



**NOS VERSION 1
REFERENCE MANUAL**

Volume 2 of 2

**CDC® COMPUTER SYSTEMS:
CYBER 170 MODELS 172, 173, 174, 175
CYBER 70 MODELS 71, 72, 73, 74
6000 SERIES**

LIST OF MACROS

ABORT	2-11-1	LOADD ③	2-11-18	ROLLOUT (006) ③	2-6-7
APPEND (007, CCAP)	2-5-17	LOADQ ③	2-11-20	ROUTE	2-8-4
ASSIGN (001)	2-4-3	LOCK (010)	2-4-6	RPHR (000)	2-3-26
ASSIGN (020)	2-4-12	MACHID (050) ④	2-6-24	RPHRLS (230)	2-3-31
ATTACH (011, CCAT)	2-5-22	MEMORY	2-11-5	RTIME	2-11-10
BKSP (040)	2-3-39	MESSAGE	2-11-7	SAVE (001, CCSV)	2-5-8
BKSPRU (044)	2-3-40	MODE (002) ④	2-6-2	SETASL (003) ④	2-6-2
CATLIST (004, CCCT) ③	2-5-11	MOVE	2-11-9	SETGLS (047) ③	2-6-23
CHANGE (012, CCCG)	2-5-23	NORERUN (016) ⑤	2-7-3	SETID (017)	2-4-11
CHECKPT ③	2-10-3	OFFSW (012)	2-6-11	SETJCR (025) ③	2-6-16
CLOCK	2-11-1	ONSW (011)	2-6-11	SETJSL (003) ④	2-6-3
CLOSE	2-3-23	OPEN	2-3-17	SETLC (022) ③	2-6-14
CLOSER	2-3-25	OVERLAY	2-11-14	SETMFL (052) ④	2-6-25
COMMON (002) ④	2-4-4	PACKNAM (035) ④	2-6-19	SETPR (001) ③	2-6-2
CONSOLE (005) ③	2-6-7	PACKNAM (036) ④	2-6-20	SETQP (000) ⑤	2-6-1
CONTROL (004)	2-10-1	PARITY ③	2-12-10	SETRFL (023) ④	2-6-15
CSET ③	2-12-9	PDATE	2-11-9	SETSS (026) ③	2-6-16
DATE	2-11-2	PERMIT (005, CCPM)	2-5-15	SETSSM (010) ③	2-6-10
DAYFILE (001, 002, 003, 005) ② ③	2-9-3	POSMF (110)	2-3-43	SETTL (003) ④	2-6-4
DEFINE (010, CCDF)	2-5-19	PRIMARY (031) ③	2-4-20	SETUI (021) ① ③	2-6-13
DISTC ③	2-12-7	PSCSF (023) ③	2-4-13	SKIPB (640)	2-3-50
EDATE ③	2-11-2	PURGE (003, CCGT)	2-5-10	SKIPEI (240)	2-3-50
ENCSSF (022) ③	2-4-12	RDVT (006) ③	2-9-4	SKIPF (240)	2-3-48
ENDRUN	2-11-3	READ (010)	2-3-27	SKIPFB (640)	2-3-51
EREXIT (004)	2-6-5	READC	2-3-55	SKIPFF (240)	2-3-49
ESYF (004) ① ③	2-9-4	READCW (200)	2-3-28	STATUS (012)	2-4-7
ETIME ③	2-11-4	RADEI (600)	2-3-33	STATUS (013)	2-4-7
EVICT (114)	2-3-48	READH	2-3-55	STIME	2-11-11
EXCST (005) ③	2-10-2	READLS (210)	2-3-30	SUBMIT (017) ③	2-7-3
FILEB	2-3-9	READN (260)	2-3-32	SUBR ③	2-11-12
FILEC	2-3-10	READNS (250)	2-3-32	SYSCOM	2-2-6
GET (002, CCGT)	2-5-9	READO	2-3-56	SYSTEM	2-11-12
GETASL (007) ③	2-6-9	READS	2-3-57	TIME	2-11-13
GETEM (016) ④ ③	2-6-13	READSKP (020)	2-3-27	TSTATUS ③	2-12-10
GETFLC (033) ③	2-6-19	READW	2-3-58	UNLOAD (060)	2-3-41
GETFNT (025) ③	2-4-18	RECALL	2-11-10	UNLOCK (011)	2-4-7
GETGLS (046) ③	2-6-22	RELEASE (004, 005, 006, 007, 016, 030)	2-4-5	USECPU (031)	2-6-18
GETJA (030) ③	2-6-17	RENAME (000)	2-4-2	USERNUM (032)	2-6-18
GETJCR (024) ③	2-6-15	REPLACE (006, CCRP)	2-5-16	VERSION (044) ④	2-6-21
GETJN (013) ③	2-6-11	REQUEST (014)	2-4-9	WPHR (004)	2-3-34
GETJO (027) ③	2-6-17	REQUEST (015) ①	2-4-10	WRITE (014)	2-3-34
GETJSL (007) ③	2-6-9	RERUN (015) ③	2-7-2	WRITEC	2-3-55
GETLC (045) ③	2-6-21	RETURN (070)	2-3-42	WRITECW (204)	2-3-36
GETMC (051) ③	2-6-24	REWIND (050)	2-3-40	WRITEF (034)	2-3-35
GETPR (015) ③	2-6-12	REWRITE (214)	2-3-36	WRITEH	2-3-56
GETQP (014) ③	2-6-12	REWRITEF (234)	2-3-37	WRITEN (264)	2-3-38
GETSS (037) ③	2-6-20	REWRITER (224)	2-3-37	WRITEO	2-3-57
GETTL (017) ③	2-6-13	RFILEB	2-3-10	WRITER (024)	2-3-35
JDATE	2-11-4	RFILEC	2-3-10	WRITES	2-3-57
LABEL (024)	2-4-14			WRITEW	2-3-58

