

M T S

The Michigan Terminal System

Volume 2: Public File Descriptions

January 1987

Updated August 1988 (Update 1)
Updated December 1988 (Update 2)
Updated May 1990 (Update 3)

The University of Michigan Computing Center
Ann Arbor, Michigan

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*      This obsoletes the April 1982 edition.      *  
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DISCLAIMER

The MTS Manual is intended to represent the current state of the Michigan Terminal System (MTS), but because the system is constantly being developed, extended, and refined, sections of this volume will become obsolete. The user should refer to the U-M Computing News and other ITD documentation for the latest information about changes to MTS.

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PREFACE

The software developed by the Information Technology Division (ITD) technical staff for the operation of the high-speed processor computer can be described as a multiprogramming supervisor that handles a number of resident, reentrant programs. Among them is a large subsystem, called MTS (Michigan Terminal System), for command interpretation, execution control, file management, and accounting maintenance. Most users interact with the computer's resources through MTS.

The MTS Volumes are a series of manuals that describe in detail the facilities provided by the Michigan Terminal System. Administrative policies ITD and the physical facilities provided are described in other publications.

The MTS Volumes now in print are listed below. The date indicates the most recent edition of each volume; however, since volumes are periodically updated, users should check the file *CCPUBLICATIONS, or watch for announcements in the U-M Computing News, to ensure that their MTS Volumes are fully up to date.

- Volume 1: The Michigan Terminal System, November 1988
- Volume 2: Public File Descriptions, January 1987
- Volume 3: System Subroutine Descriptions, April 1981
- Volume 4: Terminals and Networks in MTS, July 1988
- Volume 5: System Services, May 1983
- Volume 6: FORTTRAN in MTS, October 1983
- Volume 7: PL/I in MTS, September 1982
- Volume 8: LISP and SLIP in MTS, June 1976
- Volume 9: SNOBOL4 in MTS, September 1975
- Volume 10: BASIC in MTS, December 1980
- Volume 11: Plot Description System, August 1978
- Volume 12: PIL/2 in MTS, December 1974
- Volume 13: The Symbolic Debugging System, September 1985
- Volume 14: 360/370 Assemblers in MTS, May 1983
- Volume 15: FORMAT and TEXT360, April 1977
- Volume 16: ALGOL W in MTS, September 1980
- Volume 17: Integrated Graphics System, December 1980
- Volume 18: The MTS File Editor, February 1988
- Volume 19: Tapes and Floppy Disks, October 1989
- Volume 20: Pascal in MTS, December 1985
- Volume 21: MTS Command Extensions and Macros, April 1986
- Volume 22: Utilisp in MTS, May 1988
- Volume 23: Messaging and Conferencing in MTS, August 1988

The numerical order of the volumes does not necessarily reflect the chronological order of their appearance; however, in general, the higher

the number, the more specialized the volume. Volume 1, for example, introduces the user to MTS and describes in general the MTS operating system, while Volume 10 deals exclusively with BASIC.

The attempt to make each volume complete in itself and reasonably independent of others in the series naturally results in a certain amount of repetition. Public file descriptions, for example, may appear in more than one volume. However, this arrangement permits the user to buy only those volumes that serve his or her immediate needs.

Richard A. Salisbury

General Editor

January 1987

PREFACE TO REVISED VOLUME 2

The January 1987 revision reflects the changes that have been made to MTS since April 1982. Some of these changes were described in Updates 1 through 6 that were issued from February 1983 through May 1986 and which are incorporated in this revision. However, several changes have occurred since May 1986 and, hence, it was felt that a complete revision of this volume was in order. The revision bars have been deleted and the pages have been renumbered to facilitate the future issuing of updates.

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*HPGLPLOT225	*PROFORT365
*ICON229	*PROLOGC, *PROLOGW366
*IF66, *IF77231	*RATES367
*IG233	*RATFOR369
*KERMIT235	*REDUCE371
*LABEL237	*RESTORE373
*LABELS239	*RG379
*LABELSNIFF245	*RMLOG380
*LALRGEN247	*SDL381
*LATEX256	*SIDEBYSIDE383
*LCS257	*SIGSETUP390
*LIBRARY259	*SITES390
*LINKEDIT261	*SLIDEQ391
*LINK11265	*SNOBOL4, *SNOBOL4B395
*LOCALPLOT267	*SNOSTORM397
*LOCALPRINT271	*SOFTWARECHARGES401
*LOGPURGE273	*SORT403
*MACBINHEX275	*SPIRES409
*MACPAINT4045277	*SPITBOL411
*MACUTIL279	*SPITDEBUG415
*MACWRITE9700283	*SPITLIB417
*METATRAN285	*SYMBOLS419
*MPS287	*SYSMAC421
*MTSBIBLIOGRAPHY289	*TANGO423
*MVC291	*TAPECOPY425
*NETCOPYMAC297	*TAPEDUMP427
*NETMAILHELP299	*TAPEFIXER429
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*NETMAILSITES299	*TAPESUBMIT/*TAPERETRIEVE435
*NETWORKRATES301	*TAXIR439
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*OBJSCAN305	*TELLABANK441
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*PDSTOMNET, *MNETTOPDS339	*UTILISP469
*PEXIT341	*VALIDATEFILE471
*PFORT343	*VSS475
*PLC345	*WATBOL477
*PLOTSEE347	*WATBOLLIBGEN483
*PLOTSTACK351	*WATFIV489
*PLOTSYS353	*WBASIC493
*PLUS, *PLUS11355	*WIREWRAP501
		*11ASR507

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CHANGES IN PUBLIC FILE DESCRIPTIONS

The following public file descriptions have been added to this volume since Update 6 (May 1986) to the March 1982 edition was issued.

- *CMS
- *CMSTAPELOAD, *CMSTAPESCAN
- *COMPUCALENDAR
- *MACBINHEX
- *MACPAINT4045
- *MACWRITE9700
- *SLIDEQ

The following public file descriptions have been deleted from this volume. Some of these public files still exist in the system, but the Computing Center makes no guarantee as to how long they will exist. Documentation for some of these programs can be found in the file DOC:VOLUME.2X.

*CCMEMOS	Information combined into *CCPUBLICATIONS
*CCQUICKNOTES	Information combined into *CCPUBLICATIONS
*COBOLU	Program seldom used (replaced by *COBOLVS)
*COINFLIP	Program seldom used
*DOWNDATE	Program seldom used
*FAKEOS	Program seldom used (replaced by *VSS)
*FILEDUMP	Program seldom used
*FILESCAN	Program seldom used
*FORMAT	Described in MTS Volume 15, <u>FORMAT and TEXT360</u>
*FORTRAN	Described in MTS Volume 6, <u>FORTRAN in MTS</u>
*FORTRANH	Described in MTS Volume 6, <u>FORTRAN in MTS</u>
*GENDOCDBMS	Described in CCMemo 461
*KEYPUNCHES	Information combined into *WORKSTATIONS
*LISP	Program seldom used (replaced by *UTILISP)
*NIM	Program seldom used
*PIL	Program seldom used
*PLOT	Program seldom used
*PL360	Program seldom used
*PRINT	Described in MTS Volume 15, <u>FORMAT and TEXT360</u>
*SIDEDATE	Program seldom used
*SLIP	Library seldom used
*STATUS	Program seldom used (replaced by \$ACCOUNTING)
*TERMINALS	Information combined into *WORKSTATIONS
*TEXT360	Described in MTS Volume 15, <u>FORMAT and TEXT360</u>
*UPDATE	Program seldom used

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INDEX OF PUBLIC FILES

The following table lists all of the public files in the system that are of general use to users. Other public files exist within the system, but they are associated with internal system operations and are not listed. The list below is also contained in the public file *CCSOFTWARE.

For each public file, a subject category and a documentation reference is given. For public files that contain obsolete or seldom used programs, the reference is DOC:VOLUME.2X. This volume is maintained on-line in the file DOC:VOLUME.2X and may be copied by issuing the command

| \$COPY DOC:VOLUME.2X *PRINT*

<u>Public File</u>	<u>Subject</u>	<u>Reference</u>
*ALGOL	OS/360 ALGOL	DOC:VOLUME.2X
*ALGOLLIB	OS/360 ALGOL	DOC:VOLUME.2X
*ALGOLW	ALGOL W	MTS Volume 2; MTS Volume 16
*ALGOLWLIB	ALGOL W	MTS Volume 16
*AMENDS	File Comparison	DOC:VOLUME.2X
*ANALYSIS	System Statistics	MTS Volume 2; CCMemo 393
*ANALYZER	XPL	DOC:VOLUME.2X
*APC	File Comparison	MTS Volume 2
*APL	VS APL	MTS Volume 2; CCMemo 435
*APLEDCL	General Motors APL	DOC:VOLUME.2X; CCMemo 236
*APLFONTCONVERT	VS APL	MTS Volume 2
*APLGM	General Motors APL	DOC:VOLUME.2X; CCMemo 236
*APLLIB	General Motors APL	DOC:VOLUME.2X; CCMemo 236
*APLTRAN	General Motors APL	None
*ARC	File Archiving	MTS Volume 2, CCMemo 484
*ASA	Carriage-Control Conv.	DOC:VOLUME.2X
*ASCEBCD	ASCII-EBCDIC Conversion	MTS Volume 2
*ASMBLR	Same as *ASMG	
*ASMG	360/370 Assembler	DOC:VOLUME.2X
*ASMGSYSMAC	360/370 Assembler	DOC:VOLUME.2X
*ASMH	360/370 Assembler	MTS Volume 2; MTS Volume 14
*ASMT	360/370 Assembler	DOC:VOLUME.2X
*ASMTIDY	360/370 Assembler	MTS Volume 2; MTS Volume 14
*ASMTSYSMAC	360/370 Assembler	DOC:VOLUME.2X
*ASSIST	360/370 Assembler	MTS Volume 2; MTS Volume 14
*ASSISTMAC	360/370 Assembler	MTS Volume 14
*AUTOSTART	Batch Processing	MTS Volume 2
*BASIC	Same as *BASICUM	
*BASICUM	U of M BASIC	MTS Volume 2; MTS Volume 10
*BCDEBCD	BCD-EBCDIC Conversion	DOC:VOLUME.2X

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*BIBTEX	Text Processing (TEX)	MTS Volume 2
*BIGTEX	Text processing (TEX)	None
*BRAILLE	Braille Output	None
*CAMPUSZIPS	Campus Zip Listing	None
*CBELL	C Programming Language	MTS Volume 2
*CBELLASMMAC	C Programming Language	None
*CBELLINCLUDE	C Programming Language	*CBELL, MTS Volume 2
*CBELLLIB	C Programming Language	*CBELL, MTS Volume 2
*CCBIBLIOGRAPHY	Documentation Info.	MTS Volume 2
*CCDELIVERY	Output Delivery Info.	MTS Volume 2
*CCHOURS	Building Information	MTS Volume 2
*CCMEMOS	Documentation Info.	None
*CCNEWSDEADLINES	Documentation Info.	None
*CCPHONES	Telephone Information	MTS Volume 2
*CCPUBLICATIONS	Documentation Info.	MTS Volume 2
*CCQUEUE	Plot System	MTS Volume 2; MTS Volume 11
*CCRESHOURS	Residence Hall Info.	None
*CCSOFTWARE	Software Information	MTS Volume 2
*CDUPDATE	File Updating	MTS Volume 2; CCMemo 434
*CKID	Signon ID Security	MTS Volume 2
*CKSIG	Signon ID Security	MTS Volume 2
*CLPARSEGEN	Syntactic Parser	MTS Volume 2; *CLPARSER.W
*CLPARSER	Syntactic Parser	MTS Volume 2; *CLPARSER.W
*CLPARSELIB	Syntactic Parser	*CLPARSER.W
*CMDMACLIB	MTS Command Macros	MTS Volume 2
*CMS	IBM VS/CMS simulator	MTS Volume 2; CCMemo 448
*CMSFILETYPEMAP	IBM VS/CMS Simulator	MTS Volume 2
*CMSTAPELOAD	Magnetic Tapes	MTS Volume 2; MTS Volume 19
*CMSTAPESCAN	Magnetic Tapes	MTS Volume 2; MTS Volume 19
*CNFGINFODSECT	Subroutine Dsect	CNFGINFO, MTS Volume 3
*COBLIB	COBOL	*COBOLU, DOC:VOLUME.2X
*COBLINKEDIT	COBOL VS	CCMemo 439
*COBOLU	COBOL	DOC:VOLUME.2X
*COBOLVS	COBOL VS	MTS Volume 2; CCMemo 439
*COBOLVSRUN	COBOL VS	CCMemo 439
*COINFLIP	Demonstration	DOC:VOLUME.2X
*COLLATE	Record Collating	MTS Volume 2
*COMBINE	Record Combination	MTS Volume 2
*COMPARE	File Comparison	MTS Volume 2
*COMPUCALENDAR	Information	MTS Volume 2
*CONDITIONSOFUSE	Information	MTS Volume 2
*CONSULTINGHOURS	Counseling Information	MTS Volume 2
*CONSULTINGSCHED	Counseling Information	MTS Volume 2
*CONVSNOBOL	SNOBOL4	MTS Volume 9
*COUNSELINGHOURS	Same as *CONSULTINGHOURS	
*CRISPINFO	U-M Course Info.	None
*CRCBOOKLIST	CRC reference books	MTS Volume 2
*CRCSOFTWARE	CRC evaluation software	MTS Volume 2
*CSMP	CSMP	MTS Volume 2
*CSMPEXEC	CSMP	*CSMPTRAN, MTS Volume 2
*CSMPLIB	CSMP	*CSMPTRAN, MTS Volume 2
*CSMPTRAN	CSMP	MTS Volume 2
*C87	C Programming Lang.	MTS Volume 2, R1032

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*C87INCLUDE	C Programming Lang.	*C87, MTS Volume 2
*C87LIB	C Programming Lang.	*C87, MTS Volume 2
*DAVE	Data-flow Analyzer	MTS Volume 2; CCMemo 394
*DAVE.GENLIB	Data-flow Analyzer	CCMemo 402
*DCALC	Numerical	DOC:VOLUME.2X
*DECODE	File Compression	DOC:VOLUME.2X
*DEDIT	Distribution Editor	MTS Volume 2
*DELIVERY	Same as *CCDELIVERY	MTS Volume 2
*DICT	TEXT360	MTS Volume 15
*DICTUPD	TEXT360	MTS Volume 15
*DITTO	Ditto Master Program	MTS Volume 2
*DI3000.IG	DI-3000 Graphics Library	MTS Volume 2; CCMemo 463
*DI3000.PRINTER	DI-3000 Graphics Library	MTS Volume 2; CCMemo 463
*DI3000.TX4010	DI-3000 Graphics Library	MTS Volume 2; CCMemo 463
*DI3000.TX4113	DI-3000 Graphics Library	MTS Volume 2; CCMemo 463
*DOCINFO	Online Documentation	MTS Volume 2
*DOWNDATE	File Comparison	DOC:VOLUME.2X
*DVIAPS	Text Processing (TEX)	MTS Volume 2; CCMemo 810
*DVITYPE	Text Processing (TEX)	CCMemo 811
*DVIXER	Text Processing (TEX)	MTS Volume 2; CCMemo 810
*EBCDASC	EBCDIC-ASCII Conversion	MTS Volume 2
*EBCDBCD	EBCDIC-BCD Conversion	DOC:VOLUME.2X
*ENCODE	File Compression	DOC:VOLUME.2X
*ENCRYPT	File Security	MTS Volume 2
*ENDJUNK	Loader Records	MTS Volume 2; MTS Volume 5
*EXCOM	Extended-XPL	*EXPL, MTS Volume 2; CCMemo 416
*EXPL	Extended-XPL	MTS Volume 2; CCMemo 416
*EXPLBNF	Extended-XPL	CCMemo 416
*EXPLIB	Extended-XPL	*EXPL, MTS Volume 2; CCMemo 416
*EXSKELETON	XPL	*EXPL, MTS Volume 2; CCMemo 416
*FAKEOS	OS/360 Environment	DOC:VOLUME.2X
*FAKEOSCREBLDL	OS/360 Environment	*FAKEOS, DOC:VOLUME.2X
*FAKEOSTRACE	OS/360 Environment	*FAKEOS, DOC:VOLUME.2X
*FILEDUMP	File Dumping	DOC:VOLUME.2X
*FILESCAN	File Scanning	DOC:VOLUME.2X
*FLOPDSECT	Floppy Disk Sense Data	None
*FLOWCHART	Flowcharting	MTS Volume 2
*FOREVER	Unlimited output	None
*FORMAT	FORMAT	MTS Volume 15
*FORTRAN	FORTRAN	MTS Volume 6
*FORTRANH	FORTRAN	MTS Volume 6
*FORTRANVS	FORTRAN	MTS Volume 2; MTS Volume 6
*FORUM	User Conference	MTS Volume 2; MTS Volume 23
*FS	File Saving	MTS Volume 2; MTS Volume 19
*FSAVE	File Saving	DOC:VOLUME.2X
*FSCON	File Saving	DOC:VOLUME.2X
*FTN	FORTRAN	MTS Volume 2; MTS Volume 6
*FTNGTEST	FORTRAN	MTS Volume 6
*FTNTIDY	FORTRAN	MTS Volume 2; MTS Volume 6
*FTNTOPL1	FORTRAN-PL/I Conversion	MTS Volume 6

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*GASP	GASP	MTS Volume 2; CCMemo 246
*GASPCOM	GASP	CCMemo 246
*GASPIV	GASP	CCMemo 246
*GASPIVCOM	GASP	CCMemo 246
*GDINFODSECT	Subroutine Dsect	GDINFO, MTS Volume 3
*GENLIB	Library Generator	DOC:VOLUME.2X
*GFINFODSECT	Subroutine Dsect	GFINFO, MTS Volume 3
*GOM	MAD Programming Language	None
*GPSS	GPSS	DOC:VOLUME.2X
*GPSSERR	GPSS	DOC:VOLUME.2X
*GPSSH	GPSS/H	None
*GPSSH2	GPSS/H Version 2	MTS Volume 2
*GPSSLIB	GPSS	DOC:VOLUME.2X
*HPGLPLOT	Remote Plotter Support	MTS Volume 2; CCMemo 466
*HYPHDICT	TEXT360	MTS Volume 15
*ICON	ICON Prog. Language	MTS Volume 2
*ICONLIB	ICON Prog. Language	MTS Volume 2
*IEBUPDAT	Data Set Utility	CCMemo 449
*IEHMOVE	Data Set Utility	CCMemo 449
*IF	Same as *IF66	MTS Volume 2; MTS Volume 6
*IF66	FORTRAN	MTS Volume 2; MTS Volume 6
*IF77	FORTRAN	MTS Volume 2; MTS Volume 6
*IG	Integrated Graphics	MTS Volume 2; MTS Volume 17
*IG.AJ830	Integrated Graphics	MTS Volume 17
*IG.AMIGO	Integrated Graphics	MTS Volume 17
*IG.ARU	Integrated Graphics	MTS Volume 17
*IG.CCMP	Integrated Graphics	MTS Volume 17
*IG.CK400	Integrated Graphics	MTS Volume 17
*IG.CRT	Integrated Graphics	MTS Volume 17
*IG.DDRXF	Integrated Graphics	MTS Volume 17
*IG.DEBUG	Integrated Graphics	MTS Volume 17
*IG.DTC300	Integrated Graphics	MTS Volume 17
*IG.DTC302	Integrated Graphics	MTS Volume 17
*IG.FPS	Integrated Graphics	MTS Volume 17
*IG.GT40	Integrated Graphics	MTS Volume 17
*IG.HIDP11	Integrated Graphics	MTS Volume 17
*IG.HPGL	Integrated Graphics	MTS Volume 17
*IG.HP2648A	Integrated Graphics	MTS Volume 17
*IG.HP7203	Integrated Graphics	MTS Volume 17
*IG.HP7221	Integrated Graphics	MTS Volume 17
*IG.HP7470	Integrated Graphics	MTS Volume 17
*IG.HUGHES	Integrated Graphics	MTS Volume 17
*IG.MEGATEK	Integrated Graphics	MTS Volume 17
*IG.MUGRAF	Integrated Graphics	MTS Volume 17
*IG.MX12000	Integrated Graphics	MTS Volume 17
*IG.PEP	Integrated Graphics	MTS Volume 17
*IG.PICK	Integrated Graphics	MTS Volume 17
*IG.PRINTER	Integrated Graphics	MTS Volume 17
*IG.PS	Integrated Graphics	MTS Volume 17
*IG.QUMES5	Integrated Graphics	MTS Volume 17
*IG.SAVE	Integrated Graphics	MTS Volume 17
*IG.SCODL	Integrated Graphics	MTS Volume 17
*IG.SHUFFLE	Integrated Graphics	MTS Volume 17

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*IG.TD4000	Integrated Graphics	MTS Volume 17
*IG.TX4002	Integrated Graphics	MTS Volume 17
*IG.TX4006	Integrated Graphics	MTS Volume 17
*IG.TX4010	Integrated Graphics	MTS Volume 17
*IG.TX4014	Integrated Graphics	MTS Volume 17
*IG.TX4025	Integrated Graphics	MTS Volume 17
*IG.TX4025GIN	Integrated Graphics	MTS Volume 17
*IG.TX4027	Integrated Graphics	MTS Volume 17
*IG.TX4105	Integrated Graphics	MTS Volume 17
*IG.TX4113	Integrated Graphics	MTS Volume 17
*IG.TX4662	Integrated Graphics	MTS Volume 17
*IG.TX4663	Integrated Graphics	MTS Volume 17
*IG.XX1620	Integrated Graphics	MTS Volume 17
*IG.3270	Integrated Graphics	MTS Volume 17
*IG.339	Integrated Graphics	MTS Volume 17
*INDEX	Index Program	MTS Volume 15
*I8080ASR	Intel 8080 Assembler	CCMemo 422
*KDFLIB	OS/360 ALGOL	DOC:VOLUME.2X
*KERMIT	Network File Transfer	MTS Volume 2; CCMemo 473
*KEYPUNCHES	Key punch Information	None
*LABEL	Magnetic Tapes	MTS Volume 2
*LABELS	Page Printer Output	MTS Volume 2; MTS Volume 19
*LABELSNIFF	Magnetic Tapes	MTS Volume 2; MTS Volume 19
*LALRGEN	Grammar Parser	MTS Volume 2
*LATEX	Text Processing (TEX)	MTS Volume 2; CCMemo 815
*LCS	Loader Records	MTS Volume 2; MTS Volume 5
*LIBRARY	System Library	MTS Volume 2
*LINKEDIT	Linkage Editor	MTS Volume 2; MTS Volume 5
*LINK11	PDP-11 Linkage Editor	MTS Volume 2; CCMemo 286
*LINPG	Numerical	DOC:VOLUME.2X
*LISP	LISP	MTS Volume 8
*LISPLIB	LISP	MTS Volume 8
*LOADINFODSECT	Subroutine Dsect	LOADINFO, MTS Volume 3
*LOCALPLOT	Remote Plotter Support	MTS Volume 2; CCMemo 465
*LOCALPRINT	Remote Printer Support	MTS Volume 2
*LOGPURGE	Log-File Processing	MTS Volume 2
*MACBINHEX	Microcomputers	MTS Volume 2
*MACGEN	Macro Library Generator	DOC:VOLUME.2X
*MACPAINT4045	Microcomputers	MTS Volume 2
*MACUTIL	Macro Library Generator	MTS Volume 2; MTS Volume 14
*MACWRITE9700	Microcomputers	MTS Volume 2
*MADTOPL1	7090 MAD-PL/I Conversion	DOC:VOLUME.2X
*MCS650XASR	MOS Tech 6500 Assembler	CCMemo 422
*METATRAN	DI-3000 Metafile Xfr.	MTS Volume 2; CCMemo 463
*MNETTOPDS	Plot System	*PDSTOMNET, MTS Volume 2
*MPS	Numerical	MTS Volume 2
*MTSBIBLIOGRAPHY	Documentation Info.	MTS Volume 2
*MVC	Record Rearrangement	MTS Volume 2
*M6800ASR	Motorola 6800 Assembler	CCMemo 422
*M6809ASR	Motorola 6809 Assembler	CCMemo 422
*NETCOPYMAC	MTS Command Macros	MTS Volume 2
*NETMAILHELP	Remote Message Info.	MTS Volume 2
*NETMAILSCHEDULE	Remote Message Info.	MTS Volume 2

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*NETSERVERS.W	Server information	MTS Volume 1
*NETWORKRATES	Rate Information	MTS Volume 2
*NIM	Demonstration	DOC:VOLUME.2X
*OBJLIST	Object Module Utility	MTS Volume 2
*OBJSCAN	Object Module Utility	MTS Volume 2
*OBJUTIL	Object Module Utility	MTS Volume 2; MTS Volume 5
*OLDFIO	FORTRAN	None
*OSMAC	OS Macro Library	MTS Volume 2
*OVERDRIVE	FORTRAN	MTS Volume 2; MTS Volume 6
*PAGEFONTCONVERT	Page Printer Output	MTS Volume 2
*PAGEPR	Page Printer Output	MTS Volume 2; R1038
*PASCAL/JB	Same as *PASCALJB	
*PASCAL/VS	Same as *PASCALVS	
*PASCALJB	Pascal/JB	MTS Volume 2; MTS Volume 20
*PASCALJBINCLUDE	Pascal/JB	*PASCALJB, MTS Volume 2
*PASCALJBLIB	Pascal/JB	*PASCALJB, MTS Volume 2
*PASCALJBSYSLIB	Pascal/JB	*PASCALJB, MTS Volume 2
*PASCALTIDY	Pascal	MTS Volume 2; MTS Volume 20
*PASCALVS	Pascal/VS	MTS Volume 2; MTS Volume 20
*PASCALVSINCLUDE	Pascal/VS	*PASCALVS, MTS Volume 2
*PASCALVSLIB	Pascal/VS	*PASCALVS, MTS Volume 2
*PASCALVSSYSLIB	Pascal/VS	*PASCALVS, MTS Volume 2
*PDP11ASR	PDP 11 Assembler	CCMemo 422
*PDSTOMNET	Plot System	MTS Volume 2
*PEXIT	360/370 Assembler	MTS Volume 2; MTS Volume 14
*PFORT	FORTRAN Verifier	MTS Volume 2; CCMemo 406
*PGF	Page Printer Fonts	*PAGEPR, MTS Volume 2
*PIL	PIL/2	MTS Volume 12
*PL/C	Same as *PLC	
*PL/1	Same as *PL1	
*PL/1LIB	Same as *PL1LIB	
*PL/1SCAN	Same as *PL1SCAN	
*PL/1TIDY	Same as *PL1TIDY	
*PLC	PL/I Cornell Compiler	MTS Volume 2; MTS Volume 7
*PLOT	Printer Plotting	DOC:VOLUME.2X
*PLOTSEE	Plot System	MTS Volume 2
*PLOTSTACK	Plot System	MTS Volume 2
*PLOTSYS	Plot System	MTS Volume 2; MTS Volume 11
*PLOTTIMES	Plot Information	MTS Volume 2
*PLUS	PLUS Programming Lang.	*PLUS, MTS Volume 2
*PLUS.OBJLIB	PLUS Programming Lang.	*PLUS, MTS Volume 2
*PLUS.SOURCELIB	PLUS Programming Lang.	None
*PLUS11	PLUS Programming Lang.	*PLUS, Volume 2
*PL1	Same as *PL1F	
*PL1F	PL/I (F)	MTS Volume 2; MTS Volume 7
*PL1FLIB	PL/I (F)	*PL/I, MTS Volume 2; MTS Volume 7
*PL1LIB	Same as *PL1FLIB	
*PL1OPT	PL/I Optimizing Comp.	MTS Volume 2; MTS Volume 7
*PL1OPTLIB	PL/I Optimizing Comp.	*PL1OPT, MTS Volume 2; MTS Volume 7
*PL1SCAN	PL/I (F)	MTS Volume 2; MTS Volume 7
*PL1TIDY	PL/I (F)	MTS Volume 2; MTS Volume 7

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*PL360	PL360	CCMemo 75
*PL360LIB	PL360	CCMemo 75
*PRESCAN	TEXT360	MTS Volume 15
*PRINT	TEXT360	MTS Volume 15
*PRODUCTSUPPORT	Support information	MTS Volume 2
*PROFORT	FORTRAN Exec. Profiler	MTS Volume 6
*PROLOGC	Prolog language	MTS Volume 2; CCMemo 478
*PROLOGW	Prolog language	MTS Volume 2; CCMemo 477
*RATES	Rate Information	MTS Volume 2
*RATFOR	FORTRAN Preprocessor	MTS Volume 2
*REBATEFORM	Rebate Request Form	None
*REDUCE	Symbolic Mathematics	MTS Volume 2
*REQUESTACCOUNTS	Request Account Info.	None
*RESTORE	File Restoration	MTS Volume 2
*RG	Report Generator	MTS Volume 2; CCMemo 437
*RMLOG	Resource Manager Log	MTS Volume 2; R1037
*SCRAMBLE	File Security	DOC:VOLUME.2X
*SDL	Survey Definition Lang.	MTS Volume 2, CCMemo 452
*SENSEDSECT	Subroutine Dsect	MTS Volume 4
*SIDEBYSIDE	Page Printer Output	MTS Volume 2
*SIDEDATE	File Comparison	DOC:VOLUME.2X
*SIGSETUP	Sigfile processing	MTS Volume 2
*SIMSCRIPT2	SIMSCRIPT II	DOC:VOLUME.2X
*SIM2ASM	SIMSCRIPT II	DOC:VOLUME.2X
*SIM2CERRORS	SIMSCRIPT II	None
*SIM2COMP	SIMSCRIPT II	DOC:VOLUME.2X
*SIM2ERRORS	SIMSCRIPT II	DOC:VOLUME.2X
*SIM2LIB	SIMSCRIPT II	DOC:VOLUME.2X
*SITES	Campus Comp. Sites Info.	MTS Volume 2
*SKELETON	XPL	DOC:VOLUME.2X
*SLIDEQ	Graphics	MTS Volume 2; R1048
*SLIP	SLIP	MTS Volume 8
*SLIPDEC	SLIP	MTS Volume 8
*SNAP	Text Processing	DOC:VOLUME.2X
*SNOBOL4	SNOBOL4	MTS Volume 2; MTS Volume 9
*SNOBOL4B	SNOBOL4	MTS Volume 2; MTS Volume 9
*SNOSTORM	SNOBOL4	MTS Volume 2; MTS Volume 9
*SOFTWARECHARGES	Rate Information	MTS Volume 2
*SORT	Sort/Merge Program	MTS Volume 2; MTS Volume 5
*SPIRES	Database Management	MTS Volume 2
*SPITBOL	SNOBOL4	MTS Volume 2; MTS Volume 9
*SPITDEBUG	SNOBOL4	MTS Volume 2; MTS Volume 9
*SPITERR	SNOBOL4	*SPITBOL, MTS Volume 2; MTS Volume 9
*SPITLIB	SNOBOL4	MTS Volume 2; MTS Volume 9
*SPITSYSLIB	SNOBOL4	MTS Volume 2; MTS Volume 9
*SS.FTN.EX	Screen Routines Example	MTS Volume 4
*SS.PAS.EX	Screen Routines Example	MTS Volume 4
*STATUS	Signon ID Information	DOC:VOLUME.2X
*ST360	System/360 Simulator	DOC:VOLUME.2X
*SURVEY	User Survey	None
*SURVEYCOMMENTS	User Survey Comments	None
*SURVEYRESULTS	User Survey Results	None

*SYMBOLS	Symbol Information	MTS Volume 2
*SYSMAC	System Macro Library	MTS Volume 2; MTS Volume 14
*TABEDIT	Tab-Editing	DOC:VOLUME.2X
*TALLY	Instruction Counting	DOC:VOLUME.2X
*TANGO	Tango Programming Lang.	MTS Volume 2
*TANGOLIB	Tango Library	*TANGO, MTS Volume 2
*TAPECOPY	Magnetic Tapes	MTS Volume 2; MTS Volume 19
*TAPEDUMP	Magnetic Tapes	MTS Volume 2; MTS Volume 19
*TAPEFIXER	Magnetic Tapes	MTS Volume 2; MTS Volume 19
*TAPERETRIEVE	Magnetic Tapes	MTS Volume 2; T7012
*TAPES	Magnetic Tapes	MTS Volume 2; T7012
*TAPESUBMIT	Magnetic Tapes	MTS Volume 2; T7012
*TAXIR	Database Management	MTS Volume 2; Taxir Primer
*TDAY88FSMUTIL	T-Day Translation	None
*TDAY88TRANS	T-Day Translation	MTS Volume 2; CCMemo 480
*TELLABANK	Tell-A-Graf Graphics	MTS Volume 2, CCMemo 450
*TELLAGRAF	Tell-A-Graf Graphics	MTS Volume 2, CCMemo 450
*TELLALIB	Tell-A-Graf Graphics	CCMemo 450
*TERMINALS	Terminal Information	None
*TERMLIST	Terminal Information	MTS Volume 2
*TERMTYPES	Terminal Information	MTS Volume 2
*TEX	Text Processing	MTS Volume 2, CCMemo 810
*TEXLEVELCHECK	Text Processing (TEX)	CCMemo 810
*TEXTFORM	Text Processing	MTS Volume 2
*TEXT360	Text Processing	MTS Volume 15
*TIDY	FORTRAN	DOC:VOLUME.2X
*TIME	Time of Day	DOC:VOLUME.2X
*TRANNOBOL	SNOBOL3-SNOBOL4 Conv.	MTS Volume 9
*TYPEIT	Text Processing	None
*TYPEQ	Phototypesetter	MTS Volume 2
*T360MASTCONV	TEXT360	MTS Volume 15
*T90T360	TEXT360	None
*UAM	System Information	None
*UMIST	UMIST	DOC:VOLUME.2X
*UNEDIT	File Comparison	MTS Volume 2
*UNIXSTAR	Unix Tape Processing	None
*UNLINKER	Data Set Utility	CCMemo 449
*UPDATE	File Updating	DOC:VOLUME.2X
*USERDIRECTORY	Message System	MTS Volume 2; MTS Volume 23
*UTILISP	LISP	MTS Volume 2; MTS Volume 22
*VALIDATEFILE	File Checking	MTS Volume 2
*VSS	VSS Environment	MTS Volume 2, CCMemo 448
*VSSEMPYPDS	VSS Data Set Utility	CCMemo 449
*VSSPDSBUILD	VSS Data Set Utility	CCMemo 449
*VSSPDSCOMPRESS	VSS Data Set Utility	CCMemo 449
*VSSPDS CONVERT	VSS Data Set Utility	CCMemo 449
*VSSPDSLST	VSS Data Set Utility	CCMemo 449
*WATBOL	Waterloo COBOL	MTS Volume 2
*WATBOLLIB	Waterloo COBOL	*WATBOL, MTS Volume 2
*WATBOLLIBGEN	Waterloo COBOL	MTS Volume 2
*WATFIV	Waterloo FORTRAN	MTS Volume 2; MTS Volume 6
*WATGENLIB	Waterloo FORTRAN	MTS Volume 6
*WATLIB	Waterloo FORTRAN	*WATLIB, MTS Volume 2; MTS

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		Volume 6
*WBASIC	Waterloo BASIC	MTS Volume 2
*WIREFRAP	Hardware Logic Design	MTS Volume 2; CCMemo 267
*WORKSTATIONS	Terminal Information	MTS Volume 2
*WWICMAC	Hardware Logic Design	CCMemo 267
*WWLABMAC	Hardware Logic Design	CCMemo 267
*WWLIB	Hardware Logic Design	CCMemo 267
*WWSQGRD	Hardware Logic Design	CCMemo 267
*WWSTGRD1	Hardware Logic Design	CCMemo 267
*WWSTGRD2	Hardware Logic Design	CCMemo 267
*XALGOLW	ALGOL W	MTS Volume 16
*XCOM	XPL	DOC:VOLUME.2X, CCMemo 230
*XMON	XPL	CCMemo 230
*XPL	XPL	DOC:VOLUME.2X; CCMemo 230
*XPLCOMPILER	XPL	*XPL, MTS Volume 2; CCMemo 230
*XPLGO	XPL	DOC:VOLUME.2X; CCMemo 230
*XPLIBRARY	XPL	DOC:VOLUME.2X; CCMemo 230
*Z80ASR	Zilog X-80 Assembler	CCMemos 422 and 423
*1	L6 Macro Library	None
*1ASR	PDP-1 Assembler	CCMemo 329
*11ASR	PDP-11 Assembler	MTS Volume 2; CCMemo 286
*1130ASM	IBM 1130 Assembler	DOC:VOLUME.2X
*8ASR	PDP-8 Assembler	CCMemo 329
*8LINK	PDP-8 Linkage Editor	CCMemo 329
*9ASR	PDP-9 Assembler	CCMemo 329

MTS 2: Public File Descriptions

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SUBJECT CATEGORIES OF PUBLIC FILES

In an effort to aid people in finding programs that may be useful in their work, a number of subject categories have been defined. Each category consists of a type of activity a user might be doing, and under each category are listed the names of the public files that might be of use in that activity. The file names are listed alphabetically.

Assembly Language Usage

- *ASMH
- *ASMTIDY
- *ASSIST
- *MACUTIL
- *PEXIT
- *SYSMAC

C Language

- *CBELL
- *CBELLINCLUDE
- *CBELLLIB
- *C87
- *C87INCLUDE
- *C87LIB

Database

- *RG
- *SPIRES
- *TAXIR

File Manipulation

- *APC
- *CDUPDATE
- *COMBINE
- *COMPARE
- *ENCRYPT
- *FILESCAN
- *FS
- *RESTORE
- *UNEDIT
- *VALIDATEFILE

FORTRAN Usage

- *DAVE
- *FORTRANVS
- *FTN
- *FTNTIDY
- *IF66
- *IF77
- *PFORT
- *PROFORT
- *RATFOR
- *WATFIV
- *WATGENLIB
- *WATLIB

Graphics

- *CCQUEUE
- *DI3000.xxx
- *HPGLPLOT
- *IG
- *LOCALPLOT
- *METATRAN
- *MNETTOPDS
- *PDSTOMNET
- *PLOTSEE
- *PLOTSTACK
- *PLOTSYS
- *SLIDEQ
- *TELLABANK
- *TELLAGRAF

Information

- *CAMPUSZIPS
- *CCBIBLIOGRAPHY
- *CCDELIVERY
- *CCPHONES
- *CCPUBLICATIONS
- *CCRESHOURS
- *CCSOFTWARE
- *COMPUCALENDAR
- *CONSULTINGHOURS
- *CONSULTINGSCHED
- *CRCBOOKLIST
- *CRCSOFTWARE
- *CRISPINFO
- *DOCINFO
- *FORUM
- *MTSBIBLIOGRAPHY
- *NETMAILSCHEDULE

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|
|
*NETWORKRATES
*PRODUCTSUPPORT
*RATES
*REQUESTACCOUNTS
*SITES
*SOFTWARECHARGES
*TERMLIST
*TERMTYPES

Language Processors

|
*ALGOLW
*APL
*ASMH
*ASSIST
*BASICUM
*CBELL
*COBOLVS
*CSMP
*CSMPTRAN, *CSMPEXEC
*C87
*EXPL
*FORTRANVS
*FTN
*GASP
*GPSSH2
*ICON
*IF66
*IF77
*PASCALJB
*PASCALVS
*PLC
*PLUS
*PLUS11
*PL1F
*PL1OPT
*PROLOGC
*PROLOGW
*SNOBOL4
*SNOBOL4B
*SPITBOL
*TANGO
*UTILISP
*WATBOL
*WATFIV
*WBASIC
*11ASR

Macro Libraries

- *CMDMACLIB
- *MACUTIL
- *NETCOPYMAC
- *OSMAC
- *SYSMAC

Microcomputers

- *KERMIT
- *MACBINHEX
- *MACPAINT4045
- *MACWRITE9700

Numerical and Mathematical

- *MPS
- *REDUCE

Object Module Processing

- *ENDJUNK
- *LCS
- *LINKEDIT
- *OBJLIST
- *OBJSCAN
- *OBJUTIL

Pascal Usage

- *PASCALJB
- *PASCALJBINCLUDE
- *PASCALJBLIB
- *PASCALJBSYSLIB
- *PASCALTIDY
- *PASCALVS
- *PASCALVSINCLUDE
- *PASCALVSLIB
- *PASCALVSSYSLIB

PL1 Usage

- *PLC
- *PL1F
- *PL1FLIB
- *PL1OPT
- *PL1OPTLIB

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*PL1SCAN
*PL1TIDY

SNOBOL4 Usage

*SNOBOL4
*SNOBOL4B
*SNOSTORM
*SPITBOL
*SPITDEBUG
*SPITERR
*SPITLIB
*SPITSYSLIB

Subroutine Libraries

*CBELLLIB (see *CBELL)
*CSMPLIB
*C87LIB
*EXPLIB (see *EXPL)
*ICONLIB (see *ICON)
*LIBRARY
*PASCALJBINCLUDE (see *PASCALJB)
*PASCALJBLIB (see *PASCALJB)
*PASCALJBSYSLIB (see *PASCALJB)
*PASCALVSINCLUDE (see *PASCALVS)
*PASCALVSLIB (see *PASCALVS)
*PASCALVSSYSLIB (see *PASCALVS)
*PL1FLIB (see *PL1F)
*PL1OPTLIB (see *PL1OPT)
*SPITLIB
*SPITSYSLIB
*SYMBOLS
*TANGOLIB (see *TANGO)
*WATBOLLIBGEN
*WATLIB (see *WATFIV)
*WATGENLIB

Tape Usage

*CDUPDATE
*CMSTAPELOAD
*CMSTAPESCAN
*DEDIT
*FS
*LABEL
*LABELSNIFF
*TAPECOPY
*TAPEDUMP
*TAPEFIXER

- *TAPERETRIEVE
- *TAPES
- *TAPESUBMIT
- *UNIXSTAR

Text Processing

- *BIBTEX
- *DITTO
- *DVIAPS
- *DVIXER
- *LATEX
- *MACPAINT4045
- *MACWRITE9700
- *TEX
- *TEXTFORM

Utility Programs

- *ANALYSIS
- *APLFONTCONVERT
- *ARC
- *AUTOSTART
- *BCDEBCD
- *CKID
- *CKSIG
- *CLPARSEGEN
- *CMS
- *COLLATE
- *EBCDBCD
- *FLOWCHART
- *LABELS
- *LOCALPRINT
- *LOGPURGE
- *MVC
- *PAGEFONTCONVERT
- *PAGEPR
- *RMLOG
- *SDL
- *SIDEBYSIDE
- *SIGSETUP
- *SORT
- *SYMBOLS
- *TDAYTRANS
- *USERDIRECTORY
- *VSS
- *WIREWRAP

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OTHER AVAILABLE FILES

This volume describes only "public files"--files maintained by the Computing Center for general use. Public file names are distinguished by an asterisk "*" as the first character of their name. In addition to public files, many groups on campus maintain collections of files for general use. These are read-only shared files, and are accessed by prefixing the file name with the Computing Center ID that owns the file and a colon ":". For example, STAT:CATALOG. The Computing Center ID used for such communication purposes is usually some mnemonic name, such as STAT. Some of these are:

- BSAD - Graduate School of Business Administration
- CAP - Computer Assistance Program, Department of Political Science
- ECON - Department of Economics (TROLL, SHAZAM, TIMESERIES)
- EDUC - School of Education
- ILIR - Institute of Labor and Industrial Relations (MICRO, MIST)
- ISR - Institute for Social Research (OSIRIS-IV)
- NAAS - Numerical Analysis and Applications Software
- NEW - New versions of Computing Center software
- PCn - Computing Center Micro Consultants Group (Personal computer software - currently, the IDs PC, and PC1 through PC6 are being used)
- OLD - Old versions of Computing Center software
- SPSS - Department of Sociology
- STAT - Statistical Research Laboratory (MIDAS, TEXTEDIT)
- UNSP - Unsupported software
See below.

Specific reference will be made in other volumes of the manual. Several departments also maintain such communication CCIDs. These are usually for courses within the department, but often may contain files of general interest.

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The Computing Center ID UNSP is part of an effort to gather a number of unsupported programs and subroutines into one location. This unsupported software is being made available under UNSP rather than in public files because the Computing Center does not have the resources (people, time, or money) to completely insure its quality or to provide continuing maintenance. Many of these programs and subroutines represent interim solutions to particular problems which will be replaced with supported software as better solutions are developed.

As the name UNSP suggests, this software is not actively supported by the Computing Center staff. This means that there are no guarantees as to its reliability, performance, or continued availability, no counseling is available beyond that normally provided for user programs, and no rebates will be given for errors caused by the operation of unsupported software. (It should be noted, however, that before any software is made available under UNSP, a member of the Computing Center staff will have done minimal testing and determined that the program does what it claims to do for the common cases.) The file UNSP:CATALOG may be copied to obtain a list of the programs and subroutines currently available together with a short description and directions for obtaining additional documentation.

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PUBLIC FILE DESCRIPTIONS

Following are the descriptions of the public files available in MTS. These descriptions are designed to be used as reference for using the files; full explanatory descriptions are not provided here. Introductions and detailed usage guides will be found in the other volumes, and in general the public file descriptions are repeated there.

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*ALGOLW

Contents: The MTS version of the ALGOL W compiler.

Purpose: To compile ALGOL W programs.

Use: The compiler is invoked by the \$RUN command.

Program Key: *EXEC

Logical I/O Units Referenced:

- SCARDS - program or external procedure to be compiled (exactly one ALGOL W program or external procedure is allowed).
- SPRINT - output of compilation listing.
- SERCOM - diagnostic messages produced by the compiler.
- SPUNCH - object module of the compiled program.

Return Codes: 0 - Successful return.
 4 - Error return.
 8 - Error return.
 16 - Execution suppressed.

Description: This compiler is the MTS version of the ALGOL W compiler written at Stanford University. The definition of the language and the details for its use in MTS are given in MTS Volume 16, ALGOL W in MTS.

Examples: \$RUN *ALGOLW SCARDS=ALGOLWSOU SPUNCH=ALGOLWOBJ PAR=DECK

In the above example, the ALGOL W source program is read from the file ALGOLWSOU and the object module is written to the file ALGOLWOBJ.

```
$RUN *ALGOLW
/COMPILE
    source program
/EXECUTE
    data
/STOP
```

The above example illustrates the method of running ALGOLW in compile-and-execute mode. By default, a source listing is written to the file -AWLIST.

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*ANALYSIS

Contents: A program for analyzing the statistics produced on magnetic tape by the data collection facility of MTS (the STAT job).

Purpose: To aid in the processing of the detailed statistical data records on magnetic tape by the UMMPS data collection facility.

Use: The program is invoked by a \$RUN command specifying *ANALYSIS (or in some cases, *ANALYSIS(0)) as the object file.

Program Key: *ANALYSIS

Logical I/O Units Referenced:

SCARDS - the statistical tape to be processed.
 SPRINT - all output produced by the program, in machine carriage-control format.

Return Codes: None.

Description: The data collection facility of MTS (the STAT job) produces a very detailed chronological history of certain events of interest occurring in the system. Paging events, input/output operations, assignments of processors to tasks, etc., may all be recorded. The data collection procedure must be invoked from the operator's console. It cannot be invoked by a user at a terminal or by a batch job.

Once a statistics tape has been produced, *ANALYSIS may be used to aid in any data reduction necessary. It has a large number of optional features controlled by the PAR field of the \$RUN command. These options allow direct printout of the statistics on the tape, at varying levels of detail, or selection of statistics relating only to certain tasks or certain aspects of system activity. In addition, user-written subroutines may be loaded with *ANALYSIS. *ANALYSIS will pass data to these subroutines for further processing.

The use of the data collection facility and *ANALYSIS is a fairly complex procedure requiring more documentation than it is possible to reproduce here. For a complete description of the use of *ANALYSIS (and the collection of data) the following references are given.

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- (1) Computing Center Memo 393, "Data Collection Facility."

This contains a complete operating guide to both the data collection facility and *ANALYSIS. The level of detail is sufficient to allow the use of the facilities by a user with a familiarity of the structure of the UMMPS/MTS system.

- (2) Program Behavior and Control in Virtual Storage Computer Systems, CONCOMP Project Technical Report 4, by Tad B. Pinkerton.

The appendix of this report contains a good discussion of the philosophy of the data collection facility and the overhead incurred in its use.

- (3) Performance Analysis of Multilevel Paging Hierarchies, James A. Hamilton, Doctoral Dissertation, University of Michigan.

An appendix to this dissertation updates the overhead analysis in (2).

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*APC

Contents: The "all-purpose compare" program.

Purpose: To test for equality between records of two files.

Use: The program is invoked by the \$RUN command.

Program Key: *APC

Logical I/O Units Referenced:

- SPRINT - printed output.
- SERCOM - diagnostic messages.
- GUSER - user responses in conversational mode.
- 0 - file or device to be compared.
- 1 - file or device to be compared.

Return Codes:

- 0 - Both files or devices are equal.
- 4 - One or more records are unequal, or they may be all equal but their lengths or line numbers are not and LENCHK or LNRCHK option is ON.
- 8 - An input or fatal error has occurred.

Description: This program is primarily used to test for equality between records of two separate files or devices for verification. Other programs that indicate differences between files or devices are *AMENDS (to generate MTS command mode lines), *DOWNDATE (to generate *UPDATE control cards), *SIDEDATE (to compare two *UPDATE command streams), and *UNEDIT (to produce context editor control cards).

The files or devices to be compared are read from the logical I/O units 0 and 1. A one-to-one positional comparison of all characters is made on each record from the two files or devices. If two records being compared are of unequal lengths and LENCHK is not specified, the comparison is made as if the shorter record is padded with blanks. The FILES parameter may be specified so that a certain number of or all files of the two tapes attached to the logical I/O units 0 and 1 can be compared.

The all-purpose compare program generally compares the two files or devices record by record. However, instead of waiting for the user action after a mismatch, the program can run in the synchronization mode when the user enables the SYNCH option. Then after a mismatch is discovered, the program will attempt to look ahead and to resynchronize, i.e., to match a specified number of

consecutive records of the two files. This number depends on the parameters BREAK, MAXCOMP, MAXDEL, and SLOPE. MAXCOMP is the maximum number of records that the program will compare in attempting to resynchronize; MAXDEL is the maximum number of consecutive records that will be deleted from one of the two files in attempting to resynchronize; BREAK and SLOPE control the actual number of records that must match. The synchronization mode is especially useful in batch where there is no interaction on the part of the user.

Parameters: The following parameters may be specified in the PAR field of the \$RUN command. The parameters must be separated by commas or blanks. Some of the parameters (as indicated in the list below) may be negated by prefixing with "NO", "N", "-", or "~". Minimum acceptable abbreviations are underlined>.

BREAK=n	"n" and "m" (from the SLOPE parameter) control the number of records that must match in the two files before a "resynch" is recognized. If "d" is the size in deleted records preceding the resynch, then the match must be $n+(d-n)/m$ records long, unless "d<n", in which case, "d" is used. If the result is greater than the value of MAXCOMP, then MAXCOMP is used. The defaults are n=3 and m=7.
EBCD	Print two erroneous records in EBCDIC format. This is the default.
FILES={n ALL}	If specified, "n" or all files on two tapes, designated by the units 0 and 1, are compared. The default is ALL.
HEX	Print two erroneous records in hexadecimal format. The parameter EBCD forces the program to print in EBCDIC instead of hexadecimal format.
LIMIT=n	This is enforced only in batch mode. If the number of errors exceeds "n", the program will be terminated. The default is 10.
[NO]LENCHK	If specified, line lengths are compared for equality. The default is NOLENCHK.

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[NO] LNRCHK If specified, line numbers of records are compared for equality. The default is NOLNRCHK.

MAXCOMP=n "n" is the maximum number of records to be compared between the two files before deciding that a resynch has been found. The actual number of records compared depends on the size of the preceding deletion and the value of BREAK and SLOPE parameters. The default is 25.

MAXDEL=n "n" is an estimate of the maximum number of records to be deleted in any one deletion from one file to the other file. Specifying a value slightly larger than the number of records actually deleted will greatly reduce the cost of running the program. If "n" is too small, the comparison output to SPRINT will be valid, but much longer than necessary. The default is 500.

PADCHAR=xx When two records have unequal lengths, the shorter record is padded on the right with a character of the value of two hexadecimal digits "xx". The default is a blank, hexadecimal 40.

SLOPE=m See the BREAK parameter.

[NO] SYNCH If the synchronization mode is on, the program will attempt to compare a certain number of records according to BREAK, MAXDEL, MAXCOMP, and SLOPE parameters. This will result without the user's interaction. The default is NOSYNCH.

[NO] TRIM Input records are trimmed off at right. The default is NOTRIM.

X This is same as the HEX parameter.

All-Purpose Compare Command Language

If neither logical I/O unit 0 nor 1 is specified, APC goes into command mode. Otherwise, it starts out comparing the two files. When it finds a mismatch, it reports this and lapses into command mode. Note: In batch, commands are not implemented; the user must specify the units and/or parameters.

The following is the list of available APC commands. The uppercase portion of command names and keywords indicates minimum abbreviations that may be used. A command line beginning with an asterisk "*" is considered to be a comment and is not processed. A command line beginning with a dollar sign "\$" is assumed to be an MTS command; it will be executed and APC will regain control. All APC commands start with the first nonblank character, which need not start at position 1. At least one blank should separate the command name and the first operand, and there must be a blank or a comma between any two operands.

Command: BACKward [{0|1|BOTH}] [n]

Example: BACKWARD 0 15

Explanation: This command skips backwards "n" records on either logical unit 0 or 1 or both. If "n" is negative, forward-spacing takes place. The default for "n" is 1. A CONTINUE command will start comparing.

Command: COLUMN [{0|1|BOTH}] [(m,n)]

Example: COLUMN (1,72)

Explanation: This command sets the left and right columns for either unit 0 or 1 or both between which APC may compare. The default is m=1 and n=32767 for both units.

Command: COMMENT comments

Example: COMMENT - Now we print two unequal records

Explanation: The COMMENT command is useful for documenting sequences of commands given to APC. Note that command lines beginning with an asterisk are also treated as comments.

Command: COMPARE FDname0 FDname1 [HOLD] [Visual]

Example: COMPARE MAC MACLIB

Explanation: The COMPARE command attaches two files or devices to the unit 0 and 1. If HOLD is specified, the comparison is

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not started at once; instead, APC gets back into command mode. A CONTINUE command starts comparing these two. If VISUAL is specified, the units are put directly in visual mode.

Command: CONTINUE [{COL|COL0|COL1}={m|*} | {SKIP|SKIP0|SKIP1}=n]

Example: CONTINUE

Explanation: This continues the comparison with the next character (or the character at the column "m" if COL is specified or at the current column pointer plus "n" if SKIP is specified). COL=* compares the current characters. Alternatively, COL0 (for unit 0), COL1 (for unit 1), SKIP0 (for unit 0), and SKIP1 (for unit 1) may be set for unit 0 or 1 instead of both units. If COL=m or SKIP=n is not specified, the default is the next column.

Command: DISPLAY [item] ...

Example: DISPLAY PFKEYS

Explanation: This command displays various things. Things that can be displayed currently are PFKEYS and STATUS.

DISPLAY PFKEYS

The action of DISPLAY PFKEYS depends on whether the command is issued while in visual mode or while in line mode. If issued in line mode, the current PFkey definitions are displayed. If issued in visual mode, the user is placed in the editor in visual mode, and the PFkey definitions can be viewed, edited, etc.

DISPLAY STATUS

DISPLAY STATUS is a synonym for the STATUS command.

Command: EDit {0|1} [cmdnd]

Example: EDIT 1 visual

Explanation: This command is the same as issuing the MTS command \$EDIT for the given unit.

Command: EXPLAIN [item] ...

Example: EXPLAIN STATUS

Explanation: This command gives explanations of the items specified in full-screen help. The following items can be explained: \$, *, ?, BACK, BREAK, COLUMN, commands, COMMENT, COMPARE, CONTINUE, description, EBCD, everything, example, EXPLAIN, FILES, FWD, HELP, HEX, LENCHK, LIMIT, LINE, LNRCHK, MAXCOMP, MAXDEL, MCMD, MTS, parameters, PADCHAR, PRCOL, PRINT, PRLN, READ, RETURN, SCAN, SET, SLOPE, STATUS, STOP, SYNCH, TRIM, VISUAL.

Command: {FORward|Fwd} {0|1|BOTH} [n]

Example: FORWARD BOTH 5

Explanation: This command skips "n" records on either logical unit 0 or 1 or both. If "n" is negative, backspacing takes place. The default for "n" is 1. A CONTINUE command will start comparing.

Command: HELP

Example: HELP

Explanation: This command is a synonym for the EXPLAIN command.

Command: LINE {0|1|BOTH} lnr

Example: LINE 0 1.55

Explanation: A record is read from the unit 0 or 1 at the line number "lnr". In addition to its actual line number value, "lnr" can have the value of *F, *L, *N, and *P for the first line, last line, next line, and previous line, respectively, just as in the editor.

Command: MCMD cmdnd

Example: MCMD \$LIST FYLE(20,25)

Explanation: "cmdnd" must be a valid MTS command. It will be executed, and control is returned to APC. Alternatively, the user may issue the MTS command directly in the command mode by prefixing it with a dollar sign, e.g., \$EMPTY QQ.

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Command: MTS [cmnd]

Example: MTS

Explanation: "cmnd", if specified, must be a valid MTS command. It will be executed, and APC may be reentered by a \$RESTART MTS command.

Command: PRINT [{0|1|BOTH}] [{HEX|X|EBCD}] [LEN=1] [COL={*|c}]
[COUNT|CNT]=n]

Example: PRINT EBCD LEN=56 C=1

Explanation: This prints unit 0 or 1 or both on I/O unit SPRINT in either hexadecimal (see the previous descriptions of the HEX and X parameters) or EBCDIC (see the previous description of the EBCD parameter) format with length = "1", starting at either the current column "*" or the specified column "c". If "0" or "1" is not specified, current records from both units are printed. The defaults are EBCD, LEN=32767, and COL=1. These defaults may be overridden by the SET command. If COUNT or CNT is set to "n", then "n" records of unit 0 or 1 are printed. This is similar to listing records.

Command: READ [{0|1|BOTH}]

Example: READ 0

Explanation: If "0" and "1" are not specified, both units will be read. Otherwise, a record from the specified unit is read. Then, APC starts comparing.

Command: RETURN

Example: RETURN

Explanation: This terminates the processing and control returns to the caller (normally MTS command mode).

Command: SCAN {0|1} [{BACK|FWD}]

Example: SCAN 0

Explanation: This command scans the logical unit 0 or 1 for the matching record from the other unit. If successful, it prints the line number. If not, a message is printed. If BACK parameter is specified, the scanning will be backwards instead of forwards.

Command: SET option ...

Example: SET HEX=ON, PRLLEN=56, PRCOL=*

Explanation: The SET command is used to alter the status of various APC options, default switches or default characters. Options must be separated by blanks or commas; there must be no blanks within any option.

BREAK=n Default: 3

"n" and "m" (from the SLOPE option) control the number of records that must match between the two files before a "resynch" is recognized. If "d" is the size in deleted lines preceding the resynch, then the match must be $n+(d-n)/m$ records long, unless $d < n$, in which case, "d" is used. If the result is greater than the value of MAXCOMP, then MAXCOMP is used. The defaults are n=3 and m=7.

FILES={n|ALL} Default: ALL

The FILES option is used to compare "n" or ALL files of two tapes, 0 and 1. Two consecutive end-of-files terminate the processing.

HEX={ON|OFF} Default: OFF

If the HEX option is ON, all records are printed in hexadecimal notation when the user issues the PRINT command and does not specify the EBCD parameter. If the option is OFF, records will be printed in EBCD.

LENCHK={ON|OFF} Default: OFF

If the LENCHK option is ON, line lengths are compared. If an error occurs in the line lengths, a message indicating the erroneous line lengths will be printed. This can easily occur when MTS trims a record off by removing extra trailing blanks on the left. Line lengths are never compared if LENCHK is OFF or if records are unequal.

LNRCHK={ON|OFF} Default: OFF

If the LNRCHK option is ON, line numbers are compared. If an error occurs in the line numbers (i.e., if they are not identical in both files), a message indicating the erroneous line numbers will be printed. If LNRCHK is OFF or records are unequal, line numbers are not compared.

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MAXCOMP=n Default: 25

"n" is the maximum number of records to be compared between two files before deciding that a resynch has been found. The actual number of records compared depends on the size of the preceding deletion and the value of BREAK and SLOPE.

MAXDEL=n Default: 500

"n" is an estimate of the maximum number of records to be deleted in any one deletion from one file to another file. Specifying a value slightly larger than the number of records actually deleted will greatly reduce the cost of running the program. If "n" is too small, the comparison output to SPRINT will be valid, but much longer than necessary.

PADCHAR=xx Default: 40 (blank)

The PAD option with value in two hexadecimal digits is used to pad shorter records before the comparison is made. The default of the PAD option is a blank, equivalent to hexadecimal 40.

PRCOL={*|c} Default: 1

The PRCOL option prints the records starting at position "c" or "*" (the current column). PRCOL=1 will print records starting at column 1.

PRLLEN=1 Default: 32767

The PRLLEN option specifies the length of an erroneous record to be printed. This controls the amount of information. The default is from the current column to the end of record.

SLOPE=m Default: 7

See the BREAK option.

SYNCH={ON|OFF} Default: OFF

If SYNCH is ON, the program will attempt to synchronize the records of the two files it is comparing.

TRIM={ON|OFF} Default: OFF

The input records are usually read without trimming. If the user desires to set the trim feature on so that excessive blanks at right are removed, he

should set TRIM=ON. TRIM option should be set on especially for tapes in visual mode.

Command: STATUS [{0|1|BOTH}]

Example: STATUS 0

Explanation: This command prints units 0 and/or 1 with FDnames, file numbers (if a tape), record numbers (if a tape), line numbers, record lengths, and current columns.

Command: STOP

Example: STOP

Explanation: This command terminates processing, and control is returned to the caller (normally MTS command mode).

Command: VEXEcute

Example: VEXECUTE

Explanation: This command causes APC to execute a command given on the current command line when in visual mode. Note that this command is really only effective when used as a pfkey command.

Command: VEXIT

Example: VEXIT

Explanation: This command causes APC to exit visual mode.

Command: VISUAL [lnr0 [lnr1]]

Example: VISUAL *F 10.5

Explanation: This command gets APC into visual mode. Line numbers may be specified for units 0 and 1; the defaults are the current line numbers. This command should normally follow the COMPARE command with the word HOLD. See below.

The VISUAL command is supported for any device supported by the MTS screen-support routines. Two files being compared by APC are displayed in two columns on the screen. In addition, the cursor, control keys, and program-function keys can be used to keep the command language to a minimum. In the visual mode of APC, the screen has three parts:

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- (1) A "status" line (the top line of the screen) indicating the file names being displayed. The user can also type in the lines he wants to compare.
- (2) A "line" area, divided in two columns, showing as many lines as possible of the two files, with corresponding line numbers. If the lines are different, the line numbers are intensified. All nonprinting characters of lines are automatically converted to "?".
- (3) A "command" line, which occupies the bottom line. Here the user can enter any valid APC command.

Program-function keys have the following default assignments:

- PF1: Similar to "BACK 0 10", which moves ten previous lines of the first file back to the screen.
- PF2: BACK BOTH 10. Ten lines of both files are moved back.
- PF3: BACK 1 10. Ten previous lines of the second file are moved into the screen.
- PF4: Similar to "FWD 0 10". Next ten lines of the first file are shown on the screen.
- PF5: FWD BOTH 10. Next ten lines of both files are shown.
- PF6: FWD 1 10. Next ten lines of the second file are shown.
- PF7: FWD 0 1. Next line of the first file is shown.
- PF8: FWD BOTH 1. Next lines of both files are shown.
- PF9: FWD 1 1. Next line of the second file is shown.
- PF10: SCAN 0. The first file is scanned, starting from the current line, and terminating at a line matching the current line of the second file.
- PF11: CONTINUE. Both files are compared, until a mismatch is found.
- PF12: SCAN 1. The second file is scanned, starting from the current line, and terminating at a line matching the current line of the first file.

Notice that the program-function keys are arranged in three columns. The left column is used for the first file displayed in the left column of the screen, the right column of program-function keys is used for the second file, and the middle column is used for both files.

The lines can be made current by moving the cursor to the desired row displaying these lines, or by typing the line numbers in the status area just before the file name.

The bottom lines can be used to send the APC commands (especially those not readily available on the program-function keys), such as "COLUMN (1,72)", "\$EDIT FILE2", or "SET LNRCHK=ON".

The other control keys are:

- CLEAR = rewrite the screen,
- PA1 = interrupt (especially useful during the comparison or scanning),
- CNCL (or PA2) = cancel the visual mode,

TESTREQ = set the cursor to the command area,
 ENTER = process the command, etc.

APC program-function keys are summarized below:

PF1 Back 0 10	PF2 Back both 10	PF3 Back 1 10
PF4 Fwd 0 10	PF5 Fwd both 10	PF6 Fwd 1 10
PF7 Fwd 0 1	PF8 Fwd both 1	PF9 Fwd 1 1
PF10 Scan 0	PF11 Continue	PF12 Scan 1

Example

```

#$run *apc
#EXECUTION BEGINS
@compare *sysmac *asmtsysmac
Mismatch at col 12 unit 0 *SYSMAC lnr 2.5 and unit 1 *ASMTSYSMAC
lnr 2.5
@status
Unit 0: *SYSMAC lnr 2.5 len 13 col 12
Unit 1: *ASMTSYSMAC lnr 2.5 len 13 col 12
@print
Unit 0: *SYSMAC lnr 2.5 len      Unit 1: *ASMTSYSMAC lnr 2.5
13 col 12                        len 13 col 12
IHBOPPLST 268                    | IHBOPPLST 265
@print hex
Unit 0: *SYSMAC lnr 2.5 len      Unit 1: *ASMTSYSMAC lnr 2.5
13 col 12                        len 13 col 12
C9C8C2D6D7D3E2E340F2F6F840      C9C8C2D6D7D3E2E340F2F6F540
@column (1,8)
@continue
Mismatch at col 7 unit 0 *SYSMAC lnr 10.5 and unit 1 *ASMTSYSMAC
lnr 10.5
@print
Unit 0: *SYSMAC lnr 10.5 len      Unit 1: *ASMTSYSMAC lnr 10.5
13 col 7                          len 13 col 7
IOPMOD  912                        | IOPMODS  909
@set synch=on
@column
@compare 0 1
*****
2      TWO                1 equal line *****
*****
7      SEVEN              4 equal lines *****
After line 6
    
```

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```
*****
After line 8          1 equal line *****
                    8.25  EIGHT AND A QUARTER
                    8.5   EIGHT AND A HALF
*****
11      ELEVEN       2 equal lines *****
12      TWELVE      After line 10
*****
19      NINETEEN    6 equal lines *****
                    After line 18
*****
Files have 7 mismatches
@stop
9 errors
#EXECUTION TERMINATED  RC=4
```

MTS 2: Public File Descriptions

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*APL

Contents: The IBM VS APL Version 3.0 System.

Use: The VS APL System is invoked by the \$RUN command. If a terminal with an APL character set is being used, its APL character set and the VS APL procedures for input line editing may be invoked; otherwise, a character transliteration scheme that maps the APL characters into 2- or 3-character (ASCII or EBCDIC) combinations will be invoked. VS APL will not assume that the user's terminal is one that will support the APL character set; the user must request the support via a PAR field parameter. See the main APL reference, Computing Center Memo 435, "MTS VS APL User's Guide," for a detailed description of this system.

Program Key: *APL

Logical I/O Units Referenced:

SCARDS - Source statements and commands for VS APL.
 SPRINT - Output from VS APL.

Return Codes: 0 - Successful return.
 >0 - Internal APL error.

Parameters: The following parameters may be specified in the PAR field of the \$RUN command. The parameter names must be completely specified.

SIZE=nP This specifies the initial default clear-workspace size in pages. The range of n is 5 to 256, inclusive. The default is 12 pages. Alternately, the size may be given in bytes by specifying SIZE=n where n is the byte size value. Also, WSSIZE is a synonym for SIZE. Note that this parameter approximates the actual workspace size in that the actual space presented to the user will be approximately 95% of the value given due to the workspace-management-storage overhead associated with the specification value.

APL This parameter instructs VS APL to invoke the APL character set appropriate to the user's terminal if the set is known by VS APL. Some terminals have the capability of using either standard (ASCII or EBCDIC) codes or APL codes without user intervention. If VS APL recognizes the user's terminal as being in this

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class then it will automatically send control codes to the terminal to cause it to use its APL character codes. For other terminals, the user must physically change the terminal's operation (e.g., change a print wheel). Regardless of the terminal type, if VS APL supports it with an APL character set, then standard APL line editing procedures may be used. If, however, the terminal cannot be supported in this fashion, then VS APL will use a character transliteration scheme to allow the user to use APL at that terminal with its standard character set.

VS APL uses the terminal type, as established by either the terminal answerback received at signon time or explicitly set by the TERMINAL device command, to determine whether the terminal is capable of communicating via APL graphics. The currently recognized terminal types are:

AJ630	AJ830	AJ860	CD1203	DTC300
DTC302	GE300	GSI300	LA120	LA36
LS120	TI745	T4015	X1620	

See MTS Volume 4, Terminals and Networks in MTS, for further information. The IBM 2741 and Model 38 Teletype terminals may have different APL character assignments depending on the typing element or box mounted. Therefore, the APL character set cannot be uniquely determined by the terminal type. One of the following parameters must be specified instead of the APL parameter to resolve the terminal type.

CORR This must be specified when an IBM 2741 with a CORRESPONDENCE keyboard and a 987 typing element is to be used; otherwise, the IBM 2741 terminal is assumed to have a PTTC keyboard with a 988 typing element.

APL2,APL3 These specify the mutually exclusive APL2 and APL3 character assignments, respectively (e.g., for a Model 38 Teletype).

TIME=t This specifies a non-zero CPU time limit (in seconds) to be applied to this invocation of VS APL. Alternately, T=t may given. The value t may be either in integer or floating-point form. For example, TIME=3 or T=5.0E-3. When

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the time limit is satisfied during the session, VS APL suspends its operation (e.g., a function being executed) and places the user in APL command mode. Thereafter, a new time limit may be set via the)TIME APL command. Also, the user can reset the time by using this command with a zero argument.

SPACE,SP Either parameter causes the output transliteration codes to be bracketed with spaces, thus improving readability at the expense of compactness. Also, either forces transliteration to be used.

NM This turns off the printing of the VS APL logon message which is normally printed prior to workspace establishment.

ECHO At a terminal, input lines from a)SOURCE file are not normally echoed. Specification of this parameter will force the echoing.

NOECHO,NE In batch, input lines from either a)SOURCE or the APL input stream are echoed. Specification of this parameter will defeat the echoing. NE is an alternate for NOECHO.

NOCONTENT When VS APL loads an APL/360 workspace it does a format conversion in which all global objects (variables, functions, and groups) and their names are converted into VS APL internal format. In addition, it performs a content conversion in which all function statements are examined for items that require conversion in order to execute properly under VS APL. Such items are converted to their VS APL equivalent, if possible, and are noted on the conversion report. Items with no VS APL equivalent are just noted. Specification of this parameter affects only the format part of the conversion.

NOSUMMARY After VS APL converts an APL/360 workspace and reports on the process, it prints a summary containing the number of functions, variables and other items. Specification of this parameter will defeat the printing of the summary.

Description: APL is a general-purpose computing language first defined by K. E. Iverson in A Programming Language (Wiley, 1962). IBM Corporation originally developed a conversation interpreter for this language called APL/360. This was supported in MTS at the University of Michigan until the new IBM version of APL, VS APL, was installed to

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supercede APL/360 but yet provide an APL/360-to-VS APL workspace-conversion process which would effect conversions, as needed, and summarize their results. VS APL supports new operations that are not supported by APL/360. Moreover certain APL/360 functions or system variables do not have VS APL equivalents. For more information, see Computing Center Memo 435, "MTS VS APL User's Guide," and the following IBM documents:

- (1) APL Language, GC26-3874 (Reference Text)
- (2) APL/360 Primer, GH20-0689 (Student Text)
- (3) VS APL Reference Summary, ST00-0602 (Reference card)

Examples:

```
$RUN *APL
```

```
$RUN *APL PAR=APL,ECHO
```

```
$RUN *APL PAR=APL,SIZE=200P
```

```
$RUN *APL PAR=APL2,TIME=10
```

```
$RUN *APL PAR=APL,NOCONTENT,NOSUMMARY
```

```
$RUN *APL PAR=SIZE=200000
```

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*APLFONTCONVERT

Contents: A program to translate VS APL transliteration code input into output formats and font codes appropriate for producing APL symbols on the Xerox 9700 page printer.

Use: APLFONTCONVERT is invoked by the \$RUN command.

Program Key: *APL

Logical I/O Units Referenced:

- SCARDS - Transliteration code input to be converted into APL symbols.
- SPRINT - The page-printer-oriented output from the font conversion process.
- SERCOM - Error messages and summary of the conversion process.

Return Codes: Always zero.

Description: The APLFONTCONVERT program reads transliteration code input and converts it into either portrait or landscape formats in the APL font to be printed on the page printer. All transliteration code input that is accepted by VS APL (*APL) is accepted by this program. Output lines that are too long to fit on the page width of the page format are wrapped around to successive lines with a five-column indentation.

The transliteration code input to this program may be generated in *APL by first issuing the)SINK <FDname> command and then using *APL to output the information to be page printed. Output from *APL will be directed to <FDname> (e.g., an MTS file) until the command)SINK *MSINK* is given.

By default, the name of the SCARDS stream, the current time and date, and the user's ID are printed as a header on each output page. Also, the output pages are labeled at the bottom by means of a footer line containing the page number and a blank footer.

The input stream record length is limited to 255 characters. Long lines are truncated to this limit, with the line number of the first long line being printed on SERCOM.

When illegal transliteration code input is encountered, the line number of the first line in error is printed on SERCOM. All illegal input characters are flagged in the

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output with the `▪` square bullet character of the normal font 1.

When the program ends, it produces a process summary of the number of truncated long lines, the number of erroneous input characters, and the number of input lines processed, and indicates whether the process was completed (all input lines were processed) or terminated (not all lines were processed, e.g., due to a user attention or MTS I/O error).

The parameters, described below, may be used to control the page layout. Basically, the user may select either portrait or landscape page orientations, define footer text, remove either the header or page numbers, and select one-sided or two-sided output. Hence, the output can be minimally, just APL text, and maximally, fully labeled and annotated APL output.

The user may direct the output file to the page printer by \$RUNning `*PAGEPR` and specifying the output file from `*APLFONTCONVERT` as input. `*PAGEFONTCONVERT` provides certain `*PAGEPR` controls (the `FORMAT` selection, `FONTINDEX`, and either the `ONESIDED` or `TWOSIDED` parameter) as part of its output; hence, the user may only augment these parameters, as needed, in the `PAR` field of the `*PAGEPR` invocation (e.g., `PAR=OVERLAY=SHADING,SHIFT`).

Parameters: The following parameters may be specified to direct the conversion process. They are listed with their minimum abbreviations being underlined. The parameters that can be negated are also presented in their negated forms with the "NO" prefix; however, "`~`" and "`-`" are also acceptable. All parameters may be separated by one or more blanks and/or single commas.

PORTRAIT Produce the output in portrait page orientation.

LANDSCAPE Produce the output in landscape page orientation (the default).

FOOTER=<str> Define the footer to be the text contained in the string `<str>`, which may be delimited by either primes (`'`) or quotes (`"`). Doubled occurrences of the delimiter within `<str>` will be treated as a single occurrence in the resultant footer string. The resultant string length is limited to 65 characters. The default footer is `""` (the null string). The footer will be printed at the bottom of each page, possibly with the page number,

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	depending on the specification of the PAGENUMBER parameter.
<u>HEADER</u>	Produce the standard header at the top of each page (the default).
<u>NOHEADER</u>	Delete the standard header from the top of each page.
<u>PAGENUMBER</u>	Produce the page number in the footer/page line at the bottom of each page (the default).
<u>NOPAGENUMBER</u>	Do not number the pages. However, if a nonblank footer was specified, print it at the bottom of each page.
<u>TWOSIDED</u>	Produce the output for both sides of page printer sheets (the default).
<u>ONESIDED</u>	Produce each output page for the the front side of a page printer sheet. In portrait mode, each page is to be treated as a front page, rather than alternating the page number and/or footer placement and justification on each page. In landscape mode, no special processing need be done.

Examples: Landscape with header and page numbers:

```
$RUN *APLFONTCONVERT SCARDS=APLFUNC SPRINT=-P
$RUN *PAGEPR SCARDS=-P
```

Portrait with header and page numbers, shifted and shaded:

```
$RUN *APLFONTCONVERT SCARDS=-L SPRINT=-P PAR=PO
$RUN *PAGEPR SCARDS=-P PAR=OVERLAY=SHADING,SHIFT
```

Portrait with header, footer and page numbers:

```
$RUN *APLFONTCONVERT SCARDS=-L SPRINT=-P PAR=PO
FO="MAT Function in MATH Workspace"
$RUN *PAGEPR SCARDS=-P
```

Landscape with a footer but, no page numbers:

```
$RUN *APLFONTCONVERT SCARDS=-L SPRINT=-P PAR=NOPA
FO="MAT Function in MATH Workspace"
$RUN *PAGEPR SCARDS=-P
```

Portrait with just the APL text:

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```
$RUN *APLFONTCONVERT SCARDS=-L SPRINT=-P PAR=PO NOH NOPA  
$RUN *PAGEPR SCARDS=-P
```

One-sided portrait with header and page numbers:

```
$RUN *APLFONTCONVERT SCARDS=-L SPRINT=-P PAR=PO,O  
$RUN *PAGEPR SCARDS=-P
```


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*ARC

Contents: The MTS implementation of the ARC file-archive interchange program.

