containing the saved system parameters is corrupt.

SAVED FILE NOT FOUND

The file containing the saved system parameters cannot be found.

SORRY, SPLOT IS BUSY

SPLOT was invoked from the keyboard while it was servicing a FACTOR program.

SPECIAL CHAR IN VERIFY NUMBER

A special character was found by SCAN in input command.

SPLO: ERROR. INVALID UNIT (TE 109)

An illegal tester unit number was found in the XUNIT or YUNIT arguments.

SPM RANKC ERROR

Error in Rank C data.

START ADD. GREATER THAN PAGE SIZE (TE 26)

The local memory address entered in the command exceeds set page size.

STEP TOO LARGE

User specified a value of STEP, or PPLOG calculated a value of STEP based on a user specified value of WALK, which exceeds the scope of the PPM program. The PPM step count generated during program execution never reached the user specified value.

SYMBOL SUMMARY: UNDEFINED =
NOT USED =

Total number of linkage errors = Undefined and not used.

SYMBOL/ENTRY/EXTERNAL TABLE OVERFLOW

Self explanatory.

SYSTEM BUSY

Operating system or tester busy. In make phase, if override option is specified, DBUP continues otherwise DBUP ends.

SYSTEM IS BUSY - TRY LATER

The system is busy. The system parameters cannot be restored at this time.

SYSTEM IS BUSY, PROGRAM ABORTED

Some task is active, control is returned to the monitor.

TAPE CHECKSUM INCORRECT

Message will be displayed if a checksum error occurrs. If CS1 is up, DBUP continues.

TAPE ERROR

After 10 retries for tape read or write errors, DBUP ends. If CS1 is up, DBUP continues.

TAPE UNIT OFFLINE/CONTINUE OR EXIT (C/E)?

Tape unit off line, control returns to monitor if 'E' typed, otherwise continue.

TESTER-BUSY FGCMD ABORTED

If tester is busy, GLOB and VAR command will abort after issuing this message.

THD BUSY - OTHER USER

Test Head busy.

TOO MANY UNITS (TE 117)

More than 20 tester and dummy units were attempted.

TRIED TO ASG DD FILE TO SC FILE

The datakind of data to be added is requested as binary format but the file is SC. Applies to magnetic tape only.

UNABLE TO ADJUST MEMORY

Unable to update file size in MACTAB.

UNABLE TO EXPAND

The test program is unable to expand to make room for a patch. This may be due to memory being fully utilized or due to a busy overlay at a higher memory address.

UNDEFINED BINARY RECORD ID n

Undefined record ID encountered by BTRAC, n is the full word containing the undefined record ID.

VERIFY 'filename' filetype (verify-number)

This is the command that should be typed to check 'filename' at some later time.

WARNING, REFRESH COUNTER NOT RESTORED

RFC register is write-only, therefore SPLOT cannot restore the original value. This message appears at the end of the plot.

WRITE RING MISSING/CONTINUE OR EXIT (C/E)?

No write ring on tape, control returned to monitor is 'E' typed, otherwise check for write ring if 'C' is typed.

WRONG NUMBER OF DIGITS FOUND

The verify-number was not eight octal digits long.

WRONG STATION ON LINE

Current station on line is different from the command or default station.

XMASK/YMASK ERROR

Incorrect mask values specified in PPM or FACTOR program (PPLOG reads back incorrect X/Y address from hardware). Also may result from a read of RAM rather than a write.

XXX...TAPE RETRIES

Number of retries for each soft error condition. If number is zero, message is not displayed. Message is only displayed at the end of DBUP.

XXXXXX CONTAINS NO DATA.

A reference file was requested but no data was placed in it during CREATE.

XXXXXX LINKING ERRORS

The total number of errors detected are displayed at the end of CREATE.

XXXXXX-CLOSE PROBLEM

An M3IO data check occurred while closing an object file.

XXXXXX-OBJECT FILE NOT FOUND FOR OPEN

The named object file could not be found.

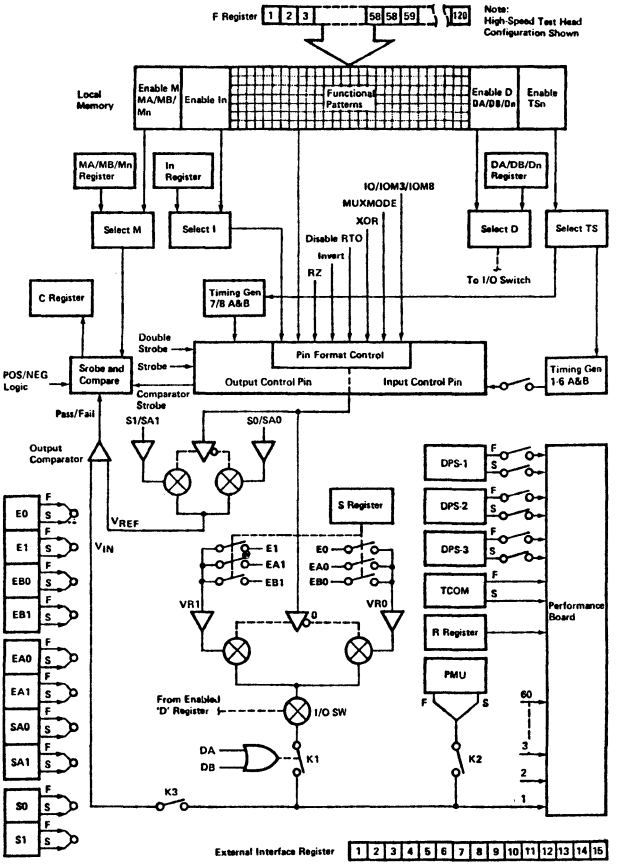
XXXXXX-OBJECT FILE READ ERROR

An M3IO data check occurred while reading a created object file.

XZM3 NOT FOUND

XZM3 can not be found on disk.

B Programmers Block Diagram for Series 20/Sentry 21


F Register
1
2
3
58
59
120
Note:
High-Speed Test Head
Configuration Shown
Local
Memory
Enable M
MA/MB/
Mn
Enable In
Functional
Patterns
Enable D
DA/DB/Dn
Enable
TSn
MA/MB/Mn
Register
In
Register
DA/DB/Dn
Register
IO/IOM3/IOM8
MUXMODE
XOR
Disable RTO
Invert
RZ
Select M
Select I
Select D
Select TS
To I/O Switch
C Register
Timing Gen
7/8 A&B
Double
Strobe
Strobe
Comparator
Strobe
Pin Format Control
Output Control Pin
Input Control Pin
Timing Gen
1-6 A&B
POS/NEG
Logic
Srobe and
Compare
Pass/Fail
S1/SA1
S0/SA0
Output
Comparator
S Register
VREF
VIN
E1
EA1
EB1
E0
EA0
EB0
VR1
VR0
0
From Enabled
'D' Register
I/O SW
DA
DB
K1
K2
K3
DPS-1
DPS-2
DPS-3
TCOM
R Register
PMU
Performance
Board
60
3
2
1
E0
E1
EB0
EB1
EA0
EA1
SA0
SA1
S0
S1
F
S
External Interface Register
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

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