① For system origin jobs or users with system origin privileges.

② Some features of this macro require system origin privileges.

③ This macro is not available in SYSTEXT. The user must call common deck COMCMAC.

④ This macro is not available in SYSTEXT. The user must call common deck COMCCMD.



**NOS VERSION 1
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Volume 2 of 2

CDC® COMPUTER SYSTEMS:

CYBER 170

MODELS 171, 172, 173, 174, 175

CYBER 70

MODELS 71, 72, 73, 74

6000 SERIES

LIST OF EFFECTIVE PAGES

New features, as well as changes, deletions, and additions to information in this manual, are indicated by bars in the margins or by a dot near the page number if the entire page is affected. A bar by the page number indicates pagination rather than content has changed.

PAGE	REV	PAGE	REV	PAGE	REV	PAGE	REV	PAGE	REV
Front Cover	-	2-3-26	D	2-5-1	C	2-8-1	C	2-B-7	B
Inside Front Cover	-	2-3-27	C	2-5-2	C	2-8-2	D	2-B-8	B
Title Page	-	2-3-28	E	2-5-3	C	2-8-3	E	2-B-9	B
ii	E	2-3-29	E	2-5-4	D	2-8-4	C	2-B-10	B
iii	E	2-3-30	E	2-5-5	D	2-8-5	C	2-C-1	A
iv	E	2-3-31	B	2-5-6	E	2-9-1	C	2-C-2	A
v	E	2-3-32	B	2-5-6.1/ 2-5-6.2	D	2-9-2	C	2-C-3	A
vi	C	2-3-33	D	2-5-7	C	2-9-3	B	2-C-4	A
vii	D	2-3-34	C	2-5-8	D	2-9-4	A	2-C-5	A
viii	D	2-3-35	C	2-5-9	D	2-10-1	E	2-C-6	A
ix	E	2-3-36	E	2-5-10	C	2-10-2	C	2-C-7	A
x	E	2-3-37	B	2-5-11	C	2-10-3	A	2-C-8	A
xi	E	2-3-38	C	2-5-12	D	2-10-4	A	2-C-9	E
xii	E	2-3-39	D	2-5-13	D	2-10-5	A	2-C-10	B
2-1-1	D	2-3-40	E	2-5-14	E	2-11-1	B	2-C-11	A
2-2-1	D	2-3-41	B	2-5-15	C	2-11-2	E	2-C-12	A
2-2-2	D	2-3-42	D	2-5-16	D	2-11-3	B	2-C-13	A
2-2-3	D	2-3-43	D	2-5-17	D	2-11-4	A	2-C-14	A
2-2-4	D	2-3-44	E	2-5-18	D	2-11-5	D	2-C-15	A
2-2-5	E	2-3-45	E	2-5-19	D	2-11-6	D	2-C-16	A
2-2-6	E	2-3-46	D	2-5-20	D	2-11-7	C	2-C-17	A
2-2-6.1/ 2-2-6.2	D	2-3-47	D	2-5-21	D	2-11-8	C	2-D-1	A
2-2-7	E	2-3-48	B	2-5-22	C	2-11-9	E	2-D-2	A
2-2-8	D	2-3-49	B	2-5-23	C	2-11-10	A	2-D-3	A
2-2-9	E	2-3-50	B	2-5-24	D	2-11-11	A	2-D-4	A
2-2-10	C	2-3-51	C	2-6-1	D	2-11-12	A	2-D-5	A
2-2-11	B	2-3-52	C	2-6-2	C	2-11-13	A	2-D-6	A
2-2-12	B	2-3-53	C	2-6-3	C	2-11-14	D	2-D-7	A
2-2-13	B	2-3-54	C	2-6-4	C	2-11-15	A	2-D-8	A
2-2-14	B	2-3-55	B	2-6-5	C	2-11-16	C	2-D-9	A
2-3-1	D	2-3-56	B	2-6-6	D	2-11-17	D	2-D-10	A
2-3-2	D	2-3-57	E	2-6-7	C	2-11-18	D	2-D-11	A
2-3-3	D	2-3-58	C	2-6-8	C	2-11-19	C	2-D-12	A
2-3-4	E	2-3-59	C	2-6-9	C	2-11-20	D	2-D-13	A
2-3-5	E	2-4-1	D	2-6-10	C	2-11-21	C	2-D-14	A
2-3-6	E	2-4-2	C	2-6-11	D	2-11-22	C	2-D-15	A
2-3-6.1/ 2-3-6.2	E	2-4-3	A	2-6-12	C	2-12-1	A	2-D-16	A
2-3-7	E	2-4-4	C	2-6-13	C	2-12-2	E	2-D-17	A
2-3-8	E	2-4-5	C	2-6-14	C	2-12-3	E	2-D-18	A
2-3-9	E	2-4-6	C	2-6-15	C	2-12-4	D	2-E-1	D
2-3-10	B	2-4-7	D	2-6-16	C	2-12-5	D	2-E-2	D
2-3-11	D	2-4-8	D	2-6-17	C	2-12-6	C	2-E-3	C