Purpose: To create and maintain file archives in a compressed form portable to other operating systems.

Use: The program is invoked with the \$RUN command.

Program Key: *ARC

Logical I/O Units Referenced:

SCARDS - list of files to process.
 SPRINT - comments, listings, notes, and warnings.
 SERCOM - fatal error messages.

Return Codes: 0 - Successful return.
 1 - Fatal internal error (since ARC is written in the C programming language, this return code is not a multiple of 4).

Description: This program is a direct port of the ARC program from MS-DOS and Unix. It is used to maintain archives, which are groups of files collected into a single file. Files are typically archived in this manner to ease the task of transferring them to other sites, particularly when using file-transfer protocols which do not easily allow transfer of multiple files. In addition to maintaining some directory information of the archived files, ARC performs highly sophisticated data compression algorithms on the archived files. While actual results will vary depending on the files in question, typical size reductions are:

Binary files	20-40%
Standard text files	50-60%
Spreadsheets	50-90%

ARC will try a number of compression schemes, and will use whichever yields the smallest result. Methods used are:

- (1) No compression; the file is stored as is.
- (2) Repeated-character compression; repeated sequences of the same byte value are collapsed into a three-byte code sequence. This is called "packing."
- (3) Huffman squeeze; commonly occurring byte values are replaced by smaller bit strings. A binary tree is used to map bit strings to characters,

and is stored along with the compressed data. This is called "squeezing."

- (4) Dynamic Lempel-Zev compression; the file is stored as a series of variable-sized bit codes representing commonly occurring character strings, and which are created "on the fly." The two variants of this method that ARC uses are called "crunching" and "squashing."

Note that since one of the methods involves no compression at all, the resulting archive entry will never be larger than the original file.

By default, an archive name can be up to 8 characters, with the string ".ARC" appended to it. Other names may be used. For example:

```
FILENAME      would be treated as FILENAME.ARC
FILENAME.     would be treated as simply FILENAME
FILENAME.XXX  would not be changed
```

Usually archives have names of the form FILENAME.ARC, in which case only "FILENAME" need be specified in the command to ARC.

Parameters: All commands and options are specified in the PAR field of the \$RUN command. They may be given in either uppercase or lowercase. Commands and options are specified by single letters, and a single command must be given. If no valid commands are present, a summary of valid parameters will be printed.

One of these commands must be specified:

- A (Add) Add listed files to archive. File lists will be described in detail below.
- M (Move) Move listed files to archive. The MTS files will be destroyed after being added to the archive.
- U (Update) Update the specified files in the archive. If the specified file has been modified since it was last archived, the archived version will be replaced by the current version. Also, if the specified file does not exist within the archive, it will be added.
- F (Freshen) Similar to Update, but it only replaces files that already exist within the archive. If a file name is specified that

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does not exist in the archive, it will be ignored.

- D (Delete) Deletes an archived file from an archive.
- X or E (Extract)
X and E are synonyms; both request that the listed files be extracted from within the archive.
- P (Print) Prints the specified file onto SPRINT, which may be directed to a file, to *PRINT*, or to *SINK* (the default). Since the file is not printed with MTS carriage controls, the user should extract the file before printing.
- L (List) Lists the contents of the archive. The name, the original length of the file before compression (in bytes), and the date last modified are listed for each archived file.
- V (Verbose) Verbose listing of archive contents. Similar to the List command above, but also shows method of compression used to store the file, the time last modified, and the compression ratio, as well as the current size of the compressed file and the Cyclical Redundancy Check (CRC) value of the raw (uncompressed) file.
- T (Test) Test archive integrity. The CRCs for each member of the archive are recomputed and checked against the stored value. If any values do not match, a warning message will be printed. This is most often used immediately after transferring an archive from one site to another in order to detect whether any errors occurred during the transfer.
- C (Convert) Converts archived files from older storage methods to current methods. This command is typically used for archives that were created by a version of ARC prior to version 5.0. Older files are listed as "crunched" in a Verbose listing, newer files are listed as "Crunched" (note the use of lowercase "c" versus uppercase "C").

Any of the following options may also be specified. No spaces should separate the command and option letters.

B (Backup) A backup of the original archive will be kept. An archive named FILENAME.ARC would have a backup named FILENAME.BAK. By default, the original archive file is deleted.

The normal procedure of ARC, when changing an archive, is to perform all changes in a temporary file, copying any unchanged files from the original archive. When completed, the original archive is deleted, and the temporary file is renamed to the original archive name. With the Backup option, the original archive is renamed with the suffix .BAK, and then the temporary file is renamed.

I (Image) Operate on files in "image" or binary mode. ARC on MTS defaults to text mode, where files are translated from EBCDIC to ASCII when being stored, and from ASCII to EBCDIC when being extracted. If this flag is specified, no translation will take place. This is useful when transferring TeX DVI files, for example. This is also useful for extracting .COM and .EXE program files from archives before downloading, in case the archive contains other files that are not wanted.

S (Store) Files added to an archive will be stored without compression. This saves a small amount of time and cost. The archive contents may later be compressed with the Convert command.

W (Warn) When this flag is present, no warning messages will be generated. Also, ARC ordinarily will not allow making changes to damaged archives. This flag also overrides that feature.

N (Note) When this flag is present, no notes or comments will be generated. By default, ARC will display notes describing every phase of computation it executes while manipulating an archive. If both Warnings and Notes are disabled, ARC will not produce any comments or error indications.

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- O (Overwrite) Overwrite existing files when extracting. By default, if you attempt to extract a file from an archive that already exists on your account, ARC will ask you to confirm whether or not to destroy the existing file and replace it with the extracted file. If this flag is present the confirmation step is bypassed and extracted files will silently overwrite any existing files of the same name.
- Q (Squash) Use Squashing instead of Crunching to compress files. ARC uses one of four different methods to compress files in an archive. "Crunching" is the default, which is compatible with most other ARC programs on other systems. "Squashing" is newer, and often a few percent more efficient, but may not be compatible with other versions of ARC on other systems.
- G (Garble) Encrypt/decrypt archive entry. This option must be specified last. If used, it must be immediately followed by a password, which will be used in encrypting the file. Attempting to extract a file which was archived with a password will produce a lot of garbage and error messages, unless the G option and the correct password are supplied with the Extract command.

For further information on the ARC program, see Computing Center Memo 484, "ARC, The File Archiving Utility."

Examples:

```
$RUN *ARC PAR=A MYSTUFF AFILE SOMEJUNK OTHERSTUFF
```

In the above example, the files named "AFILE," "SOMEJUNK," and "OTHERSTUFF" are added to the archive named "MYSTUFF.ARC." If the MTS file "MYSTUFF.ARC" does not exist, *ARC creates it.

```
$RUN *ARC PAR=V PC1:ARC521.COM
```

This example would produce a verbose listing of the contents of file ARC521.COM on the signon ID PC1. This also illustrates an archive that does not have the default ".ARC" ending in its name, as well as how to access files stored on different accounts.

```
$RUN *ARC PAR=AI -JUNK WXYZ:?.BIN ?.DVI
```

This example will create an archive in a temporary file, named -JUNK.ARC, and will store all files on the signon ID WXYZ ending in ".BIN" as well as all files whose names end in ".DVI" from the current ID.

```
$RUN *ARC PAR=X BIGFILE -?
```

This example extracts everything in BIGFILE.ARC into a number of temporary files. Note that, while file names in an archive may be up to 12 characters long, they may get truncated in this case, since temporary files can only have up to 8-character names.

ARC treats the "-" character as a "directory" name, not part of the file name. Thus, the above command extracts all the files in BIGFILE.ARC, and creates them in a directory name "-", which is where MTS temporary files are stored. Similarly, if the temporary files -FILE1 and -FILE2 exist, the command

```
$RUN *ARC PAR=A TEST -?
```

would create an archive named TEST.ARC, with FILE1 and FILE2 among its members.

```
$RUN *ARC SPRINT=*PRINT* PAR=P MYPAPERS
```

This example sends everything in MYPAPERS.ARC to the printer.

```
$RUN *ARC PAR=A WASTE JUNK.TXT @TRASH
```

The list of file names given to ARC may include indirect references. If a file name begins with an at-sign "@", it is taken as the name of a file that contains a list of file names. The list can consist of any number of file names on a line separated by blanks, and any number of lines. The list of file names may include further indirection. If there is no "." in the file name, a suffix of .CMD is appended. In the above example, ARC adds JUNK.TXT plus all files listed in the file TRASH.CMD to an archive named WASTE.ARC. If no file is specified, then the list is read from SCARDS.

```
$RUN *ARC PAR=A TRASH @
```

This example reads a list of file names from the terminal adding those files to TRASH.ARC. The list is terminated by an end-of-file.

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*ASCEBCD

Contents: The ASCII-to-EBCDIC translation program.

Purpose: To translate records from ASCII to EBCDIC code.

Use: The program is invoked by the \$RUN command.

Program Key: *ASCEBCD

Logical I/O Units Referenced:

- SCARDS - ASCII records to be translated.
- SPRINT - listing of the records resulting from the translation.
- SPUNCH - EBCDIC records resulting from the translation.

Return Codes: 0 - Successful return.
4 - Invalid parameter specified.

Parameters: At most, one of the following parameters may be specified in the PAR field of the \$RUN command. The default parameter is TDAY88.

- TDAY88 Characters are translated according to the TDAY88 translation table. This translation corresponds to that used in MTS for translating ISO 8859/1 8-bit codes (ASCII) to the IBM Code Page 37 codes (EBCDIC) used in MTS.
- 7BIT Characters are translated according to a 7-bit translation table. This translation corresponds to that used in MTS for translating the low-order 7 bits of ISO 8859/1 codes (ASCII) to the IBM Code Page 37 codes (EBCDIC) used in MTS.

Description: Records are read from SCARDS, translated according to the appropriate table as specified by the parameter field, and written to SPUNCH. Each output record is also prefixed by a blank character (for logical carriage control) and written to SPRINT. An end-of-file on SCARDS terminates the program.

The 7BIT translation uses a 256-entry "folded" table in which the first and second halves are identical so that the effect is to ignore the high-order ASCII bit.

See the *EBCDASC description in this volume for a program to translate from EBCDIC into ASCII.

The TDAY88 translation table is given below. This table is also contained in the file DOC:ALLCHARTABLE.

Example: \$RUN *ASCEBCD SCARDS=*T* SPUNCH=NEWFILE SPRINT=*PRINT*

In the above example, ASCII records are read from the tape *T*, translated to EBCDIC, written to the file NEWFILE, and printed on *PRINT*.

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*ASMH

Contents: The MTS version of the IBM Assembler H.

Purpose: To assemble System 360/370 assembly language programs.

Use: The assembler is invoked by the \$RUN command.

Program Key: *ASMH

Logical I/O Units Referenced:

- SCARDS - the source program to be assembled.
- SERCOM - assembler diagnostics.
- SPRINT - listing and reference tables.
- SPUNCH - the resulting object module.
- 0 - library of macro definitions. If 0 is not assigned, *SYSMAC will be used.
- 1 - the resulting object module.
- 2-10 - additional libraries of macro definitions.

Return Codes: 0 - Successful return.
n - "n" is the highest severity level of errors detected.

Description: This assembler is the IBM program product Assembler H, Version 2 (program number 5668-962) modified for use in MTS. The language accepted by ASMH is given in the IBM publication, Assembler H Version 2 Application Programming: Language Reference (form GC26-4037). Extensions to the language are discussed in the section "Assembler H Extensions" of MTS Volume 14, 360/370 Assemblers in MTS. The error messages produced by ASMH are listed and explained in the IBM publication, Assembler H Version 2 Application Programming: Guide (form SC26-4036). Additions and changes to these messages are described in the section "Assembler H Messages" in Volume 14.

The complete description of the use of this assembler is given in MTS Volume 14. A brief summary of the assembler options is given below.

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<u>Option</u>	<u>Default</u>
ALGN or ALIGN / NOALGN or NOALIGN	ALGN
BATCH or MULT / NOBATCH or NOMULT	NOBATCH
CALIGN=n / NOCALIGN	NOCALIGN
DECK / NODECK	DECK
ESD / NOESD	ESD
EXTEN / NOEXTEN	EXTEN
FLAG(n) or MSGLEVEL(n)	FLAG(0)
LINECNT(n) or LINECOUNT(n)	LINECNT(55)
LIST / NOLIST	See Vol. 14
LOAD or OBJECT / NOLOAD or NOOBJECT	NOLOAD
MAXCREf / NOMACXREF	NOMACXREF
NUM(LEFT) or NUM / NUM(RIGHT) / NONUM	NUM(LEFT)
PEXIT=*PEXIT	
REL2 / NOREL2	NOREL2
RENT / NORENT	NORENT
RLD / NORLD	NORLD
SYSARM(n)	See Vol. 14
TERM / NOTERM	See Vol. 14
TEST / NOTEST	NOTEST
UMAP / NOUMAP	UMAP
XREF(FULL) or XREF / XREF(SHORT) / NOXREF	XREF(FULL)

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*ASMTIDY

Contents: The 360/370 assembly "tidying" program.

Purpose: To edit 360/370 assembly programs into an easily readable
 format and to indent programs containing structured
 macros to show the program structure.

Use: The program is invoked by the \$RUN command.

Program Key: *ASMTIDY

Logical I/O Units Referenced:

- SCARDS - the input file consisting of an untidied assembly source.
- SPUNCH - the output file to contain the tidied assembly source.
- SPRINT - the listing of the tidied source plus MTS line numbers of SPUNCH, statement numbers, and level numbers.
- SERCOM - severe error comments.

Return Codes: 0 - Successful return.
 4 - Syntax error or line too long.
 8 - Severe error occurred.

Description: *ASMTIDY may be used to tidy 360/370 assembler source programs. It reads an untidied assembler source program from the logical I/O unit SCARDS and writes out the tidied source on the unit SPUNCH. If LIST is specified, *ASMTIDY will produce an indented listing of the source program showing any program structure (if structured programming macros are used).

The complete description of *ASMTIDY is given in MTS Volume 14, 360/370 Assemblers in MTS.

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*ASSIST

Contents: The student assembler for the IBM 360/370 assembly language.

Purpose: To provide a fast assembler/interpreter for student-written assembly language programs.

Use: The program is invoked by the \$RUN command.

Program Key: *ASSIST

Logical I/O Units Referenced:

SCARDS - assembler commands, source program, and program data (the default is *SOURCE*).

SPRINT - assembler diagnostics, source program listing, and program output (the default is *SINK*).

SERCOM - severe error diagnostics (the default is *SINK*).

Return Codes: Always zero.

Description: ASSIST is a 360/370 assembler/interpreter that was written at Pennsylvania State University and modified to run under MTS by the University of British Columbia. ASSIST is especially designed for use by students learning assembly language. ASSIST accepts a large subset of the G-Assembler Language provided by *ASMG, including most of the macro and conditional assembly features. The execution-time interpreter simulates the full 370 instruction set with complete error checking, meaningful diagnostics, and program dumps of a much smaller size than the normal system dumps.

For the complete description of ASSIST, see the section "ASSIST Assembler and Interpreter" in MTS Volume 14, 360/370 Assemblers in MTS. A brief summary of the assembler options is given below.

<u>Option</u>	<u>Default</u>
BATCH / NOBATCH	NOBATCH
CMPRS / NOCMPRS	NOCMPRS
COMNT / NOCOMNT	NOCOMNT
CPAGE / NOCPAGE	CPAGE
LIBMC / NOLIBMC	NOLIBMC
LIST / NOLIST	LIST
LOAD / NOLOAD	LOAD
SS / NOSS	NOSS
SSD / NOSSD	NOSSD
SSX / NOSSX	NOSSX
SIZE=n	SIZE=15
KP=n	KP=29
L=n	L=60
MACTR=n	MACTR=200
MNEST=n	MNEST=15
MSTMG=n	MSTMG=4000
NERR=n	
P=n	P=25
PAGES=n or PX=n	PAGES=10
PD=n	PD=2
T=n	T=10
TD=n	TD=0.5
TIME=n or TX=n	TIME=10
XREF=n	XREF=2

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*AUTOSTART

Contents: The automatic batch scheduling program.

Purpose: This program enables users to automatically schedule MTS batch jobs that are contained in files.

Use: The program is invoked by a \$RUN command.

Program Key: *AUTOSTART

Logical I/O Units Referenced:

SCARDS - The source of commands to *AUTOSTART (defaults to *SOURCE*).

SPRINT - Output response to user requests (defaults to *SINK*).

SERCOM - Error messages (defaults to *MSINK*).

Return Codes: 0 - Successful return.
8 - Error return.

Description: The *AUTOSTART program is used to automatically schedule MTS batch jobs that are contained in MTS files. The program submits the jobs through *BATCH* at times specified by the user. After submission, the job is under the control of the system batch monitor and the actual time the job is started can be later than the submission time. Each time a job is submitted to run, a message will be sent to the user giving the job receipt number.

Files being scheduled by *AUTOSTART differ from normal batch files and must conform to the following rules:

- (1) If the file type is sequential, the first line of the file must be a \$SIGNON command with the CCID specified (\$SIGNON * will not work).
- (2) If the file type is line, the \$SIGNON command with the CCID specified must be the first line numbered 1.000 or greater.
- (3) The signon ID on the \$SIGNON command must be the same as the signon ID of the user running the *AUTOSTART program.
- (4) For private files (those not prefixed with a *) the owner of the file must be the user running the *AUTOSTART program.
- (5) Batch jobs submitted by *AUTOSTART do not need a password after the \$SIGNON line.

Commands

The underlined portions in the following descriptions may be used as abbreviations.

ACCESS

This command displays the access that a user has to special features.

DELETE filename

This command deletes the specified file from the automatic scheduling mechanism.

DISPLAY filename [{SCHEDULE|OUTPUT}=filename2]

This command prints out the current scheduling information for the specified file. If the SCHEDULE or OUTPUT parameters are given, a copy of the scheduling commands is also placed in the specified file.

HELP [command]

This command prints a general description of the *AUTOSTART program or, if a specific command name is entered, a description of the specified command.

MTS [MTS-command]

This command returns control to MTS command mode. Execution of the *AUTOSTART program may be resumed by the \$RESTART command. If an MTS command is specified, that command will be executed upon the return to MTS command mode.

QUEUE

This command lists all of the user's files currently under control of the automatic starting mechanism.

RETURN

This command returns control to MTS command mode. Execution of the *AUTOSTART program may be resumed by the \$RESTART command.

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SCHEDULE filename [{SCHEDULE|INPUT}=filename2]

This command schedules the specified file or, if the specified file is already scheduled, reschedules it. A full description of the scheduling process is given below.

STOP

This command terminates the *AUTOSTART program.

\$command

Command lines starting with \$ will be interpreted as MTS commands. These commands will return control to MTS command mode for the execution of the specified command. An immediate return then will be made to the *AUTOSTART program.

Scheduling Jobs

Issuing the SCHEDULE command will invoke the MTS editor. The file being edited is a dummy file with a series of commands in it that controls the frequency of the job's submission. Different commands control different aspects of the submission.

There are no abbreviations for any of the keywords in the following commands. Optional keywords are in brackets. The periods following some of the commands are required.

Setting the Starting and Ending Dates for the Job

The following command must appear once at the front of every run schedule.

CONTROL FROM date1 UNTIL date2.

This command defines the period of time the file is to be controlled by the scheduling mechanism. "date1" must be at least ten minutes later than the current date and time. "date2" must be greater than the date/time specified for "date1" and less than the expiration date for the user's signon ID. One of the following

{EXPIRE|EXPIRATION|EXPIRATION DATE}

may be specified for "date2" if the file is to be controlled until the expiration of the owner's signon ID. Note that if a signon ID is renewed, *AUTOSTART will update any jobs that are controlled by this phrase.

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Defining the Action Taken During Unattended Mode

*AUTOSTART must be told what to do with the jobs during unattended mode. One of the following three commands must appear after the CONTROL command. Tasks requiring operator intervention, such as requesting a tape mount, should not be initiated during unattended mode.

RUN DURING UNATTENDED MODE.

This command instructs the scheduling mechanism to run the file as it normally would even if a scheduled run time falls during unattended mode.

SKIP RUNS DURING UNATTENDED MODE.

This command instructs the scheduling mechanism to ignore the starting of files if the system is in unattended mode.

DELAY RUNS DURING UNATTENDED MODE.

This command causes a file that is scheduled during unattended mode to be delayed until MTS leaves unattended mode provided that the run window has not expired (see the description of the WINDOW command below).

Defining the Days On Which To Schedule the File

The following commands are used to define days on which the file is scheduled. The days, months, and years may be given in the following formats:

day

{1|2|...|30|31}

weekday

{SUNDAY|MONDAY|...|SATURDAY} [.]

month

{JANUARY|FEBRUARY|...|DECEMBER} [.]
{1|2|...|12}

year

yy or 19yy

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date

```
mm/dd/yy
mm-dd-yy
mm dd yy
```

Following almost all commands in this group are one or more WINDOW commands that define the time(s) the file is to be run on the specified days. As many RUN/WINDOW command sequences as needed may be entered. At least one RUN command must appear in a run schedule.

RUN AFTER EVERY RELOAD.

This command causes the file being scheduled to be started after a system reload. Note that this is the only command in this group that does not have a WINDOW command following it.

```
RUN ON month day [year].
RUN ON THE kTH DAY OF month [year].
RUN ON THE [lTH FROM] LAST DAY OF month [year].
RUN ON THE mTH weekday OF month [year].
RUN ON THE [nTH FROM] LAST weekday OF month [year].
```

All of these commands schedule the file to be run on the date specified. The abbreviations appearing above must have one the following values:

```
kTH - {1ST|2ND|...|28TH}
lTH - {2ND|3RD|...|28TH}
mTH - {1ST|2ND|3RD|4TH}
nTH - {2ND|3RD|4TH}
```

RUN EVERY [nTH] DAY [BASED ON date].

This command schedules the file every day or every "n" days. The BASED ON clause is used to specify the starting date for the file if it is different from the starting date specified in the CONTROL command. If nTH is specified, the BASED ON date is also used as the starting date for counting. If no BASED ON date is specified, the starting time on the CONTROL command is used as the BASED ON date. nTH must be one of the following values:

```
{1ST|2ND|...|365TH}
```

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RUN EVERY [nTH] {WEEK|WEEKEND|WORK-WEEK|WORK-END}
[BASED ON date].

This command schedules the file for the days falling in the given period. These periods occur every week or every "n" weeks. The periods are defined as follows:

WEEK - Monday 00:00 am until Friday 11:59 pm.
WEEKEND - Saturday 00:00 am until Sunday 11:59 pm.
WORK-WEEK - Monday 8:00 am until Saturday 7:59 am.
WORK-END - Saturday 8:00 am until Monday 7:59 am.

The BASED ON clause is used to specify the starting date for the file if it is different from the starting date specified in the CONTROL command. If nTH is specified, the BASED ON date is also used as the starting date for counting. If no BASED ON date is specified, the start time on the CONTROL command is used as the BASED ON date. nTH must be one of the following values:

{1ST|2ND|...|52ND}

RUN ON weekday OF EVERY [nTH] WEEK [BASED ON date].

This command schedules the file for a specific weekday in a specific week. The BASED ON clause is used to specify the starting date for the file if it is different from the starting date specified in the CONTROL command. If nTH is specified, the BASED ON date is also used as the starting date for counting. If no BASED ON date is specified, the starting time on the CONTROL command is used as the BASED ON date. nTH must be one of the following values:

{1ST|2ND|...|52ND}

RUN ON THE jTH DAY OF EVERY [nTH] MONTH [BASED ON date].

RUN ON THE [kTH FROM] LAST DAY OF EVERY [nTH] MONTH [BASED ON date].

RUN ON THE lTH weekday OF EVERY [nTH] MONTH [BASED ON date].

RUN ON THE [mTH FROM] LAST weekday OF EVERY [nTH] MONTH [BASED ON date].

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These commands schedule the file for the specified day occurring in a scheduled month. The BASED ON clause is used to specify the starting date for the file if it is different from the starting date specified in the CONTROL command. If nTH is specified, the BASED ON date is also used as the starting date for counting. If no BASED ON date is specified, the start time on the CONTROL command is used as the BASED ON date. The abbreviations appearing in the above commands must have one of the following values:

```
jTH - {1ST|2ND|...|28TH}
kTH - {2ND|3RD|...|28TH}
lTH - {1ST|2ND|3RD|4TH}
mTH - {2ND|3RD|4TH}
nTH - {1ST|2ND|...|12TH}
```

```
RUN ON month day YEARLY.
RUN ON THE kTH DAY OF month YEARLY.
RUN ON THE [lTH FROM] LAST DAY OF month YEARLY.
RUN ON THE mTH weekday OF month YEARLY.
RUN ON THE [nTH FROM] LAST weekday OF month YEARLY.
```

These commands schedule the file on the specified day of the specified month every year in the control interval. Note the abbreviations appearing in the above commands must have one of the following values:

```
kTH - {1ST|2ND|...|28TH}
lTH - {2ND|3RD|...|28TH}
mTH - {1ST|2ND|3RD|4TH}
nTH - {2ND|3RD|4TH}
```

Defining the Times To Schedule the File

Times may be given in the following format:

```
hh:[mm]           (24-hour clock)
hh[:mm] {am|pm}  (12-hour clock)
```

WINDOW commands, which follow the RUN commands, are used to define the time period in which it is possible to run the job. WINDOW commands should be given after each RUN command, and the windows set will affect that run schedule. The automatic scheduling mechanism will attempt to initiate the job at the start of a run window, if possible. If this is not possible (for example, if MTS is not operating at the time), the job will still be run provided it has not reached the end of the run window. The following are formats for the WINDOW command.

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```

WINDOWS:  start-time1[,start-time2,...]
WINDOWS:  (start-time1,end-time1) [,(start-time2,
end-time2)...]
    
```

The first form of the WINDOW command defines only the time(s) that the job may be run; the ending time(s) need not be specified as the program will assume a run window of fifteen minutes. The second form allows the user to explicitly set the run windows. A run window has a maximum period of 24 hours. Thus, if the ending time of a window is less than or equal to the associated starting time, the ending time is assumed to occur on the following day. As many WINDOW commands may be entered after a RUN command as needed to describe all run times occurring on the the specified day(s).

Defining the End of a Run Schedule

The following command occurs at the end of every run schedule.

```
END.
```

Examples: The following are examples of the commands that control the scheduling of jobs.

Below is an example of a run schedule to control the running of a file that is to be run on the 15th and the last day of every month. On the 15th of the month the job is to be run at noon while on the last day of the month it is to be run at 11:59 pm. Both runs will have a 12-hour run window.

```

Control from July 19 until expiration date.
Delay runs during unattended mode.
Run on the 15th day of every month.
Window: (12:00 pm,12:00 am)
Run on the last day of every month.
Window: (11:59 pm,11:59 am)
End.
    
```

The next example schedules a job to be run after every reload. It is run regardless of whether the system is unattended mode or not.

```

Control from 4pm Dec 31 until 12/31 1pm.
Run during unattended mode.
Run after every reload.
End.
    
```

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The above schedule could have also been written as

```
Control from 16:00 Dec 31 until 12/31 13.  
Run during unattended mode.  
Run after every reload.  
End.
```

Following is a schedule for a job that is to be run on the first Monday, second Saturday, and last Friday day every month. The WINDOW command will use the default window size of 15 minutes.

```
Control from Sept 1 1983 until Nov 2 1983.  
Skip runs during unattended mode.  
Run on the 1st Mon of every month.  
Window: 3am  
Run on the 2nd Saturday of every month.  
Window: 3am  
Run on the last Fri of every month.  
Window: 3am  
End.
```


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*BASICUM

Contents: The University of Michigan BASIC System.

See also *WBASIC in this volume for a description of the University of Waterloo BASIC System.

Use: The BASIC system is invoked by the \$RUN command.

Program Key: *BASICUM

Alt. Name: *BASIC

Logical I/O Units Referenced:

None

Return Codes: Always zero.

Description: This program is intended for use as a self-contained system for debugging, modifying, and running programs written in the BASIC language. Commands, source program lines, and data are read from the MTS pseudodevice *SOURCE*. Output from BASIC is written to the MTS pseudodevice *SINK*. The University of Michigan BASIC differs from the "standard" BASIC in several minor respects. The potential user should refer to MTS Volume 10, BASIC in MTS.

Parameters: The following parameters may be specified in the PAR field of the \$RUN command. The parameters must be separated by commas. The entries may appear in any order. A standard default will be assumed for any missing parameters. Following each parameter in the list below is an abbreviated form for the option. The default form of any option is dependent on the "device type" of *SINK*.

BACKSPACE	(BS)	If the output device is recognized as a "terminal", underlining and overstriking through the use of the "backspace character" will be attempted (e.g., underlining text, such as <u>BASIC</u>).
NOBACKSPACE	(NB)	No backspacing will be attempted.
BATCH	(BAT)	Command errors or program errors will cause BASIC to terminate operation.
NOBATCH	(NBT)	Errors will not cause BASIC to terminate operation.

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ECHO	(E)	All command lines will be echoed to the output device.
LC		Upper- and lowercase output for system messages and user-generated text will be attempted.
UC		Upper- and lowercase output will be disabled. <u>All</u> messages will be entirely in uppercase.
NC		The user will not be queried before the destroying, emptying, or freeing of a BASIC file.
NOSIG	(NS)	The "signon message" after the \$RUN command will not be printed.
SIG	(S)	The "signon message" will be printed.

All of the above parameters except NOSIG cause the setting of "user-defined" switches which are interrogated by BASIC to effect the specified behavior. These switches may be modified later in the session through the use of the appropriate BASIC commands (see MTS Volume 10). The various defaults for these parameters are detailed below according to the "device type". The PAR field is used to override these defaults. The NOSIG option is never defaulted and the BATCH, NC, and ECHO options are defaulted in batch mode regardless of device type.

Batch		<u>The device type is not checked.</u> The options are NOBACKSPACE, BATCH, ECHO, NC, and UC. The default output line length is 131.
ARU		The options are NOBACKSPACE, NOBATCH, and UC. The default output line length is 255.
UMnet		The options are NOBACKSPACE, NOBATCH, and LC. The default line length is 255.
IBM 3278		Same as UMnet.
All other devices		The options are NOBACKSPACE, NOBATCH, and UC. The default output line length depends on the maximum output line length for the device.

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*BIBTEX

Contents: The BibTeX bibliography program for use with the LaTeX text-processing system.

Use: BibTeX is invoked by the \$RUN command.

Program Key: *BIBTEX

Logical I/O Units Referenced:

SERCOM - error messages, error-recovery prompting, and diagnostics.

GUSER - error-recovery prompt input.

BiBTeX references all files explicitly by name.

Return Codes: Always zero.

Description: The complete description of the BibTeX bibliography program is given in the following publications:

LaTeX: A Document Preparation System, Leslie Lamport, Addison-Wesley Publishing Company (1986), ISBN 0-201-15790-X.
Computing Center Memo 815, "Using LaTeX on MTS"

BibTeX is a program for compiling a reference list for a document from a bibliographic database. The current MTS version of BibTeX, Version .98i, corresponds to the current LaTeX version 2.09 on MTS, but was not installed when LaTeX was originally made available.

If LaTeX and BibTeX are being used on a variety of computing systems, note the version numbers involved, since .98i .bst files are incompatible with .99a and vice-versa. PCTeX uses .98i. The author of BibTeX, Oren Patashnik, has announced that the program will be frozen at version 1.00, after which there will be bug fixes only; the MTS version will probably be upgraded when 1.00 is available.

BibTeX is run by typing

```
$RUN *BIBTEX PAR=MYFILE
```

where MYFILE.TEX is the name of the LaTeX input file. This reads the file MYFILE.AUX, which was generated when Latex was run on MYFILE.TEX, and produces the file MYFILE.BBL. BibTeX should be run from the userID con-

taining MYFILE.TEX (which should be the same userID from which LaTeX was run on that file).

If the .BIB file is not on the same userID as the LaTeX input file, for example, if someone else's .BIB file is being used, then the userID must be included as part of the file name specified by the `\BIBLIOGRPAHY` command. For example, the LaTeX command

```
\BIBLIOGRPAHY{1XYZ:GNUS}
```

specifies the file GNUS.BIB residing on the userID 1XYZ.

In addition to the bibliography styles described in the manual, there is an IEEE_{TR} style that formats entries in the style of the IEEE transactions. Users can also customize styles to their particular requirements. Details on how to customize styles are provided in Appendix A of CCMemo 815.

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*CBELL

Contents: The AT&T Bell Laboratories compiler for the C programming language.

| Note: It is now recommended that the *C87 C Language
| compiler be used instead of the *CBELL compiler.

Purpose: To compile C source programs.

Use: The compiler is invoked with the \$RUN command.

Program Key: *CBELL

Logical I/O Units Referenced:

SCARDS - input of the source programs(s).
 SPUNCH - output of the object program(s).
 SERCOM - error messages from compiler or preprocessor.
 2 - local include libraries used by preprocessor
 (the standard library *CBELLINCLUDE is always
 used).

Parameters: The following parameters may be specified in the PAR field of the \$RUN command. The case of the parameter names is unimportant, but case distinction is made in the values of the parameters for DEFINE and UNDEFINE.

ASMSOURCE / NOASMSOURCE Default: NOASMSOURCE

With this option, the assembler source produced by the compiler is made available in the temporary file ___#C.ASM.

ASSEMBLE / NOASSEMBLE Default: ASSEMBLE

NOASSEMBLE suppresses the assembly phase.

BREG=n Default: BREG=1

The BREG option is used to set the number of base registers used to address the source code. This compiler is less sophisticated than many and is unable to determine how many base registers are needed to address its code. An addressability error in the assembly phase indicates the need for additional base registers. The maximum number of base registers that can be specified is 5. The number of registers reserved for use as bases should be kept as small as possible since increasing the number of base registers decreases the number of work regis-

ters. The amount of space used for local variables, temporaries, and copies of the parameters is limited to 4K bytes (1 page). There is no feature in this compiler to use more than one base register for accessing this local data.

CSOURCE / NOCSOURCE Default: NOCSOURCE

With this option, the output from the preprocessor is made available in the temporary file, -__#C.CMP.

COMMENTS / NOCOMMENTS Default: NOCOMMENTS

COMMENTS causes the preprocessor phase to pass source comments through into its output.

COMPILE / NOCOMPILE Default: COMPILE

NOCOMPILE suppresses the compiler and assembly phases.

DEFINE(name=value) / DEFINE(name) Default: None

DEFINE(name=value) causes the preprocessor to generate the equivalent #define statement. If the value is omitted, the value 1 is used.

PRETDAY / TDAY88 Default: TDAY88

PRETDAY assumes that the program source file contains pre-T-Day translation codes (i.e., the file was created before February 22, 1988 and not translated). See Computing Center Memo 480, "Translation Day Character Code Changes on MTS."

RENT / NORENT Default: NORENT

RENT causes the assembler phase to test for reentrancy violations (stores within a CSECT). This feature is provided primarily for writing programs to be incorporated into the operating system and would not normally be used for an applications program.

STACK_CHECK / NOSTACK_CHECK Default: STACK_CHECK

The current version of *CBELL storage protects the first page after the end of the allocated stack so that references into this region will result in a protection exception. This is done regardless of the setting of this parameter. Future versions may generate code to test for stack overflow if the STACK_CHECK option is specified.

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TEST / NOTEST Default: TEST

NOTEST suppresses the assembler-phase generation of SYM records, which can be used by the SDS debugger.

UNDEFINE (name) Default: None

UNDEFINE causes a "#undefine name" to be processed by *CBELL.

Return Codes: 0 - Successful return.
 4 - Error in PAR field, a file needed by *CBELL does not exist, or insufficient access to the file.
 8 - Error message from compiler.
 12 - Insufficient memory for compilation.
 16 - Internal error in compiler (should not occur).

Description: *CBELL is a program that successively links together the three phases of the compiler, where the output of one phase is transmitted to the next in a temporary file. The three phases are:

- (1) The preprocessor, which processes entities such as #define and #include statements.
- (2) The main compiler, which turns the preprocessed C source into assembler-language source.
- (3) The *ASMH assembler, which turns the assembler-language output of the compiler into object code.

The following standard include files are supported: <assert.h>, <ctype.h>, <errno.h>, <limits.h>, <math.h>, <setjmp.h>, <stdarg.h>, <stdio.h>, <stdlib.h>, <time.h>, and <times.h>. In addition, several nonstandard files are supported: <mtsio.h> and <mts.h>.

Object programs produced by *CBELL must be run using the library in *CBELLLIB. This library supports some Berkeley Unix 4.2 system routines to enhance portability.

The C language is described in numerous texts, one of the most widely used being The C Programming Language, by Brian Kernighan and Dennis Ritchie. The use of C in MTS is described in Computing Center Memo 472, "*CBELL - Bell Labs C in MTS."

Example: \$RUN *CBELL SCARDS=SOU SPUNCH=OBJ
 \$RUN OBJ+*CBELLLIB SCARDS=INFILE

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*CCBIBLIOGRAPHY

Contents: A bibliographical list of current documentation for MTS.
Use: The \$COPY command should be used, e.g.,
\$COPY *CCBIBLIOGRAPHY
Description: The list of available documentation is organized by subject category.

*CCDELIVERY

Contents: A schedule of delivery times for courier service between the Computing Center and the Main Campus public batch stations. The following items are currently handled by this service:
Page printer output printed at CNTR
Plotter output plotted at CNTR
Magnetic tapes both to and from CNTR
Floppy disks both to and from CNTR
Phototypesetter output set at CNTR
Use: The \$COPY command should be used, e.g.,
\$COPY *CCDELIVERY

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*CCHOURS

Contents: A list of the hours of the Computing Center and its public stations on campus.

Use: The \$COPY command should be used, e.g.,

\$COPY *CCHOURS

*CCPHONES

Contents: A list of Computing Center telephone numbers.

Use: The list may be obtained via the \$COPY command, e.g.,

\$COPY *CCPHONES

*CCPUBLICATIONS

Contents: A list of the current Computing Center Memos, Quicknotes, MTS Volumes, and other publications.

Use: The \$COPY command should be used, e.g.,

\$COPY *CCPUBLICATIONS

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*CCQUEUE

Contents: The queueing program for requesting postprocessing of user plot descriptions.

Purpose: To place the user's plotting request(s) on the queue for plotting.

Use: This program is invoked by the \$RUN command.

Program Key: *CCQUEUE

Logical I/O Units Referenced:

- SCARDS - queueing requests.
- SPRINT - plot receipt numbers and prompting messages for queueing requests.
- SERCOM - error comments.
- GUSER - user responses to error comments.

Return Codes: Always zero.

Parameters: A single queueing request may be specified in the PAR field of the \$RUN command, if no requests are to be read from SCARDS.

Description: The complete description of the plotting system is given in MTS Volume 11, Plot Description System.

Each queueing request specifies a file or tape containing one or more plot descriptions. *CCQUEUE reads the plot descriptions, determines the cost of plotting, places the request in the system plotting queue, and charges the user for the plotting costs. At each scheduled plotting time, the system postprocessor removes the request from the queue, reads the user's file (or tape), and produces commands for the plotter.

*CCQUEUE prompts for queueing requests using the message "ENTER PLOT REQUEST". The response may be a queueing request for a file or tape, a line consisting of the string "MTS", a line beginning with a "\$", or an end-of-file indicator. If the queueing request is for a file, the request should consist of the file name, optionally followed by one or more blanks and a scale factor. Explicit concatenations are permitted, as are line number ranges. Only permanent files may be queued--temporary files may not be queued.

The response "MTS" causes a return to MTS command mode. A response that begins with a dollar sign is treated as

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an MTS command that is to be executed immediately. For either response, "MTS" or an MTS command, execution of *CCQUEUE may be resumed by entering a \$RESTART command (unless an MTS command causes *CCQUEUE to be unloaded). An end-of-file response terminates execution of *CCQUEUE.

If the request is for a magnetic tape, the tape should already be mounted. The request should contain first the pseudodevice name, followed by the tape ID. Parameters must be separated by one or more blanks and/or commas. There are three optional parameters. One is the scale factor, which may appear anywhere after the pseudodevice name. Another is the FILES parameter, which may also appear anywhere after the pseudodevice name. This takes the form FILES=n, where "n" is the number of files to be plotted. The default is FILES=1. Finally, the POSN parameter may appear anywhere after the tape ID. This takes the form, POSN=string, where "string" specifies a file on the tape (any string legal for the POSN control command). If this parameter is not specified, *CCQUEUE begins reading at the current tape position (even if that is in the middle of a file). (At postprocessing, the tape will be mounted and positioned appropriately, even to the middle of a file.) *CCQUEUE and the postprocessor use whatever blocking is in effect at the time the queueing request is entered. *CCQUEUE does not rewind the tape after reading it. Pool tapes may not be queued.

Any plot request may include a scale factor. The scale factor will be applied to each point of the plot. This parameter takes the form SCALE=x, where "x" is a positive integer, F-type, or E-type real number.

Users can request delivery of plots to another station by specifying the DELIVERY=station parameter on the queue request, e.g., DELIVERY=NUBS. The DELIVERY parameter is effective for only one queue request. If the DELIVERY parameter is not specified, the setting of the MTS \$SET DELIVERY option will be used (which defaults to the Computing Center).

Users can request "quick" plotting by specifying the ASAP parameter on the queue request. This will provide a faster than normal service. Ballpoint pens will be used instead of liquid ink and the appearance of the plot will differ; lines will be thinner and not as dark, and dots may not be drawn very well. The plotter will use only red, blue, and black ballpoint pens, and pen size changes will not be allowed. See the public file *PLOTTIMES for the schedule of ASAP plotting service.

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Error Processing:

If *CCQUEUE encounters an error in the user's plot description file, it prints a comment describing the error, together with the file name and line number where the error was discovered. If an error is encountered in batch mode, reading of the current plot description stops, the plot is not queued, and *CCQUEUE begins processing the next request, if any. In conversational mode, the user is asked if he wishes *CCQUEUE to continue. The legal responses are YES (or OK) to continue processing (taking the error recovery action described below), and NO, to stop processing at this point (this does not abort the plot). The user may also enter MTS or an MTS command preceded by a "\$", in which case control will be returned to MTS. (The user may restart using \$RES, and he will again be prompted for a response.) The error recovery actions are

<u>Error</u>	<u>Action Taken by *CCQUEUE</u>
Record not a plot record	Record ignored
Actual record length not equal to expected length	Record ignored
Missing PBGN	PBGN (logically) inserted with default normalizing factor
Invalid PSYM record	Record ignored
Invalid PPEN record	Record ignored
Missing PEND	PEND (logically) inserted

If the user indicates that processing should continue after an error is encountered, and then queues the plot, the same error recovery action will be taken by the postprocessor.

A line beginning \$CONTINUE WITH ... will be treated as an invalid plot line. Implicit concatenation may not be used in plot description files (or tapes).

Queueing:

After *CCQUEUE finishes reading the plot description (because it has reached the end or the user has told it not to continue after an error), it prints the number of plots (blocks), the plotting time required, the amount of paper required, and the cost. In conversational mode, the user is asked whether the plot should actually be queued. If he replies NO, the plot is aborted and he is

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prompted for a new plot request (unless the plot request was taken from the PAR field). If he replies YES, or if *CCQUEUE is being executed in batch mode, the plot request is placed in the queue, he is charged for the plot, and a receipt number is printed (this receipt number must be used to obtain the plot at the output window later). In addition, if the plot description was contained in one or more disk files, *CCQUEUE will, if necessary, permit the queued files so that the postprocessor, which is a program with PKEY=*CCQUEUE, may access the plot descriptions. *CCQUEUE will establish READ access for the file to the postprocessor if necessary. (Specifically, the file will be permitted "READ PKEY=*CCQUEUE" unless the postprocessor already has read access. See the description of the \$PERMIT command in MTS Volume 1, Michigan Terminal System.) A message is printed for each file so permitted. If *CCQUEUE cannot determine the permit status of a file, a message is printed, and the user must be sure that the file is permitted before the plot request is postprocessed. See the section below on postprocessing.

The plot will be aborted if it is null, if the user's plotting time limit (local, global, or ID) has been exceeded, if the user indicated abort after an attention interrupt (see below), or if reading stopped on an error while in batch mode.

Cancellation:

A queued plot may be canceled by entering CANCEL nnnnnn where "nnnnnn" is the receipt number, whenever *CCQUEUE is prompting for a plot request. A plot can be canceled only by the signon ID which queued it. If the plot specified is still in the queue (i.e., it has not been postprocessed), it will be canceled and a message to that effect will be printed. Plotting charges will be rebated automatically at a later time.

Attention Interrupt Processing:

If the user issues an attention interrupt, processing of the current plot request is suspended; the subsequent action taken by *CCQUEUE is as follows: (1) If it was parsing a plot request, the plot request is discarded and the user is prompted to enter a new request; (2) *CCQUEUE will print "READING:" or "QUEUEING:", depending upon whether it was in the process of reading the plot description or queueing the plot. In either case, if the user enters a null line or an end-of-file, *CCQUEUE will resume processing the current request. If the user enters "MTS" or an MTS command beginning with a "\$", *CCQUEUE will return to MTS command mode; if a command

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was given, it will be immediately executed by MTS. If the user enters anything else, the plot request will be aborted.

If the user issues a second attention interrupt while *CCQUEUE is processing the first interrupt, an immediate return is made to MTS command mode. The user may subsequently reenter *CCQUEUE via the \$RESTART command.

Postprocessing:

After a plot request has been queued, the user's plot description must be available for reading by the system postprocessor at the scheduled plotting time. If the plot description is in a file, the file must be permitted, and it must not be locked at any level higher than READ. If the file is not permitted, the plot will be canceled; if it is locked, the plot request will remain queued until the next scheduled plot time at which it is accessible. If the plot description is on a tape, the tape must be available for mounting (e.g., not already mounted); otherwise, the plot will remain queued until the tape is available at a scheduled postprocessing time. If the tape ID is incorrect, the plot will be canceled.

Examples: In the following examples, terminal output appears in uppercase and user input appears in lowercase.

In the first example, the plots contained in two files, PLOTS and MOREPLOTS, are to be queued. At line 2 in MOREPLOTS, *CCQUEUE discovers that a PBGN record seems to be missing, and asks the user if it may assume a PBGN record with a default normalizing factor. The user OKs this, so *CCQUEUE continues reading the plot file. At line 2.5, *CCQUEUE discovers a PPEN record with an invalid color, and asks the user whether it may ignore the line. The user invokes the file editor to examine the line, and then tells *CCQUEUE not to continue. The user then OKs queuing of all plots up to line 2.5 of MOREPLOTS.

```

#$r *ccqueue
EXECUTION BEGINS
.
.
ENTER PLOT REQUEST:
plotfile
  2 PLOTS; PLOTTING REQUIRES  94 SEC. AND 19 IN.; $.31
  PEN WAS UP 34% OF THE TIME
OK?
ok
PLOT ASSIGNED RECEIPT # 516061

```

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```

ENTER PLOT REQUEST:
plots+moreplots
MISSING PBGN RECORD.
DISCOVERED AT LINE      2.000 IN MOREPLOTS
OK TO USE DEFAULT?
Y
INVALID PEN TYPE.
DISCOVERED AT LINE      2.500 IN MOREPLOTS
OK TO IGNORE?
$ed moreplots
#$ED MOREPLOTS
:p 2.5
:      2.5      PPEN??PINK
:stop
OK TO IGNORE?
n
PLOT UP TO LAST ERROR CAN BE QUEUED.
  2 PLOTS; PLOTTING REQUIRES 47 SEC. AND 9 IN.; $.17
  PEN WAS UP 41% OF THE TIME
OK?
ok
PLOT ASSIGNED RECEIPT # 516064.
.
.

```

In the second example, the user does not have appropriate access to XXXX:PLOTS for *CCQUEUE to determine its permit status. Note that the user must make sure that the file is permitted before the next postprocessing time.

```

#$r *ccqueue
EXECUTION BEGINS
.
.
ENTER PLOT REQUEST:
xxxx:plots
  1 PLOTS; PLOTTING REQUIRES 35 SEC. AND 7 IN.; $.13
  PEN WAS UP 61% OF THE TIME
OK?
Y
**PERMIT STATUS OF "XXXX:PLOTS      " UNKNOWN.
PLOT ASSIGNED RECEIPT # 516068.
.
.

```

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*CCSOFTWARE

Contents: A list of software supported by the Computing Center.

Use: The \$COPY command should be used, e.g.,

\$COPY *CCSOFTWARE

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*CDUPDATE

Contents: The "context-directed" update program.

Use: The program is invoked by the \$RUN command.

Program Key: *CDUPDATE

Logical I/O Units Referenced:

- SCARDS - update records to be applied to the master file.
- SPRINT - source and command listings and error messages.
- SERCOM - error messages and commands containing errors (if assignment different from SPRINT).
- 0 - old master file (input).
- 1 - new master file for updated source (output).

Parameters: The PAR field of the \$RUN command may be used to specify any of the options that may be selected by the /OPTIONS command.

- Return Codes:
- 0 - Successful return.
 - 4 - Errors detected while preprocessing the input and the update phase was skipped.
 - 8 - Errors detected while applying the update.
 - 12 - The program ran out of storage (this might result from a /BUFFER command that was not correctly terminated). The program will terminate processing, but will attempt to produce the command listing that will usually indicate the command causing the problem.
 - 16 - Internal error in CDUPDATE occurred. The program will terminate processing, but will attempt to produce the command listing.

Description: CDUPDATE is a program that applies updates to an "old master file" to produce a new "updated master file." It is typically used in maintaining a program in the form of a "base-level source" (the master) and a set of updates to be applied to it to produce the current version.

The program has the following properties:

- (1) Like *UPDATE, it takes an old master file and a control file (consisting of update commands and insertions) and produces updated source as an output file, without changing the original.
- (2) Records are located contextually using patterns to describe the records to be found, rather than by sequence numbers. The patterns allowed are a subset of SNOBOL4 patterns, and include those

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- provided by the MTS file editor.
- (3) It is possible to move large sections of text either forward or backward in the output file, relative to the position in the input file.
 - (4) The program will automatically add a "change-code" to inserted or modified records.
 - (5) The program will apply multiple updates in a single pass through the input file.

The input to this program consists of a sequence of independent update sets, each of which must be delimited by the commands /BEGIN and /END. Only comments and /OPTIONS commands may appear outside of these delimiting commands. The /BEGIN record may also specify an update name and/or change code, which will be placed in each record inserted by that update. Thus, the input for one update set looks like:

```
/BEGIN update-name
... (other update commands and insertions)
/END
```

Logically, the separate updates are applied sequentially. That is, each update is applied to the output file produced by the previous update. In fact, the whole series of updates is applied in a single pass through the old master file.

Each update level takes a queue of input records and produces a queue of output records. The output from one level is the input to the next. The input to the first is, of course, the input file, and the output from the last is written to the output file. The whole process is performed incrementally, so that it is not necessary to have large numbers of records in memory at any time.

This multilevel facility allows the user to group together all changes to the source which relate to a particular functional change in the program. The change-code can be used to identify the resulting changes in the new source.

The complete description of the CDUPDATE program is given in Computing Center Memo 434, "The CDUPDATE Program." This memo includes a description of the following:

- (1) Commands and options.
- (2) CDUPDATE listings.
- (3) Change-code processing.
- (4) CDUPDATE buffers.
- (5) CDUPDATE patterns.
- (6) Examples.

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Commands: A list of the commands is given below. The descriptions of the commands are given in Computing Center Memo 434.

```

/BEGIN [update-name] [CHANGECODE=string]
/BUFFER name [{INPT|OUTPUT}] [operands]
/BUFFER END
/COMMENT anything
/.anything
/COPY operand [/operand] ...
/DELETE [MAXCOUNT=n] pattern [TO operand]
/DEBUG debugoptions
/EDIT [HOLD] replacement [/replacement] ...
/END [update-name]
/EOF
/INCLUDE name [{INPT|OUTPUT}]
/MESSAGE anything
/OPTIONS optionlist
/SKIP operand [/operand] ...

```

Options: Several CDUPDATE options may be selected, either via the PAR field of the \$RUN command, or by using a /OPTIONS command. The options are listed below. The descriptions of the options are given in Computing Center Memo 434.

```

ANCHOR={ON|OFF}
{ANYCASE|AC}={ON|OFF}
{CHANGECODE|CC}=changecodeoptions
COMMANDLIST={ON|OFF}
CLIST={ON|OFF}
LIST=listoption
LIST=(listoption1,listoption2)
{SORCEMARGINS|SM}={n|n-m|FREE}
TITLE="string"
VERSION=n.n

```


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*CKID

Contents: A Computing Center ID (signon ID) checking program.

Purpose: To provide additional security for signon IDs that must be shared by several users.

Use: The program is invoked using the \$RUN command.

Program Key: *CKID

Logical I/O Units Referenced:

- 0 - the authorization file that lists the group signon IDs that CKID is being used to protect together with the individual signon IDs allowed to use them.
- 1 - the log-file that will be used to hold information about each successful or unsuccessful signon attempt.

Parameters: The following parameters may be specified in the PAR field of the \$RUN command:

ID_TRIES=n

The ID_TRIES parameter specifies the number of attempts to be given to the user to enter an individual signon ID that is authorized to use the group signon ID. "n" may be 1, 2, or 3; the default is 1.

PW_TRIES=n

The PW_TRIES parameter specifies the number of attempts to be given to the user to enter the correct password for the individual signon ID. "n" may be 1, 2, or 3; the default is 1.

SIGFILE={ON|OFF|ALWAYS}

The SIGFILE parameter controls the processing of the user's sigfile. If ON is specified (the default), the user's sigfile is processed unless the user specifies SIGFILE=OFF on one of the input lines. If OFF is specified, the user's sigfile is not processed unless the user specifies SIGFILE=ON on one of the input lines. If ALWAYS is specified, user sigfile-processing is done regardless of any SIGFILE specification by the user. Note that when user-sigfile processing is enabled, the \$RUN *CKID com-

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mand should be the last command in the main sigfile since control will not be returned to the sigfile after processing of the user's sigfile is completed.

TEST

If the TEST parameter is specified, CKID will not check the password of the individual signon ID, will not issue the \$SOURCE command for the user's sigfile, will not set SIGFILEATTN=OFF, and will not sign the user off if the CKID checking fails. This parameter is intended for testing authorization files for correctness of syntax.

Return Codes: Always zero.

Description: In the description that follows, the term "group signon ID" refers to the signon ID(s) that are to be shared, while the term "individual signon ID" refers to some other signon ID. To successfully sign on to an account protected by CKID, a user must know the group signon ID and its password together with an individual signon ID that has been specifically authorized to use the group signon ID and the password associated with the individual signon ID.

CKID reads from *MSOURCE* using the prefix 'ID?' to prompt for the individual signon ID and the prefix 'PW?' to prompt for the password associated with the individual signon ID. When CKID is run from a sigfile (as is intended), it will unconditionally set SIGFILEATTN of OFF.

If the individual signon ID entered is authorized to use the group signon ID and the individual-signon ID/password combination is correct, the SIGFILE of the individual signon ID (if any) is processed and an entry is made in the log-file assigned to logical I/O unit one. If the individual signon ID is not authorized to use the group signon ID, the individual signon ID is invalid, or the individual signon ID/password combination is incorrect, an entry is placed in the log-file, an explanatory message is printed on *MSINK*, and the user is signed off. CKID never causes the project SIGFILE associated with the individual signon ID (if any) to be processed.

The individual signon ID and password may be entered on the same line separated by one or more blanks. In addition, the string, "SIGFILE=OFF", may be entered anywhere on an input line to suppress the individual signon ID SIGFILE processing (subject to the setting of the SIGFILE parameter).

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The authorization information in the file assigned to logical I/O unit 0 consists of one or more lines in one of the following two formats:

(1) NAMES exp1 exp2 ...

where "exp" is an expression of the form

([ID=]ccid, [NAME='name'])

(2) group-ID exp1 exp2 ...

where "group-ID" is a group signon ID that is being shared and "exp" is either an individual signon ID being granted access to the group signon ID, or an expression of the form

([ID=]ccid, [NAME='name'])

or

([ID=]ccid,*)

If the first expression form is given, CKID will attempt to set the specified name using the password of the owner ID (the name must have been previously enrolled in *USERDIRECTORY). This is equivalent to issuing the \$SET NAME='name' command for the group ID. If the second expression form is given, CKID assumes that the name for the specified signon ID was given on a NAMES record in the authorization file (see (1) above). This form allows names to appear only once in the authorization file.

The simplest example of an authorization file is as follows where there is one group ID per line followed by the single individual IDs:

```
WABC W001 W003
KSTA KSTB W003
```

A more complex example is as follows in which CKID will attempt to set the specified name for the group ID to the individual name associated with the individual signon ID:

```
WABC (W001,'Mary Smith) (W003,'John Brown')
KSTA (KSTB,'Paula Green') (W003,'John Brown')
```

The most complex example is as follows in which a NAMES line is added to the authorization file to lessen the number of times an individual name is repeated:

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NAMES (W003,'John Brown')

WABC (W001,'Mary Smith) (W003,*)
KSTA (KSTB,'Paula Green') (W003,*)

The authorization file must be permitted at least READ to each group signon ID and/or PKEY=*CKID.

After successful signons, the line written to the log-file contains the following information:

group signon ID
individual signon ID
MSOURCE device-type
time
date
answerback

The line written to the log-file after unsuccessful signons contains the same information listed above except that the answerback is replaced with the string '*FAIL*' followed by one of the following reasons:

File Access one of the files used by CKID was inaccessible (should not occur unless the SIGFILE was set up incorrectly).

ID Access the individual signon ID is not allowed to access this group signon ID.

Password the password entered doesn't match the actual password associated with the individual signon ID.

No ID/PW no individual signon ID and/or password was given or an invalid individual signon ID was entered.

The log-file must be permitted at least WRITE-EXPAND (WE) to each group signon ID and/or PKEY=*CKID. Extra security is provided if the log-file is not stored under any of the group IDs and is not permitted WRITE-CHANGE (WC) to any of them.

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```

Example:  $SIGNON SBCD
          ...
          $CREATE SIG
          $CREATE LOGFILE
          $CREATE AUTHFILE
          $PERMIT SIG R K100
          $PERMIT LOGFILE WE PKEY=*CKID
          $PERMIT AUTHFILE R PKEY=*CKID
          $COPY *SOURCE* SIG
          $SET SIGFILEATTN=OFF
          $RUN *CKID 0=SBCD:AUTHFILE 1=SBCD:LOGFILE T=0.25
          $ENDFILE
          $COPY *SOURCE* AUTHFILE
          SBCD SB01 SB02 SB03 SCAB
          K100 SB01 SB03 K123
          $ENDFILE

```

The above lines could be used to establish the files necessary to protect the group signon IDs SBCD and K100. The signon IDs SB01, SB02, SB03, and SCAB are authorized to use SBCD, while the signon IDs SB01, SB03, and K123 are authorized to use K100.

```
$SET SIGFILE=SBCD:SIG SIGFILEATTN=OFF
```

This command must be issued twice, once while signed on under the ID SBCD and again while signed on under K100. It will establish the file, SBCD:SIG, as the SIGFILE for both group signon IDs and disable attention interrupts while the SIGFILE is being processed.

```

$SIGNON SBCD
<password for SBCD>
SB02
<password for SB02>

```

or

```

$SIGNON SBCD S
<password for SBCD>
SB02 <password for SB02>

```

or

```

$SIGNON SBCD S
<password for SBCD>
SIGFILE=OFF SB02 <password for SB02>

```

In the three examples shown above a user signs on to the group signon ID, SBCD, and enters the individual signon ID, SB02, and its associated password in response to prompts from *CKID. In the final example no processing of the SIGFILE associated with the individual signon ID, SB02, takes place.

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*CKSIG

Contents: The program to validate a sign-on by checking specified values against the day of the week, a GUINFO item, a SNS item, the time of day, or the signon ID.

Use: The program is invoked by the \$RUN command.

Program Key: *CKSIG

Logical I/O Units Referenced:

- SCARDS - the specification of the values to be checked.
- SPUNCH - if specified, a line file into which is placed the signon ID, the time of the sign-on, and whether the sign-on succeeded or failed as determined by CKSIG.
- SERCOM - error comments and TEST and TRACE output.

Parameters: The following parameters may be specified in the input stream to SCARDS. One or more parameters may be entered on each input line; blanks or commas may be used as separators. The underlined portion of each parameter may be used as an abbreviation.

DAY If specified, the current day of the week must be one of the specified days. The day is specified in the form DAY=day or DAY=(day ...). The minimum abbreviations for the days are SU, M, TU, W, TH, F, and SA.

GUINFO If specified, the current information returned by GUINFO must meet the condition specified for the value. The GUINFO information is specified in the form

GUINFO=(specification) or
 GUINFO=((specification) [, (specification)]...)

where "specification" is

ITEM={itemno|itemname} [LENGTH=length]
 [OFFSET=offset] [VALUE{<|<=|=|>|=|>|~=}]
 {integer|"string" |'string'|string}

itemno is the number of a GUINFO item.
 itemname is the name of a GUINFO item.
 length is the number of bytes or characters to be included in the comparison. Padding on the right with blanks is provided, if necessary. If not specified, a default

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of 4 bytes is used if the specified value is an integer, or the length of the specified string is used if the value is a string.

offset is the number of bytes or characters in the information returned by GUINFO to be skipped before starting the comparison. If not specified, a default value of 0 is used.

integer is an integer consisting of an optional sign and digits. This integer is converted into a 4-byte, binary number before comparing it with the current GUINFO value.

string is a string of characters to be compared with the current GUINFO value. If the string contains all digits, digits preceded by a plus or minus sign, or a comma or blank, it must be enclosed in primes (') or quotation marks ("); if the string is thus enclosed, then two such marks must be used to represent a single prime or quotation mark within the string.

ID If specified, the current signon ID must be one of the specified signon IDs. The signon ID is specified in the form ID=ccid or ID=(ccid ...).

SNS If specified, the SNS information for *MSOURCE* must meet the condition specified for the value. The sense information is specified in the form

SNS=(specification) or
 SNS=((specification) [, (specification)]...)

where "specification" is

[LLENGTH=length] OFFSET=offset
 [VALUE{<|<=|=|>|=|>|~=}]
 {"string" | 'string' | string}

length is the number of bytes or characters to be included in the comparison. Padding on the right with blanks is provided, if necessary. If not specified, the default of the length of the string specified for the value is used.

offset is the number of bytes or characters in the information returned by the SNS control command to be skipped before starting the comparison.

string is a string of characters to be compare-

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dwith the current SNS information. If the string contains a comma or blank, it must be enclosed in primes (') or quotation marks ("); if the string is thus enclosed, then two such marks must be used to represent a single prime or quotation mark within the string.

TIME If specified, the current sign-on time must meet the specified condition. The current sign-on time is specified in the form

TIME{<|<=|>=|>}hh[:mm[:ss]]

If ":mm" or ":ss" are not specified, the default value of :00 is used.

END This parameter is used to terminate a keyword parameter group.

The following parameters may be specified in the PAR field of the \$RUN command. The underlined portion of the parameter may be used as an abbreviation.

TEST If specified, a failure does not produce a sign-off; instead, a success or failure message is written on SERCOM.

TRACE If specified, the values used in each test and the results of the test are written on SERCOM. This is useful for debugging a set of parameters.

Return Codes: None.

Description: The values specified in the keyword parameters are compared with the current value. If any condition for a parameter is true, that parameter is considered to be successful. If any parameter is not successful, the user is signed off when control is returned to MTS command mode.

Parameters may be grouped by terminating each group with the END parameter (or the end of input on SCARDS). In the case of groups, a sign-off is produced on return to MTS command mode only if at least one parameter in each group was not successful.

For further information about the GUINFO information, see the GUINFO subroutine description in MTS Volume 3, System Subroutine Descriptions. For further information about the SNS information for a particular I/O device, see the appropriate section of MTS Volume 4, Terminals and Networks in MTS.

Example: \$RUN *CKSIG
 DAY=(M,TU,W,TH,F) TIME>=08 TIME<=16:30
 ID=T012
 GUINFO=((ITEM=SYSOLOAD 0) (ITEM=LSS 0))
 END
 ID=T987
 GUINFO=(ITEM=UNATMODE 0)

For the sign-on to continue in the above example, the signon ID must be T012, the day of the week must be Monday through Friday, the sign-on time must be between 8 am and 4:30 pm, and either the system overload indicators must be off or LSS must be off; or the signon ID must be T987 and the system must not be running in unattended mode.

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*CLPARSEGEN, *CLPARSER

Contents: A command-language syntactic parser.

Use: The *CLPARSEGEN program is invoked by the \$RUN command to produce a syntax table which is used in conjunction with the user's compiled program.

Program Key: *CLPARSEGEN (for *CLPARSEGEN)
*EXEC (for *CLPARSER)

Return Codes: 0 - Successful return.
4 - Error return.

Description: Many programs dynamically interact with users, reading and interpreting commands the user enters on the PAR field of the \$RUN command or in response to prompts from the program. Other programs must perform some sort of syntactic analysis of data. Writing procedures to analyze the syntax of these commands or data can be time consuming and awkward. The KWSCAN subroutine can be used as an aid, but KWSCAN is limited to keyword recognition unless extra work is done outside the subroutine.

The command-language parser, a facility for syntactic analysis, may be used as an aid. This consists of the CLPARSEGEN table generator and a table-driven procedure, referred to as the CLPARSER. The table generator takes a file containing a BNF-like grammar describing the syntax of the data, and produces tables in object-module form which are then used by the user's compiled program and the CLPARSER to process text.

The parser assists in developing good command grammars and also in parsing other types of data records where efficiency is not as important as ease of coding. Although the parser is sufficiently quick for parsing command languages, it is not designed for parsing programming languages. The parser is callable from any language generating standard S-type calling sequences (e.g., FORTRAN) as well as those using the MTS coding conventions (e.g., PLUS).

The parser was developed at the University of British Columbia by Alan Ballard and is based on the BNF-Action parser used by the Spires project at Stanford University. A complete description of the parser is available in the file *CLPARSER.W, which will produce about 100 pages when copied to a printer. The parser is used by the Computing Center staff regularly and is very reliable.

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*CMDMACLIB

Contents: The default MTS command macro library of general utility macros.

Program Key: *EXEC

Logical I/O Units Referenced:
 None.

Description: If MTS command macros are enabled by the MTS command \$SET MACRO=ON, this macro library is automatically attached to obtain a set of general utility macros.

For documentation on using MTS command macro libraries, see MTS Volume 21, MTS Command Extensions and Macros.

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*CMS

Contents: The IBM VM/CMS operating system execution simulator.

Purpose: To allow software written for CMS to run unmodified under MTS.

Use: *CMS is invoked by the \$RUN command or by concatenating the file to an appropriate driver program.

Program Key: *CMS

Return Codes: See CCMemo 448.

Description: *CMS is an extended version of *VSS. *CMS supports a subset of the CMS SVC 202 and 203 functions, VM/SP diagnose instruction functions, virtual device support via the System 370 I/O machine instructions (e.g., SIO), and direct addressing of the VM/SP virtual page-zero storage locations commonly known as the NUCON area.

The complete description of VSS is given in Computing Center Memo 448, "VSS: OS/VS Simulator."

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*CMSFILETYPEMAP

Contents: A standard CMS-to-MTS file-type mapping definition.

Program Key: *EXEC

Description: Since the CMS operating system allows file names with a total of 16 significant characters and MTS allows only 12 characters in file names, it is necessary to define a one-to-one mapping between the longer CMS file names and the shorter MTS file names. The file *CMSFILETYPEMAP is provided to define a standard mapping for MTS users who run programs under the *CMS simulator or who import files to MTS from a CMS system via the CMS TAPE DUMP program (see descriptions of *CMSTAPELOAD and *CMSTAPESCAN in this volume).

CMS file identifiers (fileIDs) within a give userID are actually composed of a 1- to 8-character "filename" and a 1- to 8-character "filetype", whereas MTS fileIDs are defined as a single 12-character string. By convention, CMS fileIDs are therefore mapped to MTS fileIDs without altering the "filename" portion and by mapping the "filetype" part to a 3-character code that is appended to the "filename" with a delimiting period. For example, using *CMSFILETYPEMAP as the mapping file,

```
MYPROGRM FORTRAN
```

becomes

```
MYPROGRM.FOR
```

Users may concatenate their own private file-type maps to *CMSFILETYPEMAP or duplicate and edit the public file as needed.

The file is processed free-form and each line should have the following elements separated by at least one blank:

```
filetype code comment
```

where "filetype" is the 1- to 8-character CMS filetype to be mapped, "code" is a 1- to 3-character abbreviation for the filetype, "comment" is an optional comment of any length.

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*CMSTAPELOAD, *CMSTAPESCAN

Contents: The CMS tape restore and scanning programs.

Use: These programs are invoked by the \$RUN command.

Program Key: *CMSTAPELOAD and *CMSTAPESCAN

Logical I/O Units Referenced:

For *CMSTAPELOAD:

0 - The pseudodevice name of a magnetic tape written by the CMS TAPE utility.
SPRINT - the listing of restored files.
SERCOM - error comments and prompts.
GUSER - responses to prompting messages.

For *CMSTAPESCAN:

0 - the pseudodevice name of the CMS TAPE DUMP tape to be scanned.
SPRINT - the listing of the files on the scanned tape.

Return Codes: For *CMSTAPELOAD:

0 - Successful return.
8 - Error return.

For *CMSTAPESCAN:

Always zero.

Description: *CMSTAPELOAD restores files saved with the "TAPE DUMP" command available on IBM's CMS (VM/370 and VM/SP) operating system to MTS line files.

*CMSTAPESCAN lists the contents of a CMS magnetic tape in an intelligible format. A descriptive header is written every 50 output lines.

Both of these programs are described in further detail in MTS Volume 19, Tapes and Floppy Disks.

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*COBOLVS

Contents: The IBM COBOL VS compiler.

Purpose: To compile COBOL/VS source programs.

Use: The compiler is invoked by the \$RUN command.

Program Key: *COBOLVS

Logical I/O Units Referenced:

- SCARDS - COBOL source program to be compiled.
- SPRINT - source-program listing, diagnostics, etc.
- SERCOM - error messages when the compiler is invoked from a conversational task or when the TERM parameter is specified.
- SPUNCH - resultant object module if the DECK parameter is specified. A new source deck if the FDECK or CDECK parameter is specified.
- 0 - resultant object module if the LOAD parameter is not overridden (defaults to -LOAD).
- 1 - information needed by the compiled program for symbolic debugging when the SYMDMP parameter is used (defaults to -SYMLoad).

Return Codes: 0 - Successful return.
8 - Error return.

Description: *COBOLVS contains a version of the IBM COBOL OS/VS compiler (release 2.3) that has been modified for use in MTS. Any COBOL program that will successfully compile in an IBM VS1 (SVS), VS2 (MVS), or VM370/CMS operating system should compile equally well in MTS. The object modules as generated by the compiler will not execute in the normal MTS environment because the modules contain SVC's that are specific to IBM operating systems. An SVC is an machine instruction that requests a specific service from the operating system.

In order to run these object modules, the user must invoke the interface program *COBOLVSRUN that simulates an IBM VS2 operating system. This program is described in Computing Center Memo 439, "IBM VS COBOL under MTS."

The following parameters may be specified in the PAR field of the \$RUN command. Minimum abbreviations are underlined. The complete description of these parameters is given in Memo 439.

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<u>Parameter</u>	<u>Default</u>
<u>ADV</u> or <u>NOADV</u>	ADV
<u>APOST</u> or <u>QUOTE</u>	APOST
<u>BATCH</u> or <u>NOBATCH</u>	NOBATCH
<u>CLIST</u> or <u>NOCLIST</u>	CLIST
<u>COUNT</u> or <u>NOCOUNT</u>	NOCOUNT
<u>DECK</u> or <u>NODECK</u>	NODECK
<u>DMAP</u> or <u>NODMAP</u>	DMAP
<u>DYNAM</u> or <u>NODYNAM</u>	NODYNAM
<u>FDECK</u> or <u>NOFDECK</u>	NOFDECK
<u>FLAGW</u> or <u>FLAGE</u>	FLAGW
<u>FLOW</u> [=nn] or <u>NOFLOW</u>	NOFLOW
<u>LANGLVL</u> (1) or <u>LANGLVL</u> (2)	LANGLVL(2)
<u>L1COL1</u> or <u>L1COL2</u>	L1COL2
<u>LINECNT</u> =nn	LINECNT=57
<u>LOAD</u> or <u>NOLOAD</u>	LOAD
<u>LSTONLY</u> , <u>LSTCOMP</u> , or <u>NOLST</u>	NOLST
<u>LVL</u> =A/B/C/D or <u>NOLVL</u>	NOLVL
<u>L120</u> or <u>L132</u>	L132
<u>NAME</u> or <u>NONAME</u>	NONAME
<u>NUM</u> or <u>NONUM</u>	NONUM
<u>OPTIMIZE</u> or <u>NOOPTIMIZE</u>	NOOPTIMIZE
<u>P1MAP</u> or <u>NOP1MAP</u>	NOP1MAP
<u>RESIDENT</u> or <u>NORESIDENT</u>	NORESIDENT
<u>SEQ</u> or <u>NOSEQ</u>	NOSEQ
<u>SIZE</u> =nnnnnn	SIZE=141312
<u>SOURCE</u> or <u>NOSOURCE</u>	SOURCE
<u>SPACE1</u> , <u>SPACE2</u> , or <u>SPACE3</u>	SPACE1
<u>STATE</u> or <u>NOSTATE</u>	NOSTATE
<u>SUPMAP</u> or <u>NOSUPMAP</u>	SUPMAP
<u>SXREF</u> or <u>NOSXREF</u>	NOSXREF
<u>SYMDMP</u> or <u>NOSYMDMP</u>	NOSYMDMP
<u>SYNTAX</u> , <u>CSYNTAX</u> , or <u>NOSYNTAX</u>	NOSYNTAX
<u>SYST</u> or <u>SYSx</u>	SYST
<u>TERM</u> or <u>NOTERM</u>	TERM (terminal), NOTERM (batch)
<u>TRUNC</u> or <u>NOTRUNC</u>	NOTRUNC
<u>VBSUM</u> or <u>NOVBSUM</u>	NOVBSUM
<u>VBREF</u> or <u>NOVBREF</u>	NOVBREF
<u>VERB</u> or <u>NOVERB</u>	VERB
<u>XREF</u> or <u>NOXREF</u>	XREF
<u>ZWB</u> or <u>NOZWB</u>	ZWB

The *COBLINKEDIT program may be run to invoke some of the more advanced features of VS COBOL, such as the dynamic call option. This program is also described in Memo 439.

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*COLLATE

Contents: A record collating program.

Purpose: To select records from two input files that either match or do not match according to user specified keys, and to write out one or more combinations of these records or to produce output records that have data combined from matched records.

Use: *COLLATE is invoked by the \$RUN command.

Program Key: *COLLATE

Logical I/O Units Referenced:

- 0 - input file containing "master" records.
- 1 - input file containing "detail" records.
- SPRINT - input/output statistics.
- SERCOM - warning, error, and prompt messages.
- GUSER - error prompt responses.

Parameters: The following parameter must be included in the PAR field of the \$RUN command:

KEY=({key-spec | (key-spec) [, (key-spec)] ... })

where "key-spec" is:

begin,length[,detail_begin[,detail_length[,pad]]]

and

begin-end or detail_begin-detail_end

may be substituted, respectively, for

begin,length or detail_begin,detail_length

This specifies the keys for matching the records. "begin" is the beginning position of the key in the "master" record. "length" is the length in bytes, or characters, of the key in the "master" record. "end" is the ending position of the key in the "master" record. "detail_begin" is the beginning position of the key in the "detail" record. If "detail_begin" is not specified, the value of "begin" is used. "detail_length" is the length in bytes, or characters, of the key in the "detail" record. "detail_end" is the ending position of the key in the "detail" record. If neither "detail_

length" nor "detail_end" is specified, the length of the key in the "master" record is used for the length of the key in the "detail" record. "pad" is a character to use to pad keys when the "master" record and "detail" record key lengths are not equal. If "pad" is a blank, comma, or right parenthesis, it must be enclosed in single quotes (') or double quotes ("). Otherwise, it may be a single character or a single character enclosed in quotes. If "pad" is not specified, a blank is used. The input records must be ordered so that if the keys are treated as characters or unsigned binary numbers, they will be in ascending sequence. Where more than one key field is specified, the key is evaluated as though the fields were concatenated from left to right in the order given. Depending on the MULTIPLEMASTERS and IGNOREMULTIPLEMASTERS parameters, there may be only one "master" record for each key value, or there may be more than one for each key value. There may be any number of "detail" records for each key value.

At least one of the following parameters must be included in the PAR field of the \$RUN command:

```
{MATCHEDMASTERS | MM} = {FDname | @MD | @UM | @UD | @C | @IMM}
{MATCHEDDETAILS | MD} = {FDname | @MM | @UM | @UD | @C | @IMM}
{UNMATCHEDMASTERS | UM} = {FDname | @MM | @MD | @UD | @C | @IMM}
{UNMATCHEDDETAILS | UD} = {FDname | @MM | @MD | @UM | @C | @IMM}
```

These designate the output files. "FDname" is the name of an output file or device. "@MM" specifies that the same output file as the one for matched "master" records is to be used. "@MD" specifies that the same output file as the one for matched "detail" records is to be used. "@UM" specifies that the same output file as the one for unmatched "master" records is to be used. "@UD" specifies that the same output file as the one for unmatched "detail" records is to be used. "@C" specifies that the same output file as the one for combined matched records is to be used. "@IMM" specifies that the same output file as the one for ignored multiple master records is to be used.