2-3-12	C	2-4-8.1/ 2-4-8.2	D	2-6-18	C	2-12-7	C	2-E-4	C
2-3-13	D	2-4-9	A	2-6-19	C	2-12-8	B	2-E-5	C
2-3-14	D	2-4-10	A	2-6-20	C	2-12-9	B	2-F-1	E
2-3-15	D	2-4-11	C	2-6-21	C	2-12-10	B	2-F-2	E
2-3-16	D	2-4-12	C	2-6-22	C	2-12-11	C	2-G-1	B
2-3-17	D	2-4-13	C	2-6-23	C	2-12-12	B	2-G-2	B
2-3-18	D	2-4-14	E	2-6-24	C	2-A-1	E	2-G-3	B
2-3-19	D	2-4-15	E	2-6-25	C	2-A-2	E	2-G-4	B
2-3-20	D	2-4-16	E	2-6-26	D	2-A-3	E	2-G-5	D
2-3-21	E	2-4-17	E	2-6-27	E	2-A-4	C	2-G-6	B
2-3-22	E	2-4-18	C	2-6-28	E	2-A-5	C	2-G-7	C
2-3-23	D	2-4-19	C	2-6-29	E	2-B-1	A	2-G-8	C
2-3-24	B	2-4-20	D	2-7-1	E	2-B-2	B	2-G-9	C
2-3-25	E	2-4-21	E	2-7-2	C	2-B-3	B	2-H-1	A
		2-4-22	E	2-7-3	C	2-B-4	B	2-H-2	C
		2-4-23	E	2-7-4	C	2-B-5	B	2-H-3	C
				2-7-5	C	2-B-6	B	2-H-4	C

PAGE	REV	PAGE	REV	PAGE	REV	PAGE	REV	PAGE	REV
Index-1	E								
Index-2	E								
Index-3	E								
Index-4	E								
Index-5	E								
Index-6	E								
Index-7	E								
Index-8	E								
Index-9	E								
Index-10	E								
Index-11	E								
Cmt Sheet	E								
Back Cover	-								

PREFACE

The Network Operating System (NOS) was developed by Control Data Corporation to provide network capabilities for time-sharing and transaction processing, in addition to local and remote batch processing on CONTROL DATA® CYBER 170 Series, Models 171, 172, 173, 174, and 175 Computer Systems; CYBER 70 Series, Models 71, 72, 73, and 74 Computer Systems; and 6000 Series Computer Systems.

This manual describes the external features of NOS 1.2 for the batch user. Information in this manual should be useful to those who use the programs and utilities supplied with the system and those who wish to write their own. The manual is contained in two volumes to separate information pertaining primarily to the applications programmer from that of interest to the applications COMPASS programmer.

Volume 1 (publication no. 60435400) contains information for the applications programmer. This includes general information about files, job flow and execution, control statement processing, and an extensive discussion of control statements.

Volume 2 (publication no. 60445300) contains information for those who write system or assembly language programs for use with NOS. It is primarily intended for the applications COMPASS programmer; however, several portions contain information for users of higher level languages.

Throughout this manual, cross-references to the NOS Reference Manual, Volume 1, are of the form, "refer to section (or appendix) n, volume 1." If volume 1 is not stipulated, the reference is to this manual.

This manual does not contain a description of NOS system operation, detailed descriptions of the software product set available under NOS, or descriptions of the time-sharing commands.