```
COMBINED = ( {FDname | @MM | @MD | @UM | @UD | @IMM} ,
  {MASTER = (combine-spec) | DETAIL = (combine-spec)} , ... )
```

where "combine-spec" is:

```
begin,length,outloc[,begin,length,outloc]...
```

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and

begin-end

may be substituted for

begin,length

This specifies the data from a matched "master" record and a matched "detail" record that is to be combined into an output record. "FDname" is the name of an output file or device. "@MM" specifies that the same output file as the one for matched "master" records is to be used. "@MD" specifies that the same output file as the one for matched "detail" records is to be used. "@UM" specifies that the same output file as the one for unmatched "master" records is to be used. "@UD" specifies that the same output file as the one for unmatched "detail" records is to be used. "@IMM" specifies that the same output file as the one for ignored multiple master records is to be used. "begin" is the beginning position of data in the "master" or "detail" record to be placed in the combined record. "length" is the length of the data to be placed in the combined record. "end" is the ending position of the data to be placed in the combined record. "outloc" is the beginning position in the combined record for the data.

```
{IGNOREMULTIPLEMASTERS|IMM}
  [= {FDname|@MM|@MD|@UM|@UD|@C}]
```

This specifies that any number of "master" records with the same key value can occur. The first "master" record having each key value will match all "detail" records having the same key value. All additional "master" records having the same key value will not be matched with any "detail" records. "FDname" is the name of an output file or device for the additional "master" records with the same key value. "@MM" specifies that the same output file as the one for matched "master" records is to be used. "@MD" specifies that the same output file as the one for matched "detail" records is to be used. "@UM" specifies that the same output file as the one for unmatched "master" records is to be used. "@UD" specifies that the same output file as the one for unmatched "detail" records is to be used. "@C" specifies that the same output file as the one for combined matched records is to be used. If this is the only parameter used from this group, a file or device

name must be specified. This parameter may not be specified if the MULTIPLEMASTERS parameter is specified.

The following parameters may be included in the PAR field of the \$RUN command:

[NO|~|~]MULTIPLEMASTERS

If no multiple masters is specified, there can be only one "master" record with each key value. Each "master" record will match all detail records having the same key value. If multiple masters is specified, any number of "master" records with the same key value can occur. Each "master" record can match only one "detail" record. If there are more "master" records than "detail" records or more "detail" records than "master" records for a given key value, the excess records are treated as unmatched records. The default is NOMULTIPLEMASTERS. This parameter may not be specified if the IGNOREMULTIPLEMASTERS parameter is specified.

{MASTERLENGTH|ML}=maxlen

This specifies the maximum length of the "master" records. "maxlen" is the maximum number of bytes, or characters, that occur in a "master" record. If this parameter is not specified, the maximum input length for the first file attached to logical unit 0 is used.

{DETAILLENGTH|DL}=maxlen

This specifies the maximum length of the "detail" records. "maxlen" is the maximum number of bytes, or characters, that occur in a "detail" record. If this parameter is not specified, the maximum input length for the first file attached to logical unit 1 is used.

Return Codes: 0 - Successful return.
4 - Error detected.

Example: \$RUN *COLLATE 0=MASTERFILE 1=DETAILFILE PAR=K=(1,4)
C=(COMBINEDFILE,M=(1,15,1, 16-26,27, 28-44,68),
D=(5-15,16, 16,29,38))

This reads records from MASTERFILE and DETAILFILE and compares columns 1 through 4 of both the "master" and "detail" records. If the records match (columns 1 through 4 are equal), a combined record

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is written to the file COMBINEDFILE. The format of the output records is:

```
col 1-15   master columns 1-15
col 16-26  detail columns 5-15
col 27-37  master columns 16-26
col 38-66  detail columns 16-44
col 68-84  master columns 28-44
```

Since no multiple masters is in effect, no two "master" records will have the same key in columns 1 through 4; but each "master" record may match zero or more "detail" records. One output record will be written for each "detail" record that matches a "master" record.

```
$RUN *COLLATE 0=MASTERFILE 1=DETAIL1+DETAIL2
PAR=K=(2-5,1) MM=MATCHED MD=@MM ML=32
```

This reads records from MASTERFILE and DETAIL1 concatenated with DETAIL2 and compares columns 2 through 5 of the "master" records with columns 1 through 4 of the "detail" records. "Master" records that match "detail" records are written to the file MATCHED. "Detail" records that match "master" records are written to the same file as the matched "master" records, i.e., the file MATCHED. The maximum record length for the records in MASTERFILE is 32 bytes, or characters. The maximum record length for the "detail" records is the maximum input record length returned by the GDINFO subroutine for the file DETAIL1.

```
$RUN *COLLATE 0=MASTERFILE 1=DETAILFILE PAR=K=((1,4,17),
(5-12)) MD=MATCHEDDET UD=UNMATCHEDDET MU
```

This reads records from MASTERFILE and DETAILFILE and compares columns 1 through 4 of the "master" records with columns 17 through 20 of the "detail" records and columns 5 through 12 of both the "master" and "detail" records. If the records match, the detail records are written to the file MATCHEDDET. If the records do not match, the detail records are written to the file UNMATCHEDDET. Since multiple master records is specified, there may be more than one "master" record with the same key and each "detail" record must match a separate "master" record. If there are "detail" records that would match a "master" record, but the "master" record has already matched a previous "detail" record and there are no more "master" records with the same key, the "detail" record will be considered unmatched and written to the file UNMATCHEDDET.

```
$RUN *COLLATE 0=MASTERFILE 1=DETAILFILE PAR=K=(1,4)  
C=(REPLACEDFILE,M=(6,10,1),D=(5,76,11))
```

This reads records from MASTERFILE and DETAILFILE and compares columns 1 through 4 of both the "master" and "detail" records. If the records match, the detail record is written to REPLACEDFILE with columns 6 through 15 of the "master" record replacing the original first four columns of the "detail" record.

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*COMBINE

Contents: The record-combination program.

Use: The program is invoked by the \$RUN command.

Program Key: *COMBINE

Logical I/O Units Referenced:

SCARDS - input commands to the COMBINE program.
 SERCOM - error comments and diagnostic messages.
 GUSER - input commands to the COMBINE program (after
 attention interrupt).

Return Codes: Always zero.

Description: *COMBINE is a record-combination program used to combine records or parts of records from one or more input files or devices, and to write the combined records onto one output file or device, or to execute the combined records as MTS commands.

Input commands to COMBINE (instructions for combining records) are entered from SCARDS, one command per line, e.g.,

```
$RUN *COMBINE SCARDS=command-input
```

Alternatively, a single input command may be entered via the PAR field of the \$RUN command, e.g.,

```
$RUN *COMBINE PAR=single-command
```

COMBINE may be used as a subroutine by concatenating *COMBINE to the file containing the calling program. For example, if the file GOODSTUFF contains the calling program, the MTS command

```
$RUN GOODSTUFF+*COMBINE
```

will load COMBINE for use. COMBINE is invoked as a subroutine by a call of the form:

```
CALL COMBIN
```

or

```
CALL COMBIN(command)
```

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where "command" is a halfword array with the command length in the first halfword and with the command starting in the second halfword. COMBINE returns to the calling routine after executing the single command. If no parameters are given in the call, COMBINE will read and execute multiple commands from SCARDS. When a STOP command is read, COMBINE will return to the calling routine.

Commands: The following commands may be used with the COMBINE program.

COPY parameter ...

The COPY command specifies what is to be copied and where to put it. The command has the form

COPY FDname<C,C,...> FDname<C,C,...>... FDname

where "FDname" is a file or device name (line-number ranges, concatenations, and modifiers are allowed). The rightmost FDname is the output file or device name unless only one FDname is given, in which case SPUNCH is used for output.

Movement of columns from an input record to the output record is controlled by the items listed between the angle brackets, "<" and ">". The available items are listed below, with the underlined letters giving the minimum acceptable abbreviations.

n	"n" is a column number from which to move; e.g., 54
n-m	"n" and "m" are column numbers giving a column range to move; e.g., 7-16
<u>S</u> PACE n	blanks "n" column spaces in the output record; e.g., SPACE 10
<u>I</u> SPACE n	skips "n" column spaces in the input record; e.g., ISPACE 8
<u>T</u> AB n	tabs to the nth column in the output record; e.g., TAB 33
<u>I</u> TAB n	tabs to the nth column in the input record; e.g., ITAB 50
<u>M</u> OVE n	moves the next "n" columns to the output record; e.g., MOVE 8
'xxxx'	a literal string; e.g., 'FRAXINUS'
<u>O</u> UTPUT n	writes "n" output records; e.g., OUTPUT 3
<u>I</u> NPUT n	reads "n" additional records from the input source; e.g., INPUT 5

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The spaces within each item specification are optional; e.g., INPUT 1 and INPUT1 have the same effect.

The following example illustrates the use of these items (this command should be on one line).

```
COPY A<5,'SCILLA'> B<7,SPACE6,1-13,OUTPUT1,
      50-END,TAB15,'IRIS'> C D<OUTPUT1> Z
```

This command uses files A, B, C, and D for input and file Z for output. The records written to Z will be constructed as follows:

- (1) A record is read from file A and column 5 is moved to column 1 of the Z output buffer.
- (2) The characters "SCILLA" are moved to columns 2 to 7 of the Z output buffer.
- (3) A record is read from file B, and column 7 moved to column 8 of the Z buffer.
- (4) Columns 9 to 14 of the Z buffer are skipped (filled with blanks).
- (5) Columns 1 to 13 (including 7) of B are moved to columns 15 to 27 of the Z buffer.
- (6) OUTPUT1 causes these 27 columns to be written to file Z.
- (7) Columns 50 to the end of the record are moved from B to columns 1 to ? of the Z buffer.
- (8) TAB15 causes the characters "IRIS" to be overlaid on columns 15 to 18 of the Z buffer. (If column ? is short of 15, then blanks are inserted up to column 15.)
- (9) Next, a record is read from file C and is moved in its entirety to columns 19 to ? of the Z buffer.
- (10) A record is read from file D and immediately thereafter the current Z buffer is written.
- (11) Finally, the entire record just read from D is moved to columns 1 to ? of the Z buffer and this record is written.

This entire process is repeated until an end-of-file is received from one of the input files.

Notes:

- (1) Column ranges must be ascending.
- (2) The first column of an input record is always 1.
- (3) The last column of an input record may be designated END, LAST, or *L.
- (4) If no column number or column range is given with an input FDname, the program assumes the

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range 1-END as the last item between the angle brackets (or the only item if no angle brackets were used).

- (5) Items listed between pairs of pointed brackets are separated by blanks and/or commas.
- (6) Groups of items may be enclosed by parentheses, (...), with an integer repetition count preceding the left parenthesis. This causes the enclosed items to be rescanned when the corresponding right parenthesis is reached. Parentheses may be nested up to 10 deep.
- (7) Literals may be used without the surrounding apostrophes. Such a literal is terminated by any of the characters

<>,'-0123456789()

or by any of the words INPUT, OUTPUT, SPACE, TAB, ISPACE, ITAB, END, LAST, or *L, or their abbreviations. Blanks may be embedded within these literals, and leading and trailing blanks are included in the literal.

- (8) If an input end-of-file is received while the output buffer still has characters in it, these characters will not be written.
- (9) @I modifiers are ignored on input FDnames but are recognized on the output FDname. The record number of the last input record is used as the output record number.

COMMANDS parameter

The COMMANDS command is written like a COPY command with "COPY" replaced by "COMMANDS". COMMANDS executes the output lines as MTS commands instead of copying them to an output file or device (in fact, there should be no output file or device included in a COMMANDS command).

Note: An attention interrupt issued during the processing of an MTS command terminates that MTS command; not knowing of the attention, COMBINE then continues with the next line of the file. Thus, it is virtually impossible to stop the COMBINE COMMANDS command once started.

Suppose the file NAMES contains file names. Then the following command would permit the files "read-only" to CCID MINA:

COMMANDS NAMES<'\$PERMIT ',1-END,' READ MINA'>

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Note the necessary blanks after "\$PERMIT" and before "READ MINA".

Since the COMMANDS use of COMBINE commonly involves file names, a pseudofile of file names is provided. The pseudofile has the form

(string)

where "string" is a partially specified file name (PSFN), and is written as in the \$FILESTATUS command. That is, a question mark (?) is used to designate an arbitrary string of characters within a name. File names matching the PSFN are returned, one at a time, as if they were being read from a file. For example, suppose a user has files with the following names: EPILOBIUM, EPIMIDIUM, EPISTASIS, and EPODE. Then the command

```
COMMANDS (?EPI?)<$DESTROY 1-END OK>
```

would execute the MTS commands

```
$DESTROY EPILOBIUM OK
$DESTROY EPIMIDIUM OK
$DESTROY EPISTASIS OK
```

and the command

```
COMMANDS (?I?I?)<LIST 1-END' (*L) '>
```

would execute the MTS commands

```
LIST EPILOBIUM(*L)
LIST EPIMIDIUM(*L)
LIST EPISTASIS(*L)
```

SET option ...

The SET commands sets switches that control some aspects of the program. The options that take ON or OFF as a value may take YES or NO instead.

CC={ON|OFF} Default: CC=ON

CC controls carriage control when the output device is a printer or a terminal. When CC=ON, the first character of an output record is used for carriage control, and when CC=OFF, the output records are single-spaced.

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PAD={ON|OFF} Default: PAD=ON

PAD controls the treatment of short input records. If PAD=ON and columns that do not exist are to be moved from an input record to the output record, then blanks will be used to extend the input record to the required length. If PAD=OFF, then no characters are moved to the output record from beyond the end of a short input record.

WARN={ON|OFF} Default: WARN=ON

WARN controls the printing of warning messages for records that are too long to fit in internal buffer of the program. WARN=ON prints a warning message when an output record is truncated. WARN=OFF suppresses these messages.

BLANK={ON|OFF} Default: BLANK=ON

BLANK controls the replacement of zero-length records with blanks. The value of blank is only relevant when NULL=ON. BLANK=ON replaces a zero-length record by a record with one blank (" "). If BLANK=OFF, a zero-length record is written.

NULL={ON|OFF} Default: NULL=ON

NULL controls the output of zero-length (null) records. NULL=ON causes these records to be written. NULL=OFF suppresses the output of these records. For example, the command

COPY A<1-5,OUTPUT2,6-10> B

writes columns 1 to 5 of file A to a record of file B. Then if NULL=ON (and BLANK=OFF), a zero-length record is written, and this is followed by a record containing columns 6 to 10 of file A. The only effect here is that the line numbers in file B will not be consecutive integers, since a zero-length record deletes the line with the same line number (if there is one) and does not enter the file. If NULL=OFF, zero-length records will not be written to the output file, and the line numbers in B will be consecutive.

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BEGIN=char Default: BEGIN=<
 END=char Default: END=>

BEGIN and END control the column selection characters. It is necessary to change these from the defaults only when using files whose names contain "<" or ">".

EXPLAIN command

The EXPLAIN command prints a brief explanation of a command. For example,

EXPLAIN COPY

prints an explanation of the COPY command.

HELP

The HELP command prints a list of commands.

CONTINUE

The CONTINUE command may be used after an attention interrupt to continue execution of an interrupted COPY or COMMANDS command.

MTS

The MTS command returns control to MTS. The program can be restarted with \$RESTART provided that none of the following MTS commands is used in the interim: \$RUN, \$LOAD, \$UNLOAD, \$DEBUG, or \$RERUN.

MCMD MTS-command

The MCMD command executes one MTS command and returns to the program, provided the command is not one of the following: \$RUN, \$LOAD, \$UNLOAD, \$DEBUG, or \$RERUN. For example:

MCMD LIST EPIMIDIUM

In addition, any line beginning with a "\$" sign is executed as an MTS command with control returning to the program. For example:

\$LIST EPIMIDIUM

STOP

The STOP command terminates the program.

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Examples: The following example executes a COPY command to combine columns 4 to 9 from file ABE with columns 8 to 11 of file PDP and writes the combined records into file HAM.

```
$RUN *COMBINE PAR=COPY ABE<4-9> PDP<8-11> HAM
```

<u>Contents of ABE</u>	<u>Contents of PDP</u>	<u>Contents of HAM</u>
1234567890	abcdefghijkl	456789hijk
2345678901	bcdefghijklm	567890ijkl
3456789012	cdefghijklmn	678901jklm

The following example empties the file FG, and then fills it with columns 1 to 5 and 6 to 10 of file F and columns 7 to 9 of file G. Then pairs of records from file H are combined and written to file HH.

```
$RUN *COMBINE
MCMC $EMPTY FG
COPY F<1-5, SPACE 3, 6-10> G<TAB 6, 7-9> FG
COPY H<1-*L, INPUT 1, 1-*L> HH
STOP
```

<u>Contents of F</u>	<u>Contents of G</u>	<u>Contents of FG</u>
abcdefghijkl	1234567890	abcde789fghij
bcdefghijklm	2345678901	bcdef890ghijk
cdefghijklmn	3456789012	cdefg901hijkl

<u>Contents of H</u>	<u>Contents of HH</u>
12345	1234567890
67890	abcdefghijklmnoqrst
abcdefg	
ijklmnoqrst	

The following is part of a FORTRAN program that uses COMBINE as a subroutine to execute the command COPY A<1-5,10-15> B.

```
INTEGER*2 CMD(11)
...
CALL MOVEC(19, 'COPY A<1-5,10-15> B', CMD(2))
CMD(1) = 19
CALL COMBIN(CMD)
...
```

<u>Contents of A</u>	<u>Resulting Contents of B</u>
abcdefghijklmnoqrst	abcdeklmno
bcdefghijklmnoqrstu	bcdeflmnop
cdefghijklmnoqrstuv	cdefgmnoqp

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*COMPARE

Contents: A file comparison program.

Purpose: To compare two files.

Use: The program is invoked with the \$RUN command.

Program Key: *COMPARE

Logical I/O Units Referenced:

- SPRINT - printed output.
- SPUNCH - control command output for *CDUPDATE or *UPDATE.
- 0 - original file or device.
- 1 - current file or device.
- GUSER - prompting responses
- SERCOM - prompting messages for the FDnames and error comments.

Parameters: The parameters that are preceded by [NO] can also be specified as "option={ON|OFF}" or as "{NO|N|-|~}option".

SYNCH

If SYNCH is specified, a comparison between two files is performed; this is the opposite of DOWNDATE (see below). An attempt is made to synchronize the lines of the two files. The differences are printed on SPRINT, unless SPUNCH is specified in which case DOWNDATE overrides the SYNCH specification. SYNCH is the default.

WIDTH=nn

If WIDTH is specified, the width of the SYNCH output is set to "nn", where "nn" may be from 65 to 133, inclusive. By default, the width of SYNCH output is set to the SPRINT maximum output length.

PRLLEN=nn

If SYNCH is specified, only the first "nn" characters of each record are printed on SPRINT. The default for PRLLEN is the value MAXLEN.

[NO]HEXADECIMAL

If HEXADECIMAL is enabled, the lines of the two files will be printed in hexadecimal. The default is HEXADECIMAL=OFF.

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ONELINE

If ONELINE specified, records from each unit will be truncated so that they are printed on one line. This would be the same as if PRLIN is set to the WIDTH divided by 2 less 14. The default is ONELINE=OFF.

MAXLEN=nn

For all comparisons, only the first "nn" characters of a record from both units are compared. The default is MAXLEN=32767. The user should set this to 72 for assembly sources.

[NO] LENCHK

If LENCHK is enabled, lines are equal if their contents and lengths are equal. The default is NOLENCHK.

[NO] LNRCHK

If LNRCHK is on, lines are equal if their contents and line numbers are equal. The default is NOLNRCHK.

CONTEXT=nn

Only the first "nn" and last "nn" lines are fully printed. This can be zero, causing the COMPARE program to produce just the message indicating how many equal lines there are. The default is CONTEXT=1; i.e., only the first and last lines are printed.

FULL

If FULL is specified, all equal lines are printed on SPRINT. The default is FULL=OFF.

[NO] STAT

Statistics, such as the number of lines in each file, the number of blocks, VM storage used, and CPU time, are printed at the end of the program. The default is STAT=ON.

RETRIES=nn

If there remain false differences (sequences of lines that incorrectly appear different but are the same and cannot be resolved by the regular comparison algorithm), the program will retry to resolve

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them by an alternative method. The retry count specifies the number of times the program will use the alternative method. If the retry count is exhausted before resolution, the number of remaining false differences is printed in the statistics. The default is RETRIES=10.

[NO]OPT

Optimization is performed after the comparison algorithm, described in the CACM article, is accomplished. This will produce fewer blocks. The default is OPT=ON.

BLKMIN=nn

If a block would contain less than "nn" records from either unit, it is deblocked. The default is BLKMIN=5. This parameter is applicable only if OPT=ON.

BLK0MIN=nn

If a block would contain less than "nn" records from unit 0, it is deblocked. The default is 5. This parameter is effective only if OPT=ON.

BLK1MIN=nn

If a block would contain less than "nn" records from unit 1, it is deblocked. The default is 5. This parameter is effective only if OPT=ON.

BLKEQ=nn

If a block contains less than "nn" equal records, it is deblocked. The default is 2. This parameter is effective only if OPT=ON.

PCEQ=nn

If the percentage of equal records in a block is less than "nn" %, the block is deblocked. The default is 25.000%. This parameter is effective only if OPT=ON.

IC={ON|OFF|DEFAULT}

The IC parameter specifies how \$CONTINUE WITH lines are to be processed. If IC=ON, \$CONTINUE WITH lines are interpreted as implicit concatenation. If IC=OFF, such lines are treated as data lines. If IC=DEFAULT, the interpretation of such lines is

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dependent of the @IC modifier specification on the FDnames for logical I/O units 0 and 1. IC=DEFAULT is the default.

The COMPARE program can be used to produce *CDUPDATE or *UPDATE control commands. The following parameters are applicable in producing such control-commands on SPUNCH.

DOWNDATE={CDUPDATE|UPDATE}

If the DOWNDATE=CDUPDATE is specified, *CDUPDATE control commands will be produced on SPUNCH. If DOWNDATE=UPDATE is specified, *UPDATE control commands will be produced on SPUNCH with SEQID and MAXLEN=72 enforced. The DOWNDATE parameter will override the SYNCH parameter. If SPUNCH is specified, DOWNDATE=CDUPDATE is assumed if only DOWNDATE is specified.

[NO] CDLIST

If DOWNDATE=CDUPDATE is specified, the last record from the original version plus its line number is recorded in a comment field for /COPY and /SKIP. The default is NOCDLIST. This is chiefly useful for those desiring to change *CDUPDATE commands into those with pattern matching.

[NO] CDLNR

If DOWNDATE=CDUPDATE is specified, the line numbers of both original and current versions are recorded in a comment field for /BUFFER, /COPY, and /SKIP. The default is NOCDLNR.

[NO] SEQID

Instead of COUNT=nn or patterns, LEN(72) "seqid" is produced for /COPY and /SKIP. This is useful for the users desiring to use the sequence IDs in similar fashion as *UPDATE program. The default is NOSEQID since the sequence IDs in columns 73-80 are not likely to be unique.

COPYMIN=nn

If DOWNDATE=CDUPDATE and OPT=ON are specified, then if the /COPY count is less than "nn", it is replaced with /SKIP and insertions. The default is 2.

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NAME=nn

"nn" is used as a name for the *CDUPDATE /BEGIN command. If NAME is not specified and DOWNDATE=CDUPDATE is specified, the program will prompt the user for the name.

Return Codes: 0 - Files are equal.
4 - Files are not equal.
8 - Error return.

Description: The COMPARE program produces on SPRINT the comparison between two files much like the SYNCH output of *APC. If either logical I/O unit 0 or 1 is not specified, the program will prompt the user. The COMPARE program is less expensive than *APC, but each of the files being compared should have less than 65,534 lines. The algorithm is completely different than the one used by current comparison programs *DOWNDATE, *SIDEDATE, *UNEDIT, and *APC. It is based on "A Technique for Isolating Differences Between Files," Communications of the ACM, Vol. 21, No. 4, pp. 264-8. The COMPARE program will even recognize a block, a series of similar lines from both files. Such a block may even be found at the start of the first file and at the end of the second.

Example: The example on the following page illustrates the output from the COMPARE program.

```

#$RUN *COMPARE
#EXECUTION BEGINS
Where is the old source?  -MAC
Where is the current source?  -ASMTMAC
Unit 0: -MAC                      Unit 1: -ASMTMAC
-----
=      1          MACRO          1          MACRO      =
=====          1 equal line =====
=      3          GBLA  &#N      3          GBLA  &#N  =
=      4          LCLC  &S*      4          LCLC  &S,   =
=          255,&LBL                &LBL                =
=      5          &LBL  SETC  '&L  5          &LBL  SETC  '&L  =
=          ABE'                    ABE'                    =
=====          7 equal lines =====
=     13          &S    SETC  '#&    13          &S    SETC  '#&  =
=          #N.A'                    #N.A'                    NA  =
=          ME OF IT                    ME OF IT                    =
=     14          .WA    AIF  ('&    14          .WA    AIF  ('&  =
=          ARG1' (1,1) EQ  ' ('      ARG1' (1,1) .' &ARG1'  =
=          .REG                    (1,1) EQ  ' ((') .REG  =
=     15          &LBL  MVC  &S+    15          &LBL  MVC  &S+  =
=          4 (4), &ARG1    MO      4 (4), &ARG1    MO  =
=          VE INTEGER                    VE INTEGER                    =
=====          11 equal lines =====
=     27          .END    MEND      27          .END    MEND    =
Old file "-MAC" has 27 lines,
and current file "-ASMTMAC" has 27 lines.
Both files have 2 mismatches.
Total virtual storage used = 3 pages.
CPU time = 0.055343 seconds.
#EXECUTION TERMINATED  16:29:11  T=.059      $.02

```

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*COMPUCALENDAR

Contents: A calendar of computing events on the University of Michigan campus.

Use: The \$COPY command should be used, e.g.,

\$COPY *COMPUCALENDAR

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*CONSULTINGHOURS

Contents: A list of the hours during which consultants are available at the Michigan Union (UNYN) and the North University Batch Station (NUBS).

Use: The \$COPY command should be used, e.g.,

\$COPY *CONSULTINGHOURS

*CONSULTINGSCHED

Contents: A chart giving the hours and names of the each of the consultants on duty at the Michigan Union (UNYN) and the North University Batch Station (NUBS).

Use: The \$COPY command should be used, e.g.,

\$COPY *CONSULTINGSCHED

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*CRCBOOKLIST

Contents: A list of reference publications available at the Computing Resource Center.

Use: The \$COPY command should be used, e.g.,

\$COPY *CRCBOOKLIST

Description: The Computing Resource Center Resource Room houses a collection of printed materials relating to microcomputers and computing at The University of Michigan. Materials are available to the entire University community. Materials may not be checked out except on a short-term basis for copying or for use in the ISS/CC labs.

*CRCSOFTWARE

Contents: A list of software available for evaluation at the Computing Resource Center.

Use: The \$COPY command should be used, e.g.,

\$COPY *CRCSOFTWARE

Description: The Computing Resource Center maintains a collection of software packages available for trial and evaluation. These programs for both IBM PC-compatible and Macintosh microcomputers can be checked out for use on specially designated computers in the Evaluation Area at any time during CRC business hours: 9:00 am to 5:00 pm Monday through Friday.

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*CSMP

Contents: A comprehensive control program for the CSMP (Continuous System Modeling Program) simulation language. See also the *CSMPTRAN description in this volume.

Purpose: To provide both the model stacking capability and full CSMP monitoring across all three CSMP phases (CSMP translation, FORTRAN compilation, and CSMP model execution).

Use: The program is invoked by the \$RUN command.

Program Key: *EXEC

Logical I/O Units Referenced:

- SCARDS - CSMP source program if unit 1 is not assigned (defaults to *SOURCE*).
- SPRINT - DECK option output if unit 2 is not assigned and CSMP listings if unit 6 is not assigned (defaults to *SINK*).
- 1 - CSMP source program (defaults to SCARDS).
- 2 - DECK option output (defaults to SPRINT).
- 5 - data storage between CSMP translation and execution phases (defaults to the sequential file -CSMP#5).
- 6 - CSMP translation listing output, FORTRAN compilation output, and CSMP execution listing output (defaults to SPRINT).
- 7 - FORTRAN source produced by CSMP translation phase (defaults to the sequential file -CSMP#7).
- 15 - PREPAR option output.

Return Codes: 0 - Successful return.
>0 - Error return.

Description: *CSMP provides full comprehensive control over all phases for one or more stacked models. The format of input source, the use of logical I/O units, and the defaults are as described above and in the *CSMPTRAN public file description. The overall processing is as described in the *CSMPTRAN description, except that *CSMP maintains overall control and does not use *CSMPTRAN and/or *CSMPEXEC. The STACK option (as described in the IBM manuals listed in the *CSMPTRAN description) is available in *CSMP and is indicated by placing the symbol STACK in columns 9-13 of the ENDJOB control statement. (The last, or only, model must terminate with an ENDJOB control statement which is blank in columns 9-13.)

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Logical I/O units 2 and 15 must be specified if the CSMP source issues the DECK or PREPAR options, respectively; otherwise, these units need not be specified. Logical I/O units 5, 7, and 15 must have read-write-rewind capability, whether specified by the user or defaulted. Units 5 and 7 are initially emptied (if attached to files) or rewound (if not attached to files), and they are left in a rewind state at the exit from *CSMP. At exit, unit 5 contains the data file for the last (or only) model translated, and unit 7 contains the FORTRAN source for the last (or only) model translated. Unit 15 contains the PREPAR option output for the last model executed which specified PREPAR as an output. These units are all used, for each source-supplied model, as described in *CSMPTRAN.

During execution, *CSMP creates three temporary sequential files named -####13, -####14, and -LOAD. Files -####13 and -####14 are for internal use only and are emptied at entry and exit to *CSMP. The file -LOAD, at exit, contains the FORTRAN-compiled object modules for the last (or only) model compiled; -LOAD is emptied before each compilation. If user-specified, these three files must have read-write-rewind attributes.

During execution, *CSMP links in sequence to the CSMP translation phase, to FORTRAN (using *FORTRAN), and to the CSMP execution phase. For this linking to occur correctly, it is imperative that the MTS SYMTAB option be ON; this is the current default setting for the SYMTAB option.

```
Example: $RUN *CSMP 2=-T 15=PLOTFILE
          .
          (CSMP model 1 source)
          .
ENDJOB STACK
          .
          (CSMP model 2 source)
          .
ENDJOB STACK
          .
          (CSMP model n source)
          .
ENDJOB
```

In the above example, the source program is read from *SOURCE* (the default for SCARDS) and the DECK option output is written to the file -T. PREPAR output is written to the file PLOTFILE.

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*CSMPTRAN, *CSMPEXEC, *CSMPLIB

Contents: The modules for the IBM CSMP (Continuous System Modeling Program) simulation language. *CSMPTRAN contains the MTS-supplied CSMP translation phase control program. *CSMPEXEC contains the MTS-supplied CSMP execution phase control program. *CSMPLIB contains the IBM-supplied CSMP library modules in a subroutine library format. (Note: See the *CSMP public file description for a comprehensive CSMP control program.)

Purpose: To translate (*CSMPTRAN) a CSMP source program into appropriate data and FORTRAN source files, and to execute (*CSMPEXEC) the various object modules composing the model specified by the CSMP source program.

Use: *CSMPTRAN and *CSMPEXEC are invoked by the appropriate \$RUN commands; *CSMPLIB is used as a library file.

Program Key: *EXEC

Logical I/O Units Referenced:

- (a) by *CSMPTRAN
 - SCARDS - CSMP source deck if unit 1 is not assigned (defaults to *SOURCE*).
 - SPRINT - DECK option output if unit 2 is not assigned (defaults to *SINK*).
 - 1 - CSMP source deck (defaults to SCARDS).
 - 2 - output for the DECK option (defaults to SPRINT).
 - 5 - data output for later use (defaults to -CSMP#5).
 - 6 - CSMP listing and error comments (defaults to SPRINT).
 - 7 - FORTRAN source output (defaults to -CSMP#7).
- (b) by *CSMPEXEC
 - SPRINT - CSMP execution output if unit 6 is not assigned (defaults to *SINK*).
 - 5 - data input (defaults to -CSMP#5, if file exists).
 - 6 - CSMP execution output (defaults to SPRINT).
 - 15 - PREPAR option output.

Return Codes: Always zero.

Description: CSMP is a simulation language especially designed for those simulation models which are expressed as differential equations or as equivalent block diagrams. The language and its use are described in the following IBM manuals:

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- (1) System/360 Continuous System Modeling Program: Application Description, form H20-0240.
- (2) System/360 Continuous System Modeling Program User's Manual, form H20-0367.
- (3) System/360 Continuous System Modeling Program System Manual, form Y20-0111.

The user of CSMP should know the FORTRAN language and the use of the FORTRAN compiler (*FTN or *FORTRANH) in MTS.

The input deck for CSMP is described in the aforementioned IBM manuals and will be reviewed quickly here. Briefly, the CSMP source deck format is as follows:

- (1) The first deck segment contains the model description together with the necessary control information for running the model; thus, this segment contains:
 - (a) all structural statements needed to define the model, together with the statements needed to define the INITIAL, DYNAMIC, and/or TERMINAL model segments;
 - (b) the control statements (translation, execution, and output) necessary to specify the first simulation run;
 - (c) the necessary data statements for value assignment.
- (2) An END statement (to restart the model) or a CONTINUE statement (to continue the model execution with new values).
- (3) As many END and/or CONTINUE segments as desired; each is composed of:
 - (a) data statements to give new values to various symbols;
 - (b) additional execution and/or output control statements, if desired;
 - (c) an END or CONTINUE statement.
- (4) The last END-CONTINUE segment must be followed by a STOP statement; user supplied FORTRAN source programs may be placed after the STOP statement, if desired.
- (5) The source deck is terminated by the ENDJOB statement; the STACK option, as specified in the IBM manuals, is not available and is ignored, if specified. (See the *CSMP public file description.)

The IBM manuals provide further deck details and card format descriptions. The source deck is identical to that described in the manuals except for the STACK option which is unavailable in *CSMPPEXEC - *CSMPTRAN usage.

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Before discussing the details of the CSMP processor, we present here an overview of CSMP processing. The CSMP processor functions in three phases: translation phase, compile phase, and execution phase. During the translation phase, the CSMP deck is read and translated into temporary files:

- (1) a data-control file, which contains information extracted from the data and control statements, and
- (2) a FORTRAN source file, which contains a FORTRAN source program constructed from the model structural statements; this file also contains any user-supplied FORTRAN source modules (supplied optionally after a STOP statement).

In the compile phase, the FORTRAN compiler is invoked to compile the FORTRAN source file produced during the translation phase; the resulting object module is then used in the execution phase. Finally, the model is simulated during the execution phase and the specified results are produced as output. The data-control file produced during translation is used as input to this phase to provide values of variables and to specify the execution-time options and control sequence. The object module produced during the compile phase, together with various CSMP library modules, form the execution object module. The first two phases of CSMP have been separated in MTS as follows:

```
*CSMPTRAN performs the translation phase
*CSMPEXEC controls the execution phase
```

The compile phase is represented by a call on the FORTRAN compiler, which must be done by the user. (Another module *CSMP provides a comprehensive control program for those who desire it.)

The CSMP translation phase is initiated by the MTS command

```
$RUN *CSMPTRAN PAR=Q
```

The CSMP source deck is read from logical I/O unit 1 (defaults to SCARDS), and the translation phase output (including error comments) is produced on logical I/O unit 6 (defaults to SPRINT). If the DECK option is specified in the source deck, then the pertinent punch output is produced on logical I/O unit 2 (defaults to SPRINT). If PAR=Q (optional) is specified, then translation errors will cause job termination at the end of the translation phase; otherwise, errors are documented, but job processing continues. The data-control file produced

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during the translation phase is written on logical I/O unit 5, while the FORTRAN source file is written on logical I/O unit 7. The user may specify these logical I/O units on the \$RUN command; if no specifications are given, then the defaults are:

```

5      -CSMP#5
7      -CSMP#7

```

If logical I/O unit 5 is not specified by the user, then a temporary sequential file named -CSMP#5 is created, emptied, and used. The same procedure is followed for logical I/O unit 7 and -CSMP#7. The file and/or device specified for unit 5 and/or unit 7 must have read-write-rewind capability and is handled as follows:

- (1) The unit is rewound initially (if a device) or emptied initially (if a file);
- (2) The unit is left in rewind position at the end of the translation phase processing.

If the source deck contained only data and control statements, and no structural statements, then no output is placed on unit 7; it is, however, rewound (emptied) as described above. A similar procedure is followed for unit 5 if no data and control statements are found in the source deck; note, however, that there must be at least one each of the END-CONTINUE, STOP, and ENDJOB statements in the source deck. Any FORTRAN source modules found after the STOP statement are written onto unit 7 with no modifications.

As a result of the processing by *CSMPTRAN, the CSMP source deck is processed through the ENDJOB statement, and the data-control file and the FORTRAN source file are produced. The compile phase is initiated by calling the FORTRAN compiler to compile the FORTRAN source file produced on unit 7. If unit 7 was defaulted, then the source program is in -CSMP#7 and may be processed by the MTS command

```
$RUN *FTN PAR=S=-CSMP#7
```

which will produce an object module in the file -LOAD. The full facilities for FORTRAN are available to the user with this command as are the facilities of MTS. Note that if the CSMP source deck contained no structural statements, then no FORTRAN source was produced and the compile phase may be skipped. Note also that user-supplied FORTRAN source modules may be used after the STOP statement as described earlier, or in the compile phase itself via explicit concatenation of files when calling FORTRAN. In either case, at the end of the

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compile phase there are two files of importance: the data-control file and the object module file.

Execution (simulation) of a CSMP model is initiated by the MTS command

```
$RUN *CSMPPEXEC+OBJ+*CSMPLIB
```

where OBJ is the name of the file which contains the object modules produced in the compile phase; OBJ may be a single file name or may be an explicit or implicit concatenation of object module files and/or user library files. Note that previously compiled user modules may be included in this way rather than as source modules in earlier phases of CSMP processing. Logical I/O units used during execution are as follows:

- 5 must be specified as the data-control file produced during the translation phase; defaults to -CSMP#5. The unit is not initially rewound during execution.
- 6 all print output produced by CSMP routines (defaults to SPRINT).
- 15 must be specified by the user only if the PREPAR statement is used in the model; this unit must, if specified, be a sequential file or device. This unit is initially rewound if needed during execution, but is not rewound at the end of execution. The format of the plot information placed on this unit is described in the IBM manual Y20-0111.

In addition, any logical I/O units required by user-supplied object modules may also be specified on the \$RUN command. For users who supply FORTRAN source or object modules with their model, it should be noted that CSMP runs with the usual FORTRAN I/O support package. Therefore, the normal defaults and assignments are effective for logical I/O units. Logical I/O units 13 and 14 are used internally by CSMP during execution, however, and should not be used by users.

It should be apparent that it is frequently unnecessary to proceed through all three CSMP phases in order to run a model. One may, for example, save the two files produced by the translation phase in permanent files. Subsequent model changes may then be made by modifying the FORTRAN source, recompiling, and executing with the previously produced data-control file. Conversely, it is possible to run a model which is already in object module form with new data by producing the new data-control file and using it with the old object modules. This does require, however, that one use the symbol table part of

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the previous data-control file. The IBM manuals discuss these possibilities further; the user needs more knowledge about the intermediate files and system processing than has been presented here to use these shortcuts.

If the user wishes to supply his own control routine for CSMP execution, he may do so by supplying a subroutine whose name is MAINEX. This differs from the technique described in Y20-0111, in that no MAIN card is needed and that the control program is supplied as a subprogram named MAINEX rather than as a main program. Otherwise, the specifications for the proper functioning of the main control program are as given in Y20-0111.

If the user desires to supply his own central integration routine for CSMP execution, he proceeds as described in Y20-0111. The source deck must contain the METHOD statement specifying CENTRL as the integration method, and the user must supply his central integration routine as a user-supplied subprogram whose name is CENTRL. The manual Y20-0111 describes this process and shows an example CENTRL routine.

As mentioned above, CSMP uses logical I/O units 13 and 14 internally, and these units should not be referred to by users. Actually, temporary sequential files named -####13 and -####14 are created and used by CSMP by attaching them to FORTRAN DSRN's 13 and 14. These files are emptied at entry and exit to *CSMPPEXEC and *CSMPTRAN, and DSRN's 13 and 14 are, in fact logically disconnected from logical I/O units 13 and 14.

```
Example:  $RUN *CSMPTRAN PAR=Q
          .
          (CSMP source program)
          .
          $RUN *FTN PAR=S=-CSMP#7
          $RUN *CSMPPEXEC+-LOAD+*CSMPLIB
```

In the above example, the source program for the CSMP translation phase is read from *SOURCE* (the default for SCARDS). The FORTRAN source output is written to the file -CSMP#7 which is then compiled by *FTN and written to the file -LOAD. The resultant program is then executed by the CSMP execution phase.

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*C87

Contents: A compiler for the C programming language. This compiler replaces the *CBELL compiler.

Purpose: To compile C programs.

Program Key: *C87

Logical I/O Units Referenced:

SCARDS - input of the source program.
 SPRINT - list output and object listing.
 SPUNCH - output of the object module.
 SERCOM - error messages from compiler.
 2 - additional include libraries containing header files. The standard include library *C87INCLUDE is always used.

Parameters: These options can be specified either in the PAR field of the \$RUN command or in a #pragma command in the source program. The PAR field and pragma option names may be upper-, lower-, or mixed-case. Most options can be negated by prefixing them with "-", "~", or "NO".

When options are specified in the PAR field, their scope is the entire compilation unit. When specified in a pragma, the scope is indicated with each description. It is quite likely that the scope of the pragmas will be changed to something more sensible in future releases.

Of the multitude of options, only a few are frequently used. These are:

- (1) SYM to aid in debugging.
- (2) PROPER to have the compiler diagnose as many suspect or nonstandard constructions as possible.
- (3) UNIX to use when porting nonstandard programs from Unix.

The options and pragmas are:

ASCII

Default: NOASCII

The ASCII option causes all character strings and character constants to be converted to ASCII internally. This option should be used with care. Serious problems may occur if a PAR=ASCII routine calls a routine that is not ASCII.

For the most part, the *C87 run-time system assumes EBCDIC. For example, GETC, SCANF, etc., all return EBCDIC characters, and the PRINTF and SCANF formats must be expressed in EBCDIC. This may change at some point in the future.

Until the library supports ASCII characters (e.g., for PRINTF formats), this option is of little utility.

Pragma scope: takes effect immediately.

CHECKIOVER Default: NOCHECKIOVER

The CHECKIOVER option causes the compiler to generate code to check that the results of all signed integer computations fit into 32 bits.

Pragma scope: the last value is used for the entire compilation unit.

DEFINE(x) Default: None

This is processed as if a "#DEFINE x 1" had been issued before the source program had started. "x" may be any legal identifier. "x" is not translated to uppercase before use.

This option cannot be negated.

This option is not allowed as a pragma; use #DEFINE.

DEFINE(x=e) Default: None

This is processed as if a "#DEFINE x e" had been issued before the source program had started. "x" may be any legal identifier. "e" can be any sequence of tokens. "x" and "e" are not translated to uppercase before use.

This option cannot be negated.

This option is not allowed as a pragma; use #DEFINE.

FILL=c Default: NOFILL

The FILL option specifies a char-sized value that is used at run-time to initialize each stack frame. This option can be used in debugging when a problem with an uninitialized variable is suspected.

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The value of "c" must fit into a single character, but can be expressed as any integer constant. For example, each of the following has the same effect.

```
#PRAGMA FILL='A'
#PRAGMA FILL=0X81
#PRAGMA FILL=129
```

Pragma scope: the last value is used for the entire compilation unit.

HIDE Default: NOHIDE

The HIDE option produces a warning if an identifier in an inner scope hides the same identifier defined in an outer scope.

I=ccid Default: None

The I option affects #INCLUDE searches. It adds the ID "ccid" to the list of IDs to be searched when a quoted #INCLUDE file is specified. For example,

```
$RUN *C87 SCARDS=... PAR=I=W123 I=W456
```

where the source file contains the following include:

```
#INCLUDE "INK.H"
```

*C87 will first look for the file W123:INK.H. If that does not exist, it will look for the file W456:INK.H and if it is not there, it looks for the file INK.H on the current ID. As many of these options as desired may be specified and they are order dependent; the first one specified is the first one searched.

This option is useful when compiling a program developed on one ID from another ID.

#INCLUDE directives that use angle brackets are unaffected by this option.

This option cannot be negated.

Pragma scope: takes effect immediately.

LIST	Default: NOLIST
LIST=n	Default: LIST=0

The LIST option controls echoing of source lines to SPRINT. The LIST identifier by itself is the same as LIST=1. NOLIST is the same as LIST=0.

If LIST=1, everything except #INCLUDE files are listed. If LIST=2, everything including #INCLUDE files is listed.

Pragma scope: takes effect immediately.

LOADNAME (cname, lname)

The LOADNAME option causes the external name "cname" in the source program to be mapped into the name "lname" in the object module. This option can be used to:

- (1) map names too long for the MTS loader into shorter names.
- (2) allow C programs to access system names which do not conform to C syntax.

Pragma scope: the same scope as "cname".

OBJECT	Default: OBJECT
--------	-----------------

Object-code generation may be suppressed with NOOBJECT.

Pragma scope: the last value is used for the entire compilation unit.

OBJLIST	Default: NOOBJLIST
---------	--------------------

If OBJLIST is specified, an object listing is written to SPRINT.

Pragma scope: the last value is used for the entire compilation unit.

OPT	Default: OPT
-----	--------------

When NOOPT is specified, no analysis of the intermediate code is made to determine code size or register usage, thus code is generated using worst-case assumptions. NOOPT saves only a very small amount of compilation time.

Pragma scope: the last value is used for the entire compilation unit.

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PORT

Default: NOPORT

If PORT is specified, *C87 prints warnings that indicate which parts of a program might not be portable. This will not detect all violations; neither does the presence of a warning guarantee a non-portable program nor does the absence of a warning guarantee a portable program.

The following cause a portability warning. Other features may also be added to cause portability warnings.

- (1) Use of the FORTRAN, _RETCODE, _PRVBASE, or _PSEUDOREGISTER extensions.
- (2) Use of the RCALL, LOADNAME, RETCODE pragmas.
- (3) Casts between pointers and integers.
- (4) Casts between pointers to different types of structures.

Pragma scope: takes effect immediately.

PROPER

Default: None

The PROPER pragma stands for a collection of other pragmas that would all be used if one were trying to write a maximally portable and correct program. The pragmas set by PROPER are:

```
#PRAGMA PORT STANDARD WARN TYPE PROTO
```

Pragma scope: takes effect immediately.

PROTO=n

Default: NOPROTO

The PROTO option controls whether prototypes are required and how they are used. It may have the following values:

- 0 All prototypes are ignored.
- 1 Permits the last parameter to be omitted without generating an error or warning. This is to be used with the ZEROARG option for compatibility with certain Unix implementations (e.g., that of Sun Microsystems) that allow final parameters to be omitted; it also supplies an extra zero-valued parameter.
- 2 Prototypes are used if provided, but the compiler does not insist on having them.

- 3 All function declarations, but not definitions, are required to have prototypes.
- 4 All function declarations and definitions are required to have prototypes.

Pragma scope: takes effect immediately.

RCALL(fname,inregs,outreg) Default: None

The RCALL option is used only to provide an interface to certain MTS functions.

This option specifies that the function "fname" is to use R-call linkage. The "inregs" parameter specifies which registers are to be loaded with parameters, and the "outreg" parameter specifies which register, if any, contains the result.

"inregs" is specified as a sequence of hexadecimal digits, one for each of the general registers to be loaded with a parameter. Each of the registers specified in "inregs" is restricted to the range 0-7.

Similarly, "outreg" specifies either general register R0 or R1.

For example,

```
#PRAGMA RCALL(XYZ,043,1)
```

would declare the function XYZ to use R-call linkage, loading the first parameter into R0, the second into R4, and the third into R3. The result will be returned in R1.

The register specifications are optional.

If "inregs" is omitted, parameters will be passed with an S-type linkage, but it is still possible to specify "outreg" as 1.

If "outregs" is omitted, the value is return in R0.

For example,

```
#PRAGMA RCALL(XXX,043) /* value in R0 */
#PRAGMA RCALL(YYY,,1) /* no parameter regs */
```

Pragma scope: the same scope as "fname".

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RENT Default: NORENT

The RENT option forces *C87 to check for possible reentrancy violations. If you do not know what reentrancy is, you do not need to use this option.

Pragma scope: takes effect immediately.

RETCODE Default: NORETCODE

Do not use this option for new programs. The RETCODE option is intended for users converting *CBELL programs to *C87. To get a return code in *C87, use the _RETCODE option on a FORTRAN call. Future versions of *C87 may not support this option.

When given, each function in the compilation unit will contain a predefined integer variable called RETCODE. Whenever a FORTRAN routine is called, the MTS return code is stored into this variable. If no FORTRAN routines have been called, RETCODE will contain garbage. RETCODE may be examined or modified by the function as much as desired.

Pragma scope: must occur before the first function definition.

{STANDARD|STANDARD+|UNIX|UNIX+} Default: STANDARD

These four options are especially useful in porting programs to or from Unix systems. The two effects have to (1) define compile-time symbols that control which parts of the standard header files are processed and (2) set other pragma options.

STANDARD defines only those identifiers that are in the standard header files and defined in the Draft C Standard. No additional Unix symbols are defined. This also sets the TYPE and NOUNIXCPP options. STD and ANSI are allowed as equivalent abbreviations.

STANDARD+ gives all of the standard identifiers from the standard header files and additionally defines all identifiers that would normally be defined in the Unix version of the header file. In the few cases that the standard and Unix definitions conflict, the standard definitions take precedence. This also sets the TYPE and NOUNIXCPP options. STD+ and ANSI+ are allowed as equivalent abbreviations.

UNIX gives only those identifiers in the standard header files that are defined in Unix. No addition-

al Draft C Standard identifiers are defined. This also sets the NOTYPE and UNIXCPP options.

UNIX+ defines those identifiers in the standard header files that are defined in Unix and additionally defines all nonconflicting Draft C Standard identifiers. This also sets the NOTYPE and UNIXCPP options.

Pragma scope: takes effect immediately.

SUMMARY Default: SUMMARY

The SUMMARY option provides a summary of the object code produced during the compilation of each function. It specifies the number of bytes required for the generated code, constants, and stack. It also gives information about the number of unused general and floating-point registers.

Pragma scope: the last value is used for the entire compilation unit.

SYM Default: SYM

If SYM is specified, SDS SYM records are generated in the object module. See the section on debugging *C87 programs with SDS.

Pragma scope: the last value is used for the entire compilation unit.

TEST

Synonym for SYM.

TYPE Default: TYPE

When TYPE is specified, *C87 will issue a warning whenever a type is missing (defaults to INT). Specifying NOTYPE suppresses these warnings.

Pragma scope: takes effect immediately.

UNDEF(x) Default: None

This is processed as if a "#UNDEF x" had been issued before the source program had started. "x" may be any legal identifier. As many DEFINE and UNDEFs can be issued as desired. If more than one is given, they are processed in order. "x" is not translated to uppercase before use.

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This option cannot be negated.

This option is not allowed as pragma; use #DEFINE.

UNIX

See STANDARD.

UNIXCPP

Default: NOUNIXCPP

When UNIXCPP is specified, additional text on the end of "#ENDIF" commands will be ignored as is done by the Unix C preprocessor.

Pragma scope: takes effect immediately.

WARN

Default: WARN

If NOWARN is specified, warning messages are not printed. However a summary of how many warnings were suppressed is printed.

Pragma scope: takes effect immediately.

ZEROARG

Default: NOZEROARG

If ZEROARG is specified, an extra INT zero argument is appended to every parameter list and PROTO=1 set. This is provided to mimic the behavior of the Sun Microsystems C compiler.

Pragma scope: takes effect immediately.

- Return Codes:
- 0 - the compilation was successful (except for possible warning messages).
 - 4 - a file required by *C87 could not be accessed (exception: #INCLUDE files that cannot be accessed cause RC=8).
 - 8 - one or more compile-time errors were detected or an #INCLUDE file could not be accessed.
 - 12 - the compiler ran out of memory.
 - 16 - *C87 internal failure.

Description: *C87 is an implementation of the proposed ANSI Standard C. More complete documentation is given in Computing Center Memo 483, "*C87."

A library of the standard C functions as well as some Unix functions is in the file *C87LIB, which must be concatenated on all \$RUN commands of C87 object programs.

Example: \$RUN *C87 SCARDS=X.C SPUNCH=X.O
\$RUN X.O+*C87LIB SCARDS=DATA

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*DAVE

Contents: The data-flow analyzer for FORTRAN programs.

Use: The analyzer is invoked by the \$RUN command.

Program Key: *DAVE

Logical I/O Units Referenced:

SCARDS - the FORTRAN program to be analyzed.

SPRINT - output from the analyzer.

SERCOM - error messages and program comments.

GUSER - responses to prompting messages.

Return Codes: Always zero.

Description: *DAVE is a software tool for gathering information about global data flow in FORTRAN programs, and for identifying the anomalous use of data in these programs. *DAVE is a static analysis tool, meaning that *DAVE gathers information about the subject program without executing it. *DAVE does not require modification of the subject program, nor does it require intervention by the user during execution. Only some initial setting of parameters which control the output is required.

For the complete details of using the *DAVE analyzer program and the *DAVE.GENLIB subroutine library, see

- (1) Computing Center Memo 394, "DAVE"
- (2) Computing Center Memo 402, "DAVE.GENLIB"

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*DEDIT

Contents: The distribution driver-file editor.

Purpose: To build and maintain a distribution driver file.

Use: The program is invoked by the \$RUN command.

Program Key: *DEDIT

Logical I/O Units Referenced:

- SPRINT - normal output from the program.
- SERCOM - prompting and error messages.
- SCARDS - user command input.
- GUSER - responses to prompts.

Return Codes: Always zero.

Parameter: The PAR field of the \$RUN command may be used to specify the name of the driver file to be edited.

Description: This program is used to build a distribution driver file which, when used in conjunction with the DRIVE command in the *FS program, will generate a distribution tape.

Each line in a driver file (with line number 1.001 and above) catalogs a component (or subcomponent) to be saved on a distribution tape by *FS. The components may be located on disk files or on *FS or non-*FS tapes. The *DEDIT program may be used to insert, delete, or alter lines in a driver file.

Each component cataloged in the driver file has a name and a number. Since some components of a distribution may actually consist of many "pieces" (referred to as subcomponents), provision is made also for subcomponent names and numbers. For example, component 100 might be the program XYZ organized as follows: component 100/1 (i.e., subcomponent 1 of component 100) might be the FORTRAN source for the program, 100/2 might be the compiled object code, and 100/3 might be the input to *FORMAT for the writeup describing the use of the program. In this case, the component name for all three might be XYZ, while the subcomponent names might be SOURCE, OBJECT, and WRITEUP for the subcomponent numbers 1, 2, and 3, respectively.

Components are stored at the line numbers corresponding to their component numbers. For example, component 103/23 is stored at line 103.023.

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*DEDIT will save up to 1000 lines of descriptive comments associated with each subcomponent. These comments are stored in the driver file itself (at negative line numbers) or in a separate comment file.

The descriptive comments for each component may consist of anything the user wishes to say about the component. When a driver-file listing is produced by the LIST or PLIST commands, the comments for each component will be printed immediately after the other fields such as the component number, subcomponent names, etc. *DEDIT will automatically recognize references in the descriptive comments to other component numbers, if they are given in the form "(n/m)", where "n/m" (or just "n") represents the component/subcomponent number. For example, the descriptive comments might be

This file contains the object for MAIN (123/1),
SUBR1 (123/3), and SUBR2 (123/5).

Through this mechanism, *DEDIT is able to change automatically the descriptive comments whenever a component/subcomponent number is changed, e.g., by rearranging the order of the subcomponents. *DEDIT will also prevent the deletion of components from the driver file, if they are referenced in the descriptive comments of some other component (unless it is also being deleted).

Each driver-file line has several other fields which may be specified using *DEDIT including: the location of the component (file name or tape-mount information), the type code (i.e., for FORTRAN source, *FORMAT input, etc.), the save control (a control character which indicates whether the component is ready to be distributed), two fields for the names of the persons responsible for the component, and a revision level which can be used in conjunction with *FS to distribute only selected components.

Logical I/O units need not be assigned when running *DEDIT. If the PAR field is not specified on the \$RUN command, the program will first prompt for the name of the driver file. Then the user may enter the commands that are described below. The first time a driver file is used, the user will be prompted for the name of the comment file (which can be the same file as the driver file, if desired).

New versions of *DEDIT will recognize a driver file that was built by a previous version and automatically convert the old file to the current format, if necessary.

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Commands: The following commands are available for *DEDIT. The underlined portion of each command name may be used as an abbreviation.

ASSIGN tapename [{6250|1600} mount-info]

This command associates a string of up to 40 characters of tape-mount information with an output tape name. If no mount information string is given, any string previously associated with the specified output tape name is deleted. This command is used in conjunction with the REDISTRIBUTE command.

COMMENT [{ADD|REPLACE|EEDIT}]

This command adds, replaces, or edits the comments for the current component. If ADD or REPLACE is specified, comments are entered on one or more separate lines. A null line or an end-of-file should be used to indicate the end of the comments; the program will return to *DEDIT command mode. If EDIT is specified, the MTS file editor is invoked to allow full editing of the comments. If no parameter is given, EDIT is assumed.

COMPONENT {n[/m] | *F|FIRST|*L|LAST}

This command makes component "n/m" the current component for editing. "n" is the component number; "m" is the optional subcomponent number. If no "/m" is given, /1 is assumed. Alternatively, the first or last subcomponent in the driver file may be specified.

CPRINT

This command prints the comments for the current component on SPRINT.

DELETE [item, item, ...]

This command deletes the specified components or subcomponents and their comments or the current component, if no items are given. Each item may consist of:

n - an entire component
 n/m - a specific subcomponent
 n[/m]...n[/m] - a range of components or subcomponents

DUPLICATE n

This command duplicates the current component "n" times (or once, if "n" is omitted) immediately after the current line. The remaining subcomponents in the component (if any) will be renumbered to follow the duplicated lines.

EEDIT filename

This command causes *DEDIT to switch to a new driver file "filename".

FOR item, [item, ...] /command

This command permits the application of a /command to more than one component. Since a /command is used to replace the contents of a particular field (e.g., the component name) in the current component, the FOR command may be used to replace a field in a class of lines (e.g., all components assigned to specified persons, components with specified revision levels, components with the specified save controls, subcomponents of specified components). Each item may consist of:

- n - an entire component
- n/m - a specific subcomponent
- n[/m]...n[/m] - a range of components or subcomponents
- person - a person name (up to 9 characters)
- REVL="a" - restrict to revision level "a"
- SAVE="b" - restrict to save control "b"
- ALL - the entire driver file

Note that each item must be followed by a comma. More than one item of the same type may be given to specify several components, persons, revision levels, and/or save controls.

INIT

This command regenerates several internal dictionaries used by *DEDIT. This process may take several minutes to complete for large driver files, especially if there are large numbers of component cross-references in the comments.

INSERT [n[/m]] [WITH PPROMPT]

This command inserts a new component after the specified subcomponent (or the current component, if no subcomponent number is given) and makes it the

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new current component. When the "WITH PROMPT" parameter is specified, the user will be prompted to enter the following component fields:

```

Revision level code
Save control
Component and subcomponent names
Component type
Goodness classification
File name or tape-mount information
Person responsible for component
    
```

All other component fields will remain blank except for the SHARE code which will be set to the code of the local installation. If the "WITH PROMPT" parameter is not given, all fields in the inserted component will be blank.

LIST [ON FDname] [item, item, ...]

This command produces a listing of components with their associated comments on "FDname" (or SPRINT, if omitted) for the specified person(s), components with the specified revision level(s), components with the specified save control(s), and/or component numbers. If no items are given, the entire contents of the driver file is listed. The listing is ordered by component number. Each item may consist of:

```

n          - an entire component
n/m        - a specific subcomponent
n[/m]...n[/m] - a range of components or
              subcomponents
person     - a person name (up to 9 characters)
REVL=a    - restrict to revision level "a"
SAVE=b    - restrict to save control "b"
    
```

Note that each item must be followed by a comma. More than one item of the same type may be given to specify several components, persons, revision levels, and/or save controls.

Several modifiers may be given with the LIST command to control the form of the listing. These are described with the COMMENTS, LISTING, and REFERENCES keywords of the SET command.

MERGE filename [[CHANGING] tapename1 [TO] tapename2]

This command will read lines from another driver file specified by "filename" and add them to the current driver file, optionally changing the output

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tape-name fields as specified by "tapename1" and "tapename2". As lines are added, their subcomponent numbers will be renumbered, if necessary, since each line will be added as a new subcomponent to the end of the appropriate component.

MOVE item [TO] n[/m]

The subcomponent(s) specified by the "item" parameter are moved to immediately follow the subcomponent specified by "n/m". If "/m" is omitted, the subcomponents are moved to the beginning of component "n". Other subcomponents in the affected component(s) will be renumbered as necessary so as to maintain contiguous subcomponent numbers in each component. The "item" parameter may consist of:

n - an entire component
 n/m - a specific subcomponent
 n[/m]...n[/m] - a range of components or subcomponents

MTS [command]

This command returns control to MTS command mode if no parameter is given. *DEDIT may be reentered with the MTS \$RESTART command. If a parameter is given, it is executed as an MTS command.

PLIST [ON FDname] [item, item, ...]

This command produces a listing of components with their associated comments on "FDname" (or SPRINT, if omitted) for the specified person(s), components with the specified revision level(s), components with the specified save control(s), and/or component numbers. If no items are given, the entire contents of the driver file are listed. A separate listing is produced for each person and each listing is printed in alphabetical order by component name.

Each item may consist of:

n - an entire component
 n/m - a specific subcomponent
 n[/m]...n[/m] - a range of components or subcomponents
 person - a person name (up to 9 characters)
 REVL="a" - restrict to revision level "a"
 SAVE="b" - restrict to save control "b"
 ALL - the entire driver file

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Note that each item must be followed by a comma.

More than one item of the same type may given in order to produce a listing of several components, persons, revision levels, and/or save controls.

Several modifiers may be given with the PLIST command to control the form of the listing. These are described with the COMMENTS, LISTING, and REFERENCES keywords of the SET command.

PRINT

This command prints the current component on SPRINT.

REDISTRIBUTE

This command is used in conjunction with the ASSIGN command to indicate that the current component has not changed since the last distribution and that the current location of the component is on the last distribution tape. The file-name field of the current component is replaced by the tape-mount information (see the ASSIGN command) associated with the component's output tape-name field (6250 or 1600 bpi), followed by "FSNAME=" and the FS name field for this component. In addition, the file-number field is replaced by the output tape file-number field (6250 or 1600 bpi).

SET keyword keyword ...

The legal keywords are:

CMDSCAN= {MTS | UNAMBIGUOUS | AMBIGUOUS}

The CMDSCAN keyword controls the minimum acceptable abbreviations for *DEDIT commands. It defaults to the same setting as the MTS \$SET CMDSCAN keyword. If scanning is set to UNAMBIGUOUS, then the minimum-length command abbreviations are as shown by the underlining in the command descriptions. If scanning is set to AMBIGUOUS, then the following commands have the shorter abbreviations as shown:

COMPONENT
DELETE
MTS
PRINT
STATISTICS

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COMMENTS={ON|OFF}

The COMMENTS keyword controls whether the descriptive comments are printed as part of the listings produced by the LIST and PLIST commands. The default is ON, which prints the comments. The @COMMENTS and @NOCOMMENTS modifiers may be appended to the LIST and PLIST commands to override the effect of this keyword for the duration of a single command.

LISTING={FULL|PARTIAL}

The LISTING keyword controls whether the listings produced by the LIST and PLIST commands contain all of the fields from each component or only the most important fields. The default is FULL, which prints all fields. The @FULL and @PARTIAL modifiers may be appended to the LIST and PLIST commands to override the effect of this keyword for the duration of a single command.

REFERENCES={ON|OFF}

The REFERENCES keyword controls whether the listings produced by the LIST and PLIST commands include a list of all the subcomponents whose comments reference each listed component. The default is ON. The @REFERENCES and @NOREFERENCES modifiers may be appended to the LIST and PLIST commands to override the effect of this keyword for the duration of a single command.

WARNINGS={ON|OFF}

The WARNINGS keyword controls whether warning and advisory messages are to be printed. The default is ON.

STATISTICS

This command prints summary statistics about the current status of the driver file on SPRINT (see save control field description below).

STOP

This command terminates the program.

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UPDATE [{ALL|/command ...}]

This command is similar to the /commands (described later) in that it allows specified fields in the current component to be replaced. If the ALL parameter (or no parameter) is given, *DEDIT will print the current contents of each of the component fields listed below, prompting the user for a replacement for each field. If a null line is entered in response to a prompt, the corresponding field will remain unchanged. Otherwise, the field will be replaced with the string entered. If the string is too long for the field, it will be truncated and an error comment will be printed. The fields that will be prompted for are:

- Revision-level code
- Save control
- Component and subcomponent names
- Component type
- Goodness classification
- File name or tape-mount information
- Person responsible for component

Alternatively, any single /command (with or without the slash) may be given as a parameter on the UPDATE command. In this case, *DEDIT will print only the current contents of the field corresponding to that /command and then prompt for a replacement string. If a null line is entered, the field will remain unchanged. This form of the command is useful when the user knows exactly which field needs to be replaced, but wants to see the current value before entering a replacement. The function is similar to entering the /command directly except that *DEDIT will print the current value before it is replaced.

VISUAL [{n[/m]|*F|FIRST|*L|LAST} [{VIEW|DETAILED}]]

This command is available only on terminals for which MTS full-screen support is available, e.g., OP/VIS Ontels and IBM 3270s. It provides for full-screen editing of components in two formats:

Detailed Format

In this format, all user-changeable driver file fields for the specified component (or the currently active component if no parameter is given) are shown on the screen and may be directly changed. In addition, the descriptive comments for the component are shown (to the extent they will fit on the screen) and program-function (PF) keys permit the

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forward and backward "windowing" of the comments as well as allowing the editing of the comments using the normal MTS file editor. In addition, a PF key is provided to switch the display into view format.

The display will function in detailed format if a complete component/subcomponent number is given on the VISUAL command and the VIEW parameter is not specified at the end of the command, e.g., VISUAL 204/6. In addition, detailed format will be used to display the currently active component if no parameters are given on the VISUAL command, or if the DETAILED parameter is specified at the end of the command.

View Format

In this format, the screen is filled with abbreviated information from a sequence of subcomponents with each screen line presenting information from a different subcomponent. Only the component number, name, subcomponent name, type, save control, revision level, and part of the file name/tape-mount information field are shown. PF keys allow the forward and backward "windowing" of the part of the driver file being displayed, as well as switching into view format for a specified subcomponent. In addition, the currently active component number is shown at the top of the screen.

The display will function in view format if a component number without a subcomponent number is given on the VISUAL command, e.g., VISUAL 204, if a nonexistent subcomponent number is specified, or if the VIEW parameter is specified at the end of the command.

While in visual mode, the following program functions are provided by PF keys:

Component Back 10	Move back 10 subcomponents or until subcomponent /001 is reached. If the display is already at /001, then the last subcomponent of the previous component will be displayed.
-------------------	--

Component Back 1	This function is the same as Component Back 10 except that the display is only moved back one subcomponent.
------------------	---

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Component Fwd 10	Move forward 10 subcomponents or until the last subcomponent of the current component is reached. If the display is already at the last subcomponent, then the first subcomponent of the next component will be displayed.
Component Fwd 1	This function is the same as Component Fwd 10 except that the display is only moved forward one subcomponent.
Switch to Detailed Fmt	This function switches the display screen to Detailed Format for the currently active component (generally the component pointed to by the screen cursor).
Switch to View Fmt	This function switches the display screen to View Format.
Edit Comments	This function causes the MTS editor to be invoked in visual mode for the comments associated with the currently active component.
Execute command	This function causes the command in the command area at the bottom of the screen to be executed.
Comments Back Scrn	This function causes the comments for the currently active component to be "windowed" backward by an amount equal to the number of lines visible on the screen less one.
Comments Fwd Scrn	This function causes the comments for the currently active component to be "windowed" forward by an amount equal to the number of lines visible on the screen less one.

Comments Fwd Line This function causes the comments for the currently active component to be "windowed" forward by one line.

The user may exit DEDIT visual mode at any time by pressing either the PA1 (ATTN) or PA2 (EOF) key. If the PA2 (EOF) key is used, the current command line at the bottom of the screen will be printed on the screen after visual mode is exited.

The following charts show the function assignments of the other PF keys on the terminal.

Detailed Format

PF1/13 Component Back 10	PF2/14 Switch to View Fmt	PF3/15 Comments Back Scrn
PF4/16 Component Fwd 10	PF5/17 Edit Comments	PF6/18 Comments Fwd Scrn
PF7/19 Component Fwd 1	PF8/20 Execute Command	PF9/21 Comments Fwd Line
PF10/22 Component Back 1	PF11/23	PF12/24

View Format

PF1/13 Component Back 10	PF2/14 Switch to Detail Fmt	PF3/15
PF4/16 Component Fwd 10	PF5/17 Edit Comments	PF6/18
PF7/19 Component Fwd 1	PF8/20 Execute Command	PF9/21
PF10/22 Component Back 1	PF11/23	PF12/24

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`[-]n`

This command moves the current line pointer forward or backward "n" lines in the driver file. Each line corresponds to a subcomponent in the driver file.

`$string`

Any command beginning with a dollar sign (\$) is interpreted as an MTS command.

`/Commands:` The following commands each replace a field in the current component or subcomponent. Each of these commands must begin with a slash "/". The form of each command is

`/command [string]`

where "string" is used to replace the specified field in the component or subcomponent. If no string is given, the field is replaced by blanks. Normally, the string is assumed to begin with the first nonblank character after the end of the command (there must be at least one blank). However, since this prohibits any field from beginning with blanks or slashes, the program will process a string beginning with a slash as follows: the first character after the slash will be the first character of the string used for the replacement.

The FOR command may be used to apply a `/command` to more than one line. The UPDATE command may be used to update all of the commonly used fields; the user will first be shown the current contents of each field and then prompted for a replacement.

For each command given below, the length is the maximum number of characters that may be entered into the associated field. If a string is too long for the field, it will be truncated and an error comment will be printed. Abbreviations for the commands are underlined.

<u>Command</u>	<u>Length</u>	<u>Field</u>
<u>/DISKNAME</u>	21	file name on distributed disk pack(s)
<u>/FDNAME</u>	59	file name or tape-mount information
<u>/FILE#</u>	4	file number (if tape)
<u>/GOODNESS</u>	1	goodness classification

<u>/LPERSON</u>	9	name of <u>local</u> person responsible for component
<u>/NAME</u>	25	component name
<u>/OT62</u>	6	output tape name (6250 bpi)
<u>/OT16</u>	6	output tape name (1600 bpi)
<u>/OF62</u>	4	output tape file number (6250 bpi)
<u>/OF16</u>	4	output tape file number (1600 bpi)
<u>/PERSON</u>	9	name of person responsible for component
<u>/REVL</u>	1	revision-level code
<u>/SAVECNTL</u>	1	save control
<u>/SEQID</u>	4	sequence-field identification
<u>/SHARE</u>	3	installation SHARE code
<u>/SUBNAME</u>	14	subcomponent name
<u>/TYPE</u>	3	component type

Format: The following is a description of the format of the driver file. The column-number range is given in parentheses.

Component Name (1 - 25)

The name should not contain parentheses.

Subcomponent Name (27 - 40)

The name should not contain parentheses.

Subcomponent Number (41 - 43)

The number must be in the range of 1 to 99 inclusive.

Component Type (45 - 47)

The component types (left-justified) are as follows:

- B - Binary (BTK=TeX-generated DVI file)
- C - MTS commands
 - CM=command macros
 - CML=command macro library
 - CE=commands editor

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```

D   - Data
      DF=$MAKE dependency file
      DQL=definition library for Plus
H   - Help information
      HC=CLParser format
      HF=FSHelp format
L   - Listing (same extensions as used for Source)
LE  - Linkage editor commands
LML - Load module library
M   - Messages (program message file)
O   - Object
      OC=unlinkedited
      OE=linkedited
      OL=library
      OV=MVS load modules in VSS format
P   - Printed output
      PL=line printer ready
      PP=page printer ready
S   - Source code
      SA=assembler
          SAL=assembler source library
      SAW=ALGOLW
      SB=WEB
      SC=C language
      SF=Fortran
          SF6=*FTN (Fortran66)
          SF7=VS/FORTRAN (Fortran77)
      SG=GOM
      SI=ICON
      SJ=Algol W
      SL=LISP
      SN=COBOL
      SP=PL/I
      S3=PL360
      SQ=PLUS
          SQL=PLUS source library
      SR=CLPARSER grammar
      SR=REDUCE
      S4=RATFOR
      SS=Spitbol
          SS4=Snobol4
          S*=Snostorm
      SW=Pascal
      SX=XPL
      SY=YACC
      SZ=Prolog
U   - Update deck
      UC=*CDUPDATE
      UE=$EDIT
      UI=*IEBUPDAT
      UU=*UPDATE commands
      UB=WEB update
W   - Writeup input

```


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File Name (59 - 117)

The file name (or tape-mount information) specifying the location from which *FS is to obtain the component.

This field is normally the name of the file from which *FS is to save the component. However, if the component is obtained from a tape, this field is given as

rack [volume] [VLO] ['tape id'] [keywords]

where "rack" is the rack number, "volume" is the volume name for a labeled tape, VLO is used to denote a volume-label-only tape, "tape id" is the external (paper) label, and "keywords" are any of the following:

FSNAME=name This implies that the tape is an *FS tape. "name" may be given with or without an FS version number.

POSN=name This is for non-FS tapes. "name" specifies the file name (for a labeled tape). POSN=*n* may not be used; instead the file number "n" should be put into the File Number field (see below).

FMT=fmt This is used to specify the blocking format for non-FS tapes, e.g., FB(8000,80).

File Number (118 - 121)

The file number if the component is to be obtained from a tape (optional for labeled and *FS tapes).

Sequence Identification (123 - 126)

The sequence ID to be applied to the component as it is saved by *FS.

Person (128 - 136)

The name of the person responsible for the component at the installation specified by the SHARE code (see above).

Output Tape Name (6250 bpi) (138 - 143)

This field is added by *FS and is not normally edited.

Output Tape File Number (6250 bpi) (144 - 147)

This field is added by *FS and is not normally edited.

FS Name (149 - 180)

The *FS name generated for the component. This field is added by *FS and is not normally edited.

FS Version Number (182 - 184)

The *FS version number of the component. This field is added by *FS and is not normally edited.

File Type (186 - 190)

The file type (LINE or SEQ). This field is added by *FS and is not normally edited.

Maximum Record Length (192 - 196)

The length of the longest record in the component. This field is added by *FS and is not normally edited.

Size (197 - 200)

The size of the component (in pages if the device type is PAGE, in tracks if DISK). This field is added by *FS and is not normally edited.

Device Type (202 - 205)

The device type from which the component was obtained (PAGE for non-FS tapes and files, DISK for items obtained from older (before the page-formatted file system) *FS tapes). This field is added by *FS and is not normally edited.

Date (207 - 219)

The date on which the component was saved. This field is added by *FS and is not normally edited.

Time (221 - 228)

The time at which the component was saved. This field is added by *FS and is not normally edited.

Comment Line Number (230 - 234)

The line-number range for comments associated with this component (implicitly negative). This field is automatically maintained by *DEDIT.

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Local Person (235 - 243)

The name of the person responsible for the component at the local installation. This field is used to specify a "local contact" person for a component normally maintained by a person at another installation (as specified by the Person and SHARE code fields).

Revision Level (245)

The revision-level code may be used to mark a subset of a larger driver file. The FOR, LIST, and PLIST commands have provision for operating only on specified revision level codes, as does *FS.

Disk Name (246 - 266)

The name of the public or private file where the component is located on the distributed disk pack(s). This field is used only for distributions of MTS, where tapes containing disk-pack images are distributed in addition to the normal *FS distribution tapes.

Output Tape Name (1600 bpi) (267 - 272)

This field is added by *FS and is not normally edited.

Output Tape File Number (1600 bpi) (273 - 276)

This field is added by *FS and is not normally edited.

Comment Forward Reference Index (277 - 282)

This field is used by *DEDIT as a pointer to a list of component numbers referenced by the comments of this component.

Comment Backward Reference Index (283 - 288)

This field is used by *DEDIT as a pointer to a list of component numbers referenced by the comments of this component.

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*DITTO

Contents: The ditto-master preparation program.

Purpose: To convert output from *FORMAT, *TEXTFORM (line-printer formatted output), or *TEXT360 into a format suitable for preparing a ditto master.

Use: The program is invoked by the \$RUN command.

Program Key: *DITTO

Logical I/O Units Referenced:
SCARDS - text input.
SPRINT - reformatted output.
SERCOM - error diagnostics and prompting messages.
GUSER - responses to prompting messages.

Return Codes: 0 - Successful return.
8 - Error return.

Description: This program produces output suitable for any terminal with an operational backspace character; this includes most types of terminals except for the Teletype terminals. The output is printed on a page-by-page basis. Typical applications of this program are to produce ditto masters by inserting the masters into the terminal carriage and having the output typed directly onto the master, and to produce output on sheets of bond paper.

If SPRINT is assigned to a device type other than any of the above, overprint characters will be printed on the line below the characters they are supposed to overstrike.

When the program is invoked, it will initially print the message:

TYPE "RETURN" WHEN READY FOR TYPED COPY

At this point, the ditto master or other sheet of paper should be placed in the terminal carriage, lined up one line above where the first line is to start. When this is done, the RETURN key should be depressed. The first page of the document will be typed; when this page is finished, the program will pause. At this point, a new master may be inserted and the entire procedure repeated. This may be continued for as many pages as desired.

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The program will interpret the first character of each input line as a carriage-control character in the same manner as for line printers. Lines with carriage-control characters that would cause overprinting (e.g., for underlining) will be converted into a sequence of print characters and backspace characters which will produce the same result. Pages are identified by the "1", ";", or ":" logical carriage-control characters.

If any difficulty arises in the middle of a page, an attention interrupt may be given which will interrupt the printing of that page. The program will rewind the input file to the beginning of the current page. This page may then be repeated after inserting a new sheet.

The program will terminate after the last page in the input file is printed or when the user enters an end-of-file instead of entering RETURN for a new page to begin.

The program can also be used to scan selectively for a particular page in the document. A page scan is requested by typing an integer page number before entering RETURN. This number is used to count the pages from the beginning of the input file. Note that this may not necessarily correspond to any document page; e.g., entering 5 will cause the fifth page from the beginning to be printed whether or not it is document page number 5. When using this feature, it is advisable to first insert a sheet of scrap paper into the terminal, type the desired page number, and then RETURN. The page will begin to print and the user can verify that it is the desired page. The page may then be interrupted, the ditto master inserted, and then restarted at the beginning. After typing a page in this manner, the program will print the following page if another RETURN is entered.

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*DI3000.IG
*DI3000.PRINTER
*DI3000.TX4010
*DI3000.TX4113

Contents: A library of FORTRAN-callable subroutines for drawing and manipulating pictures.

Use: The appropriate DI-3000 library file should be concatenated to the file containing the user's object modules on the \$RUN command, e.g.,

\$RUN object+*DI3000.TX4010

Program Key: *EXEC

Logical I/O Units Referenced:

- 5 - Input (default: *SOURCE*)
- 6 - Output (default: *SINK*)
- 90 - Segment Storage Output (default: *SINK*)
- 91 - Segment Storage Input (default: *SOURCE*)
- 92 - Metafile System Output (default: *SINK*)
- 93 - Metafile System Input (default: *SOURCE*)
- 94 - Device Driver Output (default: *SINK*)
- 95 - Device Driver Input (default: *SOURCE*)
- 99 - Scratch

Description: DI-3000 is a library of FORTRAN-callable subroutines for drawing and manipulating pictures. It was written by Precision Visuals, Inc., and is an implementation of the ACM SIGGRAPH Proposed Core Standard. Graphics programs written using these subroutines should be able to be run on any machine that has an implementation of the ACM SIGGRAPH Proposed Core Standard. The interface to the user's program is device independent, so a program that uses DI-3000 can be run without alteration on any of the supported devices.

In MTS, DI-3000 is made up of the DI-3000 basic level, DI-3000 Extended, the Contouring System, and the Metafile System; it supports the Tektronix 4010 and 4113 terminals, a printer (line or page), and all devices supported by *IG.

For a more complete description of DI-3000, see Computing Center Memo 463, "Using the DI-3000 Graphics Library in MTS."

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*DOCINFO

Contents: The searchable online documentation database.

Purpose: To allow users to search for documentation produced by the Computing Center staff including the U-M Computing News. The database will gradually be expanded to include documentation produced by other departments within the Information Technology Division.

Use: The program is invoked by the \$RUN command.

Program Key: *DOCINFO

Return Codes: None.

Description: *DOCINFO provides easy access to Computing Center documentation on a variety of topics. Users can send most documents to the Xerox 9790 page printers without typing *PAGEPR commands. Short documents such as QuickNotes can be read at the terminal as well as printed.

The database will present the user with a brief introduction, and then ask the user to select the viewing mode. Users unfamiliar with the PF keys for their terminals, or users connected to UMnet through a 1200 bps or slower connection, will want to select line mode.

Users can search for documents by subject, area, and title. The SUBJECT index searches a controlled list of descriptive terms. The AREA index searches a short list of general computing topic areas. The TITLE index searches for any single word or combination of words in the title. Before searching by subject or area, users should first scan the subject list or area list for the correct term.

Each document in *DOCINFO is assigned one area and an average of three subjects. Generally, an area search retrieves more documents than a subject search.

If the title of a document is known, the title index will perform the most efficient search. Any single word or combination of words in the title can be used with the title index.

Whenever a database record references a printer-ready file, users are given the option to route the document to a Xerox 9790 page printer. The necessary commands are embedded in the program, so users do not have to know how

|
|
| to construct page printer commands. As many as twenty
| documents can be queued for printing in one session.
|

|
| Users are also given the option to read short documents
| on their terminal or microcomputer screens. The program
| enables users to page through a screen-readable document
| in a controlled manner, one screen of text at a time. A
| note alerts users when the end of the document is
| reached. Users can scroll forward or backward at will.
| This is the case for a variety of terminals, including
| those lacking a conversation buffer.
|

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*DVIAPS

Contents: DVIAPS converts input from a DVI file such as that produced by the TeX text-processing program into a form suitable for typesetting by the APS-Micro 5 phototypesetter.

Use: DVIAPS is invoked by the \$RUN command.

Program Key: *DVIAPS

Logical I/O Units Referenced:

SERCOM - prompts, error recovery prompting, and diagnostics.

GUSER - prompt response input.

DVIAPS generally references all files explicitly by name. The use of SCARDS and SPUNCH on the \$RUN command is optional.

Return Codes: Always zero.

Description: A complete description of the use of *DVIAPS with the TeX text-processing language is given in the following publication:

Computing Center Memo 813, "Using Dviaps, TeX, and the APS-Micro 5 Phototypesetter on MTS."

*DVIAPS takes as input a device-independent (DVI) file produced by *TEX and converts it to a form that can be sent to the APS-Micro 5 phototypesetter. *TYPEQ must be used to queue the document for the phototypesetter in order to produce output on coated photographic paper.

The following command, without any logical I/O unit specifications, causes DVIAPS to prompt for the input file with the prompt "DVI file>":

```
$RUN *DVIAPS
```

Logical I/O unit specifications can also take the following form:

```
$RUN *DVIAPS SCARDS=inputfile SPRINT=outputfile
```

This does not assume any file-naming conventions. The following form of the \$RUN command may be used to specify the input file on the \$RUN command:

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```
$RUN *DVIAPS PAR=xxxx.dvi
```

Specification of the ".dvi" extension on the file name is optional. Once run, the program will prompt for options that control the appearance of the document or the way that *DVIAPS works. However, options specified on the \$RUN command are ignored.

Options: The following options may be specified in response to the "DVIAPS option>" prompt. The minimum abbreviation is one letter and they may be given in either upper- or lowercase. These options are fully described in Computing Center Memo 813.

HELP or ?

Provide a list of all options with their appropriate syntax.

OPTIONS

Report on the current state of all relevant options.

@filename

Read options from the file "filename". The default is to not read a user-options file.

MAGNIFICATION number

Override the DVI magnification to "number". The default is 1000.

TITLE text

Add "text" to the between-page slug. The default text is "DVIAPS Textset, Inc."

WHITESPACE min-top max-top min-height

Set white space (margin) at the top and bottom of the page. The defaults are .25 inches, .25 inches, and .0 inches.

INTERACTIVE

This allows production of partial sets of pages.

NUMBER n

Output is limited to the number of pages "n" at most. The default is no limit.

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STARTING_APS_PAGE_NUMBER n

Specify starting DVIAPS page number "n". The default is 1.

PAPERWIDTH width

Specify the width of typesetter paper to be used. The default is 7.28 inches.

XY xoffset yoffset crop-x crop-y crop-ht crop-wd

This command is used to build up "virtual pages" and to position crop marks. The defaults are .25 inches for "xoffset" and "yoffset" and no crop marks.

LAYOUT n

The layout command selects use of a page slug and/or a "cut lines" mark. The default is to do slugs and cutmarks.

ERASE

This command restores all previous XY commands to the default.

RESET

This command resets all the initial program defaults to their original (non-MTS) values.

CYCLE n

This command starts the first page of DVI output at other than the first XY location. The default is 0.

DUMP n startpos

This command causes the next "n" APS ICL commands emitted by DVIAPS to be displayed. The default is 0.

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*DVIXER

Contents: DVIXER converts input from a DVI file such as that produced by the TeX text-processing program into a form suitable for printing on the Xerox 9700 page printer.

Use: DVIXER is invoked by the \$RUN command.

Program Key: *DVIXER

Logical I/O Units Referenced:
 SERCOM - prompts, error recovery prompting, and diagnostics.
 GUSER - prompt response input.

DVIXER generally references all files explicitly by name. The use of SCARDS and SPUNCH on the \$RUN command is optional.

Return Codes: Always zero.

Description: A complete description of the use of *DVIXER with the TeX text-processing language is given in the following publication:

Computing Center Memo 810, "An Introduction to TeX."

*DVIXER takes as input a device-independent (DVI) file produced by *TEX and converts it to a form that can be sent to the Xerox 9700 page printer. That output includes nonprinting Xerox 9700 character codes. *PAGEPR must be used to produce readable hard-copy output.

The following command, without any logical I/O unit specifications, causes DVIXER to prompt for the input file with a "***" prompt:

\$RUN *DVIXER

Logical I/O unit specifications can also take the following form:

\$RUN *DVIXER SCARDS=inputfile SPRINT=outputfile

This does not assume any file-naming conventions. The following form of the \$RUN command may be used to specify additional parameters that affect the appearance of the document or the way that *DVIXER works:

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```
$RUN *DVIXER PAR=xxxx.dvi [% parameter list]
```

Specification of the ".dvi" extension on the file name is optional.

Parameters: The following parameters may be specified in the PAR field of the \$RUN command or on the same line as the file name given in the response to the "***" prompt. The parameter list must be preceded by a %-sign, followed by the individual parameters, separated by blanks or commas. Minimum abbreviations are underlined.

DIALOG or NODIALOG

The DIALOG parameter requests interactive prompting for the specification of the most useful other parameter values. The default is NODIALOG.

STARTCOUNTS=n (or STARTPAGES=n)

The STARTCOUNTS parameter specifies the starting page for translation from the DVI file. The default is the first page (which may not be #1).

MAXPAGES=n

The MAXPAGES parameter specifies a maximum number of pages to translate. All pages are translated if this parameter is omitted.

DATEMARK or NODATEMARK

The DATEMARK parameter places a date and time mark at the top of each page. The default is NODATEMARK.

ORIGIN=(n,m)

The ORIGIN parameter sets coordinates on the paper (in points) of the upper-left corner of text. "n" is the horizontal coordinate and "m" is the vertical coordinate. The minimum horizontal coordinate is 0 points and the minimum vertical coordinate is 20 points. The default is ORIGIN=(72,72).

ONESIDED or TWOSIDED

The ONESIDED parameter forces onesided copy. The default is TWOSIDED.

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PGFLINE=n

The PGFLINE parameter sets the default PGF line. The default is PGFLINE=50. The available choices are 50 (the default), 51, 52, and 53.

SORT={SHELL|INSERT}

The SORT parameter specifies the desired sort algorithm. The default is SHELL.

RESOLUTION=n or LOWRESOLUTION

The RESOLUTION parameter specifies the vertical movement size (in x-dots) for resolution cutoff. The default is 5000 (i.e., maximum possible resolution). For low resolution, the LOWRESOLUTION parameter may be specified (which takes no value).

FONTSUBS=FDname

The FONTSUBS parameter specifies the file containing an alternate font substitution table file name. This allows the substitution of an alternate set of fonts to approximate those used in the DVI file.

SHOWERRORS

The SHOWERRORS parameter specifies that extra error information should be displayed when an error occurs.

DUMPFragments

The DUMPFragments parameter displays information about each fragment as it is being processed. Normally, such information is not displayed as it is intended only for the debugging of *DVIXER.

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*EBCDASC

Contents: The EBCDIC-to-ASCII translation program.

Purpose: To translate lines from EBCDIC to ASCII code.

Use: The program is invoked by the \$RUN command.

Program Key: *EBCDASC

Logical I/O Units Referenced:
 SCARDS - EBCDIC records to be translated.
 SPUNCH - ASCII records resulting from the translation.

Parameters: At most, one of the following parameters may be specified in the PAR field of the \$RUN command. The default parameter is TDAY88.

TDAY88 Characters are translated according to the TDAY88 translation table. This translation corresponds to that used in MTS for translating the IBM Code Page 37 codes used in MTS (EBCDIC) to ISO 8859/1 8-bit codes (ASCII).

EVEN Characters are translated according to a 7-bit translation table; even-parity ASCII characters are produced, i.e., characters with the high-order parity bit set to either one or zero such that the number of one-bits in each eight-bit character is even.

ODD Characters are translated according to a 7-bit translation table; odd-parity ASCII characters are produced.

OFF or ZERO
 Characters are translated according to a 7-bit translation table; ASCII characters with the high-order parity bit set to zero are produced.

ON or ONE
 Characters are translated according to a 7-bit translation table; ASCII characters with the high-order parity bit set to one are produced.

Return Codes: 0 - Successful return.
 4 - Invalid parameter specified.

Description: Records are read from SCARDS, translated according to the appropriate table as specified by the parameter field, and written to SPUNCH. An end-of-file on SCARDS terminates the program.

For EVEN, ODD, OFF, ZERO, ON, or ONE, all EBCDIC characters that would translate to codes in the top half of the ISO 8859/1 table (hex 80-FF) are translated into the ASCII SUB character (hex 1A).

See the *ASCEBCD description in this volume for a program to translate from ASCII to EBCDIC.

The TDAY88 translation table is given below. This table is also contained in the file DOC:ALLCHARTABLE.

Example: \$RUN *EBCDASC SCARDS=OLDFILE SPUNCH=*T* PAR=EVEN

In the above example, EBCDIC records are read from the file OLDFILE, translated to even-parity ASCII using the 7-bit translation table, and written to the tape *T*.

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*ENCRYPT

Contents: A program to scramble files.

Purpose: To provide additional security for programs and data by encoding them according to a "secret" key supplied by the user.

Use: The program is invoked by the \$RUN command.

Program Key: *ENCRYPT

Logical I/O Units Referenced:
 SCARDS - the data to be encoded or decoded.
 SPUNCH - the data that has been encoded or decoded.
 SERCOM - prompting messages.
 GUSER - user responses to prompting messages.

Parameters: One of the following parameters may be specified in the PAR field of the \$RUN command. If no parameter is given, the user will be prompted. Underlining indicates the minimum acceptable abbreviation.

ENCRYPT The data are to be encrypted.
DECRYPT The data are to be decrypted.

Return Codes: 0 - Successful return.
 4 - The encryption keys do not match, thus no encryption done (in terminal mode only).
 8 - Error return.

Description: The data security is provided by the secret "key" and not by hiding the algorithm. For those interested, the source code for the program may be found in the MTS file *ENCRYPT(1000).

The following should be noted about the program:

- (1) It is invoked by the MTS command:

\$RUN *ENCRYPT SCARDS=input SPUNCH=output

- (2) The program will ask (on SERCOM) whether the user is encrypting or decrypting. The reply is given by typing "E" or "D", respectively (on GUSER). The user is then prompted for the secret "key." The key is then entered and may be of any length, the longer, the better. The same key is used to decrypt the data later. Internally, the typed key is converted to a 64-bit key before use.

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- (3) All lines read and written by the program are with the TRIM I/O modifier disabled. The user should be careful to remember to specify @-TRIM on the "from" and "to" files when \$COPYing the encrypted file to some other place. If the encrypted form of a line happens to end with two or more blanks, the original data will not be recovered if the blanks have been trimmed.
- (4) Lines shorter than 8 bytes will be padded on the right with blanks to make them 8 bytes long before encrypting. The algorithm processes the data in 8-byte blocks and there is no unambiguous way to flag short lines. All lines 8 bytes or longer have the same length in the encrypted form.
- (5) The user may wish to place some sort of sequence ID (using *MVC for example) in his lines before encryption so that identical lines of data do not have the same encrypted form. The user may also wish to pad his lines in some way to hide the actual length of the lines. Alternatively the records may be blocked first using the "copy" feature of the *SORT program. This would prevent padding of short lines and provide additional security due to the longer length of the blocks.
- (6) To encrypt using the same line file for both input and output, the MTS I/O modifier @I must be specified on the file name assigned to SPUNCH (see the second example below).

The algorithm uses a subroutine (called CRYPT) which takes three items as input. The first is a 64-bit (8-byte) word of data, the second is a 64-bit key, and the third is a switch indicating whether the data are being encrypted or decrypted. The subroutine performs a loop 32 times using two different bits of the key at each iteration. The first of these two bits indicates which of two translate tables is used to translate (using the machine translate instruction TR) the 8-byte word. The two translate tables consist of distinct random permutations of all byte values from 0 to 255. The second bit is used to determine whether the 64 bits are to be rotated 3 or 5 bits. Finally, the iteration number is added to the low-order end of the 64-bit word.

For the inverse process, all of the operations are reversed. The iteration number is subtracted, the rotations are done in the opposite direction, and two translate tables are used which are the inverses of the original ones.

The lines in the file are first padded to 8 characters using blanks. Starting with the first 8 bytes of the

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line, they are encrypted using the above subroutine. The next 8-byte block to be encrypted starts with the fifth byte. Thus, the first half of this block is the resulting last 4 bytes of the previous encryption followed by 4 new bytes to encrypt. This operation is repeated moving down the line by 4 bytes at a time until the end is reached. In case the line is not a multiple of 4 bytes long, the last 8 bytes are encrypted. This same procedure then starts with the right end of the line working back toward the front. In this way, any single bit in the line will affect the outcome of every other bit in the line. To assure that all lines have a different encryption, at least one bit should be different in every line. An appended sequence number mentioned above would suffice.

Examples: \$RUN *ENCRYPT SCARDS=DATA SPUNCH=FUNNYDATA
 \$RUN *ENCRYPT SCARDS=X SPUNCH=X@I

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*ENDJUNK

Contents: This file contains an LCS loader input record referring to the system low-core symbol dictionary LCSYMBOL and an LDT load-terminate loader input record.

Use: The LCS and LDT input records may be either copied to the end of the user's object module

```
$COPY *ENDJUNK OBJECT(LAST+1)
```

or concatenated to the object file on the \$RUN command

```
$RUN OBJECT+*ENDJUNK
```

Program Key: *EXEC

Description: Normally, the dynamic loader will search the system library *LIBRARY for unresolved symbols. The file *LIBRARY has an LCS loader input record at the end of it which causes the search of the low-core symbol dictionary if the symbol is not found in *LIBRARY. By appending LCS and LDT input records to the end of the user's object module, the search of the low-core symbol dictionary is made and the loading operation is terminated without making a search of *LIBRARY if there are no other unresolved symbols. This will reduce the loading time for the program. Because of the presence of the LDT input record, any object modules concatenated to the object module containing the LDT input record will not be loaded.

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*EXPL

Contents: The "extended" version of the XPL compiler.

Use: The compiler is invoked by the \$RUN command; the submonitor is concatenated to the object module produced by the compiler.

Program Key: *EXPL

Logical I/O Units Referenced:

 SCARDS - source input to the compiler.
 SPRINT - printed output from the compiler.
 SPUNCH - the object module produced by the compiler.
 7-14 - these units correspond to the XPL FILE function files 1 to 8. If they are not assigned on the RUN command, virtual memory space will be used for them and, consequently, the space will be released when execution terminates.

Return Codes: 0 - Successful return or no severe errors.
 n - "n" severe errors.
 8 - Internal EXPL error.

Parameter: The FSA=nP (or SIZE=nP) parameter may be specified in the PAR field of the \$RUN command. "n" is the number of pages the submonitor should use for the free string area. The default size is 15 pages. When running large programs, it is advisable to specify 25 pages.

Description: The primary advantage of "extended" XPL over *XPL is that a program may consist of several independently compiled procedures. For a complete description of the extensions, see Computing Center Memo 416, "EXPL-Extended XPL."

 The submonitor, *EXPLIB, which supports extended XPL object modules, performs the same functions as the standard XPL submonitor, but has some extra features. These features are also described in Memo 416.

 The EXPL source for the XPL proto-compiler skeleton is contained in the file *EXSKELETON. This source is suitable as a basis for constructing a one-pass compiler employing the MSP(2,1;1,1) parsing strategy. The skeleton consists of a parser and a lexical scanner for a small grammar language. The parsing tables must be replaced with the tables produced by the *ANALYZER program. *EXSKELETON is basically identical to *SKELETON

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except that it is divided into separately compilable procedures for use with the *EXPL compiler.

The EXPL source for the EXPL compiler is contained in the file *EXCOM.

Example: \$RUN *EXPL SCARDS=EXPLSOU SPUNCH=EXPLOBJ
 \$RUN EXPLOBJ+*EXPLIB

In the above example, the source of the XPL program is read from EXPLSOU and the resulting object module is written into EXPLOBJ; EXPLOBJ and the submonitor are then executed.

The input entered by the user is in lowercase; system output is in uppercase.

```

#$run *filedump
#EXECUTION BEGINS

ENTER NAME OF FILE TO DUMP:
-file(1,2)
LINE NO.      1      ; 80 CHARACTERS
02C5E2C44040404040003040400001C4E4D4D7C64040400000000400007DC
E2C5D9C3D6D440400200000040404040E2C3C1D9C4E240400200000040404040
4040404040404040C4D4D7C6F0F0F0F1
LINE NO.      2      ; 80 CHARACTERS
02C5E2C44040404040003040400004C7C5E3C6C44040400200000040404040
D9C5C1C4404040400200000040404040E2D7D9C9D5E340400200000040404040
4040404040404040C4D4D7C6F0F0F0F2
ENTER NAME OF FILE TO DUMP:
$endfile
#EXECUTION TERMINATED
    
```

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*FLOWCHART

Contents: The MTS version of the IBM flowcharting package.

Purpose: To draw flowcharts according to a user-specified flowchart program.

Use: The program is invoked by the \$RUN command.

Program Key: *FLOWCHART

Logical I/O Units Referenced:
 SCARDS - flowchart source program.
 SPRINT - source listings, label file listings, cross-reference file listings, flowcharts, and diagnostic messages.

Parameters: The following parameters may be specified in the PAR field of the \$RUN command. The parameters must be separated by a comma. The underlined portion may be used as an abbreviation.

<u>SOURCE</u>	Source listing is printed (the default if SPRINT is not assigned to a terminal).
<u>NOSOURCE</u>	No source listing is printed (the default if SPRINT is assigned to a terminal).
<u>LABELS</u>	Label file listing is printed (the default if SPRINT is not assigned to a terminal).
<u>NOLABEL</u>	No label file listing is printed (the default if SPRINT is assigned to a terminal).
<u>XREF</u>	Cross-reference file listing is printed (the default if SPRINT is not assigned to a terminal).
<u>NOXREF</u>	No cross-reference listing is printed (the default if SPRINT is assigned to a terminal).
<u>FOOTNOTES</u>	Automatic footnoting is enabled (the default).
<u>NOFOOTNOTES</u>	Automatic footnoting is disabled.
<u>SEQ</u>	Sequence checking is enabled (the flowchart source program must be in card image format). No sequence checking is the default.
<u>SBS</u>	Standard IBM Block Shapes (the default).
<u>ABS</u>	Standard ANSI Block Shapes.

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CHARS=x... Special characters for drawing lines and block shapes. The defaults are \uparrow , \downarrow , \leftarrow , \rightarrow , \swarrow , \searrow , $<$, $>$, A , $-$, $|$. If any of these are to be changed, they must all be listed in the following order: upper-right corner, lower-right corner, upper-left corner, lower-left corner, right arrow, down arrow, left arrow, up arrow, horizontal line, and vertical line, with no punctuation or intervening blanks. If this is not done, undesirable results will occur.

Return Codes: 0 - Successful return.
>0 - Error return.

Description: For the complete description of this program (program number 360A-SE-22X), see the IBM publication System/360 Flowchart User's Manual, form GH20-0293.

All output from this program uses machine carriage control. This output is designed for printers using the TN print train. Since the Computing Center's printers are run with a line spacing of 6 lines per inch, each flowchart will take up to 3 pages to print.

Example: \$RUN *FLOWCHART SCARDS=DATA SPRINT=CHART PAR=NOSOURCE

In the above example, the flowchart source program is read from the file DATA and the output is written to the file CHART. No source listing is printed.

Sample: The following is the sample input for one flowchart, followed by its output. This chart was printed at 8 lines per inch so that it might be photo-reduced to fit on one page in this volume.

```

HEAD1 /* S/360 FLOWCHART */;
HEAD2 /* PHASE SIX */;
HEAD3 /* SIDE ANALYSIS - SASHL ROUTINE */;
SASHL:  T ENTER;
%B1SA2:  P (SAPLIN) COMPUTE SIDE PREF CODE AND INSERT SIDE PREFERENCE
CODES IN SASWS;
P MOVE CODE TO SASWS + 1;
P INITIALIZE SIDE PREFERENCE CODES AND LOAD FROM SIDE;
%E1SA2:  D IS IT T, L, R, OR B;
IF NO GOTO SASW3 (XR,ET); ELSE YES;
P CHANGE SIDE PREFERENCE CODE TO SPECIFIED CODE;
SASW3:  D SWITCH;
IF BR GOTO A2SA2 (XR,ET); ELSE NOP;
M SET SASW3 TO BRANCH;
P REVERSE SIDE PREFERENCE CODE FOR TO SIDE;
P LOAD TO SIDE;
GOTO E1SA2 (XL,EL);

```

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```

%A2SA2:  M SET SASW2 TO NOP;
          P MOVE SIDE PREFERENCE CODE TO SAWORK AND REVERSE SIDE;
SAACL:   D CMP RECORD BEING CHECKED TO CARD TABLE;
          IF EQ GOTO SAACDF(XR,EL); ELSE UNEQ;
          D IS TABLE RECORD TO BLOCK;
          IF YES GOTO SAACDT(XR,EL); ELSE NO;
SAALL:   D DOES T-L REC FLOWLINE GO TO REC;
          IF YES GOTO E3SA2(XR,EL); ELSE NO;
%F2SA2:  P INCREMENT TO NEXT FLOWLINE;
          D ARE WE AT END OF RECORD;
          IF NO GOTO SAALL(XL,EL); IF YES GOTO SACDLP(XR,EL);
%H2SA2:  P (SETFMS) SET FROM SIDE;
          P (SETTOS) SET TO SIDE;
          GOTO SALPR(XR,EL); SKIP C+4;
%E3SA2:  P IC SIDE SPECIFIED;
          P (SAREPL) REMOVE SIDE FROM PREF TABLE SAWORK;
          GOTO F2SA2(XL,ER);
SACDLP:  P INCREMENT TO NEXT TABLE RECORD;
          D ARE WE AT END OF TABLE;
          IF YES GOTO H2SA2(XL,ER); IF NO GOTO SAACL(XR,EL);
SALPR:   D ARE ALL FLOWLINES PROCESSED;
          IF YES GOTO K4SA2(XR,ET); ELSE NO;
          P SET POINTER TO NEXT FLOWLINE;
          GOTO B1SA2(XB,ET); SKIP 3;
SAACDT:  D IS FROM SIDE BLANK;
          IF YES GOTO G4SA2(XR,ET); ELSE NO;
          P IC R4 WITH FROM SIDE CHARACTER;
          P (SAREPL) REMOVE SIDE FROM PREF TABLE SAWORK+4;
%G4SA2:  P INCREMENT TO NEXT FLOWLINE;
          D ARE WE AT END OF RECORD;
          IF NO GOTO SAACDT(XL,EL); ELSE YES;
%J4SA2:  P RESET ADDR TO FIRST FLOWLINE IN RECORD;
          GOTO SAALL(XR,ET);
%K4SA2:  T EXIT; BREAK; SKIP 2;
SAACDF:  D IS FROM SIDE BLANK;
          IF YES GOTO F5SA2(XR,ER); ELSE NO;
          P IC R4 WITH FROM SIDE CHARACTER;
          P (SAREPL) REMOVE FROM SIDE PREF TABLE SAWORK;
%F5SA2:  P INCREMENT TO NEXT FLOWLINE;
          D ARE WE AT END OF RECORD;
          IF NO GOTO SAACDF(XL,EL);
          IF YES GOTO J4SA2(XB,ET);
          END;

```


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*FORTRANVS

Contents: The IBM VS FORTRAN compiler.

Purpose: To compile FORTRAN 77 source programs.

Use: The VS FORTRAN compiler is invoked by the \$RUN command.

Program Key: *FORTRANVS

Return Codes: 0 - Successful return.
4 - Warning messages printed.
8 - Errors detected.
12 - Serious errors detected.
16 - Internal compiler error.

Description: The VS FORTRAN compiler supports the most recent standard for FORTRAN 77 published by the American National Standards Institute (ANSI). It also supports extensions to the language and contains features that are not available with FORTRAN 66 compilers (FORTRAN-G and FORTRAN-H).

See the description of *FORTRANVS in the section "VS FORTRAN" in MTS Volume 6, FORTRAN in MTS, for further details on using this compiler.

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*FORUM

Contents: A computer-based conferencing program.

Purpose: To provide a mechanism for holding on-line private or public meetings or conferences. FORUM allows many discussions within each conference and for extended commentary on any given discussion.

Use: The program is invoked by the \$RUN command.

Program Key: *FORUM

Logical I/O Units Referenced:
SPRINT - Printed output

Return Codes: 0 - Successful return.
8 - Error return.

Description: A complete description of FORUM is given in MTS Volume 23, Messaging and Conferencing in MTS, and Computing Center Memo 447, "FORUM - A Computer Conferencing Program." The description here gives only a general outline of the capabilities and features of the program.

The FORUM program maintains a database of on-line meetings or conferences. Like round-table meetings each FORUM meeting usually involves several people working together for some specific purpose.

Unlike round-table conferences there is no need for the people taking part to gather in the same place or at the same time. FORUM keeps a record of all the discussions going on.

FORUM can manage any number of CONFERENCES within each of which there may be many DISCUSSIONS. Each DISCUSSION is composed of an INTRODUCTION and a collection of RESPONSES. (Note: The capitalization in this paragraph emphasises the terms used in the FORUM documentation.)

A conference is usually 'managed' by someone (its creator or anyone given equivalent rights by the creator) who enters one or more discussions of an introductory nature. (FORUM can be instructed to direct new members of a conference to a particular discussion which should be read first).

A conference may be private to a small group or it may be public, that is, open to any user of MTS.

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Once a conference is begun, any participants may enter further discussions or respond to any already started. It is usually a good policy to separate clearly different issues in different discussions.

After discussions have been entered and responses made, it is possible for users with access to the conference to print out discussions and/or responses that have certain characteristics, such as all responses made to a given person or all responses made after a given date.

Parameters: A specific conference name may be given in the PAR field to restrict access to one named conference if the user participates in several FORUM conferences.

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*FS

Contents: A file-save and file-restore program.

Purpose: To save files (sequential or line) on magnetic tape and to restore them from the tape by name with the original line numbers preserved.

Use: FS is invoked by the \$RUN command.

Program Key: *FS

Logical I/O Units Referenced:

- SCARDS - The source of commands to *FS (defaults to *SOURCE*).
- SPRINT - A listing of the directory of files on the tape, prompting messages, and program comments (defaults to *SINK*).
- SERCOM - Error comments and help information (defaults to *MSINK*).
- GUSER - Responses to prompting messages.
- 0 - The pseudodevice name of the magnetic tape to be used by *FS. The tape must be a 9-track tape and, if files are to be saved, must be mounted with RING=IN.
- 1 - The tape used for output from COPY commands. This must be a 9-track tape mounted with RING=IN.
- 2 - Documentation for DSAVE. If not specified, documentation will be read from GUSER.

Parameters: The following parameters may be specified in the PAR field of the \$RUN command.

- INIT The INIT parameter must be specified when the tape on unit 0 is to be used in conjunction with *FS for the first time. The tape will be rewound and two tapemarks will be written, indicating the tape is empty.
- RECOVER The RECOVER parameter may be specified when INIT is omitted. With this option, if a record cannot be read, FS will attempt to copy or restore as much of the data as possible in the record. If RECOVER is not specified, the record causing the error will be skipped. Using RECOVER may cause a file to be copied or restored incorrectly.

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DIST The DIST parameter specifies that FS is being used in distribution mode.

FIX The FIX parameter may be used to delete a last incomplete file on a labeled tape. This is used when the program was stopped abnormally in the middle of a save operation causing the last file to be incomplete. This parameter has no effect on an unlabeled tape.

QUIT The QUIT parameter causes the user to be signed off after *FS terminates if any SAVE or RESTORE operation resulted in an error.

Return Codes: 0 - Successful return.
 4 - Warning messages were issued.
 8 - Error messages were issued.

Commands: The following commands are available for *FS. The underlined portion of each command name may be used as an abbreviation.

CANCEL tape-file[(version)]
CANCEL [(m)] [(n)]

The CANCEL command cancels all queued RESTORE or COPY command operations for the file(s) named.

COPY tape-file[(version)] [newname] [pdn]
 [PAR={INIT|RESCAN},DOCUMENT,RECOVER]
COPY [(m)] [(n)] [pdn]
 [PAR={INIT|RESCAN},DOCUMENT,RECOVER]
COPY (m) [newname] [pdn]
 [PAR={INIT|RESCAN},DOCUMENT,RECOVER]

The COPY command copies files from the FS tape to the copy tape.

DELETE tape-file[(version)]
DELETE [(m)] [(n)]

The DELETE command is the same as the CANCEL command.

DLIST [pdn] tape-file[(version)] [SORT=NAME] [ON FDname]
DLIST [pdn] [(m)] [(n)] [SORT=NAME] [ON FDname]

The documentation saved on "pdn" by DSAVE for all of the files named is printed.

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DSAVE filename [tape-file]

The DSAVE command is similar to (and may be used in place of) the SAVE command except that up to 2000 characters of "documentation" may be saved with the file.

FSTAPE pdn [PAR={INIT|RESCAN} [,FIX] [,QUIT] [,RECOVER]]

The FSTAPE command reassigns the FS tape (the tape normally attached to logical I/O unit 0).

HELP [{command|topic}]

The HELP command provides on-line assistance.

LIST [pdn] tape-file[(version)] [SORT=NAME] [ON FDname]

LIST [pdn] [(m)] [(n)] [SORT=NAME] [ON FDname]

The directory information for the specified files on tape "pdn" is printed on "FDname".

MTS

Execution of the *FS program is suspended and a return to MTS command mode is made without processing queued FS requests.

QDISPLAY

The QDISPLAY command displays all of the files that are queued to be restored or copied.

QPROCESS

All queued restore and copy requests are processed.

RESTORE tape-file[(version)] [filename]

RESTORE (m) (n) [pdn]

RESTORE (m) [filename]

The RESTORE command restores the tape-files specified to the filenames specified.

SAVE filename [tape-file]

The SAVE command specifies that the file "filename" is to be saved using "tape-file" as the name of the file on the tape.

SET option ...

The following options may be specified:

HELP={LINE|SCREEN}

This option specifies whether help information provided by the HELP command is printed in line mode or full-screen mode. The default is full-screen mode for terminals that support it.

TERSE={ON|OFF}

This option specifies whether messages from *FS are given in full or abbreviated form. The default is OFF (messages are given in full).

STOP [{DISMOUNT|NODISMOUNT}]

All queued restore and copy requests are processed; then FS returns to the program which called it.

UPDATE tape-file[(version)] [newname] [pdn]
[PAR={INIT|RESCAN},DOCUMENT,RECOVER]

UPDATE [(m)] [(n)] [pdn]
[PAR={INIT|RESCAN},DOCUMENT,RECOVER]

UPDATE (m) [newname] [pdn]
[PAR={INIT|RESCAN},DOCUMENT,RECOVER]

The UPDATE command copies the latest version of files on the FS tape to the copy tape.

VERIFY

The VERIFY command verifies the checksum information on the tape.

\$cmdnd

*FS command lines beginning with a "\$" (except for \$ENDFILE and \$CONTINUE WITH) are executed as MTS commands.

Description: The above command descriptions give only a brief summary of *FS. The complete description is given in MTS Volume 19, Tapes and Floppy Disks.

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*FTN

Contents: The interface program for the FORTRAN-G and FORTRAN-H compilers.

Use: The interface is invoked by the \$RUN command.

Program Key: *FTN

Logical I/O Units Referenced:

- SCARDS - source program (defaults to *SOURCE*).
- SPRINT - compiler source program and object module listings (defaults to *SINK* in batch mode).
- SPUNCH - object module generated (defaults to *PUNCH* in batch mode).
- SERCOM - interface and compiler diagnostic error messages (defaults to *MSINK*).
- GUSER - responses to interface prompting messages (defaults to *MSOURCE*).
- 0 - object module generated (if DECK option is specified).
- 1 - edited source module generated (if EDIT option is specified).

Return Codes: 0 - Successful return.
 4 - Warning messages printed.
 8 - Errors detected.
 12 - Serious errors detected.
 16 - Internal compiler error.

Description: The interface program for the FORTRAN-G and FORTRAN-H compilers performs the following services:

- (1) conversational entry and correction of the parameters,
- (2) intermixing of source modules, object modules, and commands within the input stream,
- (3) four source statement formats,
- (4) availability of the source program reformatted to standard IBM format,
- (5) incorporation of the MTS line numbers in the source listings and terminal diagnostics, and
- (6) an object module format using CSI loader records when possible to decrease loading time.

The complete description of the interface program is given in MTS Volume 6, FORTRAN in MTS. A brief summary of the interface options is given below.

<u>Option</u>	<u>Default</u>
<u>BCD</u> / <u>NOBCD</u>	NOBCD
<u>COMMENT</u> / <u>NOCOMMENT</u>	COMMENT
<u>COND</u> / <u>NOCOND</u>	COND
<u>DECK</u> / <u>NODECK</u>	NODECK
<u>EDIT</u> / <u>NOEDIT</u>	NOEDIT
<u>EJECT</u> / <u>NOEJECT</u>	EJECT
<u>ERR</u> / <u>NOERR</u>	ERR
<u>EXPLAIN</u> / <u>NOEXPLAIN</u>	NOEXPLAIN
<u>ID</u> / <u>NOID</u>	ID
<u>LIB</u> / <u>NOLIB</u>	NOLIB
<u>LIST</u> / <u>NOLIST</u>	NOLIST
<u>LOAD</u> / <u>NOLOAD</u>	LOAD
<u>MAP</u> / <u>NOMAP</u>	NOMAP
<u>PRINT</u> / <u>NOPRINT</u>	PRINT
<u>OVER</u> / <u>NOOVER</u>	NOOVER
<u>QUIT</u> / <u>NOQUIT</u>	See Vol. 6
<u>SCAN</u> / <u>NOSCAN</u>	NOSCAN
<u>SM</u> / <u>NOSM</u>	NOSM
<u>SML</u> / <u>NOSML</u>	NOSML
<u>SOURCE</u> / <u>NOSOURCE</u>	See Vol. 6
<u>STRU</u> / <u>NOSTRU</u>	NOSTRU
<u>TEST</u> / <u>NOTEST</u>	NOTEST
<u>XL</u> / <u>NOXL</u>	NOXL
<u>XREF</u> / <u>NOXREF</u>	See Vol. 6
<u>CALIGN</u> =n	CALIGN=0
<u>CSHIFT</u> =n	CSHIFT=0
<u>FORMAT</u> ={ <u>L</u> INE <u>I</u> BM <u>E</u> DITED}	FORMAT=EDITED
<u>L</u> INE=number	LINE=57
<u>N</u> AME=characters	NAME=MAIN
<u>O</u> PT={0 1 2 H G}	OPT=G
<u>O</u> VER=parlist	None
<u>S</u> IZE=number	SIZE=4

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*FTNTIDY

Contents: The FORTRAN "tidying" program.

Purpose: To tidy FORTRAN source programs into an easily readable format and/or to produce cross-reference listings.

Use: The program is invoked by the \$RUN command.

Program Key: *FTNTIDY

Logical I/O Units Referenced:

 SCARDS - one or more FORTRAN source programs to be tidied and/or cross-referenced.

 SPRINT - the listing of the program(s) and the cross-references.

 SPUNCH - the tidied FORTRAN source program(s).

 SERCOM - severe error comments.

Return Codes: 0 - Successful return.

 4 - Warning messages printed.

 8 - Error messages printed.

 12 - Severe errors occurred.

Description: FTNTIDY may be used to tidy FORTRAN source programs and/or to produce a cross-reference of the variables, statement numbers, functions and subroutines, and the FORTRAN logical I/O units used. By default, if the MTS logical I/O unit SPUNCH is not assigned on the \$RUN command, FTNTIDY produces a listing of the source followed by the cross-reference listings.

 The complete description of the FTNTIDY program is given in MTS Volume 6, FORTRAN in MTS.

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*GASP

Contents: The GASP simulation language. *GASP is a subroutine library file containing the modules for the GASPIIA simulation package.

Purpose: This file provides object modules to support simulation programs written in FORTRAN and organized for an event-oriented discrete simulation.

Use: The file should be concatenated to the file containing the main program on the \$RUN command, e.g.,

\$RUN main+*GASP

Program Key: *EXEC

Logical I/O Units Referenced:

Two special GASP I/O units are referenced:

NPRNT - all output.
NCRDR - data input.

NPRNT and NCRDR are set by the user.

Description: GASP is described as a FORTRAN-based discrete simulation language; in fact, GASP is a set of supporting subroutines that ease the writing of simulation programs in FORTRAN by providing certain statistical control and event-scheduling operations. The user must provide his own main program, together with certain supporting subroutines, which interact with and use the GASP routines. The version of GASP available in MTS in the public file *GASP is a modified version of GASPIIA; the original GASPIIA is well documented in the following reference:

Simulation with GASP II, by A. A. B. Pritsker and Philip J. Kiviat, Prentice-Hall, 1969.

Limitations of MTS GASP and the differences between MTS GASP and the GASP as described in the above reference are detailed in Computing Center Memo 246. Users are referred to the above for descriptions of GASP routines, their algorithms, and their calling sequences. Additional information may also be obtained via the MTS command \$COPY W020:GASPINFO.

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Example: \$RUN *FTN
 (User-supplied FORTRAN routines)
\$RUN -LOAD+*GASP
 (User-supplied GASPIIA data)

In the above example, the FORTRAN routines compiled by *FTN into the file -LOAD are executed with the GASP simulation package.

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*GENDOC

Contents: The On-Line Documentation Facility.

Purpose: To allow users to produce MTS documentation in either
terminal or hard-copy format.

| Use: The program has been deleted from the system.

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*GPSSH2

| Contents: The GPSS/H (Version 2) system, a compiler and run-time support system for programs written in the GPSS/V programming language.

| Use: *GPSSH2 is invoked by the \$RUN command.

Program Key: *EXEC

Logical I/O Units Referenced:

- SCARDS - source-program input to be compiled and executed.
- SPRINT - standard output.
- GUSER - interactive debugging input.
- SERCOM - interactive debugging output; error and warning messages.
- SPUNCH - update feature (optional) - "punched" copy of updated source.
 - 1 - Jobtape #1.
 - 2 - Jobtape #2.
 - 3 - Jobtape #3.
 - 4 - SAVE file.
 - 5 - READ file.
 - 6 - update feature - master source file.
 - 7 - update feature - updated master source file.

- | References: (1) GPSS/H User's Guide, 3rd Edition, by James O. Henriksen, Wolverine Software Corp.
- | (2) Getting Started with GPSS/H, by Carson, Banks, and Sy, Wolverine Software Corp.
- | (3) Simulation Using GPSS, by Thomas J. Schriber, John Wiley & Sons, 1974.
- | (4) IBM General Purpose Simulation System V User's Manual, form SH20-0851.

Description: GPSS/H is a new implementation of GPSS for IBM 370 and 370-compatible computers. With a few exceptions, GPSS/H is upward compatible with IBM's GPSS/V. Most programs that run under GPSS/V can be run under GPSS/H without modification. For a summary of the differences between GPSS/H and GPSS/V, please refer to Appendix C of the GPSS/H User's Guide ("Differences between GPSS/H and Other Versions of GPSS").

Options: GPSS/H options are specified via the PAR field of the \$RUN command invoking GPSS/H. In the case of conflicting specifications, the rightmost specification is used. In the descriptions that follow, allowable abbreviations are

indicated by underscoring; e.g., NOXREF indicates that NOXREF may be abbreviated as NOX.

SOURCE/NOSOURCE

If SOURCE is specified, a source listing of the program is written on SPRINT. SOURCE is the default for batch use. For terminal use, SOURCE is assumed if SPRINT is not assigned to the terminal, in which case NOSOURCE is assumed. If the program contains errors, erroneous lines and their associated error messages are always written on SPRINT.

XREF/NOXREF

XREF prints a cross-reference listing of all entity symbols and constants on SPRINT. The defaults for XREF/NOXREF are the same as those for SOURCE/NOSOURCE.

XSORT=A

By default, a cross-reference listing is grouped by entity classes and sorted by entity name/number within each class. Use of the XSORT=A option suppresses the grouping of a cross-reference listing into entity classes; i.e., the entire collection of entity names/numbers is sorted and printed without regard to entity class.

DICT/NODICT

The DICT option prints a dictionary of all GPSS entities used in a program. The dictionary is sorted by entity number and is useful for distinguishing which entities have been used in a program and which are available for use. The NODICT option may be used to suppress printing of the entity dictionary. The defaults for DICT/NODICT are the same as those for SOURCE/NOSOURCE.

UPLIST/NOUPLIST

The UPLIST option requests that UPDATE specifications be included in program output when the GPSS UPDATE feature is used. The NOUPLIST option may be used to suppress inclusion of an UPDATE listing. The defaults for UPLIST/NOUPLIST are the same as those for SOURCE/NOSOURCE.

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ERR/NOERR

The ERR option echoes compilation error messages on the terminal when the program compilation listing is directed to a destination other than the terminal. The NOERR option may be used to suppress the echoing of compilation error messages.

WARN/NOWARN

The WARN option echoes compilation warning messages on the terminal when the program compilation listing is directed to a destination other than the terminal. The NOWARN option may be used to suppress the echoing of compilation warning messages.

LIST/NOLIST

The LIST option includes an object-code listing in the program output. An object-code listing is of use only to someone familiar with the internal structure of GPSS/H. NOLIST is always the default option.

XWF

The XWF option causes conditions which would normally merely result in the printing of an execution warning message to be treated as fatal errors. For example, an attempt to store a value greater than 32767 in a halfword location ordinarily results in the issuance of a warning message, and execution is continued by storing a truncated value. In a very large model, this action could result in a costly run which produces meaningless results. Use of XWF option prevents such disasters.

JTIF={V|360}

If Jobtapes to be read by GPSS/H have been written by GPSS/V or GPSS/360, the JTIF=V or JTIF=360 options must be used, respectively.

JTOF={V|360}

If Jobtapes are to be written in formats compatible with GPSS/V or GPSS/360, the JTOF=V or JTOF=360 option must be used, respectively. If neither of these options are used, any Jobtapes written will be written in GPSS/H format.

JTF={V|360}

JTF=V is a convenient way of requesting both the JTIF=V and JTOF=V options. Similarly, JTF=360 requests both JTIF=360 and JTOF=360.

SIZE={A|B|C}

The number of entities available to a GPSS program is determined in part by the SIZE option. SIZE=A, SIZE=B, or SIZE=C may be specified, with SIZE=A being the default. The explicit or implied use of a SIZE option establishes default allocations for the number of members of each GPSS entity class. The compiler may alter default allocations, based on its knowledge of the model being compiled. For example, if it sees that no entities of a given class are referenced, it will reduce the allocation of that entity class to zero. Allocations can also be automatically increased. For example, if the compiler encounters a reference to Facility number 350, it will guarantee that at least 350 Facilities are allocated for model execution. For a complete explanation, see the description of automatic reallocation of entities in Chapter 3 of the GPSS/H User's Guide.

In many cases, the compiler cannot tell how many members of a given entity class are required. For example, if a model contains a "SEIZE PH1" Block, the number of Facilities required cannot be determined at compile time, because the values of PH1 are not known. For entity classes so referenced, the compiler has no alternative but to use the number of members implied by the SIZE option. If the number of members implied by the SIZE option is inadequate, one or more REALLOCATE control statements must be supplied to override the default allocation.

The number of members of each entity class implied by SIZE=A, SIZE=B, and SIZE=C is summarized in tabular form in the description of the REALLOCATE statement in Chapter 6 of the GPSS/H User's Guide.

TEST

The TEST option is used to invoke the GPSS/H interactive debugging system. When the TEST option is used, compilation and loading of a program proceed in the usual fashion; however, at the point at which program execution would normally begin, control is passed to the GPSS/H interactive debugging command processor, which types a READY message

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on the terminal. At this point, the user assumes (and ideally retains) control of program execution. Commands then can be issued to selectively display model output, to stop program execution at arbitrarily specified Blocks (breakpoints), and, if necessary, to step through a program, one or more Blocks at a time.

BIG

By default, the GPSS/H compiler keeps all of its internal data structures in virtual memory. For very large programs (thousands of statements), this may result in excessive use of virtual memory. The BIG option forces the compiler to make use of a scratch file (named `-$SCRATCH`). When the BIG option is used (presumably rarely in MTS), the file `-$SCRATCH` should be explicitly created prior to running GPSS/H, e.g., `$CREATE -$SCRATCH SIZE=150P`.

NOSPIE

By default, the GPSS/H simulator traps all program interrupts that occur during program execution. When user-supplied FORTRAN or PL/I subroutines cause program interrupts, determination of the exact cause of the error may be made difficult by the automatic trapping of the interrupt. When the NOSPIE option is used, GPSS/H program interrupt trapping is disabled, so that MTS system debugging tools, e.g., SDS, can be used. NOSPIE is an acronym for "no set program interrupt exit."

Return Codes: 0 - Successful return.
4 - Error return.

| Examples: \$RUN *GPSSH2 SCARDS=MODEL

In the above example, the source program is read from the file MODEL. Source, cross-reference, and dictionary listings are produced if run in batch mode, or suppressed if run in terminal mode.

| \$RUN *GPSSH2 SCARDS=MODEL PAR=SOURCE XREF DICT

The above example is the same as the previous example, except that source, cross-reference, and dictionary listings are always produced.

Using HELP and EXTERNAL Subroutines

The use of HELP and EXTERNAL subroutines is very simple in MTS. In order to use HELP or EXTERNAL subroutines, take the following steps:

- (1) Code the GPSS program, invoking HELP routines with appropriate HELP Blocks and/or invoking EXTERNAL subroutines by means of appropriate declarations and references. The use of HELP blocks and EXTERNAL subroutines is described in Chapters 8 and 14 of the GPSS/H User's Guide, respectively.
- (2) Compile the HELP/EXTERNAL routines, using the appropriate compiler.
- (3) Append the object-code file and any required libraries onto *GPSSH in a \$RUN command.

In the example which follows, FORTRAN HELP/EXTERNAL subroutines contained in the file MYFTN.S are compiled by the MTS FORTRAN/G compiler, placing the resultant object code in the file -LOAD (by default). The \$RUN command loads both GPSS/H and the HELP/EXTERNAL routines.

```
$RUN *FTN PAR=S=MYFTN.S
$RUN *GPSSH2+-LOAD SCARDS=MYMODEL
```

Connecting Files and Devices to GPSS Programs

Extended I/O capabilities introduced with release 1.0 of GPSS/H allow a GPSS program to read and write files or devices directly, without use of HELP subroutines, as was formerly necessary. The extended I/O capabilities of GPSS/H are described in Chapter 16 of the GPSS/H User's Guide.

Each I/O statement type allows specifications of an input/output file or device, by means of a FILE keyword. In MTS, the FILE keyword is supported as follows:

- (1) If no FILE specification is given in an input statement, input is read from logical unit GUSER, which defaults to the job source stream for a batch run and to the terminal for an interactive run.
- (2) If no FILE specification is given in an output statement, output is written to logical unit SERCOM, which defaults to the printer for a batch run and to the terminal for an interactive run.
- (3) If "FILE=filename" is specified in an I/O statement, the following procedure is used to associate "filename" with a file or device:
 - (a) If "filename" starts with an alphabetic character and is an MTS logical I/O unit name, the file or device assigned to the logical I/O unit is used. The following example prints a one line message on SPRINT:

```
PUTPIC FILE=SPRINT
-YOUR PROGRAM IS IN TROUBLE
```


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(Note carriage control in column 1.)

- (b) If "filename" is of the form "UNITn", where "n" is an integer, the file or device assigned to logical I/O unit "n" is used. The "UNIT" prefix is necessary to maintain compatibility with IBM operating systems, under which file names cannot begin with a numeric character. The following example reads an integer value into fullword Savevalue X1 from logical I/O unit 8:

```
GETLIST      FILE=UNIT8,END=EOFEXIT,ERR=BADINT, (X1)
```

- (c) If "filename" satisfies neither of the above conditions, but is the name of an existing file, the file is read or written directly. Note that the GPSS/H naming conventions for files require that the name start with an alphabetic character and that the name be 1-8 characters long. This restriction implies that temporary files and files belonging to user IDs other than the one under which GPSS/H is being run cannot be used. The following example reads a floating-point value into floating-point Savevalue XL\$PARM from the file named MYDATA:

```
GETLIST      FILE=MYDATA,END=EOFERR,ERR=BADFLOAT, (XL$PARM)
```

Interrupting Model Execution and Output

When the GPSS/H interactive debugging feature is used (PAR=TEST), model execution may be interrupted at any point, by pressing the BREAK, ATTN, PA1 (or similarly labeled) attention interrupt button of the terminal. The attention interrupt button can also be used to terminate most forms of GPSS/H output. For example, if an interactive debugging DISPLAY command produces too much output to be conveniently viewed on the terminal, the output may be terminated by pressing the attention interrupt button. In such a case, a PRINT command can be issued routing output to a more appropriate destination (such as a printer).

Transporting GPSS/H Programs and/or Data

If GPSS/H programs and/or data are to be transported to other sites, the following precautions should be taken:

- (1) Remember that by default, Jobtapes are read and written in GPSS/H format. If Jobtapes are being prepared for use with IBM's GPSS/V or GPSS/360, GPSS/H format will be unacceptable. By using the appropriate PAR JTF or JTOF option, Jobtapes can be prepared for use with GPSS/V or GPSS/360.
- (2) If the Jobtape file is being written on a magnetic tape for use under an IBM operating system, the following rules must be observed:
 - (a) If the Jobtape is to be used under GPSS/V, the tape must be written with a logical record length of 416 and a blocksize

- which is a multiple of 416.
- (b) If the Jobtape is to be used under GPSS/360, the tape must be written with an unblocked, fixed logical record length of 416.
 - (c) If the Jobtape is to be used under GPSS/H and is written in GPSS/H format, the tape must be written with a record format of VBS, a logical record length long enough to contain the largest Transaction, and a reasonably large block size (for efficiency). Note that the largest any Jobtape Transaction can be is 2825 bytes, so a logical record length of 2825 will always work.
- (3) GPSS/H READ/SAVE files can only be processed by GPSS/H. They are incompatible with those of other implementations of GPSS.
 - (4) If a READ/SAVE file is being written for use under GPSS/H on an IBM operating system, the tape must be written with a record format of U and a logical record length / block size of 4096.
 - (5) In all operations involving the copying of Jobtapes and READ/SAVE files, the @-TRIM I/O modifier must be used to avoid truncation of records.

Return Codes

At the completion of every run, GPSS/H passes a return code back to MTS. The return code can be interpreted as follows:

Value Interpretation

0	Successful return
4	Syntactic error(s)
8	Error(s) in entity/symbol definition(s)
12	Semantic error(s)
16	Load/Control errors
20	Execution error
24	Output error
28	Invalid PAR option

Support of GPSS/H

GPSS/H is supported by the Wolverine Software Corporation. Questions and problems should be directed to

James O. Henriksen
Wolverine Software Corp.
| 4115 Annandale Road
| Annandale, VA 22003-2500
| (703) 750-3910

Users on the University of Michigan campus may also contact

Prof. Thomas J. Schriber
School of Business Administration
764-1398

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*HPGLPLOT

Contents: A program to convert an MTS plot-file (PDS file) into a file containing HPGL (Hewlett-Packard Graphics Language) commands.

Use: The program is invoked by the \$RUN command.

Program Key: *HPGLPLOT

Logical I/O Units Referenced:

- 0 - plot-file to be translated.
- 23 - output plot file.
- SERCOM - program error messages.
- SPRINT - program nonplot output.

Parameters: The following parameters may be specified on the \$RUN command. These will control the different options for the plot-file conversion. The minimum abbreviation for each parameter is underlined.

CENTER

The CENTER option specifies that the plot is to be centered on the page. The plot will be positioned such that its midpoint is mapped to the page midpoint, i.e., the point $((x_{max}-x_{min})/2)$ of the plot is mapped to the center of the page (this is (5.5,4.25) in landscape mode and (4.25,5.5) in portrait mode). The CENTER option will override any SHIFT or ORIGIN option specifications. CENTER is useful only if NOFIT is specified; the plot is automatically centered in FIT mode.

FIT

The FIT option optimally fits each plot onto the plotter paper. The Hewlett-Packard 7550 Plotter uses 8.5 x 11 inch paper with a drawing area on that paper of 7.75 x 10.0 inches. A fitted plot will be scaled so that it is as large as possible without any part of the plot being clipped. FIT is the default mode.

FRAME=n

The FRAME option specifies which plot in the file is to be converted, e.g., FRAME=5 will convert the fifth plot. The default is FRAME=1. It is currently not possible to convert the entire plotfile at

once. Since the HPGL page-eject command is plotter-dependent, the MTS HP driver does not put any page-eject commands in the output file. If all the plots were converted at once, they would all be drawn on the same sheet of paper, one on top of the other.

LANDSCAPE

The LANDSCAPE option specifies that the plot converted is to be oriented in landscape mode, i.e., the x-axis will be parallel to the 11-inch edge of the paper.

NOFIT

The NOFIT option specifies that the coordinates to be used in each plot are in absolute inches. No implicit scaling is performed on the plots, and coordinates which are outside of the drawing area on the plotter paper will be clipped appropriately. The origin point (0.0,0.0) is at the extreme bottom left-hand corner of a page, which means that coordinates in the negative axis range will be clipped.

ORIGIN=(x,y)

The ORIGIN option may only be used in conjunction with the NOFIT option. By default, the origin point (0.0,0.0) of a NOFIT plot is located at the extreme bottom left-hand corner of a page. The ORIGIN option allows the location (0.0,0.0) to be relocated to an arbitrary point, not necessarily within the boundaries of a physical page. It is up to the user to ensure that a plot remains within the visible region if this option is used.

Either the "x" value, the "y" value, or both may be omitted from an ORIGIN command; unspecified parameters will default to 0.0. A maximum of three digits following the decimal point may be given.

The ORIGIN specification is not affected by the presence of a SCALE specification (i.e., the origin coordinates are not scaled). Using the effects of these two options, it is possible to increase the visible viewing region of a plot.

PEN(color,size)=newcolor

The PEN option respecifies the pen colors. "color" and "size" specify the color and size of the pen to be changed; "newcolor" specifies the new color of

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the pen. The "size" parameter may be omitted if the "color" parameter unambiguously specifies the pen to be changed, e.g., there is not both a medium and fine pen to the same color. For example, to have the only red pen in the plot drawn as blue, specify PEN(RED,)=BLUE; to have a fine black pen drawn as green, specify PEN(BLAC,FINE)=GREE. If a PPEN record in a plotfile specifies a nonsupported color, that color will be drawn as black.

PORTRAIT

The PORTRAIT option specifies that the plot converted is to be oriented in portrait mode, i.e., the x-axis will be parallel to the 8.5-inch edge of the paper.

SCALE=scale-factor

The SCALE option specifies a scaling factor, which must be in the range $0.0 < \text{scale-factor} \leq 1.0$. In FIT mode, this scaling is applied to the image after it has been fitted onto a page. The default scale factor is 1.0.

SHIFT

The SHIFT option may only be used in conjunction with the NOFIT option. By default, a plot produced in NOFIT mode has its origin at the bottom left-hand corner of a page. Specifying the SHIFT option will cause each image to be translated up by one inch to give more space at the bottom of the page in landscape mode and more room along the left edge of the page in portrait mode. The SHIFT option is the same as specifying ORIGIN=(0.0,1.0) in landscape mode and ORIGIN=(1.0,0.0) in portrait mode.

SLOW

The SLOW option plots the plot-file at a slower speed than normal. This will help improve the quality of the lines drawn, but will also increase the amount of time taken to draw the plot.

Return Codes: 0 - Successful return.
 | 8 - Unit 0 was unassigned.
 12 - Plotfile conversion failed.

Description: This program reads in an MTS plot-file and translates it into HPGL commands using the *IG and the *IG.HPGLFILE device driver. The device driver will request a file

| name for the HPGL output if logical I/O unit 23 is not
| specified, and request the type of plotter to be used.

See Computing Center Memo 466, "*HPGLPLOT: Converting
MTS Plotfiles into Hewlett-Packard Graphics Language,"
for further information on conversion MTS plot-files to
HPGL plot-files.

Example: \$RUN *HPGLPLOT 0=PLOTFILE

In the above example, the plot contained in the file
PLOTFILE is translated into an HPGL file.

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*ICON

Contents: The Icon programming language.

Use: The Icon processor is invoked by the \$RUN command.

Program Key: *ICON

Logical I/O Units Referenced:

- SCARDS - the Icon source program.
- SPRINT - the program listing
- SPUNCH - the Icon object module generated.
- SERCOM - diagnostic and error messages.

Return Codes: Always zero.

Description: Icon is a programming language developed by Ralph Griswold and others and is described in the following references:

The Icon Programming Language, Ralph E. Griswold and Madge T. Griswold, Prentice-Hall, N.Y., 1983
A Guide to the Use of the Icon Book for Version 2 Users, Ralph E. Griswold
Reference Manual for the Icon Programming Language Version 2, Ralph E. Griswold and David R. Hanson, TR 79-1a, Department of Computer Science, University of Arizona, Tucson, 1980
Bibliography of the Icon Programming Language, Ralph E. Griswold

An Icon program is compiled by issuing the following \$RUN command:

```
$RUN *ICON SCARDS=source SPRINT=list SPUNCH=object
```

The resulting object program is executed by issuing the following command:

```
$RUN object+*ICONLIB SCARDS=input SPRINT=output
```

Notes: The OPEN function currently only works with logical I/O units, not files; for example, after 'F := OPEN("90")', F is associated with SPUNCH. If the argument to OPEN is not numeric, an obscure error message will be generated unless 19 is assigned to a directory file, the format of which is too obscure to describe here.

The I/O units of Icon have the following MTS equivalents:

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<u>nn</u>	<u>MTS Unit</u>
90	SPUNCH
91	SCARDS
92	SPRINT
93	GUSER
94	SERCOM
0	0
..	..
19	19

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*IF66, *IF77

Contents: The Interactive FORTRAN processors.

Purpose: To interactively compile, execute, and debug FORTRAN programs.

Program Keys: *IF66 and *IF77

Return Codes: Always zero.

Description: The Interactive FORTRAN processors are completely described in the section "Interactive FORTRAN" in MTS Volume 6, FORTRAN in MTS.

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*IG

Contents: A library of FORTRAN-callable subroutines for drawing and manipulating pictures.

Use: *IG should be concatenated to the file containing the user's object modules on the \$RUN command, e.g.,

\$RUN object+*IG

Program Key: *EXEC

Logical I/O Units Referenced:

- 9 - CalComp plot file (only if a CalComp plot is requested).
- 25 - SCODL command file (only if the matrox PCR is requested).

Description: The Integrated Graphics (IG) library is a set of FORTRAN-callable subroutines for drawing and manipulating pictures. The interface to the user's program is device independent. A program that uses IG to perform its graphics can be run without alteration on any graphics terminal or on the CalComp plotter.

IG also includes an interface from the *PLOTSYS library. This interface currently allows programs that produce CalComp plots to be run on a terminal with the plot displayed on the screen rather than being written to a plot file.

For a complete description of the Integrated Graphics system, see MTS Volume 17, Integrated Graphics System.

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*KERMIT

Contents: The MTS implementation of the Kermit file-transfer protocol.

Purpose: To provide communications and file transfer capabilities between MTS and another host, mini-, or microcomputers running Kermit.

Use: MTS Kermit is invoked by the \$RUN command. The computer to be communicated with must also be running the Kermit program.

Program Key: *KERMIT

Return Codes: 0 - Successful return.
8 - Internal error.

Description: Kermit is a communications program that provides a mechanism for exchanging data between two like or unlike computers over standard telephone or computer network communications lines. Most commonly, Kermit is used between a host computer, such as the UM-MTS host or the UB-MTS host, and a microcomputer such as an Apple Macintosh or an IBM PC. The microcomputer uses its RS-232 serial communications port for data transfer.

The Kermit protocol allows the transmission of both ASCII text and binary files over any network that will accept the printable ASCII characters. In the case of binary files, any characters that are non-printable are encoded into printable characters and decoded at the other end by the other Kermit. MTS Kermit can be used to send files between MTS and any other computer with the Kermit software.

There are several microcomputer versions of the Kermit program which combine a terminal emulator with the Kermit file transfer mechanism. When a microcomputer is started using Kermit, it will display a prompt of the form "Kermit-xx>", where "xx" will be a number or name indicating the microcomputer being used. In the case of the IBM PC, this name is "MS" indicating that the microcomputer uses the MS-DOS operating system.

Documentation: Computing Center Memo 473, "Kermit on MTS," describes the MTS implementation of the Kermit program. Computing Center Memo 904, "Using the Macintosh as a UMnet Terminal: The MacKermit Program," and Computing Center Memo 922, "Using the PC-Compatible as a UMnet Terminal: The

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Kermit-MS Program," describe the Macintosh and IBM PC versions of Kermit. The "Kermit Users Guide", a lengthy document published by the Columbia University Center for Computing Activities, where Kermit originated, is also available. The guide provides a complete description of several versions of Kermit that run on a variety of systems, but is not MTS specific. This document resides in the MTS file PC:KERMIT.GUIDE and can be printed on the line or page printers; it is 260 pages long. Another document is the "Kermit Protocol Guide," which describes the internal workings of the Kermit communications scheme. This document will only be useful to programmers who are implementing new versions of Kermit. It is in the file PC:KERMIT.PROTO and is 94 pages long.

Examples: The example below illustrates the transfer of a character (text) file from MTS to the IBM Personal Computer:

```
$Run *Kermit
KERMIT-UM> MTS KERMIT (UM) Version 1.31 (16:41 Sep12/86)
KERMIT-UM>SEND TEST-ASC
KERMIT-UM>Preparing to send file 'TEST-ASC'.
KERMIT-MS>RECEIVE
```

(... transfer starts, runs, and completes ...)

```
KERMIT-MS>CONNECT
KERMIT-UM>STOP
```

The example below illustrates the transfer of a character (text) file from the IBM Personal Computer to MTS:

```
$Run *Kermit
KERMIT-UM> MTS KERMIT (UM) Version 1.31 (16:41 Sep12/86)
KERMIT-UM>REC PC-FILE
KERMIT-UM>File being received to be placed into MTS file
KERMIT-MS>SEND TEXTFILE
```

... transfer starts, runs, and completes ...

```
KERMIT-MS>CONNECT
KERMIT-UM>STOP
```

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*LABEL

Contents: The MTS magnetic tape-initializing program.

Purpose: To initialize a labeled or unlabeled magnetic tape.

Use: The program is invoked by the \$RUN command.

Program Key: *LABEL

Logical I/O Units Referenced:

GUSER - input from the user.

SERCOM - prompting for input and error comments.

Return Codes: Always zero.

Description: The program prompts for the pseudodevice name of the tape to be initialized, the density (200, 556, 800, 1600, or 6250) at which it is to be initialized, the volume name, and an optional owner ID. This tape must have been mounted with RING=IN specified on the mount request. If the last two parameters (volume name and owner ID) are omitted, the tape is initialized as an unlabeled tape, i.e., six filemarks are written at the specified density at the beginning of the tape and the tape is rewound. If the volume name is given (1 to 6 characters without embedded blanks or commas), the tape is initialized as a labeled tape, is rewound, and label processing is enabled. The specified volume name must then be used for all future mounts of the tape. An optional owner ID (the fourth parameter) will be included in the volume label if given. It must not be longer than 10 characters.

If a volume label is given, the tape will be labeled according to the IBM OS/VS magnetic-tape labeling standard, which is the standard in MTS. However, if the keyword parameter LBLTYPE=ANSI is specified as the last parameter (after the owner ID, or volume name if the owner ID is omitted), the program will write the volume label using the American National Standards Institute (ANSI) format. The tape should be ANSI-labeled if it is to be exchanged with a computer installation that does not support the IBM standard, but does support the ANSI standard.

The program will then wait for another set of parameters to initialize a second tape. An end-of-file will terminate the program.

Examples: \$MOUNT C0000 9TP *TAPE* RING=IN 'TAPE ID'
 \$RUN *LABEL
 TAPE 1600 0039JR UNIVOFMICH
 \$ENDFILE

 In the above example, the tape *TAPE* is initialized to 1600 bpi. The tape is labeled with a volume name 0039JR and an owner ID UNIVOFMICH. The IBM OS/VS labeling standard is used.

```
$MOUNT C0001 7TP *T* RING=IN 'TAPE ID'
$RUN *LABEL
*T* 556
$ENDFILE
```

 In the above example, the tape *T* is initialized at 556 bpi. The tape is unlabeled.