The user is assumed to be familiar with CDC computer systems and with operating systems in general.

Conventions for central memory word formats are as follows:

- Cross-hatching indicates a field is not used by or is not applicable to a function processor. However, CDC reserves the right to assign these fields to system use in the future.
- Fields reserved for system use are so labeled.
- Fields labeled with mnemonics indicate a specific parameter must be inserted (generally described after the word format).
- Fields with numeric identifiers indicate the actual value that is used or returned for a particular function.

For further information concerning CDC CYBER 170, CDC CYBER 70, and 6000 Series Computer Systems, the NOS time-sharing system, and the products supported by NOS, consult the following manuals.

<u>Control Data Publication</u>	<u>Publication No.</u>
CDC CYBER 170 Computer Systems Reference Manual	60420000
CDC CYBER 70/Model 71 Computer System Reference Manual	60453300
CDC CYBER 70/Model 72 Computer System Reference Manual	60347000
CDC CYBER 70/Model 73 Computer System Reference Manual	60347200
CDC CYBER 70/Model 74 Computer System Reference Manual	60347400
CDC 6400/6500/6600 Computer Systems Reference Manual	60100000
NOS Systems Programmer's Instant	60449200
NOS Applications Programmer's Instant	60436000
NOS Installation Handbook	60435700
NOS Time-Sharing User's Reference Manual	60435500
NOS Operator's Guide	60435600
NOS Terminal User's Instant	60435800
TRANEX Version 1 Reference Manual	60407900
TRANEX Version 1/TAF Version 1 User's Guide	60436500
TAF Version 1 Reference Manual	60453000
TAF Version 1 Data Manager Reference Manual	60453100
Export/Import Reference Manual	60436200
Text Editor Reference Manual	60436100
NOS Modify Reference Manual	60450100
NOS Modify Instant	60450200
Update Reference Manual	60449900
COMPASS Reference Manual	60492600
FORTTRAN Extended Reference Manual	60497800
CDC CYBER Record Manager Reference Manual	60495700
CDC CYBER Loader Reference Manual	60429800
NAM Reference Manual	60499500
RBF Reference Manual	60499600

This product is intended for use only as described in this document. Control Data cannot be responsible for the proper functioning of undescribed features or undefined parameters.

CONTENTS

VOLUME 1

SECTION 1	SYSTEM DESCRIPTION	1-1-1
SECTION 2	FILES	1-2-1
SECTION 3	JOB FLOW AND EXECUTION	1-3-1
SECTION 4	CONTROL LANGUAGE	1-4-1
SECTION 5	CONTROL STATEMENT PROCESSING	1-5-1
SECTION 6	JOB CONTROL CONTROL STATEMENTS	1-6-1
SECTION 7	FILE MANAGEMENT CONTROL STATEMENTS	1-7-1
SECTION 8	PERMANENT FILE CONTROL STATEMENTS	1-8-1
SECTION 9	LOAD/DUMP CENTRAL MEMORY UTILITY CONTROL STATEMENTS	1-9-1
SECTION 10	TAPE MANAGEMENT	1-10-1
SECTION 11	PRODUCT SET CONTROL STATEMENTS	1-11-1
SECTION 12	CHECKPOINT/RESTART	1-12-1
SECTION 13	DEBUGGING AIDS	1-13-1
SECTION 14	SYSTEM UTILITY CONTROL STATEMENTS	1-14-1

APPENDIXES

APPENDIX A	CHARACTER SETS	1-A-1
APPENDIX B	MESSAGES	1-B-1
APPENDIX C	LIBEDIT	1-C-1
APPENDIX D	JOB OUTPUT INFORMATION	1-D-1
APPENDIX E	PERMANENT FILE DEVICE STATISTICS	1-E-1
APPENDIX F	CARD FORMAT AND CONVERSION PROBLEMS	1-F-1
APPENDIX G	TAPE LABELS	1-G-1
APPENDIX H	GLOSSARY	1-H-1

VOLUME 2

SECTION 1	INTRODUCTION	2-1-1
	Function Processors	2-1-1
	Macros and Common Decks	2-1-1
SECTION 2	PROGRAM/SYSTEM COMMUNICATION	2-2-1
	System Requests	2-2-1
	Request Processors	2-2-1
	System Request Processing	2-2-2
	Issuing RA+1 Requests	2-2-4
	NOS Systems Texts	2-2-5
	Macro Usage	2-2-5
	SYSCOM	2-2-6.1
	Common Deck Usage	2-2-7
	Security Considerations	2-2-14
SECTION 3	FILE CREATION AND INPUT/OUTPUT	2-3-1
	File Environment Table (FET)	2-3-1
	Circular Buffers	2-3-2
	FIRST Address	2-3-2
	LIMIT Address	2-3-3
	OUT Address	2-3-3
	IN Address	