```
$MOUNT C0002 9TP *** RING=IN 'TAPE ID'
$RUN *LABEL
*** 1600 DATA81 LBLTYPE=ANSI
$ENDFILE
```

 In the above example, the tape *** is initialized to 1600 bpi. The tape is labeled with a volume name DATA81 using the ANSI-standard label type. The owner ID field will be blank.

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*LABELS

Contents: A mailing-label formatting program.

Purpose: To format data for multiple-label-per-sheet label stock. This is most commonly done with names and addresses, but other types of text may be formatted. Addresses may be sorted by zip code.

Use: This program is invoked by the \$RUN command.

Program Key: *LABELS

Logical I/O Units Referenced:

SCARDS - text to be formatted into labels. The input may be in one of three formats; see the description of the FORMAT option.

SPRINT - labels formatted for printing. If the labels are to be printed on the Xerox 9700, this will be the input to *PAGEPR.

SERCOM - error messages.

Options: The PAR field contains options that specify the format of the input, the layout of the label stock, how many copies of each label are to be printed, whether succeeding labels are printed across or down the page, and whether zip-code sorting is desired. The options are:

FORMAT={FREE|LINE|(i1-j1,i2-j2,...)}

The FORMAT option specifies the format of the input from SCARDS. For FORMAT=FREE, the text for each label begins on a new line. Text for successive lines is delimited by semicolons (the separator character may be changed by the DELIMITER option). To continue the text for a label onto another line, begin that line with a plus "+". The default is FORMAT=FREE.

For FORMAT=LINE, the text for each line of a label begins on a new line. The first column of the first line for each label should contain a "1". The first column of succeeding lines is ignored. Any line beginning with a "1" begins a new label, and the text for a label always begins in column 2. The text for one label line may not be continued from one input line to another.

FORMAT=(i1-j1,i2-j2,...) specifies a "fixed" format for input. The text for each label begins on a new

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input line. The text for the first line of the label is in columns i1 through j1, the text for line two is in columns i2 through j2, etc.

DELIMITER='c'

"c" will be used as the separator for lines in free-format input. The default value for "c" is the semicolon ";".

[NO] ZIP [=n]

The ZIP option specifies that labels are to be printed in zip-code order, and that the zip code is contained in the last line of each label. ZIP=n specifies that the zip code will be found on the nth line of each label. Zip codes may be either 5- or 9-digit; 9-digit zip codes must have the form "iiii-iiii". If the input contains a mixture of 5- and 9-digit zip codes, the 5-digit zip codes are sorted as if they were iiii-0000. The zip code must be the last non-blank item on the line.

NOZIP (the default) specifies that the input is not to be sorted, but is to be printed in the order input.

ORDER={ACROSS|DOWN}

The ORDER option specifies the order in which labels appear on the page. For ORDER=ACROSS, succeeding labels are printed across a row, and then down to the next row. For ORDER=DOWN, labels are placed down the first column, then down the second, etc. For ORDER=ACROSS, the second label printed on the page is beside the first; for ORDER=DOWN, it is below the first. The default is ORDER=ACROSS.

COPIES=n

"n" copies of each label will be printed, one immediately following the other. To produce "n" sets of labels, use the output from *LABELS "n" times.

WRAPAROUND={ON|OFF}

If the text for one line of a label is too long to fit on the label, WRAPAROUND=OFF specifies that the text should be truncated at the line length. If WRAPAROUND=ON is specified, the text will be continued onto the next line of the label. The continued line will be indented two spaces. Note

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that this process may produce more lines than will fit on the label, in which case the last line(s) will be lost. The default is WRAPAROUND=ON.

PAPER={LABEL24|LABEL33}

The PAPER option specifies the name of a predefined label stock format. The stock format may also be defined (see below). Two types of stock are currently defined. PAPER=LABEL33 specifies 33 labels per 8-1/2" x 11" sheet, 3 across by 11 down. Each label is 2-13/16" wide by 1" high. PAPER=LABEL24 specifies 24 labels per 8-1/2" x 11" sheet, 3 across by 8 down. Each label is 2-13/16" wide by 1-3/8" high. For both types of labels, printing at 10 characters and 6 lines per inch is assumed. The default is PAPER=LABEL33.

TM, VG, LD, LM, LW, HG, VL, HL

These options are used to describe a user-defined label stock arrangement. See the description of these options below.

Return Codes: Always zero.

Description: User-Defined Forms

8 parameters are used to describe the size of a label and the arrangement of labels on a sheet. The units of these parameters are characters and lines rather than inches. So, when defining a form, both the label stock itself and the character size and spacing used by the printer must be considered. The parameters are:

TM=l1 Top margin, the number of lines between the top of the sheet and the first line of a label. *LABELS uses a ":" carriage control to start each page, then spaces down 11 lines to the first label. If l1=0, printing will begin on the top line. On some devices, this will result in the first line of text being "cut off" at the top.

LM=c1 The number of characters in the left margin before the first label.

LW=c2 The width of a label, in characters. For some devices, including the Xerox 9700, printing across the full width of the label will cause the first and/or last character to "bleed" off the edge. For such devices, it is better to define the label width to be one or two charac-

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ters less than the actual width of the label, and use a larger-than-actual LM and HG.

LD=12 The depth of a label, in lines. This is the number of lines of text than can be printed on each label. *LABELS begins printing at the top of each label. For some devices, including the Xerox 9700, printing the full depth causes a line to be "cut off" at the top or bottom. For such devices, setting 12 to one less than the actual depth, and setting VG to one larger than actual will fix the problem.

HG=c3 Horizontal gap between labels, in characters. For most label stock, this is zero, but see the description of LW.

VG=13 Vertical gap between labels, in lines. For most label stock, this is zero, but see the description of LD.

HL=n1 The number of labels across a sheet (horizontally).

VL=n2 The number of labels down a sheet (vertically).

TM, LM, VG, and LG default to 0. LW, LD, HL, and VL must be specified. These parameters may not be used to "override" the specifications of the predefined forms LABEL33 and LABEL24.

The accompanying diagram illustrates these parameters:

For the predefined forms LABEL33 and LABEL24, the values of these parameters are:

	TM	LM	LD	LW	HG	VG	HL	VL
LABEL33	1	0	5	28	0	1	3	11
LABEL24	1	0	7	28	0	1	3	8

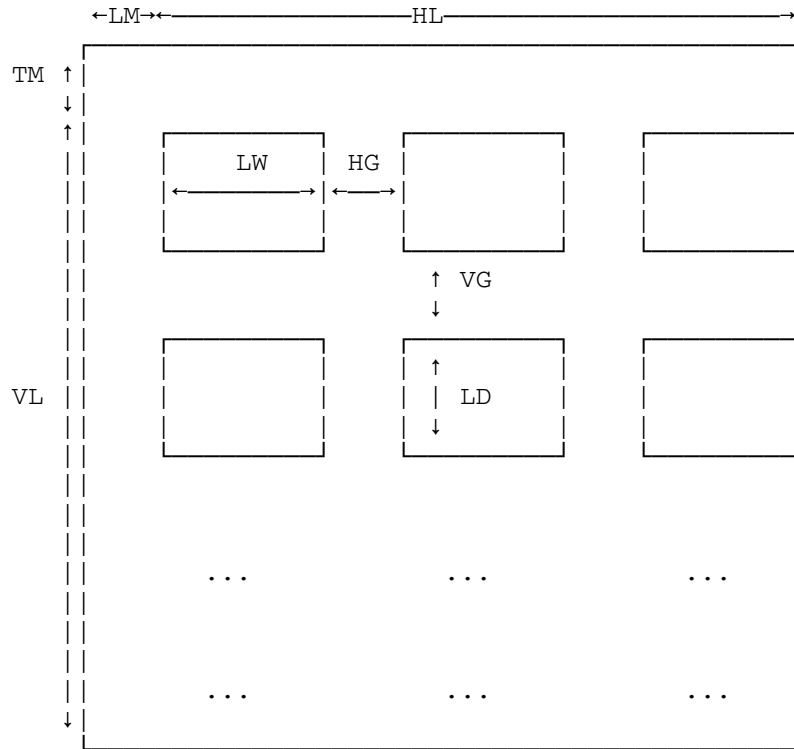
Printing Labels on the Xerox 9700

PAPER=LABEL33 and PAPER=LABEL24 will produce output suitable for papers LABEL33 and LABEL24, respectively, assuming the font used prints 10 characters and 6 lines per inch. For example,

```
$R *LABELS SCARDS=ADDR SPRINT=-T PAR=PAPER=LABEL33
$R *PAGEPR SCARDS=-T PAR=PORTRAIT,PAPER=LABEL33,MARGIN=0
```

will work. If a font with different spacing (e.g., 8 lines and 13.6 characters per inch) is used, a user-defined form must be used.

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*LABELS does not support proportional fonts.

Zip-Code Sorting

The algorithm used to locate zip codes within a line is intended to minimize the chances of "finding" something other than a zip code. It will miss some zip codes. For example, the zip code in

Ann Arbor, MI 48109

will be found, but the zip code in

Ann Arbor, MI 48109 USA

will be missed, because the zip code must be at the end of the line. Any label in which a zip code is not found will appear at the beginning of the output.

Error Conditions

If conflicting parameters are specified, or if a user-defined form is incompletely specified, *LABELS will print an error message and terminate without processing any input data. If a line must be truncated to fit on a label, an error message will be printed. If the text for

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a label requires more lines than will fit on a label, a message will be printed, and the last line(s) for that label will be omitted.

Example: The example below shows the same label data in each of the three formats:

FORMAT=LINE

```
1John Doe
  123 Main St.
  Ann Arbor, MI  48104
1James Brown
  2234 State St.
  Ann Arbor, MI  48108
1Mary Smith
  5224 Woodward
  Detroit, MI  48202
1Jane Doe
  2214 S. Woodward
  Birmingham, MI  48011
1Paul Harris
  3445 Hunter
  Birmingham, MI  48009
```

FORMAT=FREE

```
John Doe;123 Main St.;Ann Arbor, MI  48104
James Brown;2234 State St.;Ann Arbor, MI  48108
Mary Smith;5224 Woodward;Detroit, MI  48202
Jane Doe;2214 S. Woodward;Birmingham, MI  48011
Paul Harris;3445 Hunter;Birmingham, MI  48029
```

FORMAT=(1-12,13-29,30-60)

```
John Doe      123 Main St.      Ann Arbor, MI  48104
James Brown  2234 State St.      Ann Arbor, MI  48108
Mary Smith   5224 Woodward      Detroit, MI  48202
Jane Doe     2214 S. Woodward      Birmingham, MI  48011
Paul Harris  3445 Hunter          Birmingham, MI  48009
```

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*LABELSNIFF

Contents: The tape-identification program.

Purpose: To print tape information in an intelligible format.

Use: The program is invoked by the \$RUN command.

Program Key: *LABELSNIFF

Logical I/O Units Referenced:

- SPRINT - tape information output.
- SERCOM - the message "ENTER TAPE NAME" as well as confirmations and error comments.
- GUSER - input for tape names, if the PAR field is omitted or if unit 0 is not specified.
- 0 - tape to be scanned.

Parameters: The following parameters may be specified in either the PAR field of the \$RUN command or in any GUSER input line. The parameters must be separated by a blank.

- TAPE=xxx The name of the tape to be scanned, e.g., TAPE=*T*, if unit 0 is not specified.
- FILES=xxx The number of data sets on the tape to be scanned, e.g., FILES=10. If this parameter is omitted, all of the data sets will be scanned.
- FS / NOFS FS enables the automatic recognition and processing of *FS tapes. NOFS disables this processing. The default is FS.
- LP / NOLP If LP (label processing) is specified, the tape labels will be read by the system tape routines and the tape information will be passed to *LABELSNIFF for interpretation. If NOLP is specified, *LABELSNIFF will attempt to read and interpret the label information. The default is LP. Pool tapes will always be read by the system tape routines.
- OS / NOTOS If OS is specified, the LRECL (logical record length) in V and D record formats is incremented by 4. If NOTOS is specified, the LRECL remains consistent with the MTS tape conventions. The default is NOTOS.
- POSN=xxx This overrides the rewinding of the tape before the processing starts. The tape is

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positioned to the beginning of the specified data set, if possible. Otherwise, the tape will be rewound. Data set numbers or names may be entered immediately after the equal sign, e.g., POSN=*2* or POSN=COUNT.

REW The tape is rewound to the beginning of the tape after the processing is completed (the default).

NOREW The tape is positioned at the logical end of the tape or after the last data set scanned. If an attention interrupt occurs, and if the user wishes to discontinue, the tape is positioned just before the current data set.

ENGLISH The approximate tape length is given in feet (the default).

METRIC The approximate tape length is given in meters.

SKIP All data blocks are skipped. The program does not provide vital information such as record count, tape length, and average and maximum block lengths.

SHORT A short column format, with only data set name, file number, block count, record count, tape length, and record format, is provided.

LONG A long column format provides in addition to the short column format described above, average and maximum block lengths, creation date, expiration date, tape mode, user signon ID, and batch receipt number.

The default for SHORT or LONG depends on the maximum output length of the logical I/O device unit SPRINT.

Return Codes: 0 - Successful return.
 4 - Minor errors encountered.
 8 - Nonfatal tape error encountered.
 12 - Fatal tape error encountered.
 16 - System error encountered.

Description: The complete description of *LABELSNIFF is given in MTS Volume 19, Tapes and Floppy Disks.

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*LALRGEN

Contents: The LALRGEN program.

Purpose: To determine whether a context-free grammar is LALR(1) [look-ahead LR(1)].

Use: The program is invoked by the \$RUN command.

Program Key: *LALRGEN

Logical I/O Units Referenced:

- SCARDS - control cards and grammar to be processed.
- SPRINT - the results of the grammar test including diagnostic messages, listings, and other user-requested information.
- SPUNCH - the generated parse tables.
- SERCOM - diagnostic messages.

Return Codes: 0 - Successful return.
 4 - Warning messages printed.
 8 - Errors detected.

Description: LALRGEN is a program that tests whether or not a context-free grammar is LALR(1) [look-ahead LR(1)], and optionally punches a deck of tables suitable for driving an LALR(1) parser. The program was written in 1976 by Thomas G. Szymanski of the Department of Electrical Engineering and Computer Science, Princeton University and subsequently adapted for use in MTS.

This description assumes the reader is familiar with LALR parsing. For background, see Aho and Ullman, Principles of Compiler Design, Addison-Wesley (1977).

The program is run with the MTS \$RUN command using the four MTS logical I/O units SCARDS, SPRINT, SPUNCH, and SERCOM. The program reads the grammar to be processed, as well as certain control cards from SCARDS. The program writes the results of the grammar test on SPRINT, including diagnostic messages, listings, and other user-requested information. The program also writes diagnostics on SERCOM if it is assigned to a file or device different from SPRINT. The program writes the parse tables on SPUNCH. The format and quantity of output on SPRINT and SPUNCH can be controlled by several methods that are described in "Printed Output" and "Punched Output" below. The usual MTS defaults apply if SCARDS, SPRINT, SPUNCH, or SERCOM are not assigned. The following is a prototype run command for LALRGEN:

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```
$RUN *LALRGEN SCARDS=grammar SPRINT=listing  
SPUNCH=parser-tables PAR=options
```

Input:

The input to LALRGEN consists of the PAR field options and three kinds of cards. The first card of the input deck is called the "size parameter" card, and the rest of the input consists of interspersed "option" cards and "production" cards. The maximum length of any input line to LALRGEN is 256 characters.

PAR Field Options

The PAR field options for the \$RUN command include all of the options available on the @PRINT, @PUNCH, and @DEBUG option cards. These have the same effect in the PAR field as on the option cards and may be specified in either place. Two additional options, PRINT and NOPRINT, may be specified in the PAR field to control the amount of output produced on SPRINT. The PRINT option is discussed below under "Printed Output." The PAR field options may appear in any order and must be separated by one or more blanks. The length of the PAR field is limited to 256 characters.

Size Parameter Card

The first card of the input deck contains a sequence of six integer size parameters to the program. The integers must be separated by one or more blanks, and they must appear in the order given below. All six size parameters control the allocation of storage for holding the grammar and the intermediate results of the computations on it. The six size parameters are:

- (1) MAX_#_SYMS, an upper bound on the number of symbols in the vocabulary of the grammar,
- (2) MAX_#_PRODS, an upper bound on the number of productions in the grammar,
- (3) MAX_GRAMMAR_SIZE, an upper bound on the total number of symbols in all the productions of the grammar,
- (4) MAX_#_STATES, an upper bound on the number of states that the generated parser can contain,
- (5) MAX_#_KR_ITEMS, an upper bound on the number of LR(0) items in all of the basis sets of the states of the parser,
- (6) MAX_#_AFFECTED, the size of an internal table.

A value of 500 for MAX_#_AFFECTED should be sufficient for most grammars. MAX_#_SYMS, MAX_#_PRODS, and MAX_#_S-

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TATES may not exceed 999. If they are given larger values, 999 is used instead.

Production Cards

A symbol in the vocabulary of the input grammar may be any of the following: (1) the single character "<", (2) a string of up to 20 nonblank characters not starting with a "<", or (3) a string of up to 20 characters starting with a "<", followed by a nonblank character, followed by anything up to and including the next ">". The special character "@" may never appear anywhere on a production card. Symbols may actually be longer than 20 characters, but the program simply ignores all but the first 20 characters of any such symbol.

Productions are punched one per card with one or more blanks between symbols. A symbol is assumed to be a left-hand side if it begins in column one. Any other symbols on the card are assumed to be the right-hand side of the production. If column one is blank, the symbols on the card are assumed to be the right-hand side of a production with the same left-hand side as the preceding card. Lambda productions are legal, and are represented by a card with no right-hand side symbols. This implies that a blank card is a meaningful production card.

The first production card must contain an "augmenting" production that has the following characteristics. First, the left-hand side must be the start symbol of the grammar, and must not appear elsewhere in the grammar. Second, the rightmost symbol in the right-hand side must be a terminal symbol that does not appear elsewhere in the grammar.

A grammar symbol is assumed to be a terminal symbol if it never appears as the left-hand side of a production. Similarly, any symbol that appears on the left-hand side of a production is assumed to be a nonterminal. The program makes these assumptions whether or not the symbol contains the angle brackets "<" and ">".

Option Cards

Option cards are instructions to LALRGEN to perform specific operations. Option cards begin in column one with an "@" immediately followed by the option name. Usually option cards may appear anywhere after the size parameter card. Descriptions of the five types of option cards follow.

@NUMBER [symbol] ...

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This card is used for controlling the numbers assigned to terminal and nonterminal symbols of the grammar. This option is useful for interfacing a lexical analyzer with a parser for a grammar that is likely to be changed in the near future. Terminal symbols are normally assigned ascending numbers (starting with one) in order of their occurrence in the grammar. The @NUMBER option card allows a terminal to "occur" before its first use in the grammar, thus obtaining a number other than the one that would normally be assigned to it. Consider the following sequence of input cards:

```
@NUMBER tart strudel
@NUMBER cherry
<goodie> <flavor> <kind>
<flavor> apple
        cherry
<kind> pie
        strudel

tart
@END
```

This results in the following assignment of numbers to terminals:

```
tart          1
strudel       2
cherry        3
apple         4
pie           5
```

Notice that an @NUMBER card may contain more than one symbol.

Nonterminals are also assigned consecutive numbers. These numbers start after the number of the last terminal symbol, but they are assigned in reverse of the order in which the nonterminals occur in the grammar. The @NUMBER card can force the occurrence of a nonterminal before its first use in the grammar, but the numbers assigned in this way are consecutive, decreasing integers starting with the total number of symbols in the vocabulary.

@END

This card is used to indicate the end of the grammar. Any cards after the @END are ignored by LALRGEN. If it is missing, it will automatically be inserted by the program.

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@PRINT [LASET] [CLOSURE]

This card causes the program to print more than the default information about the generated parser (see the subsection "Printed Output" below for an explanation of the PRINT option). LASET causes the lookahead set of each LR(0) item to be printed when the item is printed. CLOSURE causes the listing of the items in each state to include the closure items as well as the basis items. CLOSURE is expensive in terms of both time and paper. The options may appear in any order.

@PUNCH [ALGOLW] [INTEGERS] [XPL] [EXPL] [BCPL]
 [UNPACKED_ALGOLW] [UNPACKED_INTEGERS] [UNPACKED_XPL]
 [UNPACKED_EXPL] [VOCABULARY]

This card directs the program to punch the tables with which an LALR(1) parser can be driven. Each option designates a type of table, and any combination of tables may be punched in one run of LALRGEN. XPL and EXPL are synonymous, as are UNPACKED_XPL and UNPACKED_EXPL. The different table formats are described below. If an @PUNCH card does not appear in the LALRGEN input, no tables are punched, and the logical I/O unit SPUNCH is not used. The options may appear in any order.

@DEBUG [FNA] [PROP] [MOVES] [CLOSURE1] [CLOSURE2]

This card causes the printing of various kinds of debugging information. This option card is normally used only by people modifying LALRGEN itself. The options may appear in any order.

Output:

Conceptually, the output of LALRGEN is a description of the states and functions (tables) that are needed to do an LR parse of the input grammar. The program produces this output in several forms; it writes the tables in a form suitable for human reference on SPRINT, while it writes copies of the tables in a variety of forms suitable for direct incorporation into a parser on SPUNCH.

The tables that LALRGEN produces do not duplicate exactly the form given in the literature with separate "parsing action" and "go to" functions. Instead, the program constructs one function that encodes both the action and the next state in a single numeric value. We will call this function trans. In the following paragraphs, we will describe how to extract the usual action and goto

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functions from trans, and how trans is represented in the various outputs of LALRGEN.

LALRGEN assigns integer values to the vocabulary symbols, the productions, and the parser states. trans is actually a function on integers, but for simplicity we will say "state s" when we mean "the integer assigned to state s," and the analog for other grammar objects. This minor ambiguity should be compensated by the resulting simplification of the exposition.

Like action and goto, the domain of trans is $S \times V$, where S is the set of parser states (generated by LALRGEN) and V is the set of vocabulary symbols. The range of trans is the integers interpreted as follows, where "s" is a state and "v" is a symbol:

<u>action</u> (s,v)	= shift	if <u>trans</u> (s,v) > 1
	accept	if <u>trans</u> (s,v) = 1
	error	if <u>trans</u> (s,v) = 0
	reduce by - <u>trans</u> (s,v)	if <u>trans</u> (s,v) < 0
<u>goto</u> (s,v)	= error	if <u>trans</u> (s,v) ≤ 1
	<u>trans</u> (s,v)	if <u>trans</u> (s,v) > 1

The start state of the parser is always state 1. Because of the restrictions on the augmenting production, acceptance can be and is reported at the time that the last terminal symbol would have been shifted. For this reason, reduction to the start symbol is never actually performed, and the true final state of the parser is never generated by LALRGEN. The advantage of this approach is that actions on the empty string do not need to be computed.

Clearly, one way to represent the function trans is to print a large matrix with one entry for each possible state-symbol pair. LALRGEN can do this, but for a large grammar this matrix can be huge. An alternate representation is therefore provided, called "packed," that avoids explicitly listing all the zeros (errors) inevitably present in the "unpacked" table. Packed tables consist, for each parser state, of a "symbol list," a parallel "action list," and a "default action." To find the value of trans(s,v) we look for "v" in the symbol list of "s". The corresponding value in the action list is the value of trans(s,v). If "v" is not in the symbol list for "s", then the value of trans(s,v) is the default action for "s".

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Printed Output

The printed output of LALRGEN appears primarily on SPRINT. Error messages are duplicated on SERCOM if it is assigned to a file or device different from SPRINT. The entire printed output except for error messages is suppressed if the PRINT option is off. This supersedes any @PRINT or @DEBUG option cards that may request printed output. The PRINT option defaults off unless

- (1) the run is made from batch,
- (2) SPRINT is explicitly assigned on the \$RUN command, or
- (3) an @PRINT or @DEBUG option is specified in the PAR field.

The PRINT option may be explicitly set on or off by specifying PRINT or NOPRINT in the PAR field.

The SPRINT output of LALRGEN begins with a listing of the input cards as they were read. The size parameter card is omitted from this listing. Option cards are listed, and any errors detected in them are reported here. Following this is a listing of the productions and their assigned numbers. The productions are formatted with the usual punctuation for context-free grammars. Following the productions is a listing of the vocabulary symbols and their assigned numbers, and a listing of any non-terminals that derive the empty string. Next is a listing of any conflicts encountered during construction of the LALR(1) parser. The longest component of the printed output is a detailed listing of the results of the LALR(1) analysis. This includes the LR(0) items that comprise each state, and the packed parser tables. The last item printed by LALRGEN is a table of statistics that, among other things, shows the values given on the size parameter card, and the values actually required. This information can be used to economize on storage space for runs on similar grammars.

The detailed listing of the results of the analysis mentioned above deserves more comment. This listing proceeds state by state in the order that the states were generated (and numbered). After the state number, the program prints the LR(0) items that form the basis of the state, and after this, depending on the use of the @PRINT card, the program prints the remaining LR(0) items in the state (the closure). If look-ahead sets are requested, the program will print a list of terminal symbols after each LR(0) item. These symbols will be the ones that can appear after the right-hand side of the item in a legal input string. The next item printed for each state is the portion of the packed parser tables that is associ-

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ated with the state. The symbol list and action list for the state are merged under the heading "MOVES:" with a sequence of phrases of the form "s ON v." In such a phrase, "s" is the value on the action list corresponding to the symbol "v" on the symbol list. Following all the "moves" is the default action under the heading "DEFAULT:". The last item printed for each state is a kind of cross-reference information that is not strictly part of the parser tables. Starting with the header, "ACCESSED BY:", this line is a list of all the states that can cause transitions to this state.

Punched Output

Seven distinct kinds of tables can be punched by LALRGEN. They are described here under the @PUNCH options that request them.

UNPACKED_ALGOLW

For this kind of table, LALRGEN punches six ALGOLW function procedures. NUM_PRODUCTIONS, NUM_STATES, and NUM_SYMBOLS take no parameters and return the number of productions, the number of states, and the number of vocabulary symbols, respectively. LHS_SYMBOL and RHS_LENGTH each take a single integer parameter, a production number. LHS_SYMBOL returns the assigned number of the symbol on the left-hand side of the production. RHS_LENGTH returns the number of symbols on the right-hand side of the production. TRANS takes two integer parameters, a state number and a symbol number, and returns the corresponding value of the function trans.

UNPACKED_INTEGERS

This table format provides the same information as the unpacked ALGOLW tables, but without the ALGOLW syntax. The values of the functions are punched with a PL/1 format of COLUMN(1), 20 F(4), with the first three functions on the first card, and with each function beginning a new card thereafter. The values of trans are punched starting a new card for each state.

UNPACKED_XPL or UNPACKED_EXPL

This kind of table format contains the same information again, but with XPL literals and arrays. NUM_PRODUCTIONS, NUM_STATES, and NUM_SYMBOLS are all literals. A fourth constant, NUM_TRANSITIONS, is also declared literally to be the product of the number of states and the number of symbols. LHS_

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SYMBOL and RHS_LENGTH are arrays whose subscripts are production numbers. TRANS is an array whose elements are a linearized version on the values of trans:

$$\underline{\text{trans}}(s,v) = \text{TRANS} ((s-1)*\text{NUM_SYMBOLS} + v)$$

The zero'th element of each of the XPL arrays is arbitrarily assigned the value zero.

ALGOLW

This form is a set of ALGOLW function procedures that yield packed parser tables. NUM_PRODUCTIONS, NUM_STATES, LHS_SYMBOL, and RHS_LENGTH are identical to the same procedures in the unpacked ALGOLW tables. NUM_SYMBOLS is replaced with NUM_TRANSITIONS, a parameterless function that returns the total of the lengths of all the symbol (or action) lists. The function DEFAULT_ACTION takes a state number and returns the default action for the state. The symbol and action lists are compacted into three functions, FIRST_TRANS, TRANS_SYMBOL, and TRANS_ACTION. The symbol list for state "s" is the list of values

```
TRANS_SYMBOL (FIRST_TRANS(s)),
TRANS_SYMBOL (FIRST_TRANS(s) + 1),
...
TRANS_SYMBOL (FIRST_TRANS(s+1) - 1)
```

and the action list for the same state is the list of values

```
TRANS_ACTION (FIRST_TRANS(s)),
TRANS_ACTION (FIRST_TRANS(s) + 1),
...
TRANS_ACTION (FIRST_TRANS(s+1) - 1)
```

INTEGERS

This form of parser tables provides the same information as the packed ALGOLW tables, but without the ALGOLW syntax. Like the unpacked integer tables, the values of the functions are punched with a PL/1 format of COLUMN(1), 20 F(4), with the first three functions on the first card, and with each function beginning a new card thereafter.

XPL or EXPL

This format is analogous to the packed ALGOLW tables except that XPL arrays are punched in place of the

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ALGOLW functions with parameters. NUM_PRODUCTIONS, NUM_STATES, and NUM_TRANSITIONS are punched as literals, and a new, self-explanatory literal is included, NUM_STATES_PLUS_ONE. The zero'th element of each of the XPL arrays is arbitrarily assigned the value zero.

BCPL

This form is analogous to the packed ALGOLW tables except that BCPL arrays are punched in place of the ALGOLW functions with parameters. NUM_PRODUCTIONS, NUM_STATES, and NUM_TRANSLATIONS are punched as MANIFESTs, and a new self-explanatory MANIFEST called NUM_STATES_PLUS_ONE is included. The zero-th element of each of the BCPL arrays is arbitrarily assigned the value of zero.

VOCABULARY

This option punches an entirely different kind of table from the other punch options. This causes the entire vocabulary to be punched, with the symbols in the order of their assigned numbers. Each symbol is punched on a separate card with no punctuation, starting in column one.

Miscellaneous:

LALRGEN does not detect unreachable productions. If a production is unreachable, it will be listed as part of the grammar and its symbols will be numbered, but items derived from it will be absent from the states of the resulting parser.

The program considers lowercase and uppercase letters to be different characters. This can be an advantage, because it allows grammar symbols to be input and listed in a form very similar to the way they often appear in the literature. On the other hand, if such output is mistakenly directed to a PN (uppercase only) printer, the output will be entirely uppercase and potentially very confusing.

The punched parser tables for a nontrivial grammar can be very large, particularly the unpacked tables. There is no guarantee that these tables will satisfy compiler restrictions such as those on the number of constants, number of procedures, or size of arrays.

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*LATEX

Contents: The LaTeX text-processing program.

Use: LaTeX is invoked by the \$RUN command.

Program Key: *LATEX

Logical I/O Units Referenced:
 SERCOM - error messages, error recovery prompting, and diagnostics.
 GUSER - error recovery prompt input.

LaTeX references all files explicitly by name.

Return Codes: Always zero.

Description: The complete description of the LaTeX text-processing language is given in the following publications:

LaTeX: A Document Preparation System by Leslie Lamport, Addison-Wesley Publishing Company (1984), ISBN 0-201-15790-X.
 Computing Center Memo 815, "Using LaTeX on MTS."

LaTeX is a special version of Donald Knuth's TeX text-processing system. LaTeX is actually a set of macros for use with TeX that simplify the use of TeX dramatically and provide a structured document format that handles all the typographical details for the user, while providing a variety of useful document styles and features not available in regular TeX. These include section numbering, cross-referencing, automatic table of contents generation, and indexing. The typical output device for LaTeX on MTS is the Xerox 9700 page printer.

Mathematics and technical applications that use special characters or accents are LaTeX's strong point; other text processors may be more appropriate for simple documents. LaTeX is device-independent, which means that commands used to produce a document on one device need not be changed to produce the same document on another device.

LaTeX accepts an input file containing text to be formatted and control codes to direct the formatting process and produces a device-independent (DVI) output file. The DVI file is written in internal (binary) format. This file must be processed by another program to produce readable hard-copy results. The program

*DVIXER transforms the DVI file into one that can be sent to the Xerox 9700 and printed by running *PAGEPR as the final step. Support for use of LaTeX with a phototype-setter is available also within certain font limitations.

LaTeX is designed principally for the production of multi-page documents. Although LaTeX is quite capable of producing small documents, the cost associated with initialization of LaTeX may be more than the cost of formatting a small document.

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*LCS

Contents: This file contains an LCS loader input record referring to the system low-core symbol dictionary LCSYMBOL. This card placed at the end of the user's object module can reduce the loading time of the program if no library subroutines are referenced.

Use: The LCS input record may be either copied to the end of the user's object module

\$COPY *LCS OBJECT(LAST+1)

or concatenated to the object file on the \$RUN command

\$RUN OBJECT+*LCS

Program Key: *EXEC

Description: Normally, the dynamic loader will search the system library *LIBRARY for unresolved symbols. The file *LIBRARY has an LCS loader input record at the end of it which causes the search of the low-core symbol dictionary if the symbol is not found in *LIBRARY. By appending an LCS input record to the end of the user's object module, the search of the low-core symbol dictionary is made before the search of *LIBRARY is made. Thus, if the user's object module does not refer to any *LIBRARY symbols, this file will not be searched if all unresolved symbols are found in the low-core symbol dictionary. This will reduce the loading time for the program.

For further information on the dynamic loader and loader records, see the section "The Dynamic Loader" in MTS Volume 5, System Services.

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*LIBRARY

Contents: The standard MTS subroutine library.

Use: In standard use, *LIBRARY is never explicitly invoked. Instead, after loading the user's explicitly specified object modules, the system loader will implicitly scan *LIBRARY if there remain any unresolved external symbols. This implicit scanning of libraries by the system loader can be controlled by the MTS \$SET command options

```
$SET *LIBRARY={ON|OFF}
$SET LIBR={ON|OFF}
$SET LIBSRCH={ON|OFF}
```

as described in MTS Volume 1, The Michigan Terminal System.

Program Key: *EXEC

Example: If the user specifies

```
$RUN -LOAD+*PLOTSYS
```

then the loader goes through the following steps:

- (1) The object modules in the file -LOAD are loaded and linked together.
- (2) Next, the object modules are selectively loaded from *PLOTSYS (since it is a library) to resolve external symbols (i.e., subroutine names) in -LOAD.
- (3) Finally, if there are still unresolved external symbols, *LIBRARY is searched for the appropriate object modules.

Description: A list of and descriptions of the subroutines contained in *LIBRARY is contained in MTS Volume 3, System Subroutine Descriptions, along with a description of the format of a library. Note that *LIBRARY is only one of several libraries available in MTS. Others (which must be specified explicitly on a \$RUN or \$LOAD command) are *CBELLLIB, *CSMPLIB, *EXPLLIB, *ICONLIB, *PASCALJBLIB, *PASCALVSLIB, *PLOTSYS, *PL1FLIB, *PL1OPTLIB, *SPITLIB, *TANGOLIB, and *WATLIB.

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*LINKEDIT

Contents: The MTS linkage editor.

Purpose: To link-edit files that contain programs in object module form.

Use: The program is invoked by the \$RUN command.

Program Key: *LINKEDIT

Logical I/O Units Referenced:

 SCARDS - either the input file containing the object modules to be edited, or a sequence of linkage editor commands.

 SPRINT - printed output produced by the linkage editor.

 SPUNCH - default output unit for object modules punched by the linkage editor.

 SERCOM - linkage editor diagnostics and prompting messages.

 GUSER - user responses to prompting (if terminal mode).

Parameters: The following parameters may be specified in the PAR field of the \$RUN command. The parameters must be separated by commas or blanks. The minimum acceptable abbreviation for each parameter is underlined.

COMSAVE/NOCOMSAVE

COMSAVE specifies that COM (comment) records are to be saved during linkedit processing. NOCOMSAVE specifies that COM records are not saved. The default is NOCOMSAVE.

GENSAVE/NOGENSAVE

GENSAVE specifies that object module generation information on COM and END records is to be preserved if a combine operation is performed. NOGENSAVE specifies that the generation information is to be discarded. The default is NOGENSAVE.

SYMSAVE/NOSYMSAVE

SYMSAVE specifies that SYM (symbol) records are to be saved during linkedit processing (except during a combine operation). NOSYMSAVE specifies that SYM records are not saved. The default is SYMSAVE.

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EMPTY/NOEMPTY

EMPTY specifies that the output file assigned to SPUNCH is to be emptied before use. NOEMPTY specifies that the output file is not to be emptied. The default is NOEMPTY.

ORL=n

"n" specifies the maximum output record length to be used for output produced by the linkage editor. The default is the maximum record length of the output file or device.

GAPSIZE=n

"n" specifies the maximum object module text gap size to be filled during linkage editor processing.

MISCSAVE/NOMISCSAVE

MISCSAVE specifies that miscellaneous loader records (ALI, DEF, LCS, NCA, OPT, and RIP) are to be preserved during linkedit processing. NOMISCSAVE specifies that these records are to be deleted. The default is MISCSAVE.

MSGSAVE/NOMSGSAVE

MSGSAVE specifies that MSG (message) records are to be saved during linkedit processing. NOMSGSAVE specifies that MSG records are not saved. The default is MSGSAVE.

WXTOER/NOWXTOER

WXTOER specifies that all ESD (external symbol dictionary) symbols of type WX (weak external reference) are to be converted to type ER (external reference) during linkedit processing. NOWXTOER specifies that type WX symbols are not converted. The default is NOWXTOER.

TERSE/VERBOSE

The TERSE/VERBOSE parameters control the amount of information produced by the verification of some commands. TERSE specifies that minimal information is requested; VERBOSE specifies that full information is desired. The default is VERBOSE. This parameter pair has no effect if NOVERIFY is specified.

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VERIFY/NOVERIFY

VERIFY specifies that verification for each command is requested. NOVERIFY suppresses the verification. The default is VERIFY.

Return Codes: None.

Description: The linkage editor in MTS provides a wide range of facilities for manipulating programs which are in object module form. These facilities fall roughly into three categories: making physical changes to object programs, making logical changes to object programs, and examining the structure of object programs.

Physical changes to an object program have no effect on its execution. A large number of physical formats can represent the same object program. The linkage editor provides facilities for changing from one physical format to another so that:

- (1) an object program will fit on an alternative storage medium (e.g., from a sequential file to the card punch),
- (2) the CPU time required to load an object program is minimized,
- (3) the file space required to store an object program is minimized.

The linkage editor also provides facilities for changing the logical structure of object programs. Symbols in object programs can be replaced or deleted. Object modules can be combined, deleted, or replaced. The loader-defined entry point can be changed.

Interrogative facilities are also available for examining the logical structure of object programs. Maps and cross-reference tables of the symbols defined and referenced in an object program can be displayed.

Those users who want only to reformat object modules can simply do the following:

```
$RUN *LINKEDIT SCARDS=inFDname SPUNCH=outFDname
```

In this case, object modules will be read from "inFDname", converted to linkage editor internal representation, and written out on "outFDname". The logical structure of the modules will be completely and identically preserved, with the following exceptions:

- (1) REP records encountered in input modules will be absorbed into the text of output modules. Input

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modules are object modules read in by the linkage editor. Output modules are object modules written out by the linkage editor.

- (2) If multiple ENT records are encountered, all but the first ENT record encountered are discarded.
- (3) Nonabsolute DEF records will be incorporated into the external symbol dictionary of the appropriate output modules.
- (4) The first LDT record encountered terminates input, but is preserved in the output module(s).
- (5) Library control records are ignored. If a library is read in, all of its modules will be written out, minus any library control records.
- (6) COM records are discarded.

Those users who wish to use the more advanced features of the linkage editor must use the linkage editor command language described in Volume 5, System Services. Commands are read from SCARDS and printed output is written on SPRINT. The typical \$RUN command to use the linkage editor in command mode is:

```
$RUN *LINKEDIT
```

Command input is terminated by an end-of-file or by the STOP command.

Example: \$RUN *LINKEDIT SCARDS=OBJ1 SPUNCH=OBJ2

The object modules in the file OBJ1 are processed by the linkage editor and written into the file OBJ2.

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*LINK11

Contents: The PDP-11 link editor.

Use: The program is invoked by the \$RUN command.

Program Key: *LINK11

Logical I/O Units Referenced:

GUSER - command line input.

SPRINT - response to the commands.

Return Codes: Always zero.

Description: The MTS loader records produced by one or more runs of *11ASR are processed and an absolute binary loader tape is produced. The reading of data and writing of the results is under the control of the command language. The full description of the commands is given in Computing Center Memo 286.

Example: \$RUN *LINK11

The above command invokes the PDP-11 link editor.

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*LOCALPLOT

Contents: A program to plot output on a plotter local to a terminal/microcomputer cluster.

Use: The program is invoked by the \$RUN command.

Program Key: *LOCALPLOT

Logical I/O Units Referenced:

- SCARDS - file to be plotted.
- SPRINT - program nonplot output.
- SERCOM - program error messages.

Parameters: The following parameters may be specified on the \$RUN command. These will control the different options for the plotting and the plot-file conversion. The minimum abbreviation for each parameter is underlined.

LOCATION=plotter-location

The LOCATION option specifies the location of the local plotter. Normally this parameter is not needed since, by default, the plotter will be selected from a system table giving the locations of the plotters for each terminal cluster. This parameter is only required if the terminal is not in the system table, the terminal is a dial-up terminal, or a different plotter site is desired.

PLOTTER=plotter-type

The PLOTTER option specifies the type of plotter to be used at a certain location. Normally this parameter is not needed, since the program will select the default plotter to use at a certain location. This parameter is only required if there is more than one type of plotter at a single location, and the default type is not desired.

NOCHECK

The NOCHECK parameter specifies that the validity of the input file is not to be checked. The program will normally check the input file to see if it is a valid file for the plotter to use. It is very difficult to completely check a file full of HPGL commands, hence the program will only check the first three characters of that file for the HPGL plotter-on command, which is "ESC . (" or "ESC . Y".

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The Hewlett-Packard 7550 Plotter will work properly without the plotter-on and plotter-off commands, but every HPGL file generated in MTS will have these as the first three characters. Files with HPGL commands produced from other sources might not have these commands at the front. Caution should be used when using this parameter, since if an incorrect file is sent to the plotter, unpredictable results may occur.

SLOW

The SLOW option plots the plot-file at a slower speed than normal. This will help improve the quality of the lines drawn, but will also increase the amount of time taken to draw the plot.

The following parameters only apply to the plot-file conversions:

CENTER

The CENTER option specifies that the plot is to be centered on the page. The plot will be positioned such that its midpoint is mapped to the page midpoint, i.e., the point $((x_{max}-x_{min})/2)$ of the plot is mapped to the center of the page (this is (5.5,4.25) in landscape mode and (4.25,5.5) in portrait mode). The CENTER option will override any SHIFT or ORIGIN option specifications. CENTER is useful only if NOFIT is specified; the plot is automatically centered in FIT mode.

FIT

The FIT option optimally fits each plot onto the plotter paper. The Hewlett-Packard 7550 Plotter uses 8.5 x 11 inch paper with a drawing area on that paper of 7.75 x 10.0 inches. A fitted plot will be scaled so that it is as large as possible without any part of the plot being clipped. FIT is the default mode.

FRAME={n | (n,m) | ALL}

The FRAME option specifies which plots in the file are to be drawn. For example, FRAME=5 will draw the fifth plot, FRAME=(3,6) will draw the third through sixth plots, and FRAME=ALL will draw all the plots. The default is FRAME=ALL.

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LANDSCAPE

The LANDSCAPE option specifies that the plot drawn is to be oriented in landscape mode, i.e., the x-axis will be parallel to the 11-inch edge of the paper.

NOFIT

The NOFIT option specifies that the coordinates to be used in each plot are in absolute inches. No implicit scaling is performed on the plots, and coordinates which are outside of the drawing area on the plotter paper (10.0 inches for "x" and 7.75 inches for "y" on the HP 7550) will be clipped appropriately. The origin point (0.0,0.0) is at the extreme bottom left-hand corner of a page, which means that coordinates in the negative axis range will be clipped.

ORIGIN=(x,y)

The ORIGIN option may only be used in conjunction with the NOFIT option. By default, the origin point (0.0,0.0) of a NOFIT plot is located at the extreme bottom left-hand corner of a page. The ORIGIN option allows the location (0.0,0.0) to be relocated to an arbitrary point, not necessarily within the boundaries of a physical page. It is up to the user to ensure that a plot remains within the visible region if this option is used.

Either the "x" value, the "y" value, or both, may be omitted from an ORIGIN command; unspecified parameters will default to 0.0. A maximum of three digits following the decimal point may be given.

The ORIGIN specification is not affected by the presence of a SCALE specification (i.e., the origin coordinates are not scaled). Using the effects of these two options, it is possible to increase the visible viewing region of a plot.

PEN(color,size)=newcolor

The PEN option respecifies the pen colors. "color" and "size" specify the color and size of the pen to be changed; "newcolor" specifies the new color of the pen. The "size" parameter may be omitted if the "color" parameter unambiguously specifies the pen to be changed, e.g., there is not both a medium and fine pen to the same color. For example, to have the only red pen in the plot drawn as blue, specify

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PEN(RED,)=BLUE; to have a fine black pen drawn as green, specify PEN(BLAC,FINE)=GREE. If a PPEN record in a plotfile specifies a nonsupported color, that color will be drawn as black.

PORTRAIT

The PORTRAIT option specifies that the plot drawn is to be oriented in portrait mode, i.e., the x-axis will be parallel to the 8.5-inch edge of the paper.

SCALE=scale-factor

The SCALE option specifies a scaling factor which must be in the range $0.0 < \text{scale-factor} \leq 1.0$. In FIT mode, this scaling is applied to the image after it has been fitted onto a page. The default scale factor is 1.0.

SHIFT

The SHIFT option may only be used in conjunction with the NOFIT option. By default, a plot produced in NOFIT mode has its origin at the bottom left-hand corner of a page. Specifying the SHIFT option will cause each image to be translated up by one inch to give more space at the bottom of the page. The SHIFT option is the same as specifying ORIGIN=(0.0,1.0).

Return Codes: 0 - Successful return.
4 - Unable to generate plot.

Description: This program is designed to allow users working at a terminal/microcomputer cluster plot output on a plotter at that location. The program can either take a file containing commands for the plotter, or an MTS plot-file, which will be automatically converted. The program will automatically select the appropriate UMnet network address for the local plotter from a system table, and then route the output and necessary plotter controls to that plotter.

See Computing Center Memo 465, "*LOCALPLOT: Plotting at Remote Stations," for further information on plotting files on local plotters.

Example: \$RUN *LOCALPLOT SCARDS=PLOTFILE

In the above example, the plot contained in the file PLOTFILE is plotted on the local plotter.

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*LOCALPRINT

Contents: A program to print output on a printer local to a workstation cluster.

Use: The program is invoked by the \$RUN command.

Program Key: *LOCALPRINT

Logical I/O Units Referenced:

SCARDS - output to be printed.
SPRINT - program error messages.

Parameters: The following parameters may be specified on the \$RUN command. The following parameters apply to all types of local printers.

LOC=xxx The LOC parameter specifies the location of the local printer. Normally this parameter is not needed since, by default, the printer will be selected from a system table giving the locations of the printers for each terminal cluster. This parameter is only required if the terminal is not in the system table, the terminal is a dial-up terminal, or the user wishes to select a different printer site.

BINARY The BINARY parameter specifies that the output is to be printed without any conversion. Normally, the program converts the output to ASCII and adds printer controls that are appropriate to the local printer. The BINARY parameter is normally only used when printing output from certain text processors (e.g., T³ or Microsoft WORD) which have their own printer driver programs for the local printer.

NOCC The NOCC parameter specifies that the output file does not contain carriage-control characters.

PRETDAY PRETDAY assumes that the output file contains pre-T-Day translation codes (i.e., the file was created before February 22, 1988 and not translated). See Computing Center Memo 480, "Translation Day Character Code Changes on MTS."

The following parameters apply only to the Xerox 2700 or the Xerox 4045 local page printers.

PORTRAIT or LANDSCAPE This parameter specifies either portrait or landscape orientation for the output. The default is LANDSCAPE.

MARGIN=xx.x The MARGIN parameter specifies the left margin width (in inches). By default, the left margin is .667 inches for landscape and 0.5 inches for portrait output.

RESET The RESET parameter sends a reset sequence to the printer before the job is started. Normally, this is not required except when the previous job was fatally terminated while printing output. If the current job is printing in unexpected typefaces, then rerunning *LOCALPRINT with RESET specified may correct this problem.

HEAD/NOHEAD The HEAD parameter specifies that an identifying headsheet is to be printed with each job. The NOHEAD parameter specifies that the headsheet is to be omitted. The default is HEAD for the Xerox 4045 printer and NOHEAD for the Xerox 2700 printer.

NOREV The NOREV parameter specifies that the pages are not to be printed in the reverse order. This parameter applies only to the Xerox 4045 printer.

Return Codes: 0 - Successful return.
 4 - Empty input file or stopped by attention interrupt.
 8 - Error termination (no output printed).

Description: This program is designed to allow users working at a workstation cluster to print output on a local printer attached to the cluster. The program automatically selects the appropriate network address for the local printer from a system table and then routes the output and necessary printer controls to that printer.

For the Xerox 2700 and 4045 page printers, an identifying headsheet is printed with the output so that output from one job can be distinguished from the next job. This headsheet may be suppressed by specifying the NOHEAD parameter.

For the Xerox 4045 page printer, the pages are printed in the reverse order so that they will be in the correct

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order when they are stacked. This may be overridden by specifying the NOREV parameter.

Example: \$RUN *LOCALPRINT SCARDS=MYOUTPUT

In the above example, the output contained in the file MYOUTPUT is printed on the local printer.

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*LOGPURGE

Contents: A program to delete lines from a file based on a date recorded in each line (a log file) or from a file produced by the MTS \$LOG command.

Use: The program is invoked by the \$RUN command.

Program Key: *LOGPURGE

Logical I/O Units Referenced:

0 - the name of the line file to be purged.
 SERCOM - error comments.

Parameters: The following parameters may be specified in the PAR field of the \$RUN command. The parameters must be separated by blanks or commas; the underlined portion of each parameter may be used as an abbreviation.

RETENTION This parameter specifies the number of days, weeks, months, or years that a line is to be retained in the file. This parameter is specified in the form

[RETENTION=]n[{D|W|M|Y}]

The default is 7 days (7D). A month (M) is defined to be 365/12 days, and a year is defined to be 365 days.

DATEOFFSET This parameter specifies the offset from the beginning of each line in the file for the date used to determine if the line is to be purged. The parameter is specified in the form

DATEOFFSET=n

The default is zero. This parameter is ignored for UNIT=\$LOG.

RENUMBER This parameter specifies that the file is to be renumbered after purging starting with line 1 and incrementing by 1.

UNIT This parameter specifies the unit for the date. The parameter is specified in the form

UNIT={CHAR | DAYS | MINUTES | SECONDS | MSECONDS | ALPHA | \$LOG}

The default is CHAR (mm/dd/yy). CHAR is 8 bytes in length; MSECONDS (microseconds) is an 8-byte, binary integer; ALPHA (mmm dd/yy) is a 9-byte, character representation of the date using 3-character abbreviations for the months; \$LOG is produced by the MTS \$LOG command; the other units are 4-byte, binary integers. DAYS, MINUTES, SECONDS, and MSECONDS are based on March 1, 1900 with 0 equivalent to 03/01/00 00:00:00.000000.

| Return Codes: 0 - Successful return
 | 4 - Error return

Description: Each line of the file assigned to logical I/O unit 0 is deleted until a line is encountered which has a date more recent than the current date minus the number of days specified by the RETENTION parameter.

Example: \$RUN *LOGPURGE 0=ONEWEEK PAR=RENUMBER

In the above example, all records in the file ONEWEEK are deleted until the date, in the form mm/dd/yy starting in column position 1, is greater than or equal to the date of the day 7 days before the current day. The lines in the file are then renumbered.

\$RUN *LOGPURGE 0=TWOMONTHLOG PAR=2M D=1 R

In the above example, all records in the file TWOMONTHLOG are deleted until a record is encountered with a date greater than or equal to the date of the day 61 days before the current day. The date is 8 characters starting in column position 2 of the record. After deletion, the remaining lines are renumbered.

\$RUN *LOGPURGE 0=LOG PAR=RET=3 R U=\$LOG

In the above example, all records in the file LOG are deleted until a record is encountered beginning with "1\$Log output:" and ending with a date of the form "mmm dd/yy" that is greater than or equal to the date of the day 3 days before the current day. The file is produced by the MTS \$LOG command. After deletion, the remaining lines are renumbered.

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*MACBINHEX

Contents: A program to convert Macintosh files from Binhex 4.0 format to the Macintosh External File System (EFS) format.

Use: The program is invoked by the \$RUN command.

Program Key: *MACBINHEX

Logical I/O Units Referenced:

SCARDS - the input file containing the Binhex 4.0 file to be converted.

SPUNCH - the output file to receive the converted file.

Return Codes: 0 - Successful return.
4 - Invalid Binhex file.
8 - Checksum error. File corrupted.

Description: The *MACBINHEX program takes a Binhex 4.0 formatted file that has been uploaded to MTS from a Macintosh microcomputer and converts it to a file which can be used with the Macintosh External File System (EFS), *MACPAINT4045, or *MACWRITE9700. For information on uploading MTS files, see Computing Center Memo 904, "Using the Macintosh as a UMnet terminal: The Kermit Program." For further information on Macintosh conversion programs, see Computing Center Memo 905, "Macintosh to MTS Conversion Programs."

Example: \$RUN *MACBINHEX SCARDS=BINHEXFILE SPUNCH=MACEFSFILE

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*MACPAINT4045

Contents: A conversion program allowing MacPaint files to be printed on a Xerox 4045 printer.

Use: The program is invoked by the \$RUN command.

Program Key: *MACPAINT4045

Logical I/O Units Referenced:

SCARDS - input file containing a MacPaint picture.
 SPUNCH - output file ready for *LOCALPRINT.

Parameters: The following parameters may be specified in the PAR field of the \$RUN command. The case and positioning of the parameters is unimportant. If a parameter is specified more than once, the right-most value will be used. The underlined portion is the minimum abbreviation for that option.

{MAGNIFICATIONFACTOR|MAGFAC}={1|2|4} Default: 4

The MAGNIFICATIONFACTOR determines the size of the processed image on the page. MAGNIFICATIONFACTOR=4 is the default, which indicates that the MacPaint picture should be expanded to fill the entire page. MAGNIFICATIONFACTOR=2 produces a picture one quarter (1/4) the size of the page, and MAGNIFICATIONFACTOR=1 produces a picture one-sixteenth (1/16) the size of the page.

CENTERED / NOCENTERED Default: NOCENTERED

The CENTERED option centers the printed image on the page. The option is ignored if POSITION=(x,y) is specified in the PAR field.

BORDER / NOBORDER Default: NOBORDER

The BORDER option puts a small blank border around the printed picture. This option is valid only if the POSITION=(x,y) option is used, otherwise it is ignored.

POSITION=(x,y)

The POSITION=(x,y) option allows specifies where on the page the picture is placed. "x" and "y" can have values from 1 to 4. The "x" axis is along the short edge of the page and the "y" axis is along the

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long edge of the page. POSITION=(1,1) indicates the upper-left corner of the page (in portrait orientation) while POSITION=(4,4) indicates the lower-right portion of the page. If the x-y coordinate is one of (1,1), (1,2), (2,1), or (2,2), the MAGNIFICATIONFACTOR will default to 2 and the picture will cover one quarter of the sheet. Positions (1,3), (1,4), (2,3), (2,4), (3,1), (3,2), (3,3), (3,4), (4,1), (4,2), (4,3), (4,4) default to MAGNIFICATIONFACTOR=1 and cannot have any other MAGNIFICATIONFACTOR. A MAGNIFICATIONFACTOR larger than this will be ignored, but a smaller MAGNIFICATIONFACTOR will be used if specified.

Return Codes: 0 - Successful return.
4 - Invalid MacPaint file.

Description: The program *MACPAINT4045 takes a MacPaint file, which must first be transferred from the Macintosh to MTS, as input and prepares an output file containing the processed MacPaint file, which can then be printed on the Xerox 4045 printer in portrait orientation. For information on uploading MacPaint pictures from the Macintosh to MTS, see Computing Center Memo 904, "Using the Macintosh as a UMnet Terminal: The Kermit Program." To produce a picture ready for the Xerox 4045, issue the command:

```
$RUN *MACPAINT4045 SCARDS=paintfile SPUNCH=output
      [PAR=options]
```

where "paintfile" is the MacPaint file which has been uploaded to MTS and "output" is a file to hold the processed MacPaint picture. To finally print the picture, issue the command:

```
$RUN *LOCALPRINT SCARDS=output PAR=BINARY
```

For further information on Macintosh conversion programs, see Computing Center Memo 905, "Macintosh to MTS Conversion Programs."

Example: \$RUN *MACPAINT4045 SCARDS=PAINTFILE SPUNCH=XEROXFILE

In the above example, the MacPaint picture in the file PAINTFILE is converted to a print file for the Xerox 4045 printer.

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*MACUTIL

Contents: The MTS macro-library editor.

Purpose: To edit files that contain 370 assembler language or *FORMAT macros.

Use: The program is invoked by the \$RUN command.

Program Key: *MACUTIL

Logical I/O Units Referenced:

- SCARDS - the input file containing the macros to be replaced.
- SPRINT - printed output produced by the macro-library editor.
- SERCOM - diagnostic messages.
- GUSER - a sequence of commands or user responses in conversational mode.
- 0 - default unit for the macro library to be edited.

Parameters: The following parameters may be specified in the PAR field of the \$RUN command. The parameters must be separated by commas or blanks. Parameters may be negated by "-", "~", "NO", or "N". The minimum acceptable abbreviation for each parameter is underlined.

BREAK=n

Each new macro or copy section added to the edit file begins at the next highest multiple of the line number "n" after the last line in the macro library. Lines currently in the edit file are not changed to reflect the new value. The default value is 100.000. No fractions are permitted.

BUILDIR

The BUILDIR parameter specifies that the macro-library editor is to produce a directory in the macro library. The library is assumed to have no directory but just a series of macros and/or copy sections. The default is NOBUILDIR; i.e., the macro library should not have the directory generated.

EMPTY

The EMPTY parameter specifies that the macro library assigned to unit 0 is to be emptied before use. NOEMPTY specifies that the macro library is not to be emptied. The default is NOEMPTY. EMPTY has no effect in command mode.

HDRGEN

The HDRGEN parameter specifies that MACUTIL generate a copy-section header whenever a copy section is added with the NAME modifier in the ADD, INCLUDE, REPLACE, and UPDATE commands. NOHDRGEN specifies that the copy-section header should not be generated. The default is HDRGEN.

INCREMENT=n

The INCREMENT parameter may be used to increment each successive line in the macro library. The default is 1.000.

QUIT

The QUIT parameter specifies that if the macro-library editor encounters any errors in batch mode, the user is signed off. NOQUIT specifies that the batch user is not to be signed off if an error occurs. The default is NOQUIT.

SEQ

The sequence numbers in columns 73-80 are normally not removed. But if SEQ=OFF, they are deleted and the SEQ parameter can be used to truncate any new macros. The default is SEQ=ON.

START=n

The START parameter specifies that, if a macro library is empty or is to be renumbered, the first line of a first macro should start at MTS line number n. The parameter should be an integral number, and the default is 1000.

TERSE/VERBOSE

The TERSE/VERBOSE parameters control the amount of information produced by the verification of some commands. TERSE specifies that minimal information is requested; VERBOSE specifies that full information is desired. TERSE is an antony-

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mfor VERBOSE. The default is the setting of the MTS TERSE option. This parameter pair has no effect if NOVERIFY is specified.

UPDATE/REPLACE

The UPDATE/REPLACE parameters control whether the file assigned to SCARDS is an update or replacement file in no-command mode. UPDATE specifies that macros or copy sections read from SCARDS not in the edit file will be included. REPLACE specifies that new macros will be excluded. The default is UPDATE. The parameters are effective only if SCARDS is specified in the \$RUN command.

VERIFY

The VERIFY parameter specifies that verification for each command is requested. NOVERIFY suppresses the verification. The default is VERIFY.

Return Codes: 0 - Successful return.
4 - Errors detected.
8 - Errors detected.
12 - Unsuccessful return.

Description: The MTS macro-library editor is used for the editing of macro libraries. Many *OBJUTIL facilities, such as replacing macros, are incorporated in this macro-library editor. The macro-library editor provides facilities to replace, add, delete, or correct a macro.

Those users who want only to update their macro library can simply issue the following command:

```
$RUN *MACUTIL SCARDS=inFDname 0=editFDname
```

In the above case, macros are read from "inFDname", and written on "editFDname" replacing any previous macros. The logical structure of the macros is completely preserved except that the duplicate macros from "inFDname" are discarded. Unless the parameter REPLACE is specified, additional macros are also added to the macro library.

A typical example is a file consisting of several macros in the file MAC. While assembling the macros, the user discovers an error in one of the macros. This error may be corrected in the source file by the MTS file editor. After the macro is checked, the macro-library editor may be used to replace the erroneous macro in the macro library as follows:

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```
$RUN *MACUTIL SCARDS=MAC 0=MACLIB
```

In this example, the source code for the macros replaces corresponding macros in the file MACLIB. In addition, any macro that exists in MAC but not in MACLIB is also added.

Users who only want to build the directory in the macro library can simply issue the following command:

```
$RUN *MACUTIL 0=editFDname PAR=BUILDIR
```

The first record of the file "editFDname" should not start at line 1; otherwise, *MACUTIL will not be able to build the directory properly (the directory starts at line 1). It is recommended that the first record start at line 1000; this will allow enough room for the directory.

Those users who desire to use the more advanced features of the macro-library editor must use the macro-library editor command language which is described in MTS Volume 14, 360/370 Assemblers in MTS. Commands are read from GUSER and printed output is written on SPRINT. The typical \$RUN command to use the macro-library editor in command mode is

```
$RUN *MACUTIL
```

Command input is terminated by an end-of-file or by the STOP command.

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*MACWRITE9700

Contents: A conversion program allowing MacWrite files to be printed on a Xerox 9700 page printer.

Use: The program is invoked by the \$RUN command.

Program Key: *MACWRITE9700

Logical I/O Units Referenced:

SCARDS - input file containing a MacWrite 4.5 document.

SPUNCH - output file ready for the Xerox 9700 page printer.

Return Codes: 0 - Successful return.
4 - Invalid MacWrite file.

Description: The program *MACWRITE9700 takes a MacWrite 4.5 file, which must first be transferred from the Macintosh to MTS, as input and prepares an output file containing the processed MacWrite file, which can then be printed on the Xerox 9700 page printer. For information on uploading MacWrite files from the Macintosh to MTS, see Computing Center Memo 904, "Using the Macintosh as a UMnet Terminal: The Kermit Program." For further information on the MACWRITE9700 program, see Computing Center Memo 905, "Macintosh to MTS Conversion Programs."

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*METATRAN

Contents: The DI-3000 Metafile Translator.

Use: The appropriate DI-3000 library file should be concatenated to the DI-3000 Metafile Translator on the \$RUN command, e.g.,

\$RUN *METATRAN+*DI3000.TX4010

Program Key: *EXEC

Logical I/O Units Referenced:

- 5 - Input (default: *SOURCE*)
- 6 - Output (default: *SINK*)
- 90 - Segment Storage Output (default: *SINK*)
- 91 - Segment Storage Input (default: *SOURCE*)
- 92 - Metafile System Output (default: *SINK*)
- 93 - Metafile System Input (default: *SOURCE*)
- 94 - Device Driver Output (default: *SINK*)
- 95 - Device Driver Input (default: *SOURCE*)
- 96 - Metafile Translator Alternate Input Unit
- 97 - Metafile Translator Logging (-METALOG(*L+1))
- 99 - Scratch

Return Codes: Always zero.

Description: The DI-3000 Metafile Translator is an interactive program that postprocesses DI-3000 metafiles, sending graphics output to a selected graphics device. A metafile contains device independent picture information, each picture being equivalent to the sequence of DI-3000 calls that first defined the picture. Pictures may be read from up to five metafiles concurrently. They may be positioned, scaled, and superimposed on a selected graphics device. In addition, pictures from different metafiles may be combined and written to a new metafile.

For a more complete description of DI-3000 and the DI-3000 Metafile Translator, see Computing Center Memo 463, "Using the DI-3000 Graphics Library in MTS."

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*MPS

Contents: The Mathematical Programming System (MPS).

Purpose: To solve linear programming problems and separable programming problems.

Use: The program is invoked by the \$RUN command.

Program Key: *MPS

Logical I/O Units Referenced:
 SCARDS - the MPS source program and data. The program and data must be separated by a blank card.
 SPRINT - the output produced by the program.

Return Codes: 0 - Successful return.
 8 - Error return.

Description: MPS is an IBM program composed of a set of procedures that permit the solution of linear programming problems and separable programming problems. The full description of MPS is given in the IBM publication, Mathematical Programming System/360, form GH20-0476.

Example: \$RUN *MPS
 PROGRAM('ND')
 INITIALZ
 MOVE(XDATA,'EXAMPLE')
 MOVE(XPBNAME,'PBFILE')
 CONVERT('SUMMARY')
 SETUP
 MOVE(XOBJ,'COST')
 MOVE(XRHS,'RHS1')
 PRIMAL
 SOLUTION
 EXIT
 PEND

NAME	EXAMPLE			
ROWS				
N	COST			
L	ONE			
G	TWO			
E	THREE			
COLUMNS				
C1	ONE	3.0	TWO	-2.0
C1	THREE	2.0	COST	1.0
C2	ONE	2.0	TWO	1.0
C2	THREE	2.0	COST	2.0

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C3	ONE	3.0	TWO	-2.0
C3	THREE	1.0	COST	3.0
C4	ONE	-1.0	TWO	1.0
C4	THREE	1.0	COST	4.0
RHS				
RHS1	ONE	25.0	TWO	5.0
RHS1	THREE	20.0		
ENDATA				
\$ENDFILE				

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*MTSBIBLIOGRAPHY

Contents: A literature reference list of articles about the design of MTS.

Use: The \$COPY command should be used, e.g.,

\$COPY *MTSBIBLIOGRAPHY

Description: The list of articles is organized by author.

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*MVC

Contents: A record rearrangement program (move characters).

Purpose: Permits the user to rearrange the characters in a record according to a specified pattern, and to insert literal characters and/or sequence fields into each record.

Use: The program is invoked by the \$RUN command.

Program Key: *MVC

Logical I/O Units Referenced:

SCARDS - input records to be rearranged.

SPUNCH - output records after rearrangement.

SERCOM - error comments, prompting messages, and summary information.

GUSER - user responses to prompting messages (if any).

Return Codes: 0 - Successful return.
4 - Control command error (batch mode only).

Description: The user provides a pattern that describes the organization of output records produced by *MVC. The pattern consists of one or more elements that control the selection of characters to be placed in an output record and their position in the record.

Several types of elements may be included in the specified rearrangement pattern; consecutive elements must be separated by a single comma. The general form of the pattern is

$$e(1),e(2),\dots,e(i),\dots,e(n)$$

where e(i) is an element of the pattern. The program scans the pattern and produces a logically equivalent internal pattern that is applied to all subsequent input records. An error comment is produced if an error is detected while scanning the elements of the pattern. Scanning of the pattern is terminated when the last character is encountered or when a blank is encountered.

The pattern may contain up to 128 elements. Pattern elements are of seven types:

- (1) Single-Column Element

The single-column element is a decimal integer "dd" such that $1 \leq dd \leq 32767$. This element

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specifies that the character in position "dd" of the input record should be placed in the next available position of the output record.

(2) Column-Range Element

The column-range element has the form "bb"- "ee", where "bb" and "ee" are decimal integers such that $1 \leq bb$ and $ee \leq 32767$. This element specifies that the characters in positions "bb" through "ee" (inclusive) of the input record are to be placed in the next available positions of the output record. "bb" may be less than, equal to, or greater than "ee". When "ee" is less than "bb", field reversal occurs. When they are equal, a single column is specified.

(3) Skip Element

A skip element may take the form "Sdd" or "sdd", such that $1 \leq dd \leq 32767$, and specifies that the next "dd" positions of the output record are to be skipped over.

(4) Tab Element

A tab element may take the form "Tdd" or "tdd", such that $1 \leq dd \leq 32767$, and specifies that the next specified character of the output record should appear in position "dd". Tab elements may be used to specify any position in the output record, either before or after the current position.

(5) Literal Element

The literal element has the form 'xxxxx' where "xxxxx" is a string of literal characters that are to appear in the next available positions of every output record. The total number of literal characters may not exceed 256. If a literal is to contain the character prime, it must be represented in the literal pattern as two primes. Thus, the literal pattern element

'ABC' 'JKL' ' ' 'XYZ'

corresponds to the literal string ABC'JKL' 'XYZ which occupies the next twelve output positions. Blanks included in a literal sequence element do not terminate the pattern scan. Null literals are illegal.

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Two special literals, D and T (or d and t), are available for the insertion of the date and time into each output record. These literals are presented without primes. The D pattern element is equivalent to 'MM-DD-YY' and T is equivalent to 'HH:MM.SS', where the date or time is obtained immediately prior to the pattern scan. Each use of D or T uses 8 of the 256 available literal character positions.

(6) Decimal Sequence Element

The decimal sequence element has the form "Qnn" or "qnn", where "nn" is an integer such that $1 \leq nn \leq 15$. "nn" represents the width of the sequence field. The sequence numbers start at 1 and are incremented by 1 for each output record.

Modifiers may be appended to the basic sequence-field element to allow the user to specify different initial sequence numbers, different increments, and different moduli for the sequence fields. The form for a sequence element with modifiers is Qnn(bb,ii,mm) where bb, ii, and mm are integers such that $1 \leq bb$, and ii and $mm \leq 999999999999999$ (15 decimal positions).

"bb" is the beginning number, "ii" is the increment, and "mm" is the modulus. The default values for "bb" and "ii" are 1 and the default value for the modulus is 10 to the power "nn". If any of the default values are acceptable, they need not be explicitly presented. Thus, if only the beginning number is to be specified, then Qnn(bb) is sufficient. Similarly, if only the increment is to be specified, then Qnn(,ii) is sufficient. The comma indicates that the value presented is the increment, not the beginning number.

Only the "nn" least significant positions of a sequence counter appear in the output record even though the arithmetic operations are carried out to 16 decimal positions. A maximum of 32 decimal sequence elements may be specified in the pattern.

(7) Hexadecimal Sequence Element

This sequence element is similar to the decimal sequence element and has the form "Xnn" or "xnn" where "nn" is a hexadecimal integer such that $1 \leq nn \leq 8$. In the modified form, the beginning,

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increment, and modulus values are given in their hexadecimal representation. Either upper- or lowercase letters may be used to represent the hexadecimal digits A...F. The acceptable range of values for these modifiers is 0 through FFFFFFFF inclusive (8 hexadecimal positions). The default values for "bb" and "ii" are 1. The default value for the modulus is sixteen to the power "nn". All arithmetic is carried out in double-precision integer form, but only the "nn" least significant positions appear in the output record. A maximum of 32 hexadecimal sequence elements may be specified in the pattern.

Several sample patterns follow:

S5,1-10,T50,25-21

This pattern specifies that the first five output record characters are to be blanks, that columns 6 through 15 of the output record are to be taken from columns 1 through 10 of the input record, that columns 16 through 49 of the output record are to contain blanks, and that columns 50 through 54 of the output record are to be taken from columns 25 through 21 of the input record.

1-72,'DECK',Q4

This pattern specifies that columns 1 through 72 of the output record are to be obtained from columns 1 through 72 of the input record, columns 73 through 76 of every output record are to contain the word DECK, and columns 77 through 80 of the the output records are to contain sequence numbers starting at 1 and incremented by 1 for each record. The modulus for the sequence numbers is 10000. Thus, the sequence number 9999 is followed by 0000.

1-72,'DECK',Q4(10,5)

This pattern is the same as the previous example except that the initial sequence number is 10 and the increment is 5. The modulus is still 10000, so that the sequence number 9995 is followed by 0000.

1-72,'DECK',Q4(10,5,2000)

This pattern is similar to the previous two examples except that the modulus is 2000. Thus, the sequence number 1995 is followed by 0000.

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Input records may range in length from 0 to 32767 bytes; they are padded with trailing blanks as required. Output records may range in length from 1 to 32767 bytes (no null patterns) and trailing blanks are produced if the pattern specifies them. The trimming of trailing blanks is under the control of the @TRIM FDname modifier for the SPUNCH assignment.

For either batch or conversational usage, the PAR field of the \$RUN command may be used to provide the pattern information. If the pattern does not appear in the PAR field, the logical I/O unit GUSER is used to read the pattern.

Since GUSER defaults to the pseudodevice *MSOURCE*, the batch user may enter the pattern information on the card following the \$RUN command. The conversational user will be prompted to enter a pattern if there is no PAR field or if an error is detected in scanning the pattern.

An end-of-file condition on GUSER or SCARDS terminates execution of the program.

After the pattern has been analyzed and prior to reading the first record from SCARDS, a message giving the length of the pattern is printed on SERCOM. After an end-of-file condition is detected on SCARDS, a message giving the number of records processed is printed on SERCOM.

Examples: \$RUN *MVC SCARDS=FILE1 SPUNCH=FILE2 PAR=1-40,S30,71-80,D

In the above example, the input file is FILE1 and the output file is FILE2; the pattern is 1-40,S30,71-80,D. Columns 41-70 of every output record will contain blanks but the contents of columns 1-40 and 71-80 of the input records will be preserved in the corresponding columns of the output records. In addition, columns 81-88 of every output record will contain the date.

\$RUN *MVC SCARDS=FILE1 SPUNCH=FILE2@I PAR=1-72

In this example, all lines of FILE1 will be truncated to 72 characters and written into FILE2. The line numbers of FILE1 will be preserved in FILE2 since the @I FDname modifier is specified.

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*NETCOPYMAC

Contents: An MTS command macro library containing macros for copying files across the Merit/UMnet computer network.

Program Key: *EXEC

Logical I/O Units Referenced:
None.

Description: When MTS command macros are enabled by the MTS command \$SET MACROS=ON, this macro library may be attached to obtain a set of command macros useful for copying files across the Merit/UMnet computer network, e.g.,

MACROLIB *NETCOPYMAC

The macro library contains two principle macros, NETCOPY and BATCHCOPY. The syntax for NETCOPY is

NetCopy FromFile ToFile Destination={Local|Remote}

This macro may be used with the NET CLS to copy files between the local and remote host in either direction. It copies "FromFile" to "ToFile" where the direction is given by the "Destination" parameter, which must be either "Local" or "Remote". It must be invoked from within the NET CLS on some MTS machine while it is connected to another MTS machine that is in MTS command mode. Since the NET CLS reads from *SOURCE* with @MACRO@MFR, the NetCopy must be prefixed with a ">" character to have it recognized as a macro call. NETCOPY always copies the entire file, preserves line numbers, and ignores "\$CONTINUE WITH" and "\$ENDFILE" lines. It also copies the following attributes of the file: Size, Type, Nosave, Prot, Pkey, and Maxsize.

The syntax for BATCHCOPY is

BatchCopy LclFile RmtFile Destination= Proute=UM
T=30 CCID= CKID Rate= Permit=

This macro copies files from one MTS merit host to another, by default, from the current host to UB unless the current host is UB in which case it copies to UM. The "remote" host cannot be the same as the "local" one. It creates a network *BATCH* job to sign onto the remote host under the current CCid, copying the files using MNET:BLOCK. "LclFile" may specify a single file, a list of file names in parentheses, or a file pattern. "Rmt-

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File" may be specified only if "LclFile" is a single file. If omitted, the local name is used. This macro prompts for the password to be used to signon to the remote host. The other options are:

- CCID - specify CCid to signon on to different CCid than the current one, i.e., to copy to a different ccid.
- CKID - specify CKID if CCid is protected by *CKID (to prompt for a second level password).
- DESTINATION - where to copy the files (the XROUTE).
- PROUTE - where to print the batch job listing, UM by default.
- T=30 - time limit used for the batch job (30 seconds).
- RATE - specify for nondefault rate-group.
- PERMIT - specify to permit file(s) explicitly, e.g., Permit="R P=W?".

For documentation on using MTS command macro libraries, see MTS Volume 21, MTS Command Extensions and Macros.

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*NETMAILHELP

Contents: Instructions for sending messages to remote sites not listed in *NETMAILSITES. This file also contains the remote mail address to be used by anyone sending a remote message to UM or UB.

Use: The \$COPY command should be used, e.g.,

\$COPY *NETMAILHELP

*NETMAILSCHEDULE

Contents: A program to print the schedule of exchange times and the completion times of the most recent exchanges of messages with remote sites.

Use: The program is invoked by the \$RUN command.

Program Key *NMSCHED

Description: For each remote site that is directly contacted by MTS, the program prints the time the last exchange was completed and the scheduled times of the next exchanges.

*NETMAILSITES

Contents: A list of the remotes sites to which messages may be sent.

| Use: This list has been discontinued.

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*NETWORKRATES

Contents: The current rate schedule for the use of the Merit
Computer Network.

Use: The rate schedule may be obtained via the \$COPY command,
e.g.,

\$COPY *NETWORKRATES

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*OBJLIST

Contents: The object-module listing program.

Purpose: To list the contents of an object module in a formatted form for easy reading.

Use: This program is invoked by the \$RUN command.

Program Key: *OBJLIST

Logical I/O Units Referenced:
 SPRINT - output listing.
 SERCOM - error comments to the user.
 GUSER - input of file names if the PAR field is omitted.

Parameter: The PAR field of the \$RUN command may contain the name of a single file, plus applicable keywords, if no filenames are given via the logical I/O unit GUSER.

Return Codes: Always zero.

Description: The output listing from this program gives the following information:

- (1) The name of the file being listed.
- (2) The associated line number or sequential pointer for each record in the module.
- (3) The type of object module record indicated in columns 2-4 of each record.
- (4) The formatted list of each record.

If no PAR field is given on the \$RUN command, the program will prompt the user for a file name. The reply should consist of a file name and any applicable forms of the LIST keyword. These two elements should be separated by one or more blanks. This keyword may be used to control the selective listing of records from the file. The types of input records that may be specified by the LIST keyword are: ESD, TXT, CSI, RLD, END, SYM, FTN, LDT, REP, DEF, ENT, NCA, COM, MDL, LCS, LIB, RIP, and DIR. These records are identified by characters 2 through 4 of the record. All record types should be separated by commas. To list all but certain types, the list of loader records not desired should follow "LIST=ALL-". For further details on loader input records, see the section "The Dynamic Loader" in MTS Volume 5, System Services.

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The following examples illustrate the various forms of the keyword:

LIST=ALL	List all records (the default).
LIST=TXT	List only TXT records.
LIST=ESD,END	List only ESD and END records.
LIST=ALL-TXT	List all records except TXT records.
LIST=ALL-TXT,CSI	List all records except TXT and CSI records.

Unless a PAR field is specified, an attention interrupt will cancel the current module listing and the program will prompt for another file name. If a PAR field is given, the program will terminate at the point of the interrupt.

In both batch and conversational mode, all input errors generate an error message, but will not terminate the program. The program will continue to prompt for file names until an end-of-file is given.

The minimum and maximum output line lengths are 70 and 121 characters, respectively. A short format will automatically be used for terminals with line lengths less than 121 characters. For large files, the user should copy the output to *PRINT* since the amount of output will be great.

Examples: \$RUN *OBJLIST PAR=OBJPROG

The above example will list the object modules in the file OBJPROG on *SINK* (the default for SPRINT).

```
$RUN *OBJLIST SPRINT=*PRINT*
LIB LIST=ESD
MODULE LIST=ALL-TXT
$ENDFILE
```

In the above example, for the file LIB, only the ESD records are listed; for the file MODULE, all records except the TXT records are listed. All output is written on *PRINT*.

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*OBJSCAN

Contents: The object-scanning program.

Purpose: To give an edited account of the contents of an object file.

Use: This program is invoked by the \$RUN command.

Program Key: *OBJSCAN

Logical I/O Units Referenced:
 GUSER - input for file names if no PAR field is given.
 SPRINT - output information from the program.
 SERCOM - error comments to the user.

Parameter: The PAR field of the \$RUN command may contain the name of a single file plus applicable keywords if no file names are to be read from GUSER. The keywords must be separated by at least one blank or comma.

Return Codes: Always zero.

Description: The object-scanning program reads an object file and gives an edited account of the type of loader records in the file. If the file name is not specified in the PAR field of the \$RUN command, the program prompts for the name of a file to be scanned. The reply, which must consist of a file name and/or keywords separated from each other by a comma and/or a blank, is read from GUSER. Any file name which is identical to a keyword name (e.g., DATE) must be prefixed with the current MTS file-name character, normally '#' (thus #DATE). If no file name is specified, then specified keywords become defaults. Otherwise, the program will do the following while scanning the specified file:

- (1) Print out all entry point names in the ESD records. Any blank entry point name will be replaced by "(BLANK)" or "\$PRIVATE", whichever is applicable.
- (2) Indicate the breaks between two kinds of records (e.g., "TXT" or "RLD") by printing the beginning and ending line numbers of a block of records having the same characters in positions 2 through 4. Example: "TXT"(3,45). This is called the LONG form.
- (3) Indicate the beginning and ending line numbers of object modules followed by a list of entry point names. Each module is assumed to have the first

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record of type ESD, SYM, or FTN and the last record of type END. All other records will be ignored. This is the SHORT form usually useful for object modules produced by the FORTRAN IV (H) and the PL/I (F) compilers.

- (4) Print out the date whenever an END record has the date inserted in positions 33 through 72.

When all information has been given for the specified file, the program prompts for another file name. The program is terminated if the PAR field was specified or when the user enters an end-of-file through GUSER.

Keywords:

FILE=FDname Specify the object file to be scanned.

MAXLEN=n This controls the number of characters per
 ORL=n output line. The default is 121 or the maximum output device length, whichever is smaller.

MAXNAMES=n Only at most "n" entry point names per
 MAX=n module will be printed. "n" must be in the range (0,256). The default is 256.

DATE This prints the date information from the
 D END records.

NODATE This suppresses the printing of the date
 ND information.

LONG See the above description of the LONG form
 L in (2) above.

SHORT See the above description of the SHORT
 S form in (3) above.

MTS This returns control to MTS. A \$RESTART command will restart the program.

The default keywords are: DATE, LONG, and MAXNAMES=256. The values of all keywords remain in effect until respecified by the user.

Examples: \$RUN *OBJSCAN PAR=ALPHA

In the above example, the program scans the file ALPHA and prints the information of the file contents on *SINK* (the default for SPRINT).

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*OBJUTIL

Contents: The MTS object-file editor.

Purpose: To edit files that contain programs in object-module form.

Use: The program is invoked by the \$RUN command.

Program Key: *OBJUTIL

Logical I/O Units Referenced:

- SCARDS - either the input file containing the object modules to be replaced or a sequence of commands.
- SPRINT - printed output produced by the object-file editor.
- SERCOM - diagnostic messages.
- GUSER - user responses in conversational mode.
- 0 - default unit for the object file to be edited.

Parameters: The following parameters may be specified in the PAR field of the \$RUN command. The parameters must be separated by commas or blanks. Parameters may be negated by "-", "~", "NO", or "N". The minimum acceptable abbreviation for each parameter is underlined.

BREAK=n

Each new module added to the edit file begins at the next highest multiple of the line number "n". Lines currently in the edit file are not changed to reflect the new value. The default value is 1.000. The BREAK parameter has no effect for sequential edit files.

COMSAVE

The COMSAVE parameter specifies that COM (comment) records are to be saved during processing. NOCOMSAVE specifies that COM records are not to be saved. The default is NOCOMSAVE.

DIRECTORY

The DIRECTORY parameter specifies that the object-file editor is to produce a two-record DIR directory of the object modules in the edit file for future use by the object-file editor. The DIR record and its directory are written at line

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numbers -1 and 0, respectively, in the edit file when the object-file editor terminates processing. This record will normally not be read by the system loader since it is in the negative line number range of the file. On subsequent uses of the object-file editor, the program will read this DIR record directory to build its internal representation of the edit file instead of reading the entire file as it must do if no DIR record exists. The presence of this DIR record will increase the file space required for the edit file but will greatly reduce the expense of replacing object modules in an edit file containing an object program consisting of a very large number of modules. The default is NODIRECTORY, i.e., the object-file editor will not produce a DIR record directory. However, if the edit file contains a DIR record at lines -1 and 0, then DIRECTORY is assumed. The DIRECTORY parameter has no effect for sequential files.

DLR

If the DLR (delelibrary records) parameter is specified, library (LIB and DIR) control records will be deleted from the edit file. NODLR specifies that library records are not to be deleted. The default is NODLR.

DMD

If the DMD (delemultiple definitions) parameter is specified, object modules which are multiple definitions will be deleted from the edit file. NODMD specifies that multiple definitions are not to be deleted. The default is NODMD.

EMPTY

The EMPTY parameter specifies that the edit file assigned to unit 0 is to be emptied before use. NOEMPTY specifies that the edit file is not to be emptied. The default is NOEMPTY. EMPTY has no effect in command mode.

FILL=xx

Two hexadecimal digits "xx" specify a character to fill the gaps in the text of the control sections. The default is FILL=81.

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GAPSIZE=n

"n" specifies the maximum object module text gap size to be filled during the object-file editor processing. The default is ORL/2 or 256, whichever is smaller.

LIBRARY

The LIBRARY parameter specifies that the edit file (if empty) is to be formatted as a loader library file. In this case, the object-file editor will generate a DIR loader record at the beginning of the file and subsequently update the directory as object modules are added to the library. The default is NOLIBRARY, i.e., the file is not formatted as a loader library file. However, if the edit file is not empty, the object-file editor will examine the file and automatically determine whether or not it is a library file and act accordingly. Note that the LIBRARY parameter is distinct from the DIRECTORY parameter which requests the object-file editor to generate and maintain a special directory in the negative line-number range of the object file for its own use when editing.

MISCSAVE

The MISCSAVE parameter specifies that miscellaneous (ALI, RIP, DEF, OPT, NCA, and LCS) loader records are to be preserved during processing. NOMISCSAVE specifies that miscellaneous records are to be discarded. The default is MISCSAVE.

MSGSAVE

The MSGSAVE parameter specifies that MSG (message) records are to be saved during processing. NOMSGSAVE specifies that MSG records are not saved. The default is MSGSAVE.

OPTIMIZE

The OPTIMIZE parameter specifies that object modules are to be optimized, i.e., reformatted according to ORL, FILL, and GAPSIZE. NOOPTIMIZE specifies that input records of object modules are to be copied as is. The default is OPTIMIZE.

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ORL=n

"n" specifies the maximum output record length to be used for output produced by the object-file editor. The default is the maximum output record length of the edit file (normally 32767).

QUIT

The QUIT parameter specifies that if the object-file editor encounters any errors in batch mode, the user is signed off. NOQUIT specifies that the batch user is not to be signed off if an error occurs. The default is NOQUIT.

SLOTS=n

"n" specifies the number of slots (one slot per entry point) to be allocated for the DIR record of a library file. "n" may be between 1 and 2730; the default is 128 for sequential files or the minimum (the least possible number of slots) for line files. The SLOTS parameter should be specified only if the edit file is empty and is to be formatted as a library file. Alternatively, the LIBRARY parameter may be specified if the empty edit file is to be a library file and, if a sequential file, it requires no more than 128 slots.

SYMSAVE

The SYMSAVE parameter specifies that SYM (symbol) records are to be saved during processing. NO-SYMSAVE specifies that SYM records are not saved. The default is SYMSAVE.

TERSE/VERBOSE

The TERSE/VERBOSE parameters control the amount of information produced by the verification of some commands. TERSE specifies that minimal information is requested; VERBOSE specifies that full information is desired. TERSE is an antonym for VERBOSE. The default is the setting of the MTS TERSE option. This parameter pair has no effect if NOVERIFY is specified.

UPDATE/REPLACE

The UPDATE/REPLACE parameters control whether the file assigned to SCARDS is an update or replacement file in no-command mode. UPDATE specifies

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that object modules read from SCARDS not in the edit file will be included. REPLACE specifies that new modules will be excluded. The default is UPDATE.

VERIFY

The VERIFY parameter specifies that verification for each command is requested. NOVERIFY suppresses the verification. The default is VERIFY.

Return Codes: Always zero.

Description: The MTS object-file editor is used for the editing of object files. The object-file editor provides facilities to replace, add, delete, or correct an object module. Object modules that are added to the object file are automatically reformatted into maximum-sized records to reduce both the loading time and storage requirements. In addition, the object-file editor can generate and edit DIR-type loader library files.

Many of these same facilities are also provided by the MTS linkage editor described in this volume. However, since the linkage editor makes more general assumptions concerning the reformatting and optimization process, it generally is less efficient in providing these services. The object-file editor particularly is more efficient when replacing a single module in a file containing many modules.

Those users who want only to update their object-module file can simply issue the following command:

```
$RUN *OBJUTIL SCARDS=inFDname 0=editFDname
```

In the above case, object modules are read from "inFDname", converted to the optimized format, and written on "editFDname" replacing any previous definitions. The logical structure of the input modules is completely preserved with the following exceptions:

- (1) The duplicate modules from "inFDname" are discarded.
- (2) REP records of input modules are absorbed into the text of object modules.
- (3) Nonabsolute DEF records are incorporated into the external symbol dictionary of the appropriate output modules.
- (4) COM records are discarded.
- (5) Records other than SYM, ESD, TXT, CSI, RLD, END, REP, and nonabsolute DEF, are placed in front of the output modules. An example is a NCA record.

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A typical example is a FORTRAN program consisting of several subroutines whose object modules are in the file OBJ. While debugging the program, the user discovers an error in one of the subroutines. This error may be corrected in the source file by the MTS file editor. After the program is recompiled, the object-file editor may be used to replace the erroneous module in the object file. The last two stages would be as follows:

```
$RUN *FTN SCARDS=PROG(200,299) SPRINT=*PRINT*
$RUN *OBJUTIL SCARDS=-LOAD 0=OBJ
```

In this example, the source code for the subroutine is in the file PROG at the specified line range. The FORTRAN compiler places the new object module into the file -LOAD which is read by the object-file editor and replaces the old version of the subroutine in the file OBJ.

Those users who desire to use the more advanced features of the object-file editor must use the object-file editor command language which is described in MTS Volume 5, System Services. Commands are read from SCARDS and printed output is written on SPRINT. The typical \$RUN command to use the object-file editor in command mode is

```
$RUN *OBJUTIL
```

Command input is terminated by an end-of-file or by the STOP command.

Examples: \$RUN *OBJUTIL SCARDS=-LOAD 0=OBJPROG

The above example reads the object modules from the file -LOAD, converts them to an optimized format, and writes the result to the file OBJPROG replacing any previous definitions.

```
$RUN *OBJUTIL
EDIT OBJPROG
UPDATE FROM -LOAD
STOP
```

The above example, using the object-file editor command language, is equivalent to the first example.

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*OSMAC

Contents: The macro library for the IBM Operating System (OS).

Purpose: To enable OS users to assemble their programs in MTS. These programs must not be run under MTS.

Use: This file should be specified as a macro library when running the 360-assembler.

Program Key: *EXEC

Description: The references for the macro library are:

- (1) OS/360 System Supervisor Services and Macro Instructions, form GC28-6646.
- (2) OS Data Management Macro Instructions, form GC26-3794.

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*OVERDRIVE

Contents: The OVERDRIVE preprocessor.

Purpose: To allow the use of structured programming techniques in FORTRAN programs.

Use: The program is invoked by the \$RUN command.

Program Key: *OVERDRIVE

Logical I/O Units Referenced:
SCARDS - OVERDRIVE source.
SPRINT - listing output.
SERCOM - error messages (if in conversational mode).
2 - target module output in standard FORTRAN.

Return Codes: 0 - Successful return.
4 - Warning messages printed.
8 - Errors detected.

Description: The OVERDRIVE preprocessor extensions to FORTRAN use structured programming concepts to allow the clearer expression of a program's flow of control. The target module generated by OVERDRIVE may be compiled either with the FORTRAN-G or FORTRAN-H compilers via the *FTN interface program.

The complete description of the OVERDRIVE preprocessor is given in the section "OVERDRIVE" in MTS Volume 6, FORTRAN in MTS.

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*PAGEFONTCONVERT

Contents: The line-printer to Xerox 9700 page-printer reformatting program.

Purpose: To reformat output intended for a line printer to output appropriate to the Xerox 9700 page printer.

Use: The program is invoked by the \$RUN command.

Program Key: *PAGEFONTCON

Logical I/O Units Referenced:

- SCARDS - input data to be reformatted.
- SPUNCH - reformatted output to be printed on the Xerox 9700 page printer.
- GUSER - prompting for program parameters.
- SERCOM - error messages.

Parameters: The four program parameters (described below) may be entered in the PAR field of the \$RUN command. The parameter pairs must be enclosed in parentheses and separated by commas; omitted (defaulted) parameters must be indicated by a comma, e.g.,

```
$RUN *PAGEFONTCONVERT ... PAR=(1,T),,(3,F)
```

Return Codes: Always zero.

Description: The *PAGEFONTCONVERT program reads output containing boldface and underscored text intended for a line printer and reformats it into output appropriate for the Xerox 9700 page printer. The reformatted output takes advantage of the multiple-font capabilities of the page printer.

With output intended for the line printer, a boldface character is printed by overprinting the character with itself, thus producing a darker copy of the character on the output. However, with the page printer, overprinting a character by itself will not produce a darker copy of that character. Instead, a different font must be used to achieve this effect.

The *PAGEFONTCONVERT program divides the input text read from SCARDS into four categories:

- (1) Normal characters (characters that are not in any of the next three categories).
- (2) Underlined characters (characters that are over-

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- printed with the underscore character).
- (3) Boldface characters (characters that are overprinted with the same character).
 - (4) Underlined boldface characters (boldface characters that are also overprinted with the underscore character).

Each of these categories can be assigned a font number and an underline flag. The font number specifies the page-printer font index to be used for that category and the underline flag (TRUE or FALSE) indicates whether text in that category is to be underlined. Unless specified in the PAR field of the \$RUN command, the user will be prompted for the font number and underline flag, i.e.,

```

Normal characters          ?
Underlined characters     ?
Bold characters           ?
Underlined bold characters ?
    
```

The response must be the font number followed by the underline flag, e.g, 1,T or 2,T. Any font number may be specified that is valid for the font package being used for the page printer output.

The following defaults hold for each category:

- (1) Normal = 1,F. This specifies font 1 without underlining.
- (2) Underlined = 2,F. This specifies font 2 (italic with most font packages) without underlining.
- (3) Bold = 3,F. This specifies font 3 (bold with most font packages) without underlining.
- (4) Bold underlined = 3,T. This specifies font 3 (bold with most font packages) with underlining.

Characters that are overprinted, but are not in categories 2, 3, or 4, are overprinted in the font specified for category 1.

The *PAGEFONTCONVERT program processes the input data in the following manner:

- (1) The following *PAGEPR command is inserted at the head of the output file:

```
$**$ FONTINDEX=2
```

- (2) The output data is shifted to the right by 1 column starting at column 2. Column 1 is retained as the logical carriage-control character. The font index is inserted into column 2.

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The output from *PAGEFONTCONVERT may be printed on the Xerox 9700 page printer by using the *PAGEPR program.

Example:

```
$RUN *PAGEFONTCONVERT SCARDS=TXT SPUNCH=-OUT
EXECUTION BEGINS
Enter one character (font number) and either "T" or
"F" (whether underlining should occur), separated
by a comma for each of the prompts following.
Normal characters          ?
Underlined characters     ?
Bold characters           ?
Underlined bold characters ? 4,T
EXECUTION TERMINATED
$RUN *PAGEPR SCARDS=-OUT PAR=PORTRAIT
```

In the above example (using the font package provided by PORTRAIT), characters in the normal category are printed in font 1 without underlining (the default), underlined characters are printed in font 2 (italic) without underlining (the default), bold characters are printed in font 3 (bold) without underlining (the default), and bold underlined characters are printed in font 4 (script) with underlining.

```
$RUN *PAGEFONTCONVERT SCARDS=TXT SPUNCH=-OUT PAR=,,, (4,T)
$RUN *PAGEPR SCARDS=-OUT PAR=PORTRAIT
```

This example is the same as the first example, except that the font number and underline flag are specified in the PAR field of the \$RUN command.

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*PAGEPR

Contents: The Xerox 9700 page-printer output processing program.

Purpose: To print output on the Xerox 9700 page printer.

Use: The program is invoked by the \$RUN command.

Program Key: *PAGEPR

Logical I/O Units Referenced:

SCARDS - text to be printed (each line is assumed to contain a logical carriage-control character in column 1). Control lines beginning with \$9700 specify new options rather than text to be printed. These new options (with one exception) will take effect the next time a new image is started. See below for the list of options.

Parameters: The PAR field should contain the options that are to be processed before lines are read from SCARDS. These options will take effect on the first page of the output. See below for the list of options.

Options: Options are specified either in the PAR field of the \$RUN command or by giving them in the SCARDS input, on lines beginning with \$9700. In both cases, if more than one option is given, the options should be separated by commas or blanks. Since each \$9700 line is processed independently, the ordering of some options may be important. FORMAT (or equivalent) must appear before the FONTLIST option since it resets the font list. PAGEORIGIN must appear after the FORMAT and FONTLIST options since it depends on the spacing of the first font. The options are described in Reference R1038, "Using the Xerox 9700 Page Printer."

Description: The *PAGEPR program is the older method of printing output on the Xerox 9700 page printer. Before the installation of the Resource Manager, this program was required for all printing that used fonts other than the default landscape format.

Two versions of this program are still available. The first version simply passes the print file onto the Resource Manager for processing without intervention. This version is provided in order to maintain compatibility with MTS command macro files and \$SOURCE files that include calls to *PAGEPR. This version is run by issuing the command

```
$RUN *PAGEPR INPUT=file PAR=options
```

"file" is the name of the file containing the text you want printed. The PAR field should contain the various printing options that might apply to your file.

The second version actually processes the print file in the same manner as the previous version of *PAGEPR under HASP. This version is available in order to provide some of the more esoteric options that are not supported by the Resource Manager, such as the third and fourth parameters of the PAGEORIGIN \$9700 command and the full implementation of the LPP command. This version is run by issuing the command

```
$RUN *PAGEPR INPUT=file PAR=!
```

or

```
$RUN *PAGEPR INPUT=file PAR=!options
```

Note that in the PAR field, any options must follow the "!" without intervening blanks (e.g., PAR=!PORTRAIT).

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*PASCALJB

Contents: A Pascal Compiler from Plug Compatible Software, Inc.

Purpose: To compile Pascal/JB source programs.

Use: The compiler is invoked by the \$RUN command.

Program Key: *EXEC

Logical I/O Units Referenced:

SCARDS - Pascal source-program input.
SPRINT - listing output including compiler diagnostics.
SPUNCH - object deck output.
SERCOM - compiler diagnostics.
0 - object library to add (or replace) module to.
1 to 8 - include library

Return Codes: 0 - Successful return.
4 - Compilation warnings.
8 - Compilation errors.

Description: *PASCALJB is a Pascal compiler that supports superset of the Pascal programming language developed by Nicholas Wirth in the late 60s. This compiler conforms to the language accepted by IBM's Pascal/VS compiler; in addition, it supports other features. Source programs written in Pascal/VS can be compiled and run under PASCAL/JB.

The complete description of Pascal/JB is given in MTS Volume 20, Pascal in MTS. A brief summary of the compiler options is given below.

Compile-Time Options

<u>Option</u>	<u>Default</u>
<u>CHECK</u> / <u>NOCHECK</u>	CHECK
<u>CLG</u> / <u>DECK</u>	See Vol. 20
<u>DEBUG</u> / <u>NODEBUG</u>	DEBUG
<u>DISPOSECHECK</u> / <u>NODISPOSECHECK</u>	DISPOSECHECK
<u>INITCHECK</u> / <u>NOINITCHECK</u>	INITCHECK
<u>ARRAYINIT</u> / <u>NOARRAYINIT</u>	ARRAYINIT
<u>RECORDINIT</u> / <u>NORECORDINIT</u>	RECORDINIT
<u>LANGLVL</u> ={STANDARD EXTENDED PVS}	LANGLVL=EXTENDED
<u>LIBRARY</u> =FDname	None
<u>LINECOUNT</u> =n	LINECOUNT=60
<u>MARGINS</u> =(m,n)	MARGINS=(1,255)
<u>OPTIMIZE</u> / <u>NOOPTIMIZE</u>	NOOPTIMIZE
<u>PAGEWIDTH</u> =n	PAGEWIDTH=132
<u>SHORTRECORDS</u> / <u>NOSHORTRECORDS</u>	SHORTRECORDS
<u>SIZE</u> =n	SIZE=4P
<u>SOURCE</u> / <u>NOSOURCE</u>	See Vol. 20
<u>STATS</u>	STATS
<u>WARNING</u> / <u>NOWARNING</u>	WARNING
<u>XREF</u> / <u>NOXREF</u>	NOXREF

Execution-Time Options:

DEBUG	Disabled
STACK=n	See Vol. 20
HEAP=n	HEAP=1P

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*PASCALTIDY

Contents: The Pascal source program formatter.

Use: To reformat a Pascal source program for better readability.

Program Key: *PASCALTIDY

Logical I/O Units Referenced:

SCARDS - Pascal source to be reformatted.
SPUNCH - Reformatted source program.

Return Codes: 0 - Successful return.
8 - Formatting unsuccessful.

Description: Pascaltidy is a Pascal program formatter that creates a copy of the source program, adding spacing and indentation in appropriate ways as to make the program source file easier to read. Such "tidying" aids in debugging programs that compile correctly, but need to be proofread closely to detect logical errors. It also helps make later alterations and additions to a program easier to perform.

The Pascaltidy program is completely described in MTS Volume 20, Pascal in MTS.

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*PASCALVS

Contents: The IBM Pascal/VS Compiler.

Purpose: To compile Pascal/VS source programs.

Use: The compiler is invoked by the \$RUN command.

Program Key: *PASCALVS

Logical I/O Units Referenced:

SCARDS - Pascal source-program input.
SPRINT - listing output including compiler diagnostics.
SPUNCH - object deck output.
SERCOM - compiler diagnostics.
0 - object library to add (or replace) module to.
1 to 8 - include libraries

Return Codes: 0 - Successful return.
8 - Error in compilation phase.
12 - Error in translation/optimization phase.
16 - Error in translation/optimization or run-time environment.

Description: *PASCALVS contains a version of the IBM Pascal/VS compiler that has been modified for use in MTS.

For additional information, see the IBM publication, Pascal/VS Language Reference Manual, form SH20-6168, and MTS Volume 20, Pascal in MTS. A brief summary of the compiler options is given below.

Compile-Time Options

<u>Option</u>	<u>Default</u>
<u>CHECK</u> / <u>NOCHECK</u>	CHECK
<u>DEBUG</u> / <u>NODEBUG</u>	DEBUG
<u>GOSTMT</u> / <u>NOGOSTMT</u>	GOSTMT
<u>LANGLVL</u> ={ <u>STANDARD</u> <u>EXTENDED</u> }	LANGLVL=EXTENDED
<u>LINECOUNT</u> =n	LINECOUNT=60
<u>LIST</u> / <u>NOLIST</u>	NOLIST
<u>MARGINS</u> =(m,n)	MARGINS=(1,100)
<u>OPTIMIZE</u> / <u>NOOPTIMIZE</u>	NOOPTIMIZE
<u>PAGEWIDTH</u> =n	PAGEWIDTH=132
<u>PXREF</u> / <u>NOPXREF</u>	NOPXREF
<u>SEQ</u> =(m,n) / <u>NOSEQ</u>	NOSEQ
<u>SOURCE</u> / <u>NOSOURCE</u>	See Vol. 20
<u>WARNING</u> / <u>NOWARNING</u>	WARNING
<u>XREF</u> / <u>NOXREF</u>	NOXREF

Execution-Time Options

COUNT	Disabled
DEBUG	Disabled
ERRCOUNT=n	ERRCOUNT=1
NOCHECK	Disabled
NOSPIE	Disabled
STACK={nK nP}	STACK=12K
HEAP={nK nP}	See Vol. 20
SETMEM	Disabled

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*PDSTOMNET, *MNETTOPDS

Contents: The Plot Description System (PDS) to Merit Computer Network plot-file conversion programs.

Use: The programs are invoked by the \$RUN command.

Program Key: *PDSTOMNET
*MNETTOPDS

Logical I/O Units Referenced:

GUSER - input plot-file names.
SERCOM - prompting messages.
SPUNCH - output plot files produced.

Parameters: The name of a single plot file to be converted may be specified in the PAR field of the \$RUN command.

Return Codes: Always zero.

Description: With the *PDSTOMNET program, if the user has not specified a plot-file name in the PAR field of the \$RUN command, the program prompts the user with

ENTER PLOT FILE NAME

After the file name has been entered, the plots contained in the file are converted to the Merit Computer Network standard plot-file format (5(F8.3,F7.3,I1)). If the PAR field was not specified, the user is again prompted for a plot-file name. An end-of-file terminates execution of the program.

For the *MNETTOPDS program, if the user has not specified a plot-file name in the PAR field of the \$RUN command, the program prompts the user with

ENTER MERIT NETWORK PLOT FILE NAME:

After the file name has been entered, the plots contained in the file are converted to the Plot Description System format. If the PAR field was not specified, the user is again prompted for a plot-file name. An end-of-file terminates the program.

For additional information, contact the Merit Computer Network Office.

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Examples: \$RUN *PDSTOMNET SPUNCH=MNPLOT PAR=PDSPLOT

In the above example, the plot or plots in the file PDSPLOT are converted to the Merit Computer Network plot-file format and written to the file MNPLOT.

\$RUN *MNETTOPDS SPUNCH=PDSFILE PAR=MNFILE

In the above example, the plot or plots in the file MNFILE are converted to the PDS plot-file format and written to the file PDSFILE.

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*PEXIT

Contents: An Assembler-H listing postprocessor.

Purpose: To make cosmetic alterations to the source program listing generated by *ASMH. This will provide a more readable listing, especially if the structured programming macros are used.

Use: The subroutine is invoked by the H-level Assembler by specifying the PEXIT parameter, e.g.,

```
$RUN *ASMH [I/O units] PAR=PEXIT=*PEXIT
```

Program Key: *PEXIT

Description: The complete description of this subroutine is given in MTS Volume 14, 360/370 Assemblers in MTS.

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*PFORT

Contents: The PFORT Verifier.

Purpose: To check FORTRAN programs for adherence to PFORT, a portable subset of the 1966 version of American National Standard FORTRAN.

Use: The program is invoked by the \$RUN command.

Program Key: *PFORT

Logical I/O Units Referenced:

SCARDS - Input to the Verifier. This should take the form of one or more FORTRAN source program units to be verified. If global analysis is requested, the sequence of source program units should comprise a single executable FORTRAN program. An input line containing a period in column 1 will cause the Verifier to stop processing input. However, the preferred method of specifying the end of the input is to use one of the usual end-of-file mechanisms supported by MTS.

SPRINT - Output from the Verifier. This may be program listings, messages indicating PFORT violations, symbols tables, cross references, or global analysis.

Return Codes: Always zero.

Parameters: The following parameters or their negations may be specified in the PAR field of the \$RUN command. Parameters must be separated by blanks or commas. The minimum acceptable abbreviation for each parameter is underlined. The parameters are treated from left to right, so in case of conflicting parameters, the rightmost one will be put into effect. Any parameter may be negated by prefixing it with NO, N, -, or ~. All of the parameters below are active by default.

LIST Print a source listing for each program unit.

SYMBOLS Print a symbol table for each program unit.

XREF Print cross references with each symbol table. This option will be honored only if SYMBOLS is active.

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GLOBAL Perform and print a global analysis of the input source program. The Verifier itself may deactivate this option if it encounters serious errors during the processing of the input. Once deactivated, whether by the user or by the Verifier, the GLOBAL option cannot be reactivated.

Parameters may also be specified by including a source line with a C in column 1 and an asterisk in column 2, followed by parameters anywhere in columns 3 to 72. This permits the user to turn the output options on or off locally.

```
Example: C* LIST
          SUBROUTINE A
          ...
          END
C* NOLIST
          SUBROUTINE B
          ...
          END
C* LIST
          SUBROUTINE C
          ...
```

In this example, selected program units are LISTed. Such local parameters embedded in the source may be safely passed on to any of the FORTRAN compilers, which will treat them as ordinary FORTRAN comments.

Description: The PFORT Verifier produces a statement by statement listing of each program unit, followed by a symbol table which lists attributes and cross references for all the symbols in that program unit.

If a violation of the PFORT standard is discovered, an error message, preceded by three asterisks, is printed directly below the statement at which the error occurred. If the NOLIST option is in effect, the error message is accompanied by the program unit name and internal statement number of the statement in error.

The global structure of the program is presented in an alphabetized list of all its program units, showing for each program unit its arguments, its common blocks, the program units it calls, and the program units which call it. A table of global common block definitions is produced.

For the complete description of the PFORT Verifier, see Computing Center Memo 406, "*PFORT."

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*PLC

Contents: The Cornell compiler for PL/I.
 Purpose: To compile and execute PL/I programs.
 Use: The compiler is invoked by the \$RUN command.
 Program Key: *PLC
 Alt. Name: *PL/C

Logical I/O Units Referenced:

SCARDS - The source program to be compiled and its standard input unit.
 SPRINT - The compiler listings and diagnostics and the source program's standard output unit.

All logical I/O units can be referred to in the source program, either by using the logical I/O unit as a file name (e.g., SCARDS) if it is alphabetic or by using a TITLE option (e.g., TITLE('SCARDS') or TITLE('0')) on an OPEN statement.

Parameters: The following parameters may be specified in the PAR field of the \$RUN command. The parameters must be separated by a comma. Abbreviations, where permissible, are underlined.

DEFAULTS=list

Define the default compiler options which will be set at the beginning of each PL/C program to be compiled. Any of the compilation options described in the section "PL/C" in MTS Volume 7, PL/I in MTS, may appear on the right-hand side of this keyword. If more than one option is to be specified, they must be enclosed within parentheses, and separated with commas. A listing of the default parameters will appear at the beginning of the compilation if the OPTLIST compiler option is in effect.

HARDSTOP Should not be used except for those persons maintaining the PL/C compiler.

JCL Permit JCL "//..." cards to be recognized by PL/C. The default case is not to treat them in any special manner.

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STAT Print compilation and execution statistics on
NOSTAT SERCOM if PL/C is being run in conversational
mode and compiler output is being diverted to a
file/device other than the terminal. STAT is
the default option.

SIZE=n Define the amount of virtual memory to be
acquired by *PLC for the PL/C program code and
dynamic storage allocation during execution.
The value given specifies the region size in K
(multiples of 1024) bytes, $20 \leq \text{value} \leq 1024$. The
default is SIZE=50.

Return Codes: Always zero.

Description: PL/C is a compiler designed for instruction in the PL/I
language. It provides high-speed compilation, reasonably
efficient execution, excellent diagnostic assistance, and
upward compatibility with the IBM PL/I-F compiler.

Due to its design goals, the full PL/I language is not
supported, but the PL/C subset is large. For further
information about PL/C and reference material concerning
the MTS implementation of PL/C, see the section "PL/C" in
MTS Volume 7, PL/I in MTS.

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*PLOTSEE

Contents: The plot-previewing program.

Purpose: To allow users with Plot Description System (PDS) plot files generated via *PLOTSYS to preview their plots on any graphic device supported by the Integrated Graphics (IG) system.

Use: The program is invoked by the \$RUN command.

Program Key: *PLOTSEE

Logical I/O Units Referenced:

- SCARDS - user input.
- SPRINT - program nonplot output.
- 0 - input plot file.
- 9 - plot output for CalComp plotter.

Return Codes:

- 0 - Successful return.
- 8 - Unit 0 unassigned.
- 12 - Invalid plotfile.
- 16 - Internal error in program.

Description: The *PLOTSEE program is a graphics program that displays plots from a plot file on a graphics terminal, providing a simple and fast way to check plot files for accuracy before submitting them to the plot queue. A plot file is used on MTS to hold output for a picture that is to be plotted on the CalComp plotters. The *IG, *TELLAGRAF, and *PLOTSYS graphics packages can all produce plot files.

A plot file contains encoded instructions for drawing one or more plots on the CalComp plotter. These encoded instructions need to be stored so a program can be run which will interpret them and have the CalComp plotter draw the picture or pictures represented in the plot file. The program that submits plot files to be plotted is *CCQUEUE, which is described in this volume.

*PLOTSEE can be used to serve a number of functions, from previewing a plot before spending the time and money to get the actual plot, to manipulating several plots at one time to form a composite plot. *PLOTSEE's enlargement facility allows you to see a detailed view of a section of a plot. *PLOTSEE also allows you to move, scale, rotate and combine plots into a single picture, to which lines, text and other features may be added. Any plot, enlargement, or any picture which is a combination of

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plots and enlargements that *PLOTSEE is able to produce can be put into a new plot file for later display or plotting. If a remote plotter is attached to a terminal, *PLOTSEE can be told to draw the picture on either the terminal screen or the remote plotter.

The complete description of the *PLOTSEE program is given in Computing Center Memo 456, "*PLOTSEE."

Commands: A summary of the *PLOTSEE command language is given below. Commands may be given either interactively or in the PAR field of the \$RUN command.

ACTIVATE number	Sets the current picture.
AUXPLOT plotter	Plots the screen image on a remote plotter.
BLOWUP	Enlarges a section of the current plot.
BOX	Draws a box around the current picture.
COLOR color	Sets the color of the current picture.
CONTINUE	Continues with the next frame.
DEFAULT string	Changes default command sequence.
DELETE	Deletes the current picture from the screen.
DESTROY	Destroys unnamed pictures on a DISPLAY.
DISPLAY picture	Displays only the indicated picture.
DOWN amount	See the DY command.
DRAW	Updates the screen.
DUMP	Prints information about the data structure.
DX amount	Displaces the current picture horizontally.
DY amount	Displaces the current picture vertically.

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EDIT plotfile	Changes the plot input file to plotfile.
ENGLISH	Specifies that units should be inches.
EXPLAIN command	Explains the use of a command.
FONT fontname	Sets the font to be used by the TEXT command.
FTNCMD command	Issues a command to the FORTRAN I/O monitor.
GET name	Makes a picture the current picture.
GLOBAL	Makes the screen image the current picture.
HELP	Enter the help facility.
IGCTRL switch	Turns KEEP switch on and off.
INVISIBLE	Makes the current picture invisible.
KEEP	Prevents DELETE from destroying pictures.
LEFT amount	See the DX command.
LINE	Draws a line on the screen.
LIST	Prints a list of the pictures currently defined.
MESSAGES	Prints information about the current picture.
METRIC	Makes all units metric.
MOVE	Moves the current picture to a new position.
MTS	Returns to MTS command mode.
NAME name	Assigns a name to the current picture.
NEXT	Displays the next picture.
NOPROMPT	Turns off prompting.

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PEN number	Sets the line type or color.
PICK	Makes a displayed picture current.
PICTURE	Sets the current picture.
PLOT	Puts the screen image on a plotfile.
POLYGON sides	Draws a polygon of "sides" sides.
PPNUMBER	Prints the current picture number.
PREFIX string	Specifies a command string to be executed when a CONTINUE command is executed.
PRINT string	Prints "string" on SPRINT.
PROMPT	Enables prompting.
REDRAW	Redraws the screen.
RIGHT amount	See the DX command.
ROTATE degrees	Rotates the current picture.
SCALE factor	Scales the current picture.
SEGMENT	Picks part of a picture as the current picture.
SELECT	Allows previewing plots in any order.
STOP	Terminates the run.
UNDO	Undoes all the transformations on the current picture.
UP amount	See the DY command.
VIEWPORT picture	Puts the indicated picture in a viewport.
VISIBLE	Makes the current picture visible.
WINDOW	Displays a window of the current picture.
\$mts-command	Executes an MTS command.

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*PLOTSTACK

Contents: The program to stack plots vertically.

Purpose: To combine several plots by stacking them along the y-axis of the paper in order to save plotting paper.

Use: This program is invoked by the \$RUN command.

Program Key: *PLOTSTACK

Logical I/O Units Referenced:

- SCARDS - input plot file of plots to be stacked.
- SPUNCH - output plot file of stacked plots ready for *CCQUEUE processing.
- SERCOM - error messages.

Parameters: The following parameters may be specified in the PAR field of the \$RUN command:

YMARGIN=n

The YMARGIN parameter specifies the amount of space (in inches) to separate adjacently stacked plots. The default is 2 inches.

MAXPLOTS=n

The MAXPLOTS parameter specifies the maximum number of plots that may be placed in a single stack. The default maximum is 100 plots. Since the paper is only 33 inches wide, the actual number of plots that can be stacked is normally 2 or 3.

SCALE=n

The SCALE parameter specifies a scale factor to be applied to all plots before stacking is performed.

Return Codes: 0 - Successful return.
8 - Fatal error (message printed on SERCOM).

Description: *PLOTSTACK reads in input plot file and generates stacks of plots in the output plot file. The user must then run *CCQUEUE to plot the output plot file.

*PLOTSTACK stacks plots in the order in which they appear in the input plot file. The program places successive plots one above the other in the y-direction until it encounters a plot which

- (1) would make the stack higher than paper width allows,
- (2) would cause the MAXPLOTS value to be exceeded,
- (3) uses pens that may not be used in combination with pens used by the previous plots in the stack, or
- (4) requires a different scale factor (this generally would occur only if PLTSIZ was called for plots generated by the Plot Description System).

A new stack is started when any of the four above conditions occurs.

Examples: \$RUN *PLOTSTACK SCARDS=P1+P2 SPUNCH=STACK PAR=SCALE=.5

In the above example, the plots in the files P1 and P2 are stacked into the file STACK. The plots are scaled down to one half of their original size with the default 2-inch spacing between plots.

| \$RUN *PLOTSTACK SCARDS=IN SPUNCH=OUT
| PAR=YMARGIN=1,MAXPLOTS=3

In the above example, the plots in the file IN are stacked into the file OUT leaving a 1-inch space between plots and stacking at most 3 plots per stack.

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*PLOTSYS

Contents: The University of Michigan Plot Description System sub-routine library.

Purpose: To enable users to generate file descriptions of pictures for input to graphical devices such as the Computing Center's digital plotter.

Use: *PLOTSYS should be concatenated to the files containing the user's object modules on the \$RUN command, e.g.,

\$RUN object+*PLOTSYS

Program Key: *EXEC

Logical I/O Units Referenced:

- 9 - The MTS file or magnetic tape onto which plot descriptions are to be written. This unit may be changed via the PDS subroutines PLDNO or PFLNAM.

Description: *PLOTSYS is a collection of FORTRAN-callable subroutines for drawing graphs and other types of pictures. These subroutines produce a device-independent plot description of the plot as output. To actually obtain the plot, this description must be placed into a queue for processing by the system postprocessor. See the description of *CC-QUEUE in this volume for instructions on queuing the plot description.

The plot description may be written to a file or magnetic tape. In the case of a tape, the tape may be labeled and/or blocked and positioned to any file.

See MTS Volume 11, Plot Description System, for a complete description of the subroutines in *PLOTSYS. See MTS Volume 17, Integrated Graphics System, for descriptions of other graphics subroutines.

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*PLUS, *PLUS11

Contents: The PLUS programming language compiler.

Use: The compiler is invoked by the \$RUN command.

| Program Keys: *PLUS and *PLUS11

Logical I/O Units Referenced:

SCARDS - PLUS source program.
 SPRINT - program listing produced.
 SPUNCH - object module produced.
 SERCOM - error messages produced.
 0 - source program library.

Return Codes: 0 - Successful return.
 4 - Warnings issued.
 8 - Errors detected.

Description: Alan Ballard and Paul Whaley of the University of British Columbia have developed a language called PLUS, which is similar to Pascal but designed to be used for system implementation.

PLUS is based to a large extent on the Sue system language, which was developed at the University of Toronto, circa 1971, for the specific purpose of implementing an operating system for the IBM 360 computers. The system was never completed; however compilers for both the 360 and PDP-11 were produced. The language was used with considerable success at Toronto (most noticeably for the SP/k PL/I subsets project), and by a few students for thesis projects at UBC. The Sue language was derived (particularly in its data structure facilities) from Pascal.

PLUS is superficially quite different from Sue or Pascal; however the underlying language semantics are really very similar. Users familiar with the programming language C will also recognize much of its structure and semantics in PLUS.

The current documentation for PLUS assumes some knowledge of PASCAL or similar higher level languages and is not easy reading for a novice. The manual (approximately 125 pages long) is in the file PLUS:MANUAL, which can be copied directly to *PRINT*. Several changes to the language and compiler are not documented in this manual. The file PLUS:NEWS describes these changes. PLUS:NEWS is required reading before actually using the language,

because there are some changes to the way programs interface to the \$RUN command.

At this time, there is no consulting available to help users with problems with either the language, the compiler, or programs written in PLUS. The PLUS compiler, however, is very reliable and is used heavily by the Computing Center Staff. If you want to try writing programs in PLUS, you should also print a copy of PLUS:LIBRARY.DOC, which describes the source and object libraries used by PLUS programs. This document is about 120 pages long. Also note that PLUS is reliably available only on MTS systems at this time.

A PLUS conference using *FORUM now exists. To become a member

```
$RUN *FORUM PAR=PLUS
```

or issue the FORUM command:

```
JOIN PLUS
```

from within *FORUM.

|
| The version of PLUS in the file *PLUS produces code for
| programs run under MTS. The version of PLUS in the file
| *PLUS11 produces code for programs run on the PDP-11
| computer.

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*PL1F

Contents: The MTS version of the IBM OS/360 PL/I(F) compiler.

Purpose: To compile PL/I source programs.

Use: The compiler is invoked by the \$RUN command.

Program Key: *PL1F

Alt. Name: *PL1

Logical I/O Units Referenced:

- SCARDS - PL/I source program input (maximum input length ≤ 100).
- SPRINT - listing output, including diagnostics.
- SPUNCH - macro deck and object deck output.
- SERCOM - diagnostics (optional).
- 0 - object module output.

Return Codes:

- 0 - Successful return.
- 4 - Warning messages printed.
- 8 - Errors detected.
- 12 - Severe errors detected.
- 16 - Unrecoverable errors detected.

Description: The MTS PL/I compiler is derived from the IBM OS/360 F-level PL/I compiler (version 5.5) with modifications for MTS features.

The file *PL1FLIB contains the subroutine library required for running PL/I(F) programs. This file should be concatenated on the \$RUN command to the file containing the compiled PL/I program, e.g.,

\$RUN object+*PL1FLIB

For further information on compiling and running PL/I programs, see MTS Volume 7, PL/I in MTS. A brief summary of the compiler options is given below. Abbreviations are indicated by underlining.

<u>Option</u>	<u>Default</u>
<u>A</u> TR / NOATR or NA	See Vol. 7
CHAR60 or C60 / CHAR48 or C48	CHAR60
<u>C</u> OMP / NOCOMP or NC	COMP
<u>D</u> ECK / NODECK or ND	DECK
DIAG / NODIAG	See Vol. 7
<u>E</u> BCDIC / <u>T</u> TY / <u>B</u> CD	EBCDIC
EXTDIC or ED / NOEXTDIC or NED	NOEXTDIC
<u>E</u> XTREF / NOEXTREF or NE	NOEXTREF
FLAGW or FW / FLAGE or FE / FLAGS or FS	FLAGW
<u>F</u> REE / SORMGIN=(m,n[,c]) or SM=(m,n[,c])	SM=(1,72)
LINECNT=n or LC=n	LINECNT=60
<u>L</u> IST / NOLIST or NL	NOLIST
LOAD or LD / NOLOAD or NLD	NOLOAD
MACDCK or MD / NOMACDCK or NMD	NOMACDCK
<u>M</u> ACRO / NOMACRO or NM	NOMACRO
MTS / OS	MTS
NEST or NT / NONEST or NNT	NEST
NUM / NONUM	NUM
OPLIST or OL / NOOPLIST or NOL	See Vol. 7
<u>O</u> PT=n	OPT=1
SIZE={2K nP}	SIZE=4P
<u>S</u> OURCE / NOSOURCE or NS	See Vol. 7
SOURCE2 or S2 / NOSOURCE2 or NS2	See Vol. 7
<u>S</u> TMT / NOSTMT or NST	STMT
SYNCHKT or SKT / SYNCHKS or SKS / SYNCHKE or SKE	SYNCHKS
<u>X</u> REF / NOXREF or NX	See Vol. 7

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*PL1OPT

Contents: The MTS PL/I Optimizing Compiler.

Purpose: To compile PL/I source programs.

Use: The compiler is invoked by the \$RUN command.

Program Key: *PL1OPT

Logical I/O Units Referenced:

- SCARDS - PL/I source-program input (maximum input length ≤ 100).
- SPRINT - listing output.
- SPUNCH - macro-deck and object-deck output.
- SERCOM - output for the TERMINAL option.
- 0 - object-module output.
- 1-19 - macro libraries for %INCLUDE statements.

- Return Codes:
- 0 - Successful return.
 - 4 - Warning messages printed.
 - 8 - Errors detected.
 - 12 - Severe errors detected.
 - 16 - Unrecoverable errors detected.

Description: The MTS PL/I Optimizing compiler is derived from the IBM OS PL/I Optimizing Compiler (release 3.1) with modifications for MTS.

The file *PL1OPTLIB contains the subroutine library required for programs compiled by the PL/I Optimizing Compiler. This file should be concatenated on the \$RUN command to the file containing the compiled PL/I program, e.g.,

\$RUN object+*PL1OPTLIB

Note: Programs compiled by the PL/I(F) and the PL/I Optimizing compilers cannot be mixed.

The complete description of the PL/I Optimizing compiler may be found in the next edition of MTS Volume 7, PL/I in MTS. A brief summary of the compiler options is given below. Abbreviations are indicated by underlining.

<u>Option</u>	<u>Default</u>
<u>AGGREGATE</u> / NOAGGREGATE or NAG	NOAGGREGATE
<u>ATTRIBUTES</u> [(<u>FULL</u> <u>SHORT</u>)] / NOATTRIBUTES or NA	See Vol. 7
<u>CHARSET</u> [(<u>48</u> <u>60</u>) [<u>EBCDIC</u> <u>BCD</u>]] or CS[(<u>48</u> <u>60</u>) [<u>EB</u> <u>B</u>]]	CS(60 EB)
<u>COMPILE</u> / NOCOMPILE[(<u>W</u> <u>E</u> <u>S</u>)] or NC[(<u>W</u> <u>E</u> <u>S</u>)]	NOCOMPILE(S)
<u>COUNT</u> or CT / NOCOUNT or NCT	NOCOUNT
<u>DECK</u> / NODECK or ND	DECK
<u>DUMP</u> / NODUMP or NDU	NODUMP
<u>ESD</u> / NOESD	NOESD
<u>FLAG</u> [(<u>I</u> <u>W</u> <u>E</u> <u>S</u>)]	See Vol. 7
<u>FLOW</u> [(n,m)] / NOFLOW	NOFLOW
<u>GONUMBER</u> or GN / NOGONUMBER or NGN	NOGONUMBER
<u>GOSTMT</u> or GS / NOGOSTMT or NGS	GOSTMT
<u>IMPRECISE</u> / NOIMPRECISE or NIMP	NOIMPRECISE
<u>INCLUDE</u> / NOINCLUDE or NINC	NOINCLUDE
<u>INSOURCE</u> or IS / NOINSOURCE or NIS	See Vol. 7
<u>INTERRUPT</u> / NOINTERRUPT or NINT	NOINTERRUPT
<u>LINECOUNT</u> (n) or LC(n)	LINECOUNT(60)
<u>LIST</u> [(m[,n])] / NOLIST	NOLIST
<u>LMESSAGE</u> or LMSG / <u>SMESSAGE</u> or SMSG	See Vol. 7
<u>MACRO</u> / NOMACRO or NM	NOMACRO
<u>MAP</u> / NOMAP	NOMAP
<u>MARGINI</u> ('c') or MI('c') / <u>NOMARGINI</u> or NMI	MARGINI(' ')
<u>NEST</u> / NONEST	NEST
<u>NUMBER</u> / NONUMBER or NNUM	NONUMBER
<u>OBJECT</u> / NOOBJECT or NOBJ	NOOBJECT
<u>OFFSET</u> / NOOFFSET or NOF	NOOFFSET
<u>OPTIMIZE</u> (<u>TIME</u> 0 2) / NOOPTIMIZE or NOPT	NOOPTIMIZE
<u>OPTIONS</u> / NOOPTIONS or NOP	See Vol. 7
<u>SEQUENCE</u> (m,n) / NOSEQUENCE or NSEQ	NOSEQUENCE
<u>SIZE</u> (<u>[-]</u> nnnnn[<u>K</u> <u>P</u>] <u>MAX</u>)	SIZE(50P)
<u>SOURCE</u> / NOSOURCE or NS	See Vol. 7
<u>STMT</u> / NOSTMT	STMT
<u>STORAGE</u> or STG / NOSTORAGE or NSTG	NOSTORAGE
<u>SYNTAX</u> / NOSYNTAX[(<u>W</u> <u>E</u> <u>S</u>)] or NSYN[(<u>W</u> <u>E</u> <u>S</u>)]	NOSYNTAX(S)
<u>TERMINAL</u> [(optlist)] / NOTERMINAL or NTERM	See Vol. 7
<u>XREF</u> [(<u>FULL</u> <u>SHORT</u>)] / NOXREF or NX	See Vol. 7

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*PL1SCAN

Contents: The IBM PL/I source-program scanner with a modified interface for operation under MTS.

Purpose: To provide a rough prescan (or syntax check) of programs written in PL/I.

Use: The program is invoked by the \$RUN command.

Program Key: *PL1SCAN

Alt. Name: *PL/1SCAN

Logical I/O Units Referenced:

SCARDS - source program to be scanned.
 SERCOM - error messages from the scanner.
 SPRINT - listing of the input source program.
 SPUNCH - file to which the source is written.

Parameters: The following parameters may be specified in the PAR field of the \$RUN command or in the %PROCESS batch card. The parameters must be separated by a comma or by one or more blanks.

SOURCE prints the source on SPRINT (this defaults to SOURCE in batch only).
 NOSOURCE

CHAR48 specifies the 48-character set.
 CHAR60 specifies the 60-character set (the default).

SORMGIN=(m,n) specifies the left-hand (m) and right-hand (n) source margins. These default to 1 and 72, respectively. The right-hand margin must be equal to or less than 100.

The parameters SOURCE, NOSOURCE, CHAR48, CHAR60, and SORMGIN may be abbreviated to S, NS, C48, C60, and SM, respectively.

Return Codes: 0 - Successful return.
 4 - Syntax errors detected.
 8 - Insufficient memory.

Description: *PL1SCAN scans a PL/I source program for syntax errors. However, it cannot detect all errors, because it only scans one statement at a time and does not check interstatement dependencies (i.e., DECLARE statements, undefined labels, etc.).

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If SPUNCH is specified, the PL/I scanner will write the source program to the file specified. This is especially useful if SCARDS is assigned to the terminal (*SOURCE*).

Comments: It is often advantageous to run *PL1SCAN since it uses considerably less CPU time and virtual memory than the PL/I compiler.

When a listing of the source code is obtained, each source line is preceded by its line number (in a style similar to MTS).

The error messages are of the form

IKMxxx line# error-message-text

where "line#" is the line number of the offending card image.

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*PL1TIDY

Contents: The PL/I "tidy" program.

Purpose: To edit PL/I source programs into an easily readable format.

Use: The program is invoked by the \$RUN command.

Program Key: *PL1TIDY

Alt. Name: *PL/1TIDY

Logical I/O Units Referenced:

 SCARDS - the source program to be edited.

 SPRINT - a listing of the edited source program and diagnostics.

 SPUNCH - the edited source program.

 SERCOM - error messages plus a message for each external procedure.

Return Codes: 0 - Successful return.

 4 - Warning messages printed.

 8 - Errors detected.

 12 - Errors detected.

 16 - Fatal errors detected.

Description: *PL1TIDY edits PL/I source programs into an easily readable form. This feature is especially desirable to clean up files containing modifications made from terminals. The program will indent each statement by an amount corresponding to its nesting depth. This program can also be used to edit programs into an acceptable form which cannot be compiled because of the rather stringent SORMGIN constraints of *PL1 and *PLC. Programs also can be edited into "compressed" form with all nonsignificant blanks removed, thus minimizing the size requirements of the file containing the source program.

 The complete description of *PL1TIDY is given in MTS Volume 7, PL/I in MTS.

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*PRODUCTSUPPORT

Contents: A list of the hardware and software products supported by the Computing Center and other University units.

Use: The list may be obtained via the \$COPY command, e.g.,

\$COPY *PRODUCTSUPPORT

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*PROFORT

Contents: The FORTRAN Execution Profiler.

Use: The program is invoked by the \$RUN command.

Program Key: *PROFORT

Return Codes: Always zero.

Description: The Profiler is a tool for analyzing the performance of FORTRAN programs. The Profiler first runs a FORTRAN program, then produces a source code listing of the program showing how many times each source statement was executed during the run and how many times each path of the program was traversed.

One strategy for testing programs is to feed the program a sufficient variety of test data (not necessarily in the same test run) to cause every possible path to be traversed at least once. This does not guarantee a bug-free program, but at least it leaves no code entirely untested. A profiler is a useful tool for applying this strategy. One looks for zero counts and creates additional test data to eliminate them.

A profiler is also useful for exposing bugs, by virtue of its power to reveal erroneous loop counts, excursions into inappropriate portions of code, and other unexpected behavior.

The information provided by a profiler forms a good basis for analyzing algorithms and their implementations in code. The most frequently executed portions of a program are not necessarily where the most time is spent, but they often are. Consequently, high execution frequencies are a good indicator of where program bottlenecks exist.

Donald Knuth, together with some colleagues and students, studied the behavior of FORTRAN programs, using several different methods of analysis. He concludes (Software--Practice and Experience, 1:105-133, 1971): "The program profiles (i.e., collections of frequency counts) which we used in our analyses turned out to be so helpful that we believe profiles should be made available routinely to all programmers by all of the principal software systems." Also, "...our group came to the almost unanimous conclusion that all software systems should provide frequency counts to all programmers, unless specifically told not to do so."

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Richard Sites (ACM Sigplan Notices, 13:12:98-101, December 1978) goes so far as to say, "Statement counting is the single most useful tool that a programming system can provide to the user."

For the complete description of the Profiler, see MTS Volume 6, FORTTRAN in MTS.

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*PROLOGC, *PROLOGW

Contents: Driver programs for interpreters for the Prolog language.

Use: The driver program is invoked by the command

```
$RUN *PROLOGC
```

or

```
$RUN *PROLOGW
```

Program Key: PLOG:PROLOG

Logical I/O Units Referenced:
None

Description: These files contain the driver programs for two interpreters for the Prolog language.

The program in *PROLOGC implicitly invokes VSS and Prolog runs under VSS using CMS simulation. The syntax is based on the Edinburgh dialect of the Prolog syntax that is used by Clocksin and Mellish in their book, Programming in Prolog. While there is no official standard available for Prolog, the Clocksin and Mellish syntax is more or less accepted as being standard.

The program in *PROLOGW implicitly invokes VSS and Prolog runs under VSS using CMS simulation. The syntax is based on the Waterloo syntax which varies from the syntax used by Clocksin and Mellish in their book, Programming in Prolog. This version is made available for compatibility with the older version of PROLOG that was available in PLOG:PROLOG.

The programs are best suited for use in interactive mode. They do not use the usual MTS I/O units, SCARDS, SPUNCH, etc. Input is entered at the terminal or from a file (using the consult predicate provided in the language) or by combining both. The program output can be directed to a file. The diagnostic messages are written to the terminal.

For details on running the interpreters, see CCMemo 478, "Prolog on MTS - Core Syntax," and CCMemo 477, "Prolog on MTS - Waterloo Syntax."

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*RATES

Contents: The current rate schedule for the use of the computer.

Use: The rate schedule may be obtained via the \$COPY command,
e.g.,

\$COPY *RATES

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*RATFOR

Contents: A FORTRAN preprocessor program.

Use: To allow control structures for FORTRAN programs.

Program Key: *RATFOR

Logical I/O Units Referenced:

SCARDS - structured FORTRAN input.
 SPRINT - structured program listing.
 SPUNCH - processed standard FORTRAN source output.

Return Codes: 0 - Successful return.
 4 - Syntax errors detected.

Description: RATFOR (Rational FORTRAN) is a FORTRAN language preprocessor developed by Kernighan and Plauger and described in the publication

Software Tools, by Brian W. Kernighan and P. J. Plauger, Addison-Wesley, 1976

RATFOR was developed for the purpose of overlaying more modern and commonly accepted control structures and features on FORTRAN, making it a more palatable and versatile tool to utilize in the solution of programming tasks that for one reason or another require the use of FORTRAN. The language description as well as the preprocessor itself are described in the book and the preprocessor as implemented on MTS is very straight forward to use.

The structured FORTRAN program is read by the translator from logical I/O unit SCARDS and the standard FORTRAN source code is produced on logical I/O unit SPUNCH. A listing is produced on logical I/O unit SPRINT in batch mode and also in terminal mode if SPRINT is explicitly assigned to a file or device. The resulting standard FORTRAN output is ready for processing by a standard FORTRAN compiler.

Example: \$RUN *RATFOR SCARDS=RATPROG SPUNCH=FORTPROG

In the above example, the structured FORTRAN program in the file RATPROG is processed into a standard FORTRAN program and written into the file FORTPROG.

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*REDUCE

Contents: The REDUCE algebraic language (version 3.2).

Use: The program is invoked by the \$RUN command.

Program Key: *EXEC

Logical I/O Units Referenced:

- SCARDS - default input stream for REDUCE commands.
- SPRINT - default output stream for REDUCE output.
- GUSER - input stream after an attention interrupt when SCARDS is not assigned to the terminal.
- SERCOM - output stream after an attention interrupt when SPRINT is not assigned to the terminal.
- 1 - REDUCE checkpoint image used for the automatic restore facility.
- 10 - file to use for FAPLIB.
- 11 - file to use for XMPLIB.

Parameters: The following parameters may be specified in the PAR field of the \$RUN command.

BIG The BIG parameter invokes a version of REDUCE that provides extra space for BPS (45000 instead of the normal 18000). This should be specified if the symbolic integrator or other large parts of REDUCE are to be used.

RLISP The RLISP parameter invokes RLISP instead of REDUCE.

SLISP The SLISP parameter invokes SLISP instead of REDUCE.

Return Codes: 0 - Successful return.
 8 - Out of memory or garbage collection failure.
 12 - Internal error (should not occur).

Description: REDUCE is a LISP program designed for general algebraic computations including those of interest to physicists and engineers. Its capabilities include:

- (1) expansion and ordering of polynomials and rational functions,
- (2) substitutions and pattern matching in a wide variety of forms,
- (3) automatic and user controlled simplification of expressions,
- (4) calculations with symbolic matrices,

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- (5) arbitrary precision integer and real arithmetic,
- (6) facilities for defining new functions and extending program syntax,
- (7) analytic differentiation and integration,
- (8) factorization of polynomials, and
- (9) Dirac matrix calculations of interest to high energy physicists.

The file *REDUCE contains a small program that sets certain default I/O assignments and then calls standard LISP to restore the REDUCE checkpoint image and execute REDUCE. The usual way to run REDUCE from a terminal or batch job is

```
$RUN *REDUCE
<REDUCE commands>
.
.
.
BYE;
```

For further information on REDUCE, see the Reduce User's Manual by Anthony C. Hearn and the Reduce User's Guide for IBM 360 and Derivative Computers by Larry R. Seward.

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*RESTORE

Contents: The system file restore program.

Purpose: To restore files saved by the system file-save procedure. The Computing Center runs a special system program every day which saves all user files that have changed since the last file-save. This is done to enable files to be recovered in the event of major disk failures. It is possible for users to take advantage of this procedure to restore files to their status as of any day in the recent past (about six weeks). Files to be restored must be owned by the signon ID running the program.

Note: This program has no relation to *FS which users may use both to save and restore files on their own magnetic tapes.

Use: The program is invoked by the \$RUN command. When execution begins, *RESTORE expects the user to enter a command that indicates which of several services is desired. For example, the DISPLAY command may be used to determine which versions of a file are available for restoration. The RESTORE command may be used to indicate the name of a file to be restored. Several successive RESTORE commands may be entered; the file names are queued and then the files are restored after the QPROCESS or STOP command is given. The queue may be emptied with the CANCEL command.

After a QPROCESS, STOP, or RETURN command or an end-of-file is entered, the program automatically requests the operator to mount the proper tape(s) and searches them for the proper files. If a tape drive is unavailable or if the desired tape is in use, a message to the user will indicate which files were not restored. Since tape mounting and searching are somewhat time consuming, the restore operation may take several minutes. It may be aborted by an attention interrupt.

If the file to be restored already exists, confirmation will be required to destroy the existing version of the file. The user may respond with "OK", "YES", or "!". If the program is run in batch mode, confirmation is not required and the current version of the file will be replaced by the restored version.

In addition to restoring the data of the file, *RESTORE will restore the permit access information for the file.

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Comments: *RESTORE does not check to determine whether files queued for restoration will fit in the disk space allocated to the signed on ID. Restore operations are aborted if the user's file space limit is exceeded while a file is being restored. The save tapes used by *RESTORE only contain files which have existed during the most recent past (about six weeks). However, the Computing Center maintains a separate set of tapes to provide file restoring service for older files that are not available through *RESTORE. A request must be made to the Computing Center Business Office, if a user requires an older version of a file (one that is not contained in the tapes used by *RESTORE),

If *RESTORE is run with a global or local time estimate, the estimate should be at least 20 seconds per file in order to insure a reasonable probability of success in all cases. The approximate cost for restoring one file is \$3.00-\$5.00, but may be as high as \$10.00 or more, depending on the file size and its position on the tape.

For extremely large files, *RESTORE will buffer the file on disk during the restoration process. As a consequence, the tape may not be referenced for a long period; hence, users may get a tape-timer message, but this should not be cause for alarm.

Program Key: *RESTORE

Logical I/O Units Referenced:

SCARDS - the source of commands and responses to prompting messages (defaults to *SOURCE*).
 SPRINT - prompting messages and listings of files and the times they were saved (defaults to *SINK*).
 SERCOM - error messages. SERCOM is reassigned to *MSINK* when the files are being restored.
 GUSER - response for requested confirmation (OK) to destroy the current version of a file so that it may be replaced with an older version.

Parameters: Any single command may be specified in the PAR field of the \$RUN command.

Commands: The following commands are available for *RESTORE. The underlined portion of each command may be used as an abbreviation.

CANCEL [filename]

If no parameter is given, all files queued for restoration by all previous RESTORE commands are removed. If "filename" is given, the specified

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file(s) is removed. "filename" may be a patterned file name, e.g., PROG? or ?DATA?.

DISPLAY filename [mm/dd/yy] [hh:mm:ss] [HISTORY={n|ALL}]

If "filename" is specified, then all of the versions of "filename" available for restoring are listed. If the date or the date and time are given, only versions on or before that date are listed. "filename" may be a patterned file name, e.g., PROG?, ?DATA?, or ?.

The HISTORY option specifies the number of old versions to be displayed. The default is HISTORY=ALL for nonpatterned file names and HISTORY=1 for patterned file names.

HELP [COMMANDS]

If only the HELP command is given, an overview of *RESTORE is given. If the COMMANDS parameter is specified, a listing of *RESTORE commands is given. This information is given in full-screen format for terminals that support full-screen mode.

MCMD command
\$command

The input line is executed as an MTS command. After completion of the command, control is returned to *RESTORE.

MTS

Control is returned to MTS command mode. Execution of *RESTORE may be resumed by issuing the \$RESTART command.

NOQUIT

In batch mode, the program will sign off the job if any of the files could not be restored. If NOQUIT is specified, the job will not be signed off.

QDISPLAY

This command displays the names of all files queued for restoration.

QPROCESS

This command processes all queued restore requests. If any requests cannot be processed, due to problems

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in acquiring a tape drive or restoring the file, they are left in the queue. This permits the user to retry the restore requests at a later time.

```
RESTORE filename [mm/dd/yy] [hh:mm:ss] [NEWNAME=filename]  
[REPLACE={YES|OK|NO|PROMPT}]
```

If only "filename" is specified, the most recent version available of that file is queued for restoration. The file will be restored with the same name unless a NEWNAME is given. If a file having the same name currently exists, a warning is printed since restoration will destroy it. In conversational mode, the user will be required to answer when asked if the file should be queued for restoration. Confirmation to allow destroying an existing file will be required when the file is actually being restored. "OK" may be entered for confirmation. The file must be owned by the signon ID running the program, and the user must have "destroy" access to the file. "filename" may be a patterned file name, e.g., PROG?, ?DATA?, or ? (patterned file names may not be used with the NEWNAME option).

If a date (or date and time) is specified, the most recent version saved on or before the date or date/time specified is queued for restoration. When used in conjunction with the file-name pattern "?", this enables a user to restore all files under a signon ID to a version not later than the time and date specified. It should be remembered that since files are saved only when they have been changed, specifying a date actually amounts to requesting that a file be restored to its status as of that date.

The REPLACE option controls whether currently existing files queued for restoration are replaced. If YES or OK is specified, existing files will be replaced. If NO is specified, existing files will not be replaced. If PROMPT is specified, the user will be prompted whether to replace existing files. In all cases, non-existing file will be replaced.

```
RETURN  
STOP  
<end-of-file>
```

Terminates command input, attempts to restore all files queued for restoration, and terminates execution of the program.

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<attention>

If STOP or QPROCESS has not been given yet, an attention interrupt terminates the current command and requests another. If STOP or QPROCESS has been given (while the program is in the process of restoring files), no more files are restored, a list of unrestored files is printed, and the program terminates (STOP) or returns to command mode (QPROCESS).

Return Codes: 0 - Successful return.
4 - Internal error in program.

Example: The following is a sample terminal session using *RESTORE (user input shown in lowercase):

```
#run *restore
#Execution begins
```

Type command.

```
*? dis callmacros
```

```
1 CALLMACROS saved SUN 10/28/84 09:23:02
2 " saved TUE 10/23/84 02:59:08
3 " saved SUN 10/21/84 09:40:34
4 " saved SAT 10/20/84 02:56:33
```

Type command.

```
*? res callmacros 10/28/84
CALLMACROS (SUN 10/28/84 09:23:02) has been queued for restoration.
```

Type command.

```
*? qprocess
```

It will take some time to mount and scan the file save tape.

Use ATTN to abort.

```
W999:CALLMACROS 09:23:02 10-28-84 SUNDAY
```

"CALLMACROS" is to be replaced with a new version. OK?

```
*? ok
```

Completed

T905 released.

Type command.

```
*? dis d?
```

```
1 DG saved TUE 10/30/84 03:17:01
1 DIRECTORY00 saved SUN 10/28/84 09:26:27
1 DISASTER saved SUN 10/28/84 10:56:36
(There are 5 older versions of this file.)
```

Type command.

```
*? dis disaster history=5
```

```
1 DISASTER saved SUN 10/28/84 10:56:36
```

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```
2      "      saved SUN 10/21/84 10:06:44
3      "      saved SUN 10/14/84 10:12:13
4      "      saved SUN 10/07/84 10:21:37
5      "      saved MON 10/01/84 01:41:28
(There is 1 older version of this file.)
```

```
Type command.
*? stop
Total files restored: 1
#Execution terminated
```

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*RG

Contents: The Report Generator program.

Use: To generate reports from a database.

Program Key: *RG

Logical I/O Units Referenced:

- SCARDS - specifies the RG commands and the master file. The master file can also be assigned by the DATAFILE=FDname parameter (see below), in which case only the RG commands are read from SCARDS.
- SPRINT - specifies the output device used to print the report.
- SERCOM - specifies the output device used to print the command listing (if requested), error comments, and execution-time statistics.
- 0 - specifies the macro library to be used (optional).

Parameters: The following parameters may be specified on the PAR field of the \$RUN command. The parameters must be separated by commas.

- LIST/NOLIST The LIST parameter lists the RG commands used for the run including the line numbers. The default is NOLIST in terminal mode, and LIST in batch mode.
- LINESIZE=n The LINESIZE parameter sets the width of the output reports to "n" characters. The default is 132 characters, which includes printer carriage control. The maximum width that may be assigned to LINESIZE is the maximum output record length of the file or device that is assigned to SPRINT.
- DATAFILE=FDname The DATAFILE parameter changes the default input FDname for the master file. Normally, the master file is assigned to SCARDS. The FDname must be terminated by a blank.
- ITEMS=n The ITEMS parameter requests that only the first "n" items are to be read from the master file. The default is all items.

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Return Codes: None.

Description: The Report Generator is a simple information-retrieval system which reads a data file once (sequentially), and produces one or more reports based on the contents of that file. This master file may have almost any format as long as it is consistent and definable.

RG has the capability of extracting some or all of the data from a file and printing the extracted data in a user-defined format. RG is also capable of producing KeyWord-In-Context (KWIC) indices.

RG also may be used to generate a list of the different values contained in a field and a count of the number of times each value occurs. For example, a mailing list may be scanned to list all the different cities in the file and the number of occurrences of each.

RG has only limited arithmetic capabilities. It is possible to generate one field from another using the simple operators plus(+), minus(-), multiply(*), and divide(/). However, it is not possible to perform any computation from record to record on any field.

A run of RG is divided into two parts which provide the following information:

- (1) A description of the master file format.
- (2) A description of the report format.

The first part consists of three commands: the ITEM, ENTRY, and FIELD commands. The ITEM command specifies which physical records belong to one item or logical record. The ENTRY command specifies particular physical records within the item. The FIELD command specifies the location of each field in the physical record. A fourth command, the END command, terminates the first part.

The second part consists of five commands: the EXTRACT, TABLE, ORDER, TITLE, and PRINT commands. The EXTRACT command specifies which items are to be used in the final report. The ORDER command orders the extracted items. The TITLE command assigns title(s) to the report, and the PRINT command describes the actual report format. The TABLE command generates frequency tables of occurrences. The END command also terminates the second part.

The complete description of the Report Generator program and its command language is given in Computing Center Memo 437, "UBC RG: The Report Generator."

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*RMLOG

Contents: A program to scan the Resource Manager log files.

Use: The program is invoked by the \$RUN command.

Program Key: *RMLOG

Logical I/O Units Referenced:
 INPUT - input commands
 SERCOM - error messages

Return Codes: None

Description: *RMLOG contains a program for reporting extracts from the Resource Manager log files. These log files contain recent history data from the spooling system. Currently the Resource Manager keeps 8 days worth of history data. This data is currently updated only hourly, so *RMLOG may not have data for the period from an hour ago to the current time. The Resource Manager log files contain data on spooled jobs such as print and batch jobs, and on BITNET jobs such as file transfers and messages.

The program is invoked with the command

```
$RUN *RMLOG [INPUT=input] [SERCOM=error-messages]
```

The input read from INPUT (SCARDS) consists of an arbitrary number of commands. A command is one of the following:

\$MTS-command	Issues the given MTS command.
*comment	Does nothing.
FORMAT {FREE FIXED}	Sets the format for printed output.
HELP topic	Prints help text for the given topic.
MTS	Returns to MTS, can be restarted.
PRINT options	Selects and prints entries from the RM log files. See the description of the print options below.
STOP	Stops the program.

TIME {OFF|SHORT|DATE|FULL}
 Sets the time format

PRINT Command Options

The PRINT command has many options for selecting the log entries to be printed. The only one of these that limits the amount of data the program searches through is the TIME option. This is because the log files are ordered by time and have no indexes. The program sequentially reads each log file that could have data from the requested time. Currently each log file contains a day's data, with the data starting at about 8:00 AM each day. Thus for example, a request to print data from 9:00 AM to midnight of a particular day will search only one file, whereas a request with no time specified will search all log files.

More than one print option can be specified by separating them with blanks in the command. All of the options must match a record in order for the record to be selected for printing. The print options, with the minimum abbreviations underlined, are:

DESTNODE=dest-node	Select BITNET entries with the given destination node.
DESTUSER=dest-user	Select BITNET entries with the given destination user.
DEVICE=device-name	Select entries with the given device name.
ID=origin-id	Select entries with the given four-digit origin-id.
JOB#=job-number	Select entries for the given job number.
<u>JOBNAME</u> =job-name	Select entries for given job-name.
KIND=record-types	Select entries of the given record-types. See the list of record types below.
LINK=link-name	Select BITNET entries with the given link-name.
<u>MESSAGE</u> =msg-number	Select entries with the given message number.

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MSG#=msg-number	Select entries with the given message number.
ON FDname	Print the entries on the given FDname.
ORIGID=origin-id	Select BITNET entries with the given four-digit origin-id.
ORIGNODE=origin-node	Select BITNET entries with the given origin-node.
<u>PROCESSOR</u> =proc-name	Select entries for the given processor.
<u>QUEUE</u> =queue-name	Select entries for the given queue.
ROUTE=route	Select entries with the given print route.
SENTNODE=sent-node	Select BITNET "sent" messages from the given node.
SENTLINK=sent-link	Select BITNET "sent" messages for the given link.
<u>TIME</u> ="time/date-range"	Select entries within the given time/date-range. See below for further information on specifying time/date-ranges.
TYPE=record-types	Select entries of the given record-types. See the list of record types below.

Note that you can only access the records for your MTS userID, and that to access the BITNET records for a job, you must specify ORIGID=origin-id to select the records for only that BITNET job. The origin id of a job is the last four digits of the job's Resource Manager job number. Thus if you want to trace the job 119353, you must specify ORIGID=9353. See also the example below detailing the tracing of a BITNET message.

Time/Date Ranges

A time/date range for the PRINT TIME command may be given in the form

time/date

or

time/date1 TO time/date2

Time/date input conversion is driven by a grammar that attempts to accept most styles of time/date presentation that are commonly used. It generally requires that the components specified be meaningful and unambiguous.

An input time may be composed of the following pieces. They may be put together in most meaningful combinations, using commas and blanks as conventional separators.

Year A year is a two-digit number in the range 32 to 99, inclusive, or a four-digit number in the range 1900 to 1999, inclusive. In some unambiguous contexts, a two-digit number in the range 0 to 31 will also be recognized as a year.

Month A month is one of "January", "February", ..., "December". Month names may be abbreviated to their first three characters.

Day The day of the month is specified by a number in the range 1 to 31, inclusive.

Time Times are integer strings containing ":" and/or "." and/or followed by "AM" or "PM" (or "A.M." or "P.M.") A fully specified time appears as "23:22:05.67835".

The time must specify the hours and minutes, with the seconds and micro-seconds components optional. The minutes component may also be omitted if "AM" or "PM" appears.

Thus, the following are all allowed:

12 AM
23:59
00:01:35.5

Day of Week Days of the week are specified as "Monday", "Tuesday", ..., "Sunday". They may be abbreviated to the first three characters of the day name ("Mon", "Tue", etc.).

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The day-name is just checked for correctness with respect to the other date components. Currently, a day-name cannot be used by itself.

MM-DD-YY For compatibility with older date input and output routines the MM-DD-YY form of month, day and year is supported (it may also be specified as MM/DD/YY). For example, "11-06-88" is November 6, 1988.

This form is not recommended because of its ambiguity. Depending on where you live, the convention may be MM-DD-YY, DD-MM-YY, or YY-MM-DD. This package supports the MM-DD-YY form because that form has been the MTS standard.

IBM For compatibility with certain IBM software, the form YY.DDD is supported, where YY is a two- or four-digit year number and DDD is the day number in the year. For example, "89.103" is April 13, 1989.

Miscellaneous Forms

The following strings are recognized, with the obvious meanings.

YESTERDAY
TODAY
NOW

These first two forms represent a date only, and may be combined with a time specification. The form "NOW" represents the current time (to the micro-second level).

It is not necessary to specify all the components of the time (year through microsecond). The input conversion routines will default unspecified components in many cases.

When converting, the default is selected with respect to the current time. Any unspecified low-order components are always set to the beginning of the interval. Unspecified high-order components are copied from the current time. For example, if it is currently any time in 1990, then "Jan 25" is equivalent to "00:00:00.0 Jan 25/90".

The following examples illustrate the use of time/date ranges:

```

PRINT TIME="Jan 18/1990"
PRINT TIME="Thu January 18/90"
PRINT TIME="Jan 18"
PRINT TIME="1/18/90"
PRINT TIME="1-18-90"
PRINT TIME="90.018"
PRINT TIME="YESTERDAY"
PRINT TIME="Jan 18/90 To Jan 19/90"
PRINT TIME="January 18/1990 To NOW"
PRINT TIME="11:00 Jan 18/90 To 18:00 Jan 18/90"
PRINT TIME="6:00 PM YESTERDAY To 6:00 AM TODAY"
PRINT TIME="11:15:20 Jan 18 To 11:45:30 Jan 18"
PRINT TIME="January"
PRINT TIME="January 1990"

```

Record Types

The record types can be either a single record type, or a parenthesized list of record types, separated by blanks or commas. The individual record types are:

QUEUE	A record of a job being put on a queue.
PROC	A record of a job being given to a processor.
ACC	A record of the accounting data from the completion of a job.
DONE	A record of the completion of a job.
NETJOBIN	A record of the receipt of a BITNET job.
NETJOBOUT	A record of the sending of a BITNET job.
NETMSG	A record of a BITNET network message or command which is not a message saying that a job from this site has been relayed onwards.
MSGJOBIN	A record of the transformation of an incoming BITNET message to a message-system message.
MSGJOBOUT	A record of the transformation of an outgoing BITNET message from a message-system message.

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RNMSENT A record of a BITNET network message that indicates that an intermediary site has forwarded a job from this site onwards.

Additionally, the following aggregate abbreviations are defined:

JOB means (QUEUE, PROC, DONE, ACC)

NETJOB means (NETJOBIN, NETJOBOUT, RNMSENT)

MSGJOB means (MSGJOBIN, MSGJOBOUT)

NET means (NETJOB, MSGJOB)

SENT means (NETJOBOUT, RNMSENT)

Examples:

The following example shows the basic use of the program to obtain data on jobs that were printed yesterday. The "Log__" is a prompt printed by the program; the remainder of the line is typed by the user.

```
# run *rmlog
Log__ print time="yesterday"
Wednesday January 10, 1990
16:41 1ABC:RM193730 queued to CNTR.
16:43 1ABC:RM193733 queued to UNYN.
16:43 1ABC:RM193733 on proc PTR2.
16:43 1ABC:RM193733 on UNYN PTR2, 61 Ppp, 8,378 Ppl,
      61 PPI, 31 PPS.
16:43 1ABC:RM193733 done.
16:45 1ABC:RM193730 done.
```

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*SDL

Contents: The Survey Definition Language.
Use: SDL is invoked by the \$RUN command.
Program Key: *SDL
Logical I/O Units Referenced:
 SCARDS - survey description statements.
 SPUNCH - resulting survey object program.

Return Codes: 0 - Successful return.

Description: SDL is a specialized programming language consisting of a small number of straightforward statements which can be used to write programs that send a sequence of requests for information interactively to an individual at a terminal. Replies to the program's prompts are read immediately and can be verified at each step, stored for later analysis, or used to branch to appropriate subsections of a question list.

The most common application of SDL is the development of computerized survey questionnaires. Another potential application is data entry, either in conjunction with a survey, or as a way to enter previously selected or coded data.

The Survey Definition Language is completely described in Computing Center Memo 452, "Survey Definition Language: *SDL".

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*SIDEBYSIDE

Contents: A multiple-page output processing program.

Purpose: To place consecutive pages side-by-side on a single page, taking logical carriage controls into consideration.

Use: The program is invoked by the \$RUN command.

Program Key: *SIDEBYSIDE

Logical I/O Units Referenced:

- SCARDS - input data which is to be placed side-by-side on an output page.
- SPRINT - output containing the input data after it has been placed in a side-by-side format.
- SERCOM - error messages.

Parameters: The following parameters may be specified in the PAR field of the \$RUN command. The underlined portion of each parameter may be used as a minimal abbreviation.

INLINES=n "n" specifies the maximum number of actual input lines for a page-column in the output. Overprinting lines (those with a "+" carriage control) should each be counted as one line. The default is INLINES=132 lines.

WIDTH=n "n" specifies the width of each column on an output page. The specified width should be large enough to include any necessary additional space on the right to produce blank space between the columns (gutters). Input lines longer than this width will be truncated. The default is WIDTH=66 print positions.

COLUMNS=n "n" specifies the number of columns, or input pages, that will be placed side by side on an output page. The default is COLUMNS=2.

TOPMARGIN=n "n" specifies the number of physical lines before the first logical line on the page. This parameter describes the printer layout that will be used to print the output and should reflect the characteristics of the printer and type

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style being used. The default is TOPMARGIN=3 lines.

LOGICALLINES=n "n" specifies the number of print lines per logical page. This parameter describes the printer layout that will be used to print the output and should reflect the characteristics of the printer and type style being used. The default is LOGICALLINES=60 lines.

PHYSICALLINES=n "n" specifies the number of print lines per physical page. This parameter describes the printer layout that will be used to print the output and should reflect the characteristics of the printer and type style being used. The default is PHYSICALLINES=(LOGICALLINES + 2*TOPMARGIN) lines.

OUTLENGTH=n "n" specifies the maximum number of characters, including carriage control, to be placed in each output line. Characters beyond the maximum output length are discarded. The default is OUTLEN=columns*width+1 characters.

NO6OR8 If NO6OR8 is specified, it is assumed that logical carriage controls "6" and "8" are not recognized as such by the output device. In this case, the effect of any such carriage controls in the input is simulated in the output by the program. It is not necessary to specify this parameter if the input does not contain logical carriage controls "6" or "8." (This parameter is relevant only for output printed at installations, such as Wayne State University, that do not recognize the "6" and "8" carriage controls.)

Return Codes: None.

Description: The program reads the input from SCARDS and divides it into print pages. Groups of consecutive pages, with the number of pages per group equal to the COLUMNS parameter, are then placed in a side-by-side format, and each group is written as a single print page to SPRINT.

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```

Examples: $RUN *SIDEBYSIDE SPRINT=-OUT PAR=W=12,C=4,NO6OR8
          1ONE
          8EIGHT
          2TWO
          2TWO
          <LESS THAN
          4FOUR
          4FOUR
          4FOUR
          4FOUR
          ;SEMICOLON
          6SIX
          6SIX
          6SIX
          6SIX
          6SIX
          6SIX
    
```

In the above example, the following records would be placed in the file -OUT:

```

;
1ONE          TWO          FOUR          SEMICOLON
-            -            -            SIX
-
-
4            -            FOUR          SIX
-
0            -            -            SIX
2            TWO          FOUR          SIX
-
-
-
4            -            FOUR          SIX
-
0            -            -            SIX
-
-
-EIGHT
<            LESS THAN
    
```

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If the NO6OR8 parameter were omitted and COLUMNS were set to 3, -OUT would contain:

```

1ONE          TWO          FOUR
4             TWO          FOUR
2             TWO          FOUR
4             TWO          FOUR
8EIGHT
<            LESS THAN
9SEMICOLON
1SIX
6SIX
6SIX
2SIX
6SIX
6SIX

```

The following two sheets contain sample output using *SIDEBYSIDE.

The first sheet uses *SIDEBYSIDE in conjunction with *PAGEPR (FORMAT=TWOUP) to produce a "FOURUP" form, in which eight pages fit on one sheet. The text used is the first eight pages of the file *CCPUBLICATIONS. The command to produce this were:

```

$RUN *SIDEBYSIDE SCARDS=-CCPUB SPRINT=-P PAR=W=72
$RUN *PAGEPR SCARDS=-P PAR=FORMAT=TWOUP,MARGIN=.1

```

The second sheet uses *SIDEBYSIDE in conjunction with *PAGEPR (FORMAT=LANDSCAPE) to produce two side-by-side pages on each side of a sheet. The text used is the first four pages of the file *CCPUBLICATIONS. The command to produce this were:

```

$RUN *SIDEBYSIDE SCARDS=-CCPUB SPRINT=-P PAR=W=72
$RUN *PAGEPR SCARDS=-P PAR=MARGIN=.2

```


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*SIGSETUP

Contents: A program for executing selected commands from a sigfile.

Program Key: *SIGSETUP

Logical I/O Units Referenced:

SCARDS - input lines to the setup program.

SPRINT - output from the setup program.

GUSER - input for the Read Expression operand.

Return Codes: 0 - Successful return.
4 - Invalid input line encountered.

Description: *SIGSETUP contains a program for use in sigfiles to selectively execute various commands.

The program reads input lines consisting of expressions and commands to be performed if the expression is true. The expressions can test various conditions such as the type of device at which the user has signed on, the day of the week, or the userID signed on. The commands can be used to set MTS or device-support options, dynamically load and run other programs, print messages, etc. Various items can be substituted into a command before it is executed.

The program is invoked (usually from a sigfile) with a command of the form

```
$RUN *SIGSETUP SCARDS=input SPRINT=output PAR=ECHO
```

The input read from SCARDS consists of an arbitrary number of lines of the form

```
expression command-list
```

where "expression" is as described below. The expression is evaluated, and if the result is true, then all commands in "command-list" are performed. If it is false, all commands are skipped.

"command-list" consists of zero or more commands as described below. Commands are separated by slashes (/). If the character / is required as part of a command, it should be replaced by //.

The values of certain "variables" may be substituted into a command before it is performed. An item to be substituted is delimited with a vertical bar (|) on each

side. If a "|" is required as part of a command, it is represented by "||".

If the ECHO parameter is specified, each command to be performed is written to SPRINT before it is executed.

An input line that begins with an asterisk (*), or that is completely blank, is ignored by the program. Such lines can be used to annotate the sigfile commands.

Expressions

An "expression" is made up of terms and binary expressions, connected together by the operators &, |, and ~. Parentheses may be used in expressions to indicate intended order of evaluation.

A term in an "expression" may be:

BATCH	true if user signed on in batch.
TERMINAL	true if user signed on interactively.
ALL	always true.
DAILY	is true if this is the first time the user has signed on for the day.
WEEKLY	is true if the user has not signed on since the previous Sunday.
MONTHLY	is true if this is the first time the user has signed on in the current month.
YEARLY	is true the first time the user signs on for the year.
day of week	is true <u>each time</u> the user signs on during the specified day (e.g., MONDAY, TUESDAY).

character string

Any other character string entered as a term is compared to the device name and type at which the user is signed on. Both the local (MTS) name and type and the remote (Merit/UMnet network) name and type are tested. Thus, the term "xxxx" is treated the same as the expression

```
NAME=xxxx | TYPE=xxxx | TERMTYPE=xxxx
| TERMNAME=xxxx
```


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See below for an explanation of the NAME, TYPE, TERMTYPE, and TERMNAME variables.

The DAILY, WEEKLY, MONTHLY, and YEARLY items are determined from the "last signon time" information. For the purposes of the DAILY and WEEKLY options, the day is considered to start at 6:00 am, with signons earlier than that treated as if they were on the previous day. Note that these options will not be true if the user has signed on since 6:00 am, even if sigfile processing was not performed (e.g., because of an attention interrupt). Similarly, it should be realized that expressions such as

TERMINAL & DAILY

would be false at each signon of the day if the first is a batch run. The 6:00 am starting time will usually allow low-priority batch jobs submitted the previous day to execute without satisfying the first-signon condition.

A binary expression has the form

variable operator value

where "variable" is one of the SIGSETUP variables defined below. "operator" may be any of =, ~=, <, <=, >, or >=. A "value" may be a character string, a hexadecimal string, a number, or a date or time as may be appropriate to the "variable" specified. Examples of value are given below.

The allowed variables are:

NAME	specifies the device name of the user's MSOURCE device.
TYPE	specifies the device type of the user's MSOURCE device. For a Merit/UMnet connection, TYPE will be "MNET". For an IBM 3270 connection, TYPE will be "3270".
TERMTYPE	specifies the remote type of the user's MSOURCE device. For a Merit/UMnet connection, this is the type by which the terminal is known to the network: for an IBM PC-compatible terminal, TERMTYPE will be "IBMP"; for a Macintosh Versaterm connection, TERMTYPE will be "VERSA"; for an Ontel connection, TERMTYPE will be "OP/VIS".
TERMNAME	specifies the remote name of the user's MSOURCE device. For a Merit/UMnet connec-

tion, this contains the Merit address of the terminal port type and the transmission rate. For an IBM 3270 connection, this is the same as NAME.

ID	<p>specifies the userID of the user running the program. When it is used in a binary expression, if the specified value is shorter than four characters, the value will be padded with ".\$.", "\$.", or "." as necessary to form a valid userID.</p> <p>This variable allows using the same sig-file from a number of userIDs, but having some actions performed differently depending on the userID.</p>
PROJECT	<p>is the four-character projectID for the group to which the userID running the program belongs. DEPT and DEPARTMENT are synonyms for PROJECT.</p>
TIME	<p>specifies the <u>elapsed time</u> in milliseconds since execution of SIGSETUP began. With a little tuning, this variable can be used in expressions to skip or perform certain actions when response is bad, or when at a slow-speed terminal.</p>
RAND	<p>results in a new random number in the range 1 to 100 inclusive each time it is used. It may be used in an expression of the form</p> $\text{RAND} < n$ <p>to perform specified commands randomly at about n% of the signons.</p>
DATE	<p>specifies the date when execution of SIGSETUP began.</p>
TOD	<p>specifies the time of day when execution of SIGSETUP began.</p>
SYSTEM	<p>specifies the system being run, generally MTS. This is intended for systems programmers only (for whom it may have the value TMTS or SMTS).</p>
HOST	<p>specifies the hostID of the system on which the program is running. This will</p>

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be "UM" for the UM-MTS system, and "UB" for the UB-MTS system.

GUINFO(guinfoparm) specifies the current value of any item available from the system subroutine GUINFO. The parameter guinfoparm may be either an item-name or number (see examples below).

SENSE(n1:n2) specifies information returned by the SNS control command for the MSOURCE device. The value is the "n2" characters starting at position "n1" (0-origin). If the device does not accept the control command, or if it does not return enough information, the value is a null string.

READ("prompt") will read a line from the terminal. The input typed becomes the value of the expression. The parameter is optional; if one is given, it will be written to the terminal as a prompt. For example,

```
READ("Set macros on?") = "YES"
```

will issue the prompt and read a response. The response is then compared to the string "YES", and if equal, the expression will be true.

The values used as the right-hand sides of binary expressions may be any of the following:

- number an unsigned decimal integer.
- mm/dd/yy a date in the form month/day/year. Either / or - may be used to separate the parts.
- hh:mm:ss a time-of-day in hours, minutes, and seconds.
- 'hexstring' a string of hexadecimal digits (0-9, A-F) enclosed in primes ('), with optional interspersed blanks.
- "string" an arbitrary character string enclosed in quotes ("). A quote within the string may be represented by two quotes.
- other any sequence of characters which is none of the above, and does not contain certain

special characters, will be treated as a character string.

When dates or times are being compared, they are converted to Julian values and compared numerically. A hexadecimal string may be treated as either a character string or a numeric value, as appropriate.

If a number, date, or time-of-day appears in a context requiring a character-string, it will be treated as such. Thus, for example,

```
TYPE=3270
```

compares the device type to the character string "3270".

Character strings are compared independent of case. The character "?" may be used in a value as a pattern character to match an arbitrary string of zero or more characters in the variable. The character "#" may be used as a pattern to match any single character. Thus, for example the expression

```
ID=1?
```

will be true for any userID beginning with "1".

```
NAME = DS##
```

will be true at any terminal whose name matches the first two characters, e.g., DS20, DS35, etc.

```
NAME = ds##
```

would match the same terminal names, since the case is ignored.

"expression"s are composed by combining the above with operators &, |, and ~, with the usual meanings (and, or, and not). For flexibility, a comma is treated as synonymous with |; thus

```
VERSA,IBMPC,OP/VIS
```

is equivalent to

```
VERSA|IBMPC|OP/VIS
```

Also, either NOT or - may be used instead of ~.

In the absence of parentheses, the operation ~ is applied first, then &, then |; thus

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```
~IBMPC & ID=WXYZ | TIME<500
```

is interpreted as

```
((~IBMPC) & ID=WXYZ) | TIME<500
```

Parentheses may be used freely to modify or clarify order of operations.

Blanks may appear anywhere except within a keyword.

Commands

The command list consists of zero or more commands separated by /'s. If a / is required in a command, it is represented by //.

The following commands are recognized. Underlining indicates allowed minimum abbreviations.

%devicecommand The remainder of the command is a DSR command to be passed to the device-support routines via CONTROL. This may be used to set device options.

\$mtscmd This indicates an MTS command to be processed by MTS via the CMD subroutine. Of course, commands which cause loading of another program (\$RUN, \$LOAD, \$DEBUG, etc.) should not be used.

PRINT text The remainder of the command is a message to be printed on SPRINT.

COMMENT text This is the same as PRINT.

RUN file [PAR=parameter]
The command specifies a file from which a program is to be dynamically loaded and linked to. If PAR=parameter follows the file name, the text following PAR is passed as a parameter when the program is called.

LINK file [PAR=parameter]
LINK is a synonym for RUN.

CALL entryname [PAR=parameter]
This command specifies an entry point name that is looked up in the loader tables and called if found. It may be followed by a parameter as for the RUN command.

This is a rather questionable facility. It can be used to speed up processing considerably by link-editing together a copy of SIGSETUP with programs it is to call. This avoids opening a lot of files, which seems to be what makes sigfile processing slow. However, getting copies of the routines is a bit dangerous. Watch out for system changes, etc.

CUINFO guinfoparm value

This command may be used to set the value of any GUINFO/CUINFO parameter that can be changed by the user. "guinfoparm" may specify either a GUINFO item name or item number. "value" specifies the value to be assigned, and may be any value as described above.

STOP

This terminates processing of SIGSETUP input. SIGSETUP will flush remaining input lines until an end-of-file is encountered. It is not necessary to have a STOP command; execution will terminate normally on an end-of-file from SCARDS.

entryname [PAR=parameter]

If "entryname" is defined in the loader symbol tables, a command of this form is equivalent to

CALL entryname [PAR=parameter]

and causes the specified routine to be called.

SIGS [id-list]

The SIGS command determines if the specified userIDs are currently signed on, and prints out a message if so. If "id-list" is omitted, SIGS checks for other signons of the user running SIGSETUP. "id-list" is an arbitrary list of zero or more userIDs, separated by blanks or commas. If the userID running SIGSETUP is in "id-list", SIGS checks for other signons of that userID.

FUNDS [parameter]

The FUNDS commands prints out the remaining computing funds for the current userID, as of the time of signon. An integer may be given as a parameter. In

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this case, the output will be produced only if the remaining balance is less than the indicated amount.

Substitutions in Commands

The value of any "variable", as described above, may be substituted into any command before it is performed. This substitution is indicated by the variable name preceded and followed by (|).

For example, |ID| is replaced by the current userID; |DATE| is replaced by the current date; |GUINFO(guinfoparm)| is replaced by the value of the specified GUINFO item. See examples below illustrating the use of substitutions in commands.

In all cases, the substituted value is converted to a suitable character form if necessary. (Note that TIME will be converted to minutes.)

Examples:

```

TERMINAL PRINT File space used is |GUINFO(CURRDISK)|
DAILY & ID=WXYZ FUNDS 500
WEDNESDAY&TOD>13:00:00 PRINT Information desk at 3:00
TERMTYPE="IBMPC" %PAGE/%PF5=%INSERT R WXYZ:BATCH SCARDS=
TERMINAL & TIME<1000 RUN *FORUM PAR=R
DS## %PF3=SYS T U |id|/%FOOT=ID=|id|
GUINFO(UNATMODE)=1 PRINT ** System in unattended mode **
ALL PRINT Sigfile processing took |TIME| seconds.
ALL PRINT |type| |termtype|
ALL $SET NAME='|READ("Enter name:")|'
```

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390.10 *SIGSETUP

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*SITES

Contents: A list of the hours and the types of terminals and software available at each of the Campus Computing Sites.

Use: The \$COPY command should be used, e.g.,

\$COPY *SITES

Note: This file replaces *WORKSTATIONS and *CCHOURS.

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*SLIDEQ

Contents: The queueing program for requesting postprocessing of user slide descriptions.

Purpose: To place the user's slide request(s) on the queue for processing.

Use: This program is invoked by the \$RUN command.

Program Key: *SLIDEQ

Logical I/O Units Referenced:

SCARDS - queueing requests and user input.
 SPRINT - slide receipt numbers, prompting messages for queueing requests, and error messages.

Parameters: A single queueing request may be specified in the PAR field of the \$RUN command, if no requests are to be read from SCARDS.

Return Codes: 0 - Successful return.
 >0 - Unsuccessful return (program will print an error message and the last queue request will not be made).

Description: Each queueing request specifies a file or tape containing one or more slide descriptions written in a language called SCODL. *SLIDEQ reads the slide descriptions, places the request in the system slide queue, and charges the user for the slides. At each scheduled processing time, the system postprocessor removes the request from the queue, reads the user's file (or tape), and produces commands for the camera.

*SLIDEQ prompts for queueing requests using the message "Enter SCODL file queue request:". The response may be a queueing request for a file or tape, or a line beginning with a "\$". If the queueing request is for a file, the request should consist of the file name. Explicit concatenations are permitted, as are line-number ranges. Only permanent files may be queued; temporary files may not be queued.

A response that begins with a dollar sign is treated as an MTS command that is to be executed immediately. A null line or end-of-file response terminates execution of *SLIDEQ.

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If the request is for a magnetic tape, the tape should already be mounted. The request should contain the pseudodevice name followed by the tape ID. Parameters must be separated by one or more blanks and/or commas. There are two optional parameters. One is the FILES parameter, which may appear anywhere after the pseudodevice name. This takes the form FILES=n, where "n" is the number of files to be plotted. The default is FILES=1. The other is the POSN parameter which may appear anywhere after the tape ID. This takes the form, POSN=string, where "string" specifies a file on the tape (any string legal for the POSN control command). If this parameter is not specified, *SLIDEQ begins reading at the current tape position (even if that is in the middle of a file). (At postprocessing, the tape will be mounted and positioned appropriately, even to the middle of a file.) *SLIDEQ and the postprocessor use whatever blocking is in effect at the time the queuing request is entered. *SLIDEQ does not rewind the tape after reading it. Pool tapes may not be queued.

If *SLIDEQ encounters an illegal SCODL command in the file being queued, it will print out an error message showing the illegal command, and the file will not be queued.

A line beginning \$CONTINUE WITH will be treated as an invalid SCODL command. Implicit concatenation may not be used in plot description files (or tapes).

Queueing

After *SLIDEQ finishes reading the slide description, it prints the number of slides and the cost. The user is then asked whether the slide(s) should actually be queued. If the reply is NO, the current queue request is aborted and the user prompted for a new request (unless the request was taken from the PAR field). If the reply is YES, the slide request then is placed in the queue, a charge is made for the slide(s), and a receipt number is printed (this receipt number must be used to obtain the slide(s) at Michigan Media later). In addition, if the slide description was contained in one or more disk files, *SLIDEQ will, if necessary, permit the queued files so that the postprocessor, (a program with PKEY=*SLIDEQ) may access the plot descriptions. *SLIDEQ will establish READ access for the file to the postprocessor if necessary. (Specifically, the file will be permitted "READ PKEY=*SLIDEQ"; see the description of the \$PERMIT command in MTS Volume 1, Michigan Terminal System.) A message is printed for each file so permitted. If *SLIDEQ cannot permit a file, a message is printed, and the user ensure that the file is permitted before the

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slide request is postprocessed. See the section below on postprocessing.

Postprocessing:

After a slide request has been queued, the user's slide description must be available for reading by the system postprocessor at the scheduled time. If the slide description is in a file, the file must be permitted read to PKEY=*SLIDEQ. If the file is not permitted, the slide will be canceled. If the plot description is on a tape, the tape must be available for mounting (e.g., not already mounted). If the tape ID is incorrect, the slide will be canceled.

Examples:

In the following examples, terminal output appears in uppercase and user input appears in lowercase.

In the first example, the slides contained in two files, SLIDE (containing one slide) and MORESLIDES (containing two slides), are to be queued.

```

#$run *slideq
#run *slideq
#Execution begins

Enter SCODL file queue request:
slide

File "WXYZ:SLIDE" has been permitted
"READ PKEY=*SLIDEQ".

One slide queued for file "WXYZ:SLIDE".
Cost will be: $4.50
Okay?
ok
SCODL file assigned receipt number: 780121

Enter SCODL file queue request:
moreslides

File "WXYZ:MORESLIDES" has been permitted
"READ PKEY=*SLIDEQ".

2 slides queued for file "WXYZ:MORESLIDES".
Cost will be: $9.00
Okay?
ok
SCODL file assigned receipt number: 780122

Enter SCODL file queue request:

```

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Total of 3 slides queued this run.

#Execution terminated

In the second example, the user does not have appropriate access to WABC:SLIDES for *SLIDEQ to permit the file. Note that the user must make sure that the file is permitted before the next postprocessing time.

```
#run *slideq par=wabc:slides
#Execution begins
```

```
Unable to permit file "WABC:SLIDES".
Permit file "WABC:SLIDES" to "READ PKEY=*SLIDEQ"
before next queue processing time, or the file
will not be able to be processed.
```

```
One slide queued for file "WABC:SLIDES".
Cost will be: $4.50
Okay?
ok
SCODL file assigned receipt number: 780123
```

```
Total of one slide queued this run.
#Execution terminated
```

For more information on producing slides, see Computing Center Memo 475, "Producing Slides on MTS."

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*SNOBOL4, *SNOBOL4B

Contents: The SNOBOL4 interpreter (version 3).

Purpose: To interpret SNOBOL4 source programs.

Use: The program is invoked by the \$RUN command.

Program Key: *SNOBOL4
*SNOBOL4B

Logical I/O Units Referenced:

- 5 - source for the SNOBOL4 program to be translated, immediately followed by data to be read by the default INPUT string.
- 6 - output from compilation of the SNOBOL4 program and output via the default OUTPUT string.
- 7 - output via the default PUNCH string.

Parameters: The following parameters may be specified in the PAR field of the \$RUN command. The parameters must be separated by a comma.

- DUMP - causes a SNOBOL4 string dump only if a fatal error occurs during execution.
- XREF - causes a cross-reference dictionary of the source program to be printed after compilation.
- NOEX - prevents execution of a SNOBOL4 program if any compilation errors are present.
- SIZE=xxxx - specifies the amount of storage to be used for the compiled SNOBOL4 program and its variables (the SNOBOL4 interpreter itself uses about 40 pages). "xxxx" may be any number specifying the number of pages to be reserved or the word MIN may be used to specify that 10 pages be reserved. If no SIZE parameter is present, the default value is 30 pages.

Return Codes: Always zero.

Description: The language accepted by *SNOBOL4 is described in the publication, The SNOBOL4 Programming Language, by R. Griswold, J. Poage, and I. Polonsky (Prentice-Hall, 1971).

The file *SNOBOL4B contains a version of the SNOBOL4 interpreter that supports the BLOCKS feature.

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The file *SPITBOL contains a faster and more economical version of SNOBOL4. This is recommended for general SNOBOL4 use.

For further details on the use of the SNOBOL language in MTS, see MTS Volume 9, SNOBOL4 in MTS.

Examples: \$RUN *SNOBOL4 5=*SOURCE* 6=*SINK*

In the above example, the source program and data are read from *SOURCE* and the output is written to *SINK*.

\$RUN *SNOBOL4 5=SNOPROG+*SOURCE* 6=*DUMMY*(1,20)+*SINK*
7=*PUNCH*

In the above example, the source program is read from the file SNOPROG and the data is read from *SOURCE*. The first twenty lines of output are discarded with the remainder being written to *SINK*. Punch output is written to *PUNCH*.

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*SNOSTORM

Contents: The SNOSTORM preprocessor program.

Purpose: To preprocess SNOSTORM source programs into SPITBOL source programs and then to invoke the SPITBOL compiler to produce an object module.

Use: SNOSTORM is invoked by the \$RUN command.

Program Key: *SNOSTORM

Logical I/O Units Referenced:

SCARDS - SNOSTORM source program input.
 SPRINT - Listing output, including diagnostics.
 SPUNCH - Object deck output. The object includes a \$CONTINUE WITH *SPITLIB record at the end.
 SERCOM - Diagnostics.

Temporary files created:

Two temporary files are created in the process of translating a SNOSTORM program. Both of these files are emptied before they are used.

-PRINT is a file which will contain the SPITBOL listing of the program produced by SNOSTORM. This file name is chosen to correspond to the file that *SPITDEBUG uses in printing source statements when errors are encountered.

-SNOOBJ is the file that is used to hold the SPITBOL program produced by SNOSTORM. This is an intermediate file that is then used as input to the SPITBOL compiler.

Parameters: Options may be specified in the PAR field of the \$RUN command. If more than one option is specified, they should be separated by commas with no intervening blanks.

SIZE=n The SIZE parameter sets the amount of memory used by SNOSTORM and SPITBOL in the process of compiling the source program. It may be necessary to increase this parameter for large source programs. The value of n may not be less than 20 nor more than 256. If specified, this parameter must be placed before other parameters. The default is SIZE=20.

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COM/NOCOM The COM option controls the passage of comments into the target module. If COM is specified, all comments in the source module are passed into the target module. If NOCOM is specified, no comments are passed to the target module. The default is NOCOM.

CASE statements will also generate comments in the target module if the COM option is in effect.

INDENT='string'/NOINDENT

The INDENT option is followed by an '=' and a quoted string. This string is taken as the string to be replicated once for each indentation level. Automatic indentation may be turned off with the NOINDENT option. The default is INDENT='. '.

LIST/NOLIST

The LIST option controls all further source program listing, either suppressing it with NOLIST or enabling it with LIST. It performs the same action as the LIST {ON|OFF} statement. The default is LIST.

CONVERT

The CONVERT option converts obsolete SNOSTORM statements into a currently acceptable form. When this option is specified, SNOSTORM will read the old program from SCARDS and write a new version of the program on SPUNCH, preserving the line numbers above 1.000. SNOSTORM will not translate during this process except for translating obsolete forms to new forms.

DEBUG/NODEBUG

The DEBUG option is provided to aid in using *SPITDEBUG. The DEBUG option causes extra code to be inserted in the SPITBOL program to allow *SPITDEBUG breakpoints to be set at any statement. Execution of the program will begin in *SPITDEBUG so that there is an opportunity to issue debugging commands before the program is run.

The extra code generated by the DEBUG option will require extra CPU time and memory space in the object program. Because the number of statements (but not the CPU time) is approximately tripled, it may be necessary to increase the value of &STLIMIT.

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Without the DEBUG option, *SPITDEBUG is still included in the program, but no extra code is generated for breakpoints or to begin execution in the debugger. To suppress the inclusion of *SPITDEBUG, the NODEBUG option must be specified.

Return Codes: Always zero.

Description: The SNOSTORM preprocessor was developed at the Computing Center to facilitate structured programming in SPITBOL, a dialect of SNOBOL4. For a full description of SNOSTORM, see MTS Volume 9, SNOBOL4 in MTS.

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*SOFTWARECHARGES

Contents: A list of the programs for which program-product surcharges are made.

Use: The list may be obtained via the \$COPY command, e.g.,

\$COPY *SOFTWARECHARGES

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*SORT

Contents: The sort/merge/blocking program.

Use: The program is invoked by the \$RUN command.

Program Key: *EXEC

Logical I/O Units Referenced:

- GUSER - a control statement, which is terminated by the END parameter or an end-of-file, is read via GUSER if one is not passed as a parameter.
- SCARDS - input records are read from SCARDS if an input data set name is omitted from the control statement.
- SERCOM - prompting and sort/merge program diagnostics.
- SPUNCH - output records are written to SPUNCH if an output data set name is omitted from the control statement.

Return Codes: Return code from SORT E9 (if SORT E9 provided), or

- 0 - Successful return.
- 4 - Error return.

Description: The sort/merge program

- (1) orders records according to the collating sequence defined in its control statement;
- (2) provides blocking/deblocking facilities, processing data sets of types U, F, V, VS, FB, FBS, VB, and VBS;
- (3) allows user subroutines to gain control at several points, permitting the generation, modification, deletion, and comparison of records.

The following description is designed to familiarize users with certain aspects of the control statement and to enable them to run simple sorts using the most common type of ordering: character, or alphabetized, collation. It is not intended to describe all, or even the best, ways to do simple character sorts. Rather, it will describe one way which produces the desired results.

The sort program is invoked by entering a \$RUN *SORT command. The control statement, which describes the processing of the data, is placed in the PAR field of the \$RUN command. This control statement defines how the output is to be ordered and the locations of the input and output data. The following paragraphs describe a

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control statement for a simple character sort on quantities of data up to at least the lesser of 225,000 records and 18,000,000 characters.

The first parameter to be specified in the PAR field is the keyword "SORT=". It is then necessary to specify the criteria for ordering the data. This is done by following "SORT=" with the positional parameters "CH,A,". The "CH" means that the ordering is to be based on character data, that is, data composed of alphanumeric characters or numbers in character form. Character data are produced, for example, by keypunches, terminals, and formatted output from FORTRAN. The "A" means that the output is to be in ascending order, e.g., the characters in the string "abzAZ019" are ascending. The \$RUN command should now look like this:

```
$RUN *SORT PAR=SORT=CH,A,
```

Note that a blank must not immediately precede any equal sign or comma in the control statement.

The location of the characters which are to determine the ordering of the records must now be supplied. Suppose that the field on which the sort is to be based starts in position, or column, 15 and ends in position 20 in each record. This is indicated to SORT as shown in the example below. The "A," in the control statement is followed by the starting position, "15" in this case, and the number of characters, or length, of the field, "6" in this case. The two values are separated by a comma. The \$RUN command is now

```
$RUN *SORT PAR=SORT=CH,A,15,6
```

If the designated fields (positions 15-20 in the example) of two records are compared and found to be identical, it may be desired to compare a second field in each record to determine which record should precede the other. This is accomplished by appending a comma and another CH,A, starting-position,number-of-characters combination to the first description. Suppose that the second field occupies positions 79-80 of the records. The \$RUN command would then be

```
$RUN *SORT PAR=SORT=CH,A,15,6,CH,A,79,2
```

Additional fields for the resolution of identical comparisons may be added in the same manner.

The next step is to specify where the input is to be found. This is done with the keyword "INPUT=" followed

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by a file or pseudodevice name, e.g., IN(5,99)@-TRIM or *I*. The \$RUN command might now be

```
$RUN *SORT PAR=CH,A,15,6,CH,A,79,2
      INPUT=IN(5,99)@-TRIM
```

(In the case of blocked magnetic tapes, this is neither the most efficient nor the recommended method of completely specifying the input data set to SORT; but if tape blocking is left on, which is the default, it does work. It should also be noted that SORT does not reposition tapes either before or after using them nor does it write end-of-file marks.)

Finally, the place where SORT is to write the sorted output must be designated. The keyword "OUTPUT=" followed by a file or pseudodevice name accomplishes this. If the output is to be written to a tape with the pseudodevice name *O*, the \$RUN command would be

```
$RUN *SORT PAR=CH,A,15,6,CH,A,79,2
      INPUT=IN(5,99)@-TRIM OUTPUT=*O*
```

(The comments regarding magnetic input tapes also apply to tapes used for output). The use of the same data set for both input and output should not even be considered unless the data would be easily recoverable if it were damaged and unless the user is knowledgeable about both SORT and the characteristics of the data set.

An alternate way of specifying the input and output data sets is to assign the input data set to SCARDS and the output data set to SPUNCH. Using this alternative, the \$RUN command for the same sort as above would look like:

```
$RUN *SORT SCARDS=IN(5,99)@TRIM SPUNCH=*O*
      PAR=S=CH,A,15,6,CH,A,79,2
```

When SORT finishes, it prints two statistics separated by a slash. The first of these is the number of records read by SORT. The second, which may normally be ignored, is the number of scratch files used by SORT.

For a complete description of the sort/merge program, see "The SORT Utility Program" description in MTS Volume 5, System Services.

Examples: The following include features not described above.

```
$RUN *SORT PAR=C I=*TAPE*,VB,50,32767 O=-T
```

In the above example, the contents of *TAPE* are copied into the file -T. *T* has VB-formatted

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records with a maximum record length of 50 bytes and a maximum block length of 32,767 bytes. The records written to -T will have U format and maximum record and block lengths of 50 bytes. Assuming *TAPE* is a magnetic tape, blocking by the tape routines must be disabled.

```
$RUN *SORT SCARDS=*T* SPUNCH=*SINK* PAR=S=C,D,5,15 R=4000
```

In the above example, the contents of *T*, which is approximately 4000 records, will be written onto the current sink data set, ordered such that positions 5-19 of each record form a descending character sequence. Both *T* and the sink are treated as having U-formatted records. Assuming *T* is a magnetic tape, the maximum input record length will be the value of the SIZE parameter (if blocking is off) or the LRECL parameter (if blocking is on); the maximum output record length will be equal to the maximum input record length.

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Summary of the Control Statement

Prototype:

```
[COPY| [[SORT|MERGE] [= [[type], [aspect], [location], [length], ]...
      [type] [, [aspect] [, [location] [, [length]]]]]]]
[[DS=delimiter [string] delimiter·]...DS=delimiter [string] delimiter]
[INPUT [= [[name], [structure], [record length], [block length], ]...
      [name] [, [structure] [, [record length] [, [block length]]]]]]]
[OUTPUT [= [[name], [structure], [record length], [block length], ]...
      [name] [, [structure] [, [record length] [, [block length]]]]]]]
[additional parameter]... [END ]
```

Collating fields:

TYPE	CODE	SIGN PRESENT	FIELD LENGTH (BYTES)
alignment	<u>AL</u>	no	1 - 4095
binary	<u>BI</u>	no	1 - 256
bit	BT	no	1 - 255 (mask)
call	CA	-	-
character	<u>CH</u>	no	1 - 256
defined sequence	<u>DS(i)</u>	no	1 - 256
fixed-point	<u>FI</u>	yes	1 - 260
floating-point	FL	yes	2 - 16
length	<u>LE</u>	-	-
packed decimal	<u>PD</u>	yes	1 - 16
sequence	SE	-	-
signed decimal	<u>SD</u>	yes	1 - 17
zoned decimal	<u>ZD</u>	yes	1 - 16

Record structures:

CODE	RECORD STRUCTURE
U	undefined length
F	fixed length
V	variable length
VS	variable length; spanned
FB	fixed length; blocked
VB	variable length; blocked
VBS	variable length; blocked; spanned
FBS	fixed length; blocked; standard

Additional parameters:

```
CHK (exit check facility)
DEC (delete comments)
DEL=x[,x]... (delete output records)
HELP [topic] (enter help facility)
LIO (list data set characteristics)
{REC|MNR}=x (number of records)
RES=x (restart)
SIG (sign off on error)
TPS [{x|name,name[,name]...}] (tape-merge sort facility)
```


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*SPIRES

Contents: The SPIRES database management system.
Purpose: To define, search, and modify data bases.
Use: This program is invoked by the \$RUN command.
Program Key: *SPIRES

Logical I/O Units Referenced:
SCARDS - SPIRES commands.
SPRINT - output and error messages.

Description: SPIRES (Stanford Public Information Retrieval System) is available in MTS. SPIRES is a computer information storage and retrieval system. It is the product of an intensive development effort at Stanford, and represents a significant advance in information retrieval technology.

SPIRES allows a user to create, update, maintain, interrogate, and display stored information. This information may be kept in either the user's own private database of records or in a public database. As an on-line interactive system, SPIRES enables the user to communicate with the database in a conversational mode. SPIRES is general enough to handle most forms of data -- numeric, textual, and codified. It supports a wide spectrum of applications, ranging from management and administrative support to bibliographic reference retrieval and handling of numeric and codified information. Because of its flexibility, it can easily be adapted to changes in a user's requirements.

To find out how to obtain documentation for SPIRES, the user may issue the command

\$COPY DBMD:DOCUMENTATION

Parameters: The following parameters may be specified in the PAR field of the \$RUN command. The parameters must be separated by commas and/or blanks. The minimum acceptable abbreviations are underlined.

TERSE

The TERSE parameter will cause a shorter greeting message to be printed when the program is invoked.

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ACTIVE=filename

The ACTIVE parameter will set the file "filename" as the active file. "filename" must be a line file. If omitted, the file -SPIRES will be used as the active file.

{SPIBILD|SPICOMP|FASTBILD|SPIRES}

These parameters specify the processor to be invoked. If omitted, the SPIRES processor is invoked.

Return Codes: None.

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*SPITBOL

Contents: Version 2 of the SNOBOL4 compiler developed at the Illinois Institute of Technology.

Purpose: To compile and execute SNOBOL4 source programs.

Use: The compiler is invoked by the \$RUN command.

Program Key: *SPITBOL

Logical I/O Units Referenced:

- SCARDS - SNOBOL4 source program to be compiled followed by the data read via the default variable INPUT.
- SPRINT - source listing, object listing, parameter listing, compiler diagnostics, execution-time diagnostics, and output via the default variable OUTPUT.
- SPUNCH - object module if the DECK option was specified, and output from the default variable PUNCH.
- 0 - object module if NODECK and LOAD parameters are specified.
- SERCOM - prompting if a terminal.
- GUSER - user responses to prompting if a terminal.

Parameters: The following parameters may be specified in the PAR field of the \$RUN command. The parameters must be separated by a comma or by one or more blanks. A semicolon may be used to terminate the PAR field; the text after the semicolon is not processed by the SPITBOL compiler but is available to the program via the SYSPAR external function. The parameters may be either keywords or free verbs. Free verbs may be negated by one of three prefixes: "NO", "~", or "-". The underlined portion of the parameter may be used as the minimum acceptable abbreviation. The legal parameters are:

ALIST or NOALIST

If ALIST is specified, an object-code listing will be produced on SPRINT. The default is NOALIST. This parameter replaces the OLIST parameter.

BATCH or NOBATCH

If BATCH is specified, the compiler will batch process input decks. The batch pseudo-end-of-file is "./*" in columns 1-3. The default is NOBATCH.

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CSTAT or NOCSTAT

If CSTAT is specified, compilation statistics are printed on SPRINT. The default is NOCSTAT.

DECK or NODECK

If DECK is specified, an object module will be produced on SPUNCH. SPITBOL object modules must be run in concatenation with *SPITLIB. The default is NODECK.

DUMP=nnn

At termination of execution, the SPITBOL dump function is called with "nnn" as the argument. The default is DUMP=0 which produces no dump.

EDUMP=nnn

If execution terminates abnormally, the SPITBOL dump function will be called with "nnn" as the argument. If SPRINT is assigned to a terminal, the default is EDUMP=0 which produces no dump; if SPRINT is not assigned to a terminal, the default is EDUMP=1 which generates a dump of natural variables and keywords.

ERRXEQ or NOERRXEQ

If ERRXEQ is specified, the compiled program is executed even if errors were detected during compilation. The default is ERRXEQ.

ESTAT or NOESTAT

If ESTAT is specified, execution statistics are produced on SPRINT. The default is NOESTAT.

EXECUTE or NOEXECUTE

If EXECUTE is specified, the compiled program is executed. The default is EXECUTE.

FAILCHK or NOFAILCHK

If FAILCHK is specified, execution is terminated with an error if a statement is executed that fails and there is no conditional "goto" field. This is a useful debugging tool. The default is NOFAILCHK.

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INMGN=nnn

"nnn" is the right-hand margin for the compiler when scanning input source programs. The default is set to the minimum of the input record length for SCARDS and 255. Programs that have sequential IDs in columns 73-80 should compile with INMGN=72.

LINECNT=nnn

"nnn" is the number of lines per page for printed output. This must be in the range of $3 \leq nnn \leq 32767$. The default is 58.

LIST or NOLIST

If LIST is specified, a source listing of the compiled program is printed on SPRINT. The default is LIST unless SPRINT is assigned to a terminal. This parameter replaces the SLIST parameter.

LOAD or NOLOAD

If both LOAD and NODECK are specified, an object module will be produced on logical I/O unit 0. The default is NOLOAD.

OPTIMIZE or NOOPTIMIZE

If OPTIMIZE is specified, the object code produced will be optimized. This can reduce the CPU time and storage required for program execution. The default is OPTIMIZE.

PLIST or NOPLIST

If PLIST is specified, a list of parameter values will be printed on SPRINT. The default is NOPLIST.

SDUMP or NOSDUMP

If SDUMP is specified, a storage dump of the SPITBOL work areas will be produced on SPRINT if an internal SPITBOL error is detected. This is useful only for system debugging. The default is NOSDUMP.

SEQCHK or NOSEQCHK

If SEQCHK is specified and INMGN=72, the sequential ID field (columns 73-80) is checked for ascending order. Out-of-order cards will be flagged. The default is NOSEQCHK.

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SIZE=nnn

"nnn" is the number of pages allocated for dynamic storage within the compiler. This must be in the range of $4 \leq nnn \leq 256$. The default is 20.

TIMECHK or NOTIMECHK

If TIMECHK is specified, SPITBOL will terminate execution of the user program 0.25 seconds before any specified time limit in order that a symbolic dump may be given. The default is TIMECHK.

XREF or NOXREF

A cross-reference listing of the symbols in the compiled program is printed on SPRINT. The default is NOXREF.

Return Codes: Always zero.

Description: *SPITBOL is a SNOBOL4 compiler which is considerably faster than *SNOBOL4, and can generate object modules if desired. However, the object modules must be run with *SPITLIB. For further details, see the section "SPITBOL" in MTS Volume 9, SNOBOL4 in MTS.

The file *SPITERR contains the SPITBOL error messages. Each message is located at an MTS line number corresponding to the SPITBOL error number for that message. The message may be obtained via the \$COPY command, e.g.,

```
$COPY *SPITERR(11.009,11.009)
```

prints SPITBOL error message 11.009.

Examples: \$RUN *SPITBOL SCARDS=PROG.S PAR=SIZE=50

In the above example, the program in the file PROG.S is compiled and executed with a dynamic storage size of 50 pages.

```
$RUN *SPITBOL SCARDS=PROG.S SPRINT=*PRINT* SPUNCH=PROG.O
PAR=DECK,NOEX
```

In the above example, the program in PROG.S is compiled without being executed. The object module is written into the file PROG.O; the source listing is produced on *PRINT*.

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*SPITDEBUG

Purpose: To assist in the interactive debugging of SPITBOL programs.

Use: The following statement should be included in the SPITBOL source program at a place where it will be executed at the beginning of the program starting at column one:

-COPY *SPITDEBUG

If a copy of the SPITBOL-generated source listing is placed in the file -PRINT*, *SPITDEBUG will print the statement causing the error.

Program Key: *EXEC

Description: *SPITDEBUG contains a number of SPITBOL source statements that are invoked whenever an execution error occurs or the DEBUG function is called.

Errors are trapped using the SETEXIT function and setting &ERRLIMIT to 1. When SPITDEBUG gains control after an error, the error number and associated error comment are printed. If the statement can be found in the file -PRINT*, it is also printed. After these messages are printed, the user is placed in SPITDEBUG command mode where he may enter SPITDEBUG commands or SPITBOL statements.

If the DEBUG function is called, it may have a string as an argument which is printed at the time of the call. These calls may be placed in the source program in order to set a breakpoint and examine the status of variables using SPITDEBUG. Processing may be continued with the SPITDEBUG CONTINUE command.

The SPITDEBUG commands are given below. The underlined portion of each command is the minimum acceptable abbreviation that may be used.

<u>BREAK</u> label	Sets an execution breakpoint at "label". This breakpoint will be effective only on a goto to that label; it is not effective if execution of the previous statement falls into that label. Labels may be generated automatically on all statements via the SNOSTORM DEBUG option. The breakpoint feature is
--------------------	---

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implemented with the SPITBOL TRACE function and the keyword &TRACE is incremented by 100 each time a BREAK command is issued. This inadvertently may enable other unrelated tracing in the program. When used with programs compiled with the SNO-STORM DEBUG option, it is possible to use the source-file line number in place of the label.

<u>CONTINUE</u>	Resumes program execution.
<u>DISPLAY</u> express	Displays the program value "express", e.g., DISPLAY x<2> x<2> = "HELLO"
<u>DUMP</u> {1 2}	Produces a SNOBOL dump (DUMP(1) or DUMP(2)).
<u>EXPLAIN</u>	Synonym for HELP.
<u>GOTO</u> label	Resumes program at the location "label"; this is the same as ":(label)" in the program. GOTO START
<u>HELP</u>	Provides a list of the legal SPITDEBUG commands with a brief description of each.
<u>IGNORE</u> ["msg"] n	Causes the next "n" calls on the DEBUG function with parameter "msg" to be ignored. If "msg" is omitted, DEBUG calls with a null string parameter will be ignored.
<u>MTS</u> [command]	Enters MTS command and optionally executes an MTS command, e.g., MTS \$EDIT MYFILE
<u>REMOVE</u> label	Removes the breakpoint at "label".
<u>RESTORE</u> label	Synonym for REMOVE.
<u>STOP</u>	Terminates execution.
\$command	Executes an MTS command.

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*SPITLIB

Contents: The version 2 execution-time support routines for programs compiled by *SPITBOL.

Use: *SPITLIB should be concatenated with the object file to be executed on the \$RUN command, i.e.,

\$RUN object+*SPITLIB

Program Key: *EXEC

Logical I/O Units Referenced:

- SCARDS - data to be read via the default variable INPUT.
- SPRINT - execution-time diagnostics, and output via the default variable OUTPUT.
- SPUNCH - output via the default variable PUNCH.
- SERCOM - prompting if a terminal.
- GUSER - user responses to prompting if a terminal.

Parameters: The following parameters may be specified in the PAR field of the \$RUN command. The parameters must be separated by a comma or by one or more blanks. A semicolon may be used to terminate the PAR field; the text after the semicolon is not processed by the SPITBOL compiler but is available to the program via the SYSPAR external function. The parameters may be keywords or free verbs. Free verbs may be negated by one of three prefixes: "NO", "~", or "-". The underlined portion of each parameter may be used as the minimum acceptable abbreviation. The legal parameters are:

DUMP=nnn

At termination of execution, the SPITBOL dump function is called with "nnn" as the argument. The default is DUMP=0 which produces no dump.

EDUMP=nnn

If execution terminates abnormally, the SPITBOL dump function will be called with "nnn" as the argument. If SPRINT is assigned to a terminal, the default is EDUMP=0 which produces no dump; if SPRINT is not assigned to a terminal, the default is EDUMP=1 which generates a dump of natural variables and keywords.

ESTAT or NOESTAT

If ESTAT is specified, execution statistics are generated on SPRINT. The default is NOESTAT.

LINECNT=nnn

"nnn" is the number of lines per page for printed output. This must be in the range of $3 \leq nnn \leq 32767$. The default is 58.

PLIST or NOPLIST

If PLIST is specified, a list of parameter values is printed on SPRINT. The default is PLIST.

SDUMP or NOSDUMP

If SDUMP is specified, a storage dump of the SPITBOL work areas will be produced on SPRINT if an internal SPITBOL error is detected. This is useful only for system debugging. The default is NOSDUMP.

SIZE=nnn

"nnn" is the number of pages of dynamic storage allocated. This must be in the range of $4 \leq nnn \leq 256$. The default is 20.

TIMECHK or NOTIMECHK

If TIMECHK is specified, SPITBOL will terminate execution of the user program 0.25 seconds before any specified time limit in order that a symbolic dump may be given. The default is TIMECHK.

Description: Object modules generated by *SPITBOL must be run with the execution-time support routines in *SPITLIB. For further details, see the section "SPITBOL" in MTS Volume 9, SNOBOL4 in MTS.

Examples: \$RUN PROG.OBJ+*SPITLIB SCARDS=DATA1

In the above example, the program in the file PROG.OBJ is executed with the data being read from the file DATA1.

\$RUN -OBJ+*SPITLIB 5=INFILE 6=OUTFILE PAR=SIZE=50

In the above example, the program in the file -OBJ is executed with input from the file INFILE and output being written to the file OUTFILE.

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*SYMBOLS

Contents: A program to print a listing of all external symbols within the MTS system.

Use: The program is invoked by the \$RUN command.

Program Key: *SYMBOLS

Logical I/O Units Referenced:

SCARDS - the specified file or device from which the control record is read.

SPRINT - the specified file or device on which the output listing is produced.

Return Codes: Always zero.

Description: This program produces the listing of MTS external symbols in the system. The listing is produced by searching the external symbol dictionaries of the system and the library. Hence, it is current as of the instant it is run.

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*SYSMAC

Contents: The standard macro library for use with the MTS 360/370 assemblers *ASMG and *ASMH.

Purpose: To supply standard macro definitions for frequently used MTS facilities.

Use: The file should be assigned to one of the logical units 0, 2, 3, 4, or 5 on the \$RUN *ASMG or \$RUN *ASMH commands. For *ASMH, the default is *SYSMAC if unit 0 is not assigned.

Program Key: *EXEC

Description: The form of a macro library and descriptions of the macros in *SYSMAC are given in MTS Volume 14, 360/370 Assemblers in MTS.

Example: \$RUN *ASMH SCARDS=PROGRAM 0=*SYSMAC
\$RUN *ASMH SCARDS=PROGRAM

In the above examples which are equivalent, the macro library for the program in the file PROGRAM is assigned to logical I/O unit 0.

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*TANGO

Contents: The object module of the Tango compiler.

Use: The Tango compiler is invoked by the \$RUN command.

Program Key: *TANGO

Logical I/O Units Referenced:

SCARDS - the Tango source program.

SPRINT - a source program listing.

SPUNCH - the object module if there are no compilation errors.

Parameters: The following parameters may be specified in the PAR field of the \$RUN command.

CHECK/NOCHECK

The CHECK option causes certain run-time checks to be produced in the object module. The NOCHECK option suppresses these checks. The default is CHECK.

LIST/NOLIST

The LIST option produces a listing of the source program on SPRINT. The NOLIST option suppresses the source program listing. The default is LIST.

PRINT_CODE/NOPRINTCODE

The PRINT_CODE option produces a listing of the object code on SPRINT. The NOTPRINT_CODE option suppresses this listing. The default is NOPRINT_CODE.

Return Codes: 0 - Successful return.
4 - Warning messages printed.
8 - Errors detected.

Description: The Tango compiler, developed at the University of Michigan Computing Center, is designed to be a modern replacement for Snobol4 and Spitbol. It has the pattern matching and table facilities of Snobol and is augmented by structured-programming features and strong typing similar to those in Pascal and Modula.

The run-time library *TANGOLIB must be concatenated to the object file when it is executed.

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Example: \$RUN *TANGO SCARDS=PROG.SOU SPUNCH=PROG.OUT PAR=NOLIST
 \$RUN PROG.OUT+*TANGOLIB

In the above example, the Tango source program in the file PROG.SOU is compiled and subsequently executed.

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*TAPECOPY

Contents: The MTS tape-copying program.

Purpose: To copy magnetic tapes.

Use: The program may be invoked with the \$RUN command or may be called as a subroutine from a user-supplied program. In the latter case, the user must concatenate *TAPECOPY with the FDname(s) containing the object modules of his own program, e.g.,

\$RUN object+*TAPECOPY

Program Key: *TAPECOPY

Logical I/O Units Referenced:

- SPRINT - the listing of the number of blocks or records in each file.
- SERCOM - error comments and prompting messages.
- GUSER - input and output tape pseudodevice names.
- 0 - the input tape pseudodevice name.
- 1 - the output tape pseudodevice name.

Parameters: The following parameters may be specified in the PAR field of the \$RUN command. The parameters must be separated by commas.

- FILES=n The number of files (or data sets) to be copied is specified by "n".
- RECORDS=m The number of blocks or records (see REBLK or BLOCKS=m parameter) to be copied in file n+1 is specified by "m", where "m" is a one to six digit decimal integer. If "n" and "m" are both zero or omitted, then all files are copied (see below).
- NOREW The tapes are not rewound before or after copying.
- OMITERRORS Whenever a permanent read error is encountered on the input tape, an error comment (indicating the file and record in error) will be printed on SERCOM. The block in error will be skipped and copying will continue with the next block.
- COPYERRORS This parameter causes the same error comment as OMITERRORS. However, any blocks which are in error are copied. Any block so copied will no longer contain the error indication; however, the validity of the data in any such block is unpredictable.

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REBLK This parameter will cause blocking to be enabled for both the input and output tapes so that records, rather than blocks, are copied. Normally, blocking is disabled so that entire blocks are copied (for efficiency).

REW The tapes are rewound before and after copying.

Return Codes: 0 - Successful return.
4 - Invalid parameter.
8 - Fatal error.

Description: The complete description of *TAPECOPY is given in MTS Volume 19, Tapes and Floppy Disks.

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*TAPEDUMP

Contents: The MTS tape (or file) dumping program.

Purpose: To dump a magnetic tape or disk file in both character and binary formats.

Use: The program is invoked by the \$RUN command.

Program Key: *TAPEDUMP

Logical I/O Units Referenced:

- SPRINT - dump output.
- SERCOM - prompting and error messages.
- GUSER - tape or file to be dumped if unit 0 is not assigned.
- 0 - magnetic tape or file to be dumped.

Parameters The following parameters may be specified in the PAR field of the \$RUN command. The parameters must be separated by commas.

- FILES=n Specifies the number of files to be dumped.
- RECORDS=m Specifies the number of records to be dumped.
- NODUMP Suppresses the printing of the actual dump.
- EBCDIC Prints the dump in hexadecimal/EBCDIC.
- BCD Prints the dump in octal/BCD.
- CV Forces the reading of 7-track tapes with the data converter feature enabled.

Return Codes: Always zero.

Description: The complete description of *TAPEDUMP is given igned to in MTS Volume 19, Tapes and Floppy Disks.

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*TAPEFIXER

Contents: A program to recover data from a 9-track labeled tape which has been partially destroyed or contains unreadable blocks.

Use: The program is invoked by the \$RUN command.

Program Key: *TAPEFIXER

Logical I/O Units Referenced:

- SPRINT - labels encountered on the input tape (see the parameter descriptions below).
- SERCOM - diagnostic and prompting messages.
- 0 - input tape to be scanned. This must be a 9-track tape and cannot be a pool tape since label processing cannot be disabled for pool tapes.
- 1 - corrected version of input tape. This must be a 9-track tape and may be either labeled or unlabeled. The tape need not be positioned at the load point. The tape must be mounted with RING=IN specified on the mount request.

Parameters: The following parameters may be specified in the PAR field of the \$RUN command.

- LABELS Labels encountered on the input tape will be echoed on SPRINT. This is the default.
- NOLABELS Labels encountered on the input tape will not be echoed on SPRINT.
- NOTEXT Data records are not copied to the output tape.
- TEST When searching for a label, all blocks are inspected, not just the blocks that are exactly 80 bytes long.

Return Codes: 0 - Successful return.
8 - Error return.

Description: The complete description of *TAPEFIXER is given in MTS Volume 19, Tapes and Floppy Disks.

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*TAPES

Contents: A magnetic-tape status program.

Purpose: To allow magnetic-tape users to PERMIT, RENAME, and find out the status of magnetic tapes stored by the Computing Center.

Use: The program is invoked by the \$RUN command.

Program Key: *TAPES

Return Codes: Always zero.

Description: *TAPES is a program for changing the name and permission status of user-owned magnetic tapes, and for displaying the results of those changes.

Commands: The following commands are available for *TAPES. The underlined portion of each command name may be used as an abbreviation.

STATUS [tapename] [options ...]

The STATUS command gives information about a user's own tapes and of tapes of other users that are accessible. The syntax of this command is very similar to the MTS \$FILESTATUS command. If no parameter is given, information is given about all tapes. If "tapename" is specified, information is given about a specific tape or set of tapes. "tapename" may be the name of a tape (optionally preceded by a userID), a question mark, or a question mark preceded by a userID. For example,

```
STATUS MY_TAPE
STATUS WABC:MY_TAPE
STATUS ?
STATUS WABC:?
```

"options" may be specified to produce specific information or to control the output format or destination. "options" may be one or more of the following:

To select specific items:

ACCESS	COMMENT	CREATE DATE
DENSITY (or MODE)	DRIVES	IDLE DAYS
LASTCHG	LAST MOUNTED	LASTREF

LAST USER	LOCATION	MEDIA
MOUNT RESULT	NAME	OWNER
PDN	RACKNUMBER	RECEIPTS
REFERENCES	RING STATUS	SITE
STATUS	TAPE NAME	VOLUME

To select groups of items:

SHORTINFO TOTAL

To control formatting:

COLUMNS	HEADING	INDENT	KEYWORD
LABELLED	NOHEADING	PACKED	SPACING
TERSE	VERBOSE		

To change the output destination:

OUTPUT=FDname

For example, to display all information about all tapes on *PRINT*, enter

STATUS ? TOTAL OUTPUT=*PRINT*

To display the last time the tape F000:F000T1 was mounted with write-protection disabled, enter

STATUS F000:F000T1 LASTCHG

PERMIT tapename [access [accessor]]
PERMIT tapename1 LIKE tapename2

The PERMIT command allows the user to permit a tape in a manner similar to the MTS \$PERMIT command. The syntax takes the same form as well with the following differences.

When permitting a tape "LIKE" another tape, only one tape name may appear after "LIKE". For example,

PERMIT TAPE4 LIKE TAPE1

Certain access types are not valid with tapes. The valid access types are

<u>WRITE</u>	RENAME (or RNA)	RUN
RW	<u>READ</u>	EDIT
<u>DEFAULT</u>	<u>DESTROY</u>	UNLIM
<u>PERMIT</u>	FULL	<u>NONE</u>

For example, to permit TAPE1 READ to user WXYZ, enter

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```
PERMIT TAPE1 R WXYZ
```

Accessors may be the same as for files (userIDs, projectIDs, program keys, or qualified program keys), e.g.:

```
ALL
ME
OTHERS
OWNERS
userID
PROJECT=projectID
PKEY=pkey
```

For further information, see Tutorial T7012, "Submitting, Retrieving, and Permitting Magnetic Tapes."

RENAME oldtapename [TO] newtapename

The RENAME command takes the same form as the MTS \$RENAME command with one difference, confirmation is not allowed. For example to rename TAPE1 to be POPULATION.DATA, enter

```
RENAME TAPE1 TO POPULATION.DATA
```

Note: The RENAME command may also be used to transfer ownership of a tape to another user just like the MTS \$RENAME command.

MODIFY tapename option

The MODIFY command changes the pseudodevice name (PDN) for a tape (the default is *T*). For example,

```
MODIFY TAPE1 PDN=*OUT*
```

The MODIFY command also can change any comments associated with the tape. For example,

```
MODIFY TAPE2 COMMENTS="Includes data from TAPE1"
```

The comments must be enclosed in quotation marks and may not be more than 100 characters in length.

STOP

The STOP command terminates execution of *TAPES.

MTS

The MTS command returns control to MTS command mode.
\$RESTART can be used to resume execution of this
program.

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*TAPESUBMIT/*TAPERETRIEVE

Contents: The magnetic-tape submission and retrieval programs.

Purpose: To guide a magnetic-tape user through the tape-submission and retrieval process used at the Computing Center.

Use: The programs are invoked by the \$RUN command.

Program Keys: *TAPESUBMIT
*TAPERETRIEV

Logical I/O Units Referenced:
SERCOM - error comments, prompting messages, and summary information.
GUSER - user responses to prompting messages (if any).

Return Codes: Always zero.

Description: TAPESUBMIT is the program that must be run by all magnetic-tape users who wish to submit magnetic tapes to the Computing Center for subsequent mounting and use. Depending on the options selected, the user will supply and the program will collect all of the information necessary for a magnetic tape to be initialized (optional) and placed in the tape racks at the Computing Center.

The following commands may be used with TAPESUBMIT. Single commands may also be entered in the PAR field of the \$RUN command. In the descriptions that follow, allowable abbreviations are indicated by underlining.

DELETE receipt-code

The DELETE option deletes an entry for a tape that is in the submission process.

DISPLAY

The DISPLAY option prints information about the tapes for which the user has run TAPESUBMIT, but have not yet been entered into the tape database. Normally, the information is entered when the tape is presented to Computing Center personnel.

HELP topic

The HELP command gives detailed information about the requested topic or about obtaining more help if no topic is given. Possible topics include:

any other TAPESUBMIT commands, PROCEDURES, GLOSSARY, BULKINPUT, or EXAMPLES.

MTS

The MTS command returns control to MTS command mode. TAPESUBMIT may be re-entered with the MTS \$RESTART command.

SUBMIT (NEW|OLD|TERSE|VERBOSE)
SUBMIT (INPUT=filename)

The SUBMIT command initiates the tape-submission process and has two forms.

The first form above is used to submit a small number of tapes. The user will be asked and should respond to a number of questions concerning the tape to be submitted. By specifying the NEW or OLD option, a few questions necessary to determine the status of the tape will be skipped, shortening the process. If the tape has been used prior to this submission but there is no further need to access the data on the tape, then NEW may be specified or both NEW and OLD may be omitted. Once the user has become familiar with the questions and possible answers, the TERSE option may be specified to eliminate the detailed questions. Only use the TERSE option after first running through a submission without the option.

The second form above is used to submit a large number of tapes. For this method the information about each tape is contained on a single line in a file. The INPUT keyword of the command specifies the name of the file. All lines in the file that do not properly describe a tape will be ignored and processing will continue with the next line.

Information collected using the two forms of this command will be recorded for future use when the tapes are actually delivered to the Computing Center operations staff.

STOP

The STOP command terminates execution of the program.

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\$mts-command

Any command beginning with a dollar sign (\$) is interpreted as an MTS command.

TAPERETRIEVE is the program that must be run when a user wishes to retrieve a magnetic tape that has been previously submitted to the Computing Center. The only parameter required by TAPERETRIEVE is the tape name, which is specified in the PAR field of the \$RUN command, e.g.,

\$RUN *TAPERETRIEVE PAR=tape-name

For further information on the tape-submission and retrieval procedures, see Computing Center Memo 471, "Submitting, Retrieving, and Permitting Magnetic Tapes."

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*TAXIR

Contents: The Taxir information retrieval system.

Use: The program is invoked by the \$RUN command or may be called as a subroutine from a user program.

Program Key: *TAXIR

Logical I/O Units Referenced:

None.

Return Codes: Always zero.

Description: Taxir is a general-purpose information storage and retrieval system with facilities for building, updating, and querying user-defined data banks. Taxir includes features for generating reports that may include headings, labels, n-way tabulations, totals, and subtotals. Taxir also provides an interface to the MIDAS statistical analysis system (MIDAS is supported by the U of M Statistical Research Laboratory).

For the complete description of Taxir, see The Taxir Primer, 4th edition, by R. C. Brill. This edition describes the same version of Taxir as the 3rd edition with Updates 1 and 2 applied. It differs from the 3rd edition in the following particulars:

- (1) The contents of Update 1 (CCMemo 418) and Update 2 (CCMemo 433) have been integrated into the text.
- (2) Some parts of the text, notably the examples, have been modified to reflect changes introduced by the updates.
- (3) The example data bank in Part I, now appearing in Chapter 2, has been extensively revised and expanded.
- (4) A new section describing common errors in Boolean expressions has been added to Chapter 8.
- (5) Obsolete features that are still available in the system have been removed from the main text and have been collected together as Appendix B.
- (6) A new section, Appendix A, discusses design strategies for fitting data into Taxir's flat-file data structure.

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*TDAY88TRANS

Contents: A server program to translate files to use the IBM EBCDIC coding conventions.

Use: The program is invoked by the \$RUN command.

Program Key: *EXEC

Logical I/O Units Referenced:

SCARDS - input command lines for the translation program.
SPRINT - output messages from the translation program.

Parameters: A single command line may be entered in the PAR field of the \$RUN command.

Return Codes: Always zero

Description: On Translation Day, February 22, 1988, the Computing Center changed the codes used to represent some characters on MTS. As more and more people transfer information between microcomputers and mainframes and between mainframes and other machines, the translation of some of the less commonly used characters becomes more of an annoyance. The changes made on T-Day improve the ability of those using MTS to move files or send messages to other hosts easily without having characters become unreadable or having to translate a file that contains them upon arrival at another host.

This change brings MTS in line with the current International Standards Organization (ISO) character code standard and the newer EBCDIC standard based on this ISO standard.

For three main reasons, the Computing Center is providing a free Translation Server on UM-MTS and UB-MTS to help users convert files affected by T-Day:

- (1) To give users a quick and easy way to find out if a file has the affected characters in it.
- (2) To save users money when they translate files to the new codes.
- (3) To help users by issuing a warning if the file seems like one that should not be translated, or if the file has already been translated.

The server is also designed to preserve file security and provide a simple and error-free mode of operation.

To access the MTS translation server, you must run an interface program on your CCID to translate files on that CCID only. Users with several CCIDs will have to translate the files on each one in a separate signon. To run the server, enter the command

```
$RUN *TDAY88TRANS
```

When the server prompts for a command, enter one of the following:

```
SCAN file1,file2,...,filen  
TRANSLATE file1,file2,...,filen  
STOP
```

where "file1", "file2", etc., indicate one or more file names separated by commas or blanks. To run the server with a single command that scans a file or list of files for the affected characters, enter the command

```
$RUN *TDAY88TRANS PAR=SCAN file1,file2,...,filen
```

To run the server with a single command to translate a file or files, enter the command

```
$RUN *TDAY88TRANS PAR=TRANSLATE file1,file2,...,filen
```

with a file name or list of files as described above.

Since the server is run from your own CCID, you do not have to explicitly permit files to the server. This prevents an extra nuisance step, and also avoids file-security risks from requiring users to permit their files to the server. This means, however, that the program can only change the files on that CCID. Even files on another CCID to which your current CCID has UNLIMITED access will not be translatable from your current CCID.

The server can be run from a terminal or in batch mode.

*TDAY88TRANS validates the file (ensures the file is indeed owned by the user), permits the file to the server, and then turns control over to the server. The server then performs the actual diagnostics and character translation. Upon returning from the server, *TDAY88TRANS depermits the file to the server and asks for another file or files to convert. Because the interface program is running on your CCID, there is a minimal cost for the work it does and for the connect time, but it is

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less expensive than using the MTS Editor for small files and a considerable savings for large files.

The server will warn you, and refuse to translate the file, if it finds that it contains any non-printing characters. This will cause it to reject binary code that should not be translated, such as object code, ILIR:MICRO and STAT:MIDAS internal files, SPSSx internal files, Full-Screen Message archive files, and so on. It will warn about page printer-ready files containing \$9700 lines, since there is no way it can tell if those should be translated or not.

The server will also print a warning and refuse to translate the file if it has already translated it. It keeps track in its own file database, a method that is not infallible. For example, if a file was translated using the MTS Editor, the server has no way of knowing that file should not be translated. It also will not know if a file it has recorded as translated has been destroyed and then restored off tape in an untranslated version, and therefore truly needs translation, even though it is on the list of already-translated files. If you rename a file after it has been translated by the server, you might translate it twice by mistake. Be cautious: if you have any doubts, look at the file first to see if affected characters have been translated.

The server runs only on whole files. It does not allow filename patterns, \$CONTINUE WITH lines, or explicit concatenation of files, e.g., a+b+c+d. If you have a file that contains mixed text and binary data, such as a program file with the source code at one line range and the object at another, you will need to use the MTS Editor to translate the line ranges or individual lines that need changing. In general, if the server will not translate a file for some reason, you can use the Editor instead. Through the normal rebate procedures, you can obtain rebates for translating files using the Editor.

The translation server runs on one host at a time, and does not allow cross-host translations. This means that if you have files on UM and UB you will need to sign on to each system separately to run the server. Again, this simplifies file security issues.

If there is a system crash, or some other interruption in service while you are running the server, the program might be in the middle of translating a file and be unable to complete the translation. This could leave you with a damaged file. Therefore, before the server begins to translate a file it will depermit it so you do not have access to it. It will only restore the original

file access once the translation is completed. This means you can tell if a file being translated was damaged after a crash; MTS will tell you "Access not allowed". Use *RESTORE to restore a correct, untranslated version, and use the \$PERMIT command to get access to the file again.

See Computing Center Memo 480, "Translation Day Character Code Changes in MTS," for further information on translating MTS files.

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*TELLABANK

Contents: The TELLABANK program.

Use: The program is invoked by the \$RUN command.

Program Key: *TELLABANK

Logical I/O Units Referenced:

- 3 - vocabulary file; defaults to (and must be) TGRF:TAGSYB4.0.
- 4 - bank data file; defaults to TAGPRM if it exists, otherwise it defaults to -TAGPRM.
- 5 - terminal input, equated to SCARDS.
- 6 - printed terminal output.
- 8 - raw data input file; prompted for (do not assign).
- 9 - temporary file -PRMEDIT.
- 11 - temporary file -TAGSCR23.
- 13 - bank data copy file -PRMCOPIE.

Return Codes: Always zero.

Description: TELLABANK serves as an alternate means of entering, deleting, and editing data for use by TELL-A-GRAF. TELLABANK, unlike TELL-A-GRAF, allows input of

- (1) more than two variables at a time,
- (2) lines longer than 72 characters, and
- (3) FORTRAN-formatted data.

A PRM file is a specially formatted file used by TELL-A-GRAF to retrieve data for plotting. This file is also used to store and retrieve plots using SUBPLOT and DRAW. Data is retrieved from the PRM file by using the TELL-A-GRAF BANK DATA command. TELLABANK automatically enters data into the PRM file. TELLABANK can also delete and edit this data. Once the data has been entered into the PRM file, TELL-A-GRAF can be used to plot it.

Further information on using TELLABANK is available in Computing Center Memo 450, "TELL-A-GRAF in MTS," or by copying the file TGRF:TELLAGRAF.W.

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*TELLAGRAF

Contents: The Tell-A-Graf conversational graphics program.

Use: The program is invoked by the \$RUN command.

Program Key: *TELLAGRAF

Logical I/O Units Referenced:

- SCARDS - CONTROL file; defaults to *SOURCE*.
- SPUNCH - SAVE file; defaults to -TAGSAVE(*L+1).
- SPRINT - TRACE file; defaults to -TAGTRA or *SINK*.
- 0 - POP output; no default.
- 3 - vocabulary file; defaults to (and must be) TGRF:TAGSYB4.0.
- 4 - bank data file; defaults to TAGPRM if it exists, otherwise defaults to -TAGPRM.
- 5 - terminal input; assigned to SCARDS.
- 6 - printed terminal output.
- 8 - profile file; defaults to TAGPRO if it exists, otherwise defaults to an appropriate file under TGRF ID.
- 9 - Calcomp plot file output; no default.
- 11 - temporary file -TAGSCR23.
- 13 - bank data copy file -PRMCOPIE.
- 14 - ISSCO's SLIDES output; no default.

Return Codes: Always zero.

Description: TELL-A-GRAF, a proprietary software product of ISSCO of San Diego, is a stand-alone program for doing two-dimensional computer graphics. TELL-A-GRAF is device-independent and hence can be run with a variety of output devices. It has high-quality output, and its command language is designed to be understood by those with little computing experience.

TELL-A-GRAF is documented extensively by the "TELL-A-GRAF User's Manual" published by ISSCO. Copies may be purchased in the local bookstores and are available for reference in the documentation racks at the public batch stations.

TELL-A-GRAF is a conversational program for producing high-quality two-dimensional graphs, bar charts, pie charts, and histograms. The user has a wide variety of character fonts, axis types, shading patterns, and other enhancements to choose from, all of which may be allowed to assume simple default values.

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Because of contractual restrictions, TELL-A-GRAF is surcharged when run from an industrial (commercial) ID. The surcharge is to cover royalties to ISSCO that are required if TELL-A-GRAF is used by non-university users.

Further information on using TELL-A-GRAF in MTS is available in Computing Center Memo 450, "TELL-A-GRAF in MTS," or by copying the file TGRF:TELLAGRAF.W.

Parameter: PAR=TRACE may be specified in the PAR field of the \$RUN command in order to keep a trace record of a TELL-A-GRAF session. By default, TRACE is enabled in batch mode, and disabled in terminal mode. If enabled, output will be sent to the printer (*SINK*) in batch mode, or to -TAGTRA in terminal mode. TRACE output may be routed to another destination by assigning SPRINT on the \$RUN command, e.g.,

```
$RUN *TELLAGRAF SPRINT=*PRINT* PAR=TRACE
```

will send a session record to the printer. PAR=NOTRACE disables tracing.

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*TERMLIST

Contents: A list of terminals that have been thoroughly checked out or used on MTS via the dial-up telephone lines.

Use: The list may be obtained via the \$COPY command, e.g.,

\$COPY *TERMLIST *PRINT*

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*TERMTYPES

Contents: A list of the ASCII terminals that are supported by the UMnet Computer Network. This list includes the terminal-type code, the default screen width, the carriage-return timing, and settings of other features.

Use: The list may be obtained via the \$COPY command, e.g.,

\$COPY *TERMTYPES *PRINT*

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*TEX

Contents: The TeX text-processing program.

Use: TeX is invoked by the \$RUN command.

Program Key: *TEX

Logical I/O Units Referenced:

SERCOM - error messages, error recovery prompting, and diagnostics.

GUSER - error recovery prompt input.

TeX references all files explicitly by name.

Return Codes: Always zero.

Description: The complete description of the TeX text-processing language is given in the following publications:

The TeXbook by Don Knuth, Addison-Wesley Publishing Company (1984), ISBN 0-201-13448-9.
 Computing Center Memo 810, "An Introduction to TeX."

TeX is an extremely versatile text-processing language intended for use with high-quality output devices such as a phototypesetter. Currently, the only device at the University of Michigan that can approximate TeX's capabilities on MTS is the Xerox 9700 page printer.

Mathematics and technical applications that use special characters or accents are TeX's strong point; other text processors may be more appropriate for simple documents. TeX is device-independent, which means that commands used to produce a document on one device need not be changed to produce the same document on another device.

TeX accepts an input file containing text to be formatted and control codes to direct the formatting process and produces a device-independent (DVI) output file. The DVI file is written in internal (binary) format. This file must be processed by another program to produce readable hard-copy results. The program *DVIXER transforms the DVI file into one that can be sent to the Xerox 9700 and printed by running *PAGEPR as the final step. Support for use of TeX with a phototypesetter is also available.

TeX is designed principally for the production of multi-page documents. Although TeX is quite capable of producing small documents, the cost associated with initializa-

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tion of TeX may be more than the cost of formatting a small document.

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*TEXTFORM

Contents: The TEXTFORM text-processing program.

Use: TEXTFORM is invoked by the \$RUN command.

Program Key: *TEXTFORM

Logical I/O Units Referenced:

- SCARDS - text input to TEXTFORM.
- SPRINT - output listings produced by TEXTFORM.
- SPUNCH - formatted text produced by TEXTFORM.
- SERCOM - error messages and diagnostics.

Return Codes: 0 - Successful return.
 >0 - Return code is highest severity level that occurred during execution. From 4 to 16, the document was completed; for 20 and higher, the document is incomplete.

Description: The complete description of the TEXTFORM text-processing language is given in the Textform Reference Manual. This manual is based on the manual TEXTFORM, published by the University of Alberta (1984). An introductory description of TEXTFORM is given in Computing Center Memo 820, "Introduction to TEXTFORM"; a TEXTFORM command reference summary is given in Computing Center Memo 823, "TEXTFORM Reference Summary."

TEXTFORM can produce a variety of documents ranging from single-page memos and letters to complete manuscripts. The language is device independent, which means that commands used to produce a document on one device need not be changed to produce the same document on another device. Although the output may be slightly different, depending upon the capabilities of the intended output device, the general form of the document will remain unchanged.

TEXTFORM is designed principally for the production of multi-page documents. Although TEXTFORM is quite capable of producing small documents, the cost associated with initialization of TEXTFORM may be more than the cost of formatting a small document.

The main strength of TEXTFORM is its power to drive sophisticated output devices. Although TEXTFORM can drive simple devices such as the line printer, its features and facilities were designed for more advanced devices such as the Xerox 9700 and various phototypeset-

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ters. As a result, TEXTFORM may seem rather unwieldy and expensive for simple devices.

TEXTFORM may be used with the Xerox 9700 page printer, the line printer, and the APS Micro 5 phototypesetter.

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*TYPEQ

Contents: The program that queues files to be copied to the phototypesetter.

Purpose: To place the user's typesetting job(s) on the queue for typesetting.

Use: This program is invoked by the \$RUN command.

Program Key: *TYPEQ

Logical I/O Units Referenced:

- SCARDS - queueing requests.
- SPRINT - job receipt numbers and prompting messages for queueing requests.
- SERCOM - error comments.
- GUSER - user responses to error comments.

Parameters: A single queueing request may be specified in the PAR field of the \$RUN command, if no requests are to be read from SCARDS.

Return Codes: Always zero.

Description: Each queueing request specifies a file or tape containing a typesetting job (usually the output from a text-processor) and, optionally, the width of the paper to be used and a delivery code. *TYPEQ reads the job, determines the cost of typesetting, places the request in the system typesetting queue, and charges the user for the typesetting costs.

*TYPEQ prompts for queueing requests using the message

Enter job request (and delivery code):

The response may be a queueing request for a file or tape, a line beginning with a "\$", or an end-of-file indicator. If the queueing request is for a file, the request should consist of the file name, and optionally followed by the paper width and/or the delivery parameters. Explicit file concatenations are permitted, as are file line-number ranges. Only permanent files may be queued--temporary files may not be queued.

A response that begins with a dollar sign is treated as an MTS command that is to be executed immediately. Execution of *TYPEQ may be resumed by entering a \$RESTART command (unless an MTS command causes *TYPEQ to be

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unloaded). An end-of-file response terminates execution of *TYPEQ.

If the request is for a magnetic tape, the tape should already be mounted. The request should contain first the pseudodevice name, followed by the tape ID. Parameters must be separated by one or more blanks and/or commas. There are three optional parameters. One is the paper width, which may appear anywhere after the pseudodevice name. Another is the FILES parameter, which may also appear anywhere after the pseudodevice name. This takes the form FILES=n, where "n" is the number of files to be typeset. The default is FILES=1. Finally, the POSN parameter may appear anywhere after the tape ID. This takes the form, POSN=string, where "string" specifies a file on the tape (any string legal for the POSN control command). If this parameter is not specified, *TYPEQ begins reading at the current tape position (even if that is in the middle of a file). (At postprocessing, the tape will be mounted and positioned appropriately, even to the middle of a file.) *TYPEQ and the postprocessor use whatever blocking is in effect at the time the queuing request is entered. *TYPEQ does not rewind the tape after reading it. Pool tapes may not be queued.

A job request may specify the width of the paper (typesetting media) to be used. This parameter is given in the form

WIDTH=n

where "n" is the width of the paper in inches (either 6, 8, or 12). If the width specified is not available, the next larger available size is selected. If this parameter is omitted, 8-inch paper is used.

Users can request delivery of output to another station by specifying the DELIVERY=station parameter on the queue request, e.g., DELIVERY=NUBS. The DELIVERY parameter is effective for only one queue request. If the DELIVERY parameter is not specified, the setting of the MTS \$SET DELIVERY option will be used (which defaults to the Computing Center).

*TYPEQ checks for errors such as illegal commands and requests for non-existent fonts as it reads the job. If errors are detected, *TYPEQ prints the number of errors discovered. The job may be queued with errors present, but this is not recommended.

A line beginning with \$CONTINUE WITH ... will be treated as an invalid input. Implicit concatenation lines may not be used in the job file.

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Queueing:

After *TYPEQ finishes reading the job, it prints the number of errors in the job (if any), the number of phototypesetter units (ptus) required, the amount of paper required, and the cost. In conversational mode, the user is asked whether the job should actually be queued. If the answer is NO, the job is aborted and the user is prompted for a new job request (unless the job request was taken from the PAR field). If the answer is YES, or if *TYPEQ is being executed in batch mode, the job request is placed in the queue, the user is charged for the job, and a receipt number is printed (this receipt number must be used to obtain the output at the output window later). In addition, if the job input was contained in one or more disk files, *TYPEQ will, if necessary, permit the queued files so that the postprocessor, which is a program with PKEY=*TYPEQ, may access the job input. *TYPEQ will establish READ access for the file to the postprocessor, if necessary. (Specifically, the file will be permitted "READ PKEY=*TYPEQ" unless the postprocessor already has read access. See the description of the \$PERMIT command in MTS Volume 1, Michigan Terminal System.) A message is printed for each file so permitted. If *TYPEQ cannot determine the permit status of a file, a message is printed, and the user must be sure that the file is permitted before the job request is postprocessed (see the section below on postprocessing).

Checking the Status of a Job

The status of a queued job may be determined by entering the command

```
QUEUE nnnnnn
```

where "nnnnnn" is the job receipt number. This can only be done by the signon ID that queued the job. *TYPEQ prints a message indicating whether the job is waiting to be typeset, has been typeset but is waiting to be saved on tape, has been canceled, or is not in the queue. Once a job has been saved on tape, it is removed from the queue; hence, no information is available after the job is saved.

Cancellation:

A queued job may be canceled by entering

```
CANCEL nnnnnn
```

where "nnnnnn" is the job receipt number, whenever *TYPEQ is prompting for a job request. A job can be canceled

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only by the signon ID which queued it. If the job specified has not been typeset, it will be canceled and a message to that effect will be printed. Typesetting charges will be rebated automatically at a later time.

Attention Interrupt Processing:

If the user issues an attention interrupt, processing of the current job request is suspended; the subsequent action taken by *TYPEQ is as follows: (1) If it was parsing a job request, the job request is discarded and the user is prompted to enter a new request; (2) *TYPEQ will print "READING:" or "QUEUEING:", depending upon whether it was in the process of reading the job input or queueing the job. In either case, if the user enters a null line or an end-of-file, *TYPEQ will resume processing the current request. If the user enters "MTS" or an MTS command beginning with a "\$", *TYPEQ will return to MTS command mode; if a command was given, it will be immediately executed by MTS. If the user enters anything else, the job request will be aborted.

If the user issues a second attention interrupt while *TYPEQ is processing the first interrupt, an immediate return is made to MTS command mode. The user may subsequently re-enter *TYPEQ via the \$RESTART command.

Postprocessing:

After a job request has been queued, the user's job input must be available for reading by the system postprocessor as soon as the typesetter is available and at the scheduled job saving time. If the job input is in a file, the file must be permitted, and it must not be locked at any level higher than READ. If the file is not permitted, the job will be canceled; if it is locked, the job request will remain queued until it is accessible. If the job input is on a tape, the tape must be available for mounting (e.g., not already mounted); otherwise, the job will remain queued until the tape is available. If the tape ID is incorrect, the job will be canceled.

Examples: In the following examples, terminal output appears in uppercase and user input appears in lowercase.

```
#r *typeq
#EXECUTION BEGINS
ENTER JOB REQUEST (AND DELIVERY CODE):
typefile1 w=12
JOB REQUIRES .2 SQ.FT.; $.46
OK?
no
ENTER JOB REQUEST (AND DELIVERY CODE):
```


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```
typefile2 width=8
JOB REQUIRES .1 SQ.FT.; $.81
OK?
ok
JOB ASSIGNED RECEIPT # 790397, DUMWAIT3
**LEAVE THE JOB FILE INTACT THROUGH THE NEXT JOB
COLLECTION TIME.
ENTER JOB REQUEST (AND DELIVERY CODE):
typefile3 w=12 delivery=nubs
JOB REQUIRES .3 SQ.FT.; $2.52
OK?
ok
JOB ASSIGNED RECEIPT # 790398, NUBS
**LEAVE THE JOB FILE INTACT THROUGH THE NEXT JOB
COLLECTION TIME.
ENTER JOB REQUEST (AND DELIVERY CODE):
chapter1 w=6
JOB REQUIRES .1 SQ.FT.; $1.15
OK?
ok
JOB ASSIGNED RECEIPT # 790399, DUMWAIT3
**LEAVE THE JOB FILE INTACT THROUGH THE NEXT JOB
COLLECTION TIME.
ENTER JOB REQUEST (AND DELIVERY CODE):
queue 790399
790399 IS WAITING TO BE RUN.
ENTER JOB REQUEST (AND DELIVERY CODE):
cancel 790399
790399 HAS BEEN CANCELLED.
ENTER JOB REQUEST (AND DELIVERY CODE):
{end-of-file}
#EXECUTION TERMINATED
```


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*UNEDIT

Contents: The program to unedit a line file.

Purpose: To compare a current version of a line file with the original version and produce context editor control cards for transforming the original version into the current version.

Use: The program is invoked by the \$RUN command.

Program Key: *UNEDIT

Logical I/O Units Referenced:

- GUSER - prompting responses.
- SERCOM - prompting messages for the FDnames and error comments.
- SPUNCH - context editor control commands produced.
- 0 - original version of the file.
- 1 - current version of the file.
- SPRINT - PAR=LIST output

Parameters: The following parameters may be specified in the PAR field of the \$RUN command. The parameters must be separated by commas.

MAXDEL=n "n" is an estimate of the maximum number of lines to be deleted in any one deletion from the original version of the file. Specifying a value slightly larger than the number of lines actually deleted will greatly reduce the cost of running the program. If "n" is too small, the output written to SPUNCH will be valid, but much longer than necessary. The default is plus-infinity.

MAXCOMP=n "n" is the maximum number of lines to be compared between the original and current versions before deciding that a "resynch" has been found. The actual number of lines compared depends on the size of the preceding deletion and the value of the BREAK and SLOPE parameters. The default is 25.

BREAK=n "n" and "m" control the number of lines that must match between the original and current files before a "resynch" is recognized. If SLOPE=m "d" is the size in lines of the deletion preceding the resynch, then the match must be "n+(d-n)/m" lines long, unless "d<n", in which

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case "d" is used. If the result is greater than the value of MAXCOMP, then MAXCOMP is used. The defaults are n=3 and m=7.

LIST A listing of the differences between the old and new versions will be printed on SPRINT.

Return Codes: 0 - Successful return.
 4 - Error return.

Description: The *UNEDIT program reads two versions of a file: the original version and the current version. Both files must be line files. The entire contents of each line (including trailing blanks) is compared. The line numbers are used in the editor control commands output, but are ignored during the comparison process. The output from *UNEDIT consists of a set of context editor control commands which will transform the original version of the file into the current version. The effect of applying the output of *UNEDIT as commands to the context editor working with the original file will produce, as a result, a file with lines that have the same content as the current file and in the same order, but not necessarily with the same line numbers.

If units 0 and/or 1 are not assigned, the program will prompt for the FDnames of the two files via the logical I/O unit SERCOM; the FDnames of the two files will be read from GUSER.

For a description of the context editor, see the "Edit Mode" section of the "System Command Language" in MTS Volume 1, Michigan Terminal System. Two other programs, *DOWNDATE and *APC, are also available for comparing two versions of a file and producing the changes. A discussion of the differences of these three programs is given in the "Files and Devices" section of MTS Volume 1.

Example: \$RUN *UNEDIT 0=OLDFILE 1=NEWFILE SPUNCH=CHANGES

In the above example, the original file OLDFILE is compared with the current file NEWFILE. The context editor control commands are written to the file CHANGES.

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*USERDIRECTORY

Contents: A program that maintains a directory of names and associated information.

Use: The program is invoked by the \$RUN command.

Program Key: *USERDIRECTO

Logical I/O Units Referenced:

- SCARDS - input command to User Directory.
- SPRINT - printed output from User Directory.
- SERCOM - error messages, prompting messages, and help text.
- GUSER - responses to prompting messages.

Return Codes: Always zero.

Description: The User Directory program maintains a database, called the master directory, that allows names to be used with the MTS Message System.

There are four types of name entries that can be put into a directory, individual names, remote names, group names, and alias names.

The most common is the individual name. Messages that are sent to an individual name are put in the mailbox of the owner of that name.

The second type of name entry is the group name. When a group name is added to the directory, the user will be asked to give a list of "members", which may be a combination of individual names, remote names, userIDs, and projectIDs. Then, whenever a message is sent to this group name, it will be sent to each of the members and to the owner of the name. For example, if "Pascal Language Project" is a group with members Marlou Smith, John Brown, and Jack Black, and a message is sent to this name, the message will be sent to Marlou Smith, John Brown, and Jack Black. Groups are considered to be in the public domain, that is, any user may send a message to any group that is enrolled in the master directory.

The third type of name entry is the alias name. This can only be used with name libraries. When an alias name is enrolled in the name library, the user will be asked to give a "primary name", which must be a name that exists in the master directory. The primary name may be either an individual name, a remote name, or a group name.

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Whenever a message is sent to the alias name, it will appear that the message was sent to the primary name. Name libraries are considered to be private, that is, only a user that has access to the name-library file may send a message to individual participants (using the alias names) or to a group in the name library.

The fourth type of name entry is the remote mail name. Messages that are sent to a remote mail name are put into the remote mailbox of the name. For example, sending a message to John Q. Public with the remote mail name JQPublic@MIT is sent to the site MIT and then delivered to the user JQPublic.

Instructions for enrolling individual names is given below. Instructions for enrolling group names, alias names with name libraries, and remote mail names is given in MTS Volume 23, Messaging and Conferencing in MTS.

Each individual name first must be enrolled in the master directory. The User Directory program prompts the user for information about his or her own name and how it is to be used. The following terminal example illustrates how an individual name may be enrolled (some of the explanatory information printed by the program is omitted for the sake of brevity).

```
#$run *userdirectory
#Execution begins
```

Whenever you need help, type "HELP".

```
*add
```

```
Enter name (alternate spellings in parentheses) or
"HELP":
```

```
Example: Doug (Douglas) R. (Robert, Bob) Hofstadter
?Mary (Marlou) Louise Smith
```

```
Enter business phone (maximum 63 characters) or
"HELP":
```

```
Example: 313-764-2121
?313-764-9595
```

```
Enter business address (up to 5 lines, 63 characters
per line), or "HELP". Hit return when done.
```

```
Example: Computer Science Department
         221 Angell Hall
         University of Michigan
         Ann Arbor, MI 48109
         USA
```

```
1?Computing Center
```

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```

2?University of Michigan
3?Ann Arbor, MI 48109
4?{return}
  "Mary Louise Smith" was added with owner WABC
*display 'mary louise smith'
  "Mary (Marlou) Louise Smith", Type=Individual,
  Owner=WABC
  Fullaccess=(Unlimited Owner, Read Others)
  Busphone:      313-764-9595
  Busaddress:    Computing Center
                  University of Michigan
                  Ann Arbor, MI 48109

*stop
#Execution terminated

```

The User Directory program first prompts for the user's complete name in the order first name, middle name, and last name. Alternate names or nicknames may be given in parentheses as illustrated above. After the name has been entered, the user is prompted for information associated with the name, such as a business telephone number and business address. These items may be omitted by entering a null line.

The current userID is taken as the owner userID. This is the ID to which all messages will be directed for this name, e.g., all messages sent to Mary Louise Smith will go to the mailbox of userID WABC.

When a message is sent to a name, any combination of given names or alternate names may be used. For example, the message may be sent to Mary Louise Smith, Mary Smith, Louise Smith, or Marlou Smith. If the name is similar to another name in the directory, the sender will be prompted further to resolve the name. When the message system lists the sender of a message, the complete given name (excluding alternate names) is used.

The DISPLAY command may be used to display information about an entry in the database. The DISPLAY command is normally given as:

```
DISPLAY 'name'
```

For example, either of the following commands will display information about Mary Louise Smith (either given names or alternate names may be used):

```
DISPLAY 'Mary Louise Smith'
```

The primes are not required if the name is given without any internal blanks or parentheses; the underscore may be used to replace blanks, e.g.,

DISPLAY Marlou_Smith

The DISPLAY command allows the use of the User Directory database as an on-line directory. Information may be displayed about any person or member of a group in the User Directory database.

Commands: A brief summary of the User Directory commands is given below. Abbreviations are indicated by underlining. The complete description of these commands is given in MTS Volume 23.

ADD [{GROUP|REMOTE}] [parameter ...]

Parameters:

[NAME]= 'name'
MEMBERS={ID=ccid|P=projid}
MEMBERS={'name' | ('name1', 'name2', ...)}
PRIMARYNAME= 'name'
BUSPHONE= 'number'
BUSADDRESS={'addr' | ('addr1', 'addr2', ...)}
HOMEPHONE= 'number'
HOMEADDRESS={'addr' | ('addr1', 'addr2', ...)}
MISCELLANEOUS= 'string'
MAILNAME= 'name@destination'
REMOTENAME= 'name'
SITE= 'destination'
FULL
OWNER=ccid

CLAIM {'name' | EACH OWNER=ccid}

CLEAR group

COMMENT text

DESTROY identifier [OK]

{DISPLAY|FIND} identifier [parameter ...] [OUTPUT=FDname]

Identifiers:

'name'
MEMBER= 'name'
 ME or MY

Parameters:

NAME
NAMEID
OWNER
TYPE

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MEMBERS
 PRIMARYNAME
 MAILNAME
 REMOTENAME
 SITE
 SITEBOX
BUSPHONE
BUSADDRESS
HOMEPHONE
HOMEADDRESS
MISCELLANEOUS
 CREATEDATE
CREATESIGNONID
 LASTSETDATE
LASTSETSIGNONID
 LASTMODDATE
LASTMODSIGNONID
ACCESS
FULLACCESS or FA
 FULL
 TOTAL

EMPTY group

{HELP|EXPLAIN} [parameter]

Parameters:

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JOIN 'name'

MCMD MTS-command

MODIFY identifier parameter ...

Identifiers:

'name'
 MEMBER='name'
 ME

Parameters:

NAME='name'
MEMBERS={ID=ccid|P=projid}
MEMBERS={'name' | ('name1', 'name2', ...)}
PRIMARYNAME='name'

MAILNAME='name@destination'
REMOTENAME='name'
SITE='destination'
BUSPHONE='number'
BUSADDRESS={'addr' | ('addr1', 'addr2', ...)}
HOMEPHONE='number'
HOMEADDRESS={'addr' | ('addr1', 'addr2', ...)}
MISCELLANEOUS='string'
FULL
OWNER=ccid

MTS [MTS-command]

PERMIT identifier access accessor,

Identifiers:

'name'
MEMBER='name'
ME

Accesses:

READ
SET
MODIFY
DESTROY
JOIN
PERMIT
FULL
UNLIMITED
PWSET
DEFAULT

Accessors:

ID=ccid
PROJECTID=projid
'name'
OWNER
OTHERS
ALL
ME

RESIGN 'name'

RETURN

SET option ...

BATCH={ON|OFF}
BRIEF={ON|OFF}
ECHO={ON|OFF}

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HELP=FDname
HELPTRACE={FULL|ON|OFF}
LOG=logfile
MASTER=FDname
NAMELIB={FDname|OFF}
PARSETRACE={FULL|ON|OFF}
PROMPT={ON|OFF}
TERSE={ON|OFF}
VERBOSE={ON|OFF}

|

STATUS

{STOP|QUIT}

USE {MASTER|NAMELIBRARY [filename]}

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*UTILISP

Contents: The University of Tokyo Interactive List Processor.

Use: The processor is invoked by the \$RUN command.

Program Key: *UTILISP

Return Codes: n - Argument passed from QUIT function.

Description: The UTILISP (University of Tokyo Interactive LIST Processor) system is designed for highly interactive programming and debugging of sophisticated programs.

At present, the UTILISP system is in operation at the University of Michigan Computing Center, and is organized as a MTS program. The standard command sequence for running the system is currently as follows:

```
#RUN *UTILISP PAR=options
> (Lisp input)
```

The PAR options are

STACK

STACK=n specifies that the size of the stack area is to be "n" pages (1 page = 4 kilobytes). The default value for "n" is 16.

FIX

FIX=n specifies that the size of the "fixed heap" area (for compiled codes) is to be "n" pages. The default value for "n" is 8.

SIZE

SIZE=n specifies that "n" pages are to be allocated for use by UTILISP. The program will not get more space if this is not enough. The default value for "n" is 64.

If the logical I/O unit 0 has been assigned, the file associated with it is executed first. This execution is identical with that of the standard top-level Lisp loop, except that the results are not displayed.

After the execution of the unit 0 file (if any), the system enters the top-level loop. Each S-expression read

in is evaluated and the result is displayed. Note that the top-level evaluator is EVAL, not EVALQUOTE.

The session can be terminated by calling the function QUIT. If one wishes to terminate the session abnormally, the function ABEND can be used.

| The complete description of UTILISP is given in MTS Volume 22, UTILISP in MTS.

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*VALIDATEFILE

Contents: The line-file validation program.

Purpose: To check the internal consistency of MTS line files.

Use: The program is invoked by the \$RUN command.

Program Key: *VALIDATEFIL

Logical I/O Units Referenced:

GUSER - an input file name (if the PAR field is omitted).

SERCOM - messages to the user and the listing of defective lines if the file is inconsistent.

Parameter: A file name may be specified in the PAR field of the \$RUN command.

Return Codes: 0 - File has been validated and appears consistent.
 4 - File has been validated and appears inconsistent.
 8 - File not validated (file does not exist or access insufficient).

Description: The program accepts as input the names of line files, and checks their internal consistency. No changes are made to any file. If information for only one file is wanted, its name can be given in the PAR field of the \$RUN command. If the parameter field is omitted, file names are read via GUSER until an end-of-file or null line is entered, or an attention interrupt is given.

If the system crashes while a line file is being modified, there is a possibility that the file will be left in an inconsistent condition. A discussion of why these inconsistencies occur and how they can be recognized is given in Appendix E to "Files and Devices" in MTS Volume 1, The Michigan Terminal System. Continued use on an inconsistent file will only compound any existing problems.

*VALIDATEFILE attempts to validate the internal consistency of a line file. Although it is not able to positively identify all problems, if it returns the message

FILE SEEMS OK

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the probability is high that the file is undamaged. If it finds the file to be inconsistent, it returns the message

```
THIS FILE IS INCONSISTENT
```

The user may then enter the command `LINES` to obtain a listing of the erroneous lines or `EXPLAIN` to obtain information on how to go about repairing the damaged file.

Users should not attempt to modify an inconsistent file. Instead, the file may either be restored from a Computing Center save tape or copied (`$COPY`) to another file. Copying a file resolves the internal inconsistencies, but erroneous lines of data must still be corrected in the new copy of the file. `*VALIDATEFILE` will print the line numbers of the lines in the file which are likely to be erroneous. This list is not necessarily exhaustive, however. The file editor (`$EDIT`) can then be used to edit the new copied file.

The cost of having an inconsistent file restored or fixing an inconsistent file by copying and editing is generally rebatable as is the cost of running `*VALIDATEFILE` to determine that the file is in fact inconsistent. For each file, the cost of validation is printed by `*VALIDATEFILE`.

Example: The example below illustrates the use of the context editor and `*VALIDATEFILE` to correct an inconsistent file which has the same line of information associated with two different line numbers. Input from the user is in lowercase; output from the system is in uppercase.

```
#$edit badfile
:print 3964
: 3964 A TYPICAL LYNE IN A F
:print 4042
: 4042 A TYPICAL LYNE IN A F
:alter 3964 'lyne'line'
: 3964 A TYPICAL LINE IN A F
:print 4042
: 4042 A TYPICAL LINE IN A F
:stop
#run *validatefile par=badfile
#EXECUTION BEGINS
FILE:BADFILE
THIS FILE IS INCONSISTENT
TYPE "EXPLAIN", "LINES", OR "STOP"
explain
```


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TO PREVENT FURTHER DAMAGE, DO NOT WRITE IN THIS FILE.
 THE FILE MUST EITHER BE RESTORED FROM A COMPUTING CENTER
 SAVE-TAPE OR COPIED TO ANOTHER FILE. WITH EITHER
 METHOD

SOME INFORMATION MAY BE LOST. TO HAVE THE FILE
 RESTORED

CONTACT THE BUSINESS OFFICE AT THE COMPUTING CENTER.
 IF YOU WANT TO ATTEMPT TO FIX THE FILE YOURSELF,

FIRST COPY IT TO ANOTHER FILE USING A COMMAND LIKE:
 \$COPY BADFILE(FIRST)@-TRIM@-IC NEWFILE@INDEXD@-TRIM
 THEN EXAMINE NEWFILE FOR ERRORS.

PLEASE CONTACT THE COUNSELORS IF YOU HAVE ANY
 QUESTION OR DOUBT.

TO GET A LIST OF LINE NUMBERS THAT ARE LIKELY
 TO BE BAD, TYPE "LINES", OTHERWISE TYPE "STOP".

lines

4008.000
 4042.000
 3964.000
 4065.000
 4202.000
 4242.000
 4082.000
 \$.28

#EXECUTION TERMINATED

#\$create goodfile

FILE "GOODFILE" HAS BEEN CREATED.

##\$copy badfile(first)@-trim@-ic goodfile@index@-trim

##\$edit goodfile

:print 3964

: 3964 A TYPICAL LINE IN A F

:print 4042

: 4042 A TYPICAL LINE IN A F

:alter 3964 'line'lyne'

: 3964 A TYPICAL LYNE IN A F

:print 4042

: 4042 A TYPICAL LINE IN A F

:stop

##\$run *validatefile

#EXECUTION BEGINS

TYPE NAME OF FILE TO BE VALIDATED
 goodfile

FILE: GOODFILE

FILE SEEMS OK

\$.13

TYPE NAME OF FILE TO BE VALIDATED
 \$endfile

\$.00

#EXECUTION TERMINATED

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*VSS

Contents: The IBM OS/VS Operating System execution monitor.

Use: The program is invoked by the \$RUN command.

Program Key: *VSS

Return Codes: See CCMemo 448.

Description: VSS is an execution monitor program that makes it possible for MTS users to run application programs that normally run under the IBM operating systems OS/MFT, OS/MVT, VS1, and MVS. With the aid of simulation-assisting features available under MTS, VSS accurately recreates a fairly rich subset of the OS/VS environment, thus allowing many ordinary OS/VS programs to run unmodified in MTS.

In order to provide an OS/VS environment without introducing foreign concepts into its enclosing MTS environment, VSS uses standard MTS system functions to do the work of executing OS/VS system functions. Similarly, VSS translates MTS system responses into equivalent OS/VS system responses. In essence, VSS provides a two-way mapping between the MTS way of doing things and the OS/VS way of doing things.

VSS has a command language of its own that allows full user control of the details of this mapping and provides a number of convenience and debugging features.

VSS does not use OS/VS Job Control Language ("JCL"). The VSS command language is similar to the command languages of MTS and its subsystems. Consequently, VSS's language is much simpler to use and easier to understand than OS/VS Job Control Language.

The complete description of VSS is given in Computing Center Memo 448, "VSS: OS/VS Simulator."

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*WATBOL

Contents: The University of Waterloo COBOL compiler.
 Purpose: To compile and execute COBOL programs.
 Use: The compiler is invoked by the \$RUN command.
 Program Key: *WATBOL

Logical I/O Units Referenced:

- SCARDS - compiler control commands, COBOL source program, and program data (the default is *SOURCE*).
- SPRINT - compiler diagnostics, source program listing, and program output (the default is *SINK*).
- SERCOM - compiler error exit diagnostics (the default is *MSINK*).
- 0 - execution-time library (the default is *WATBOL-LIB). This must be a library file produced by the *WATBOLLIBGEN program.
- SPUNCH - program output (optional).
- GUSER - program input data (optional).
- 1-19 - program input data or output (optional).

Note: Any logical I/O unit may be used for execution-time I/O by specifying its name in an ASSIGN clause, e.g.,

ASSIGN TO UT-S-SPRINT

In addition, SYSIN, SYSPRINT, and SYSOUT may be used in an ASSIGN clause: SYSIN will read data from SCARDS, and SYSPRINT and SYSOUT will write output to SPRINT.

Return Codes: Always zero.

Description: The WATBOL compiler was written, and is maintained, by the University of Waterloo, Waterloo, Ontario, Canada. It is a COBOL compiler designed for the beginning programmer: common programming errors, such as undefined variables, are flagged, and meaningful diagnostics are given. For a full description of the COBOL language, see IBM OS Full American National Standard COBOL, form GC28-6396.

Restrictions: The following features of ANS COBOL are not supported by WATBOL.

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- (1) The REPLACING option of the COPY feature.
- (2) Only the TALLY, RETURN-CODE, LINE-COUNTER, and PAGE-COUNTER special registers are available.
- (3) Sequence number checking.
- (4) RENAMES clause.
- (5) Object module punching.
- (6) I/O control statements: RERUN and SAME-AREA.
- (7) Declaratives (those not associated with the Report Writer).
- (8) Tape label exit handlers.
- (9) Segmentation.
- (10) Debugging language.
- (11) Listing control features: SPACE1, SPACE2, SPACE3.
- (12) Spanned records: RECORDING MODE S.
- (13) UNSTRING verb.
- (14) Teleprocessing feature.
- (15) SIGN clause.
- (16) Sterling currency feature.
- (17) ASCII support.
- (18) Device-dependent I/O support.
- (19) Special processing for multiple volumes or reels.

Compiler Options:

The following compiler options may be specified in the PAR field of the \$RUN command. These options may be given in any order and must be separated by commas. The maximum length of the PAR field is 72 characters. Abbreviations, where available, are underlined.

BATCH

The BATCH option indicates that each job in the input stream is preceded by a /COMPILE control command. Any input lines preceding the first /COMPILE command are flushed by the compiler. If this option is not specified, the compiler will only compile and execute the first job even if it is not preceded by a /COMPILE command.

BCD or NOBCD

The BCD option specifies BCDIC input and the NOBCD option specifies EBCDIC input. The default is NOBCD.

CHECK or NOCHECK

The CHECK option causes undefined variable checking to be performed during program execution. The default is CHECK.

CLINES=n

"n" specifies the number of lines per page which

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will be printed during the compilation listing. The default is 60.

KP={26|29}

KP=26 is identical to the BCD option and KP=29 is identical to NOBCD. The default is KP=29.

LINES=n

"n" specifies the maximum number of lines per page on output written to SPRINT or SYSPRINT. The default is 60.

LIST or NOLIST

The LIST option specifies that an object code listing of the assembled program is to be produced. The default is NOLIST.

MSGLEVEL=n

The MSGLEVEL option controls compiler message printing. There are four levels of message types:

Level	Message Type
0	messages
1	warnings
2	extensions
3	errors

MSG=0 will print all levels of messages; MSG=1 will print levels 1 through 3; MSG=2 will print levels 2 and 3; and MSG=3 will print only level 3. The default is MSG=1.

PAGES=p

"p" specifies the maximum number pages to be printed during execution. The default is no page limit.

RUN or NORUN

Ordinarily, if neither the RUN nor NORUN options are specified, the WATBOL job will execute only if there are no compile-time errors. The RUN option will force program execution regardless of any compile-time errors detected. The NORUN option will prevent program execution altogether. Note that for some errors, program execution will always be suppressed even if RUN is specified, e.g., when object code overlaps the symbol table. The default is neither RUN nor NORUN.

SOURCE or NOSOURCE

The SOURCE option specifies that a source program listing is to be produced. Note that source state-

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ments containing errors will always be listed even if NOSOURCE is specified. The default is SOURCE.

SUBCHECK or NOSUBCHECK

The SUBCHECK option causes subscript checking to be performed during program execution. The default is SUBCHECK.

TIME=s

"s" specifies the maximum time, in seconds, that a given job in the batch stream can execute. The default is no time limit.

UCON=n

"n" specifies a nonnegative integer which is less than 255. The hexadecimal equivalent of this number will be used as the undefined value constant; that is, the value all variables which have not had a value assigned them by the WATBOL program will have. Note that the default value, UCON=127, will print as '127', and any other selected value should have this characteristic.

D=(opt1,opt2,opt3,...)

The D option may be used to specify the default values assumed for the options described above. They will be used only if no explicit value is specified in the input stream. These options must not contradict values specified by the M option described below, e.g., M=(T=50),D=(T=100) would be in error. Values specified in the WATBOL input stream will override values set by the D option provided they do not exceed the M values. Any options specified by M, but not specified by D, take both their default and maximum values from M.

M=(opt1,opt2,opt3,...)

The M option may be used to specify the maximum values permitted for the options described above. For numerical value options, e.g., TIME, this field specifies the maximum value that the option can have during the run. Values specified for those options in the WATBOL input stream cannot exceed these maximums or WATBOL will flag them as errors. For nonnumerical options, e.g., CHECK, this field specifies the forced state an option will have during the run. These states cannot be overridden by an option specified in the input stream.

Control Commands:

The following WATBOL control commands may be specified in the input stream. These commands are interpreted by

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WATBOL and not by MTS. Each command must start in column one.

/COMPILE option-list

The /COMPILE command initiates program compilation. The option-list is a series of compiler options that may be selected from the list of compiler options described above, but cannot include BATCH, D, or M. The /COMPILE command is not required if the BATCH compiler option has not been selected.

/EXECUTE

The /EXECUTE command initiates program execution. This command must appear before the program data (if any). This control command is not required if there are no data.

/DATA

The /DATA command is a synonym for the /EXECUTE command.

/STOP

The /STOP command terminates the compiler. This is the last command in the input stream.

/ATTACH

The /ATTACH command allows arbitrary MTS files or devices to be attached to the COBOL file. The assignment is denoted by

COBOLFILE=MTSFDname.

COBOLFILE may then subsequently appear in a SELECT clause in a COBOL program, and the COBOL file SELECTed will be attached to the MTS file; e.g., if the command

/ATTACH MASTER=1EHB:PROBLEM1DATA

has been specified,

SELECT TRANSACTION
ASSIGN TO UT-S-MASTER.

will connect the COBOL file TRANSACTION with the MTS file 1EHB:PROBLEM1DATA

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/OPTIONS

A list of options should appear, following the "/OPTION" text, selected from the compiler options described above. Any valid option may appear except for BATCH, D, LINES, M, RUN, TIME, and PAGES. These options may be used to change the state of compilation parameters during the course of a compilation. The locations in the job where options may appear are:

- (1) between level numbers in a structure, e.g.,

```

      01 X PICTURE IS 999.
/OPTIONS NOCHECK,LIST
      03 Y PICTURE IS 99.

```

- (2) between any two procedure division statements, i.e., the option must not occur in the middle of a statement.
- (3) before any statement which validly starts in margin A or before any procedure division verb.

Examples:

```

$RUN *WATBOL
/COMPILE PAGES=4
      (source program statements)
/EXECUTE
      (program data)
/STOP

```

The above example illustrates the compilation and execution of a single WATBOL program.

```

$RUN *WATBOL PAR=BATCH,D=(CLINES=50)
/COMPILE
      (source program # 1 statements)
/DATA
      (data for program # 1)
/COMPILE
      (source program # 2 statements)
/EXECUTE
/STOP

```

The above example illustrates the batching of two WATBOL programs. Each program is compiled and executed as a separate and distinct program. The default number of compilation lines per page is 50.

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*WATBOLLIBGEN

Contents: The WATBOL library-generation program.

Purpose: To generate libraries used by the WATBOL compiler.

Use: The program is invoked by the \$RUN command.

Program Key: *WATBOLLIBGE

Logical I/O Units Referenced:

- SCARDS - the description of the library to be produced.
- SPRINT - verification output.
- SPUNCH - the generated WATBOL library.
- SERCOM - terminal error messages and warnings.

Parameters: The following parameters may optionally appear in the PAR field, separated by commas or blanks, in the order presented below.

NOVERIFY (or any proper initial substring thereof) - this suppresses the verification output on SPRINT.

Any definition record, defined above, minus the "/" character. If present, the input on SPRINT is assumed free of all definition records and is placed into the library file as defined by the PAR field definition record. This parameter is provided for simpler usage when only one element is to be placed into the library file, which eliminates having a definition record in the SCARDS input text.

Return Codes: Always zero.

Description: The Version 1 Level 2 release of WATBOL, the University of Waterloo (Waterloo, Ontario, Canada) COBOL compiler, provides four sources for presenting input to the compiler. The most commonly used is the logical I/O unit SCARDS, from which the compiler reads source statements comprising the program, and possibly program data. A WATBOL library file provides the three other sources, namely:

- (1) COBOL source code incorporated into the compilation of the COBOL program via the use of the COBOL COPY verb,
- (2) non-WATBOL subroutines, compiled (or assembled) in some other language and made available to the COBOL program as object modules for external subroutines,

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- (3) list sections, text of a purely informative nature listed at the end of the compiled program text, but not compiled with the program. List sections are available as a facility within WATBOL for the distribution of information pertinent to WATBOL users.

Section Types

Each of these types of sources of input are contained in a section of a WATBOL library file, which must be an MTS file of the line or sequential type. A library file can contain an (almost) arbitrary number of these sections. The three section types are COPY sections, object module sections, and list sections.

COPY Sections:

COPY sections are collections of COBOL source statements included into the COBOL program through the use of the COPY verb in the COBOL language. These are read in from the WATBOL library as they are encountered in the program WATBOL is compiling. WATBOL expects to find a COPY section in the library with the name given after the COPY verb in the COBOL program; hence, each COPY section must have a name. COPY section text must be of no greater length than 80 characters per record, and must conform to the standard COBOL source statement formatting conventions.

Object Module Sections:

After WATBOL compiles the COBOL source program, it may have a collection of subroutine names which have been referenced by the program, but for which it has not encountered any COBOL code. If so, the subroutines are assumed to be object module sections within a WATBOL library.

The text WATBOL reads from a library object module section must be an object module generated by some assembler or compiler. The loader records comprising the object module can only be ESD, TXT, RLD, and END records. Furthermore, they must be no greater than 80 characters in length, and cannot reference any external subroutines in MTS. (The linkage editor can be used to change the record lengths in any object modules containing records longer than 80 characters.) Subroutine linkage conventions are an extension of the standard FORTRAN conventions; FOR-

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TRAN subroutines are callable from WATBOL-compiled COBOL programs.

List Sections:

List sections are sections of text listed after the compilation of a COBOL program. They are accessed by WATBOL depending on the program's PROGRAM-ID. If the PROGRAM-ID begins with the string 'COB', WATBOL searches the library for a list section with the PROGRAM-ID as its name. If one does not exist, it is not considered an error. If found, the text constituting it is listed after the program source code. The text is a maximum of 80 characters wide. Column 1 of the text is considered a carriage-control column, with blank, '1', '0', and '-' being valid there. Column 72 is a continuation column. If nonblank, the text in the line following a line with a nonblank column 72 is printed immediately following column 71 of the previous line. Only one continued line is allowed in succession.

The Library-Generation Program

Supplied with a name of a COPY section, list section, or external subroutine which it wants to find, WATBOL reads in a directory contained at the beginning of the library file which contains the names of the sections and subroutines and their storage location in the library file. WATBOL searches the directory to find and read that section or subroutine. The directory must be in one of two formats, the format depending upon the type of the MTS file, line or sequential.

The WATBOL library-generation program *WATBOLLIBGEN is provided to build this directory and place it and the text of the different section types into a file, thereby creating a WATBOL library. *WATBOLLIBGEN takes a description of the library as input from the logical I/O unit SCARDS and produces an actual library as output on the SPUNCH logical I/O unit. A description of a library is a series of records describing each section to be placed into the library file. Each section is one of the three types described above, and is input as follows:

- (1) 1 record, the definition record, giving the type and name, if necessary, of the section, followed by
- (2) n records of the actual text to be filed in the library section.

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The definition record is one of the following:

```

COPY SECTION name
LIST SECTION name
OBJECT MODULE
OBJECT MODULES

```

which defines the characteristics of the section to be placed in the library. Column 1 of each definition record must contain the identifying character '/' to distinguish it from the text of the section preceding it. The name on the COPY SECTION record is the name by which one references the COPY section text with the COBOL COPY verb. On the LIST SECTION record, it is the PROGRAM-ID which will trigger the listing of the list section text after the program source. Object module sections cannot be explicitly named because they are named by the name(s) of the subroutine(s) they contain.

Besides producing a WATBOL library as output, *WATBOLLIBGEN also produces (optionally) a listing of the names of all the sections cataloged into the library, plus the CPU time needed to do so, on SPRINT.

Any error messages are printed on SERCOM.

Running WATBOL with a WATBOL Library File

WATBOL libraries are attached to logical I/O unit 0, which is assigned to a library file on the MTS \$RUN command; e.g., if a library file to be used by WATBOL were named LIBRARY, it would be specified by

```
$RUN *WATBOL 0=LIBRARY [plus other I/O assignments]
```

WATBOL has a public library *WATBOLLIB in which it keeps some subroutines it occasionally needs for the execution of a COBOL program, a list section COBBUGS which contains a list of currently known compiler bugs, and a list section COBRWORD which contains a list of reserved words not permitted as WATBOL identifiers. *WATBOLLIB never needs to be specified on the \$RUN command -- it is always available to WATBOL. Any private library specified on I/O unit 0 is searched before *WATBOLLIB for any requested library sections, which permits private redefinition of any sections in the public library. *WATBOLLIB is only searched if the private library did not contain the needed section.

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WATBOL Library Internal Formats

A WATBOL library file consists of one or more directory records at the head of the file, followed by the text of the library sections. OBJECT MODULE text is placed into the library file wholesale. COPY SECTION text is also placed into the file as is, but a one record end-of-section terminator, '/EOF', is inserted after the last line of the section. LIST SECTION text is written into the library file with a LIST-section identifying record, '/LIST', placed in front of the list-section text, plus the '/EOF' end-of-section terminator after the text. This format does not differ from line to sequential files.

The directory structure does differ, however. Line file directories are identical to those produced for the Assembler G: one record per library section, each containing an 8-character, left-justified section title or subroutine name, followed by 1 blank, followed by an optionally signed 5-digit integral line number in the file where the beginning of the section's /subroutine text can be found.

Sequential file directories consist of one record. This record contains one 12-byte block for each section, each block containing 8 bytes of the section/subroutine name, left-justified, followed by 4 bytes of POINT information indicating the first line of the section's text in the library file. Since a maximum line length of 32767 bytes is possible for a sequential file, this puts a limit of $\text{int}(32767/12) = 2730$ elements in a sequential library file.

WATBOL External Subroutine Linkage Information

WATBOL calls external subroutines using a modified FORTRAN calling convention. That is, at the time of the call, general register 13 points to an 18-word save area, general register 14 contains the address to which the called subroutine should return, and general register 15 contains the address of the entry point of the subroutine.

In a WATBOL call (as in a FORTRAN call), general register 1 points to a parameter list. Whereas FORTRAN parameter lists contain just the addresses of the passed parameters, the parameter list that WATBOL passes to an external subroutine contains the address of the parameters, plus the length of the parameters, in the following format:

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```

fullword address of parameter 1,
fullword address of parameter 2,
.
.
fullword address of parameter n, with the high-order
    bit set to 1,
halfword length of parameter 1,
halfword length of parameter 2,
.
.
halfword length of parameter n.
    
```

The lengths in the parameter list are used internally by WATBOL; they represent the number of bytes in memory that the corresponding parameter occupies. If no parameters are passed by the calling routine, general register 1 contains a zero.

WATBOL expects all the general registers to be restored to their contents at the time of the subroutine call, except general register 15, which may contain a halfword return code which becomes the contents of the RETURN-CODE special register. This means that the subroutine cannot return a value in general register 0.

```

Examples:  $RUN  *WATBOLLIBGEN SPUNCH=library-file
           /COPY SECTION DEMO1
           .
           copy section text
           .
           /LIST SECTION COBBUGS
           .
           list section text
           .
           /OBJECT MODULES
           .
           one or more external subroutine object modules
           .
           /COPY SECTION DEMO2
           .
           more copy section text
           .
           $ENDFILE
    
```

This will place DEMO1, COBBUGS, DEMO2, and any subroutine names in the object modules into the library file directory and the text of those sections in the library file.

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*WATFIV

Contents: The University of Waterloo FORTRAN IV compiler.

Purpose: To compile and execute FORTRAN IV programs.

Use: The compiler is invoked by the \$RUN command.

Program Key: *WATFIV

Logical I/O Units Referenced:

- SCARDS - compiler input (control commands and source program) and data (defaults to *SOURCE*).
- SPRINT - compiler output (source listing and diagnostic messages), program output, and job accounting information (defaults to *SINK*).
- SPUNCH - program punch output.
- SERCOM - error comments and prompting messages in conversational mode (defaults to *MSINK*).
- 0 - library of subroutines (defaults to *WATLIB*).
- 1-19 - program input and output (default for input is SCARDS assignment and default for output is SPRINT assignment).

Parameter: The following parameter may be specified in the PAR field of the \$RUN command.

SIZE=n The number of pages of virtual memory to be used for the program(s). The default is SIZE=10.

- Return Codes:
- 0 - Successful return.
 - 3 - Syntax errors.
 - 4 - Execution errors.

Commands: The following are the most commonly used control commands for WATFIV. See the section "WATFIV" in MTS Volume 6 for a complete description of all of the control commands.

/COMPILE initiates program compilation. This command must appear before the program source statements. Compiler options may be included on this command (see below).

/DATA initiates program execution. This command must appear after the last WATFIV statement and before the data records (if any). Lines following this command are treated as data for the current job. The end of the data is signalled by the next control command or by an end-of-

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file. This command must be present even if there are no data records.

`/STOP` terminates the compiler. An end-of-file also terminates the program.

`/MTS` returns control to MTS. A `$RESTART` command may be used to resume the program.

Options:

The following compiler options may be specified on the `/COMPILE` control command. These options must be separated from the `/COMPILE` by at least one blank and from each other by commas or blanks. Abbreviations, where permissible, are underlined.

`LIST` If specified, a listing of the source program is printed on `SPRINT`; if `NOLIST` is specified, the listing is suppressed. The default is `LIST` in batch mode and `NOLIST` in conversational mode. `SOURCE` is a synonym for `LIST`; `NOSOURCE` is a synonym for `NOLIST`.

`LIBLIST` If specified, subroutines retrieved from the `NOLIBLIST` library on unit 0 will be listed on `SPRINT`. The default is `NOLIBLIST`.

`WARN` If specified, all extension messages will be printed on `SPRINT`; if `NOWARN` is specified, warnings will be suppressed. The default is `WARN`.

`EXT` If specified, all extension messages will be printed on `SPRINT`; if `NOEXT` is specified, extension messages will be suppressed. The default is `EXT`.

`TIME=s` The time estimate in seconds for the execution of the `WATFIV` compiled program, where "s" is an integer or decimal number. The default is the time remaining in the MTS time limit (global or local) minus one-fifth second.

`PAGES=n` The printed page estimate for output of the `WATFIV` program. The default is the number of pages remaining in the MTS page limit (global or local) minus one page.

`LINES=n` The number of lines printed per page. The default is 60.

`RUN=FREE` This controls the amount of error checking done by `WATFIV`.
`CHECK`
`NOCHECK`

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Description: See the section "WATFIV" in MTS Volume 6, FORTTRAN in MTS, for a complete description of the WATFIV compiler.

The file *WATLIB contains a library of WATFIV-coded functions and subroutines. This file should be assigned on the \$RUN command to logical I/O unit 0, e.g.,

```
$RUN *WATFIV 0=*WATLIB
```


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*WBASIC

Contents: The University of Waterloo BASIC System.

Also see *BASIC in this volume for the description of the University of Michigan BASIC System.

Use: The Waterloo BASIC system is invoked by the \$RUN command.

Program Key: *WBASIC

Logical I/O Units Referenced:

None by the WBASIC system; however, any of the MTS logical I/O units may be assigned by the user on the \$RUN command and referenced by the user while using WBASIC.

Parameters: See the parameter field description in the following section on WBASIC-MTS system dependencies.

Return Codes: 0 - Successful return.
>0 - Size request too large or internal WBASIC error.

Description: This program is intended for use as a self-contained system for debugging, modifying, and running programs written in the BASIC language. Terminal input to WBASIC is read from the MTS pseudodevice *SOURCE*. Terminal output from WBASIC is written to the MTS pseudodevice *SINK*.

There are differences between Waterloo BASIC and the University of Michigan BASIC (*BASIC). They are summarized later in this description.

For more information, see Waterloo BASIC - A Structured Programming Approach, Primer and Reference Manual, J. W. Graham, et al, WATFAC Publications Ltd., Waterloo, Ontario, Canada, 1980, IBSN 0-919884-22-9 which is available in the bookstores.

Note that chapters P and Q of the Waterloo BASIC Manual, which deal with system dependencies, are invalid for using *WBASIC in MTS. The following pages of this description are replacements for those chapters.

WBASIC-MTS System Dependencies - IBM 370/303x/43xxOverview

This supplement is intended to replace chapters P and Q in the Waterloo BASIC Primer and Reference Manual. It describes the features of Waterloo BASIC that apply only to the version implemented on the MTS operating system. Broadly speaking, these system dependencies apply to the file system and to the sign-on and sign-off procedures.

Signing On and Off BASIC

Once signed on to the MTS system, the user can invoke Waterloo BASIC by typing the following command:

```
$RUN *WBASIC
```

To return to the MTS level, the user may issue either the BYE or FINISH command.

When WBASIC is invoked, it automatically searches for a special execute file (belonging to the user) with the name "WBSC.PROFILE". If the file exists, WBASIC processes commands and/or statements from that file; otherwise, processing continues.

When WBASIC is active, programs may be brought into the workspace, manipulated, and run using commands provided for those purposes. Certain operations may be specified in the PAR field of the \$RUN command:

```
$RUN *WBASIC PAR=options
```

These options are described below.

'filename'	'filename', if specified, refers to either a source-program file (OLD) or an execute file (EXEC) contained in an MTS file by that name, e.g., 'PROG1' or 'EXFILE2'.
OLD/EXEC	OLD specifies that 'filename' contains a source program to be compiled into the workspace. EXEC specifies that 'filename' contains commands and/or statements to be processed. EXEC must be specified if 'filename' is an execute file. The default is OLD.
RUN/NORUN	RUN specifies that the source program loaded from 'filename' is to be automatically run. NORUN specifies that the program is not to be automatically run. The default is RUN.
BYE/NOBYE	BYE specifies that WBASIC is to be terminated (unloaded) after the program in the specified OLD file has been

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run.NOBYE specifies that control is to be retained by WBASIC after the program is run.

VERBOSE/TERSE VERBOSE specifies that all informational messages are to be displayed. TERSE suppresses the display of the log-on, 'Execution begins', and 'Execution terminated' messages.

MTS/NOMTS MTS allows MTS commands to be executed by using the MTS built-in function in a BASIC program or by issuing them at a terminal by prefixing the commands with a "\$". NOMTS does not allow the execution of MTS commands (e.g., disallows \$PERMIT).

Workspace Size (The SPACE=nP Parameter)

By default, WBASIC provides a workspace that will run a BASIC program of approximately 150 lines (depending on sizes of matrices, complexity of lines, etc.). To increase the size of the workspace, use the SPACE parameter in the PAR field of the \$RUN command. This parameter can be separated by a comma or spaces from any other items in the PAR field. The default is 8 pages and the maximum size is 256 pages. For example, to double the workspace size use the following \$RUN command:

```
$RUN *WBASIC PAR=SPACE=16P
```

Files

Waterloo BASIC uses the MTS file system for storage of either line or sequential files for WBASIC's use. Any legal MTS file or device name may be used in an OPEN statement. In addition, logical I/O units set on the \$RUN command may be referenced by enclosing the logical I/O unit name or number in parenthesis in the open statement. For example, to read lines from the file or device attached to logical I/O unit SCARDS, use the following WBASIC open statement:

```
OPEN #2, '(SCARDS)', INPUT
```

WBASIC will issue a mode error message if either of the following is attempted:

- (1) Opening anything but a line file for INOUT. WBASIC must be able to do indexed I/O to an INOUT file.
- (2) Opening an output-only device (e.g., *PRINT* for INPUT or INOUT).

A file can be created from WBASIC by using the MTS command \$CREATE or by opening the file for OUTPUT. The Waterloo BASIC Manual in Section H-5 on File Positioning states that if records are to be accessed randomly using the REC clause, they should have been previously written

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on the file sequentially. This is not necessary in Waterloo BASIC under MTS. An indexed read will always return an End-of-File if the record does not exist. Note that this is similar, but not identical, to the operation of Waterloo BASIC under CMS described in Section H-5.

The specification of logical record lengths, record formats, and block sizes as prescribed for the OPEN statement description in Section H-5 and other sections of the Waterloo BASIC manual should be disregarded by the *WBASIC user in MTS. References to parameters such as RECSIZE, LRECL, and RECFM are system-dependent (i.e., for the CPS System and VM/CMS System). OPEN statements in MTS should refer purely to an MTS file/device name (e.g., 'FDATA1', '-TEMP', or '*PRINT*') or to an MTS logical I/O unit name or number (e.g., '(SCARDS)' or '(12)').

The number in the REC clause of a PRINT or INPUT statement is rounded to three places of decimal before being used as an MTS line number. For example:

```
PRINT #3,REC=PI,PI
```

would write the value of PI in line 3.142. The RECNUM built-in function may not be used without a file-ref number as indicated in Section H-16.

The Waterloo BASIC Manual assumes that sequential reads and writes start at line zero. Under MTS they start at line one.

Keyed Files

A keyed file is created by an OPEN statement in which the names of both the index and data file must be specified. The data-file name is then saved in the index file so that the name of the data file is subsequently not needed when using the keyed file for INPUT or INOUT. If the keyed file is to be used from another ID, this user's ID should be included in the name of the datafile. For example, if this user's ID is THOR,

```
OPEN #7,'KLASS',OUTPUT,DATAFILE='THOR:KLASSDAT',KEYLEN=4
```

would create KLASS as the index file and KLASSDAT as the data file with the name THOR:KLASSDAT being entered in the index file KLASS. If user ZEUS wishes to read the data file KLASSDAT then THOR must \$PERMIT both KLASS and KLASSDAT READ to ZEUS. Then ZEUS can read KLASSDAT (assuming use of unit 8) by opening the index file with

```
OPEN #8,'THOR:KLASS',INPUT
```

and using an INPUT #8 statement with the KEY clause and other appropriate list and, possibly, format information.

WARNING: Under no circumstances should the user change the line numbers in the data file (e.g., via \$RENUMBER) since the index file's access to the datafile would then be invalid.

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Sorting

In MTS, Waterloo BASIC uses -SORTUTIL instead of SORUTIL as the utility file. This file is used for all sorting, and the USING clause of the SORT statement is ignored.

When using TAGSORT with a nonkeyed file, the four-byte record number at the beginning of each of the sorted records is the internal form of the MTS line number. This is a one-word, binary integer representing the MTS line number times 1000. For example, the MTS line number 2.000 would be represented as the binary integer 2000.

The WBASIC MTS Command and the MTS Built-In Function

Certain MTS commands may be issued without leaving WBASIC. Any line entered from the terminal, whether under program control or at command level, that begins with a '\$' is interpreted as an MTS command. This facility is inhibited and will result in an error message if NOMTS has been included in the PAR field of the \$RUN *WBASIC command. The WBASIC command "MTS" may be used to return to MTS without unloading WBASIC. The \$RESTART command returns control to WBASIC.

MTS commands may be executed under control of a BASIC program using the MTS built-in function. This function takes a single, string-valued parameter which contains the command to be executed. The return value of this function is always zero if the execution of MTS commands is allowed; otherwise, the return code is 4. In the latter case, the user has specified the NOMTS par field parameter. For example, to create a 10-page MTS line file named DATAF1 from a BASIC program at line 100, one could have the following statement in the program:

```
100 Perform_code = MTS('$CREATE DATAF1 SIZE=10P')
```

Screensize

The internal system parameter SCREENSIZE determines the number of lines to be displayed by the LIST, TYPE, and DIRECTORY commands before a system pause is effected to allow the user to read the information on a CRT-type terminal. When the user signs on, the screen size is set to zero (no pauses). This default was chosen to avoid conflict with the paging mechanism provided by the 3278-type device-support routines in MTS. Use the SCREENSIZE command to change this value.

When WBASIC is pausing while processing the above commands, pressing the return key will cause the listing to continue. Anything else will interrupt the listing and will be interpreted as a command to WBASIC.

SLIMIT Command

A facility has been provided for limiting the number of statements that may be executed in each RUN of a program. This facility may be

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used to prevent wasteful consumption of resources by runaway programs executing from unattended terminals. The command form is:

```
SLIMIT <maxcount>
```

where <maxcount> is a positive integer constant to be used to limit the number of statements executed for a single RUN command. For example, SLIMIT 5000 limits program execution to five thousand statements. If the program exceeds this limit, it is interrupted and a diagnostic message is issued.

Mixed Case

Programs and BASIC commands may be entered as either lowercase and/or uppercase characters. Lines are not translated to uppercase; therefore, variable names must be expressed consistently in whatever case the user chooses. For example, the variable Big_X is not the same as the variable Big_x.

Carriage Control

Logical carriage control may be used for output to a file or device by appending the @CC I/O modifier to the FDname whenever it is specified for output. For example, the following two program segments are equivalent:

```
10 OPEN #2, '*SINK*@CC',OUTPUT
20 PRINT #2, '0A blank line precedes this line.'

10 OPEN #2, '*SINK*',OUTPUT
20 PRINT #2, ' '
30 PRINT #2, 'A blank line precedes this line.'
```

See Appendix H to "Files and Devices" in MTS Volume 1, The Michigan Terminal System, for a complete description of logical carriage control.

Data Input to WBASIC

Free-format data items can be separated only by commas. No blank separators are allowed. Fixed-format data items must be presented just as their format-image string specifies. Formatted output to a file may, depending on the context, produce necessary trailing blanks at the end of the record being written. For example, writing the number 12 as the last item of a record with the format '@###CR@' will produce 012␣␣ (␣ is a blank) as the last characters of that record. If the user copies that file (e.g. via \$COPY) to another file without defeating the MTS TRIM option and then tries to read that record in the new file with the original format, WBASIC will flag the input operation as an error since the input record length is too short to satisfy the length requirement of the format item.

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DIRECTORY Command

The DIRECTORY command gives a list of all the permanent files under the user's ID. The command will also optionally take the same arguments as the MTS \$FILESTATUS command but they are to be enclosed, as a group, in primes. This allows interrogation of the user's file status even though the NOMTS parameter was specified in the PAR field of the \$RUN command.

DIR	is equivalent to	\$FILESTATUS
DIR 'DA?'	is equivalent to	\$FI DA?
		(prints all file names beginning with DA)
DIR 'DA?F?'	is equivalent to	\$FI DA?F?
DIR 'DATAF1 FA'	is equivalent to	\$FI DATAF1 FULLACCESS
		(obtains all users' access to DATAF1)

Unsupported Features

The following commands or statements are not supported in the MTS version of Waterloo BASIC:

ASSIGN	DEASSIGN	LOAD	LOCK
SHOW	STORE	STOREOBJ	UNLOCK

Invocation Examples

```
$RUN *WBASIC
$RUN *WBASIC PAR=SPACE=30P
$RUN *WBASIC SCARDS=DATAF1 5=-ODFILE PAR=NOMTS
$RUN *WBASIC 5=INDFILE SPRINT=*PRINT* PAR=TERSE
$RUN *WBASIC PAR='MYEXFILE',EXEC
$RUN *WBASIC PAR='MYPROG',NOBYE
```

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Features of Waterloo BASIC and U of M BASIC

The following summarizes the most important comparisons between Waterloo BASIC (*WBASIC) and U of M BASIC (*BASIC).

Waterloo BASIC

Waterloo BASIC is fully interpretive and uses BASIC statements to implement debugging. BASIC statements can be changed immediately when the program is being debugged. Breakpoints may be set by inserting PAUSE statements into the program. The input/output and assignment statements are used in immediate form to modify and display data. Since WBASIC is interpretive, directly uses MTS files for data, and provides an abundance of facilities, the program overhead cost of CPU time and memory is much higher than for U of M BASIC. However, WBASIC offers over U of M BASIC the advantages of large file data sets and programs; indexed, sequential, and keyed file access; structured programming constructs; a large set of built-in functions; long variable names; multi-dimensional arrays; multi-line, user-defined, internal functions with parameters and recursive capability; immediate (desk calculator) mode; CHAIN statement with parameters (no CALL statement); extended I/O status determination; and formatted I/O facilities.

U of M BASIC

U of M BASIC is a compile, load, and go facility that runs programs in machine code form and uses small, in-fast-memory data sets to effect a highly efficient execution. It also has a very comprehensive debugging facility which easily admits the setting and restoring of breakpoints, the stepping through or global tracing of program logic, and the simple modification and display of program variables. Variable references, however, are strictly in constant form, e.g., DISPLAY A(3) or MODIFY X 3. Program statements may be changed, but the program must be rerun to effect the changes. U of M BASIC provides advanced BASIC support for small-file I/O, matrix operations, and string operations, but not nearly to the extent that Waterloo BASIC does.

U of M BASIC was designed to provide a simple, MTS-like environment for newcomers who would be using the BASIC programming language as an introduction to computing and as a stepping stone to other languages and facilities of MTS. Hence, it has an elementary set of commands much like those of MTS, SDS, and the MTS Editor. It can be used for the efficient programming, running, and debugging of modest BASIC programs-

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*WIREWRAP

Contents: A universal computer-aided-design program for the documentation and construction of hardware logic devices.

Use: The program is invoked by the \$RUN command. A subroutine package containing a description of the hardware mounting technique must also be loaded. This is done by either specifying one subroutine package in a library file by means of the PAR field, e.g.,

```
$RUN *WIREWRAP PAR=LIB=FDname,TYPE=name
```

or by concatenating a file containing a single subroutine package to *WIREWRAP, e.g.,

```
$RUN *WIREWRAP+filename
```

Program Key: *WIREWRAP

Logical I/O Units Referenced:

- SCARDS - source input.
- SPRINT - output listings, printer plots, and error comments.
- SPUNCH - Gardner-Denver card output.
- SERCOM - error comments if PAR=SERCOM is specified.

Parameters: The following parameters may be specified in the PAR field of the \$RUN command. The parameters must be separated by commas.

LIB=FDname Specifies the library file to be searched for loading the subroutine package (mounting technique) specified in the TYPE parameter. The default is *WWLIB.

TYPE=name Specifies the subroutine package (mounting technique) to be loaded. Defaults to the first package in the library file (type LAB in file *WWLIB).

SERCOM Enables the printing of error comments on SERCOM (defaults to *MSINK*). This is useful if SPRINT output is directed to a file or line printer.

Return Codes: Always zero.

Description: *WIREWRAP is a universal, general purpose computer-aided-design program that may be used to design devices using

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any manufacturer's logic series or wirewrap panel. It was written to assume tasks which range from the design of a logic device with a logic diagram to the actual implementation of that device in real hardware, and to produce and maintain documentation needed to service the device after it is built. Some of its features include:

- (1) Checking outputs of all gates and storage elements for overloading.
- (2) Automatically deciding which modules (integrated circuits) are required to implement the device, listing them for the designer, and calculating their total cost.
- (3) Deciding where these modules should be placed on the wirewrap panel.
- (4) Establishing all wires that are required, minimizing wire length wherever possible, generating wiring instructions which give end-points and length of every wire or a card deck to control an automatic wirewrapping machine.
- (5) Generating documentation including a dictionary of signal-names and a diagram of the wirewrap panel (bay).

Besides these direct applications, *WIREWRAP can be used indirectly to derive cost comparisons of different implementations of the same device, for instance, using a new MSI (Medium Scale Integration) Integrated Circuit to replace a group of Small Scale subassemblies into printed-circuit boards. Most importantly, it offers a design language which is completely independent of the hardware implementation used, so that the device-description cards need never be altered no matter how much the designer decides to revise his hardware or mounting techniques.

Novice users should be aware that although there are significant advantages to using *WIREWRAP, there may be a "one-time" programming task necessary to create a subroutine package and/or macro dictionary before the system may be used. However, there are several public files available that may already contain packages desired by the user. The files associated with *WIREWRAP are:

```
*WWICMAC
*WWLABMAC
*WWLIB
*WWSTGRD1
*WWSTGRD2
*WWSQGRD
```

The subroutine packages available in *WWLIB are:

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LAB	(ECE breadboarding suitcase)
RSERIES	(DEC wirewrap backpanel)
MSERIES	(DEC wirewrap backpanel)
IC	(DEC wirewrap backpanel)
MIC	(DEC wirewrap backpanel)
PG1	(Augat wirewrap PC board)
PG3	(Augat wirewrap PC board)
PG5	(Augat wirewrap PC board)
PG13	(Augat wirewrap PC board)
UG1	(Augat wirewrap PC board)

For further details, see Computing Center Memo 267, "`*WIREWRAP` User's Guide."

Examples:

```
$RUN *WIREWRAP SCARDS=DATA SPRINT=*PRINT* SPUNCH=*PUNCH*
PAR=TYPE=MSERIES,SERCOM
```

In the above example, source input is read from the file DATA and output listings are written to `*PRINT*`. The Gardner-Denver output is punched on `*PUNCH*`. MSERIES is used as the subroutine package for the mounting technique, and has been loaded from the library (`*WWLIB`) containing several subroutine packages. Error comments will be produced on both SPRINT and SERCOM.

```
$RUN *WIREWRAP+SUBRTNFILE SPRINT=OUTFILE
```

In the above example, the source input is read from `*SOURCE*` (the default for SCARDS) and the output listings are written to the file OUTFILE. SUBRTNFILE contains the subroutine package for the mounting technique.

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*WORKSTATIONS

Contents: A list of public terminals, microcomputers, and microcomputer software available on the University of Michigan campus.

Use: The list may be obtained via the \$COPY command, e.g.,

\$COPY *WORKSTATIONS *PRINT*

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*11ASR

Contents: The assembler for Digital Equipment Corporation's PDP-11 computer.

Use: The assembler is invoked by the \$RUN command.

Program Key: *11ASR

Logical I/O Units Referenced:

- SCARDS - source input to assembler.
- SPRINT - listing and error comments from the assembler.
- SPUNCH - MTS loader records from assembler.
- 0 - test and timing records (optional).

Return Codes: Always zero.

Description: *11ASR translates source programs for the PDP-11 written in the U of M PDP-11 Assembly Language. The object modules produced are composed of MTS loader records which must be processed by *LINK11 to produce an absolute tape which can be loaded by DEC's absolute binary loader. *11ASR has an extensive macro capability.

A description of the U of M PDP-11 Assembly Language, a description of the assembler, and macro compiler is given in Computing Center Memo 286.

Parameters: All parameters may be specified in the PAR field of the \$RUN command, separated by commas, or in the PAR pseudo-op.

The default parameters are:

- Batch: NOESD,LIST,RLD,XREF,LONG,NOREP,WRN
- Teletype: NOESD,NOLIST,NORLD,NOXREF,SHORT,NOREP,WRN
- 2741: NOESD,NOLIST,NORLD,NOXREF,LONG,NOREP,WRN

If SPRINT is assigned to a file during a terminal session, then the batch-mode defaults are used. If SPUNCH is not assigned, the NODECK option is automatically selected. In any case, lines found in error are printed on SPRINT along with the error comment.

The legal parameters are:

- BATCH - allow the assembler to reinitialize itself after processing an END statement in PASS2 so that further assemblies may be processed.

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ESD - print the external symbol table.
NOESD - suppress printing of the ESD table.

LIST - print the source statement listing.
NOLIST - suppress printing of the source listing.

RLD - print the relocation dictionary.
NORLD - suppress printing of the relocation dictionary.

XREF - generate and print a cross-reference table.
NOXREF - suppress the generation and printing of the cross-reference table.

LONG - print sequence numbers in the listing.
SHORT - suppress sequence numbers in the listing (thus making the line shorter and the XREF table useless).

REP - enable the replacement scanner.
NOREP - disable the replacement scanner.

WRN - print a warning message if a word instruction refers to an odd address.
NOWRN - suppress the above warning.

NODECK - suppress generation of the object module.

TEST - generate and write statement timing and flow information on logical unit 0.

ON - turn on printing if PAR=LIST is specified.
OFF - turn off printing of the listing.

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Public File Descriptions
Volume 2
January 1987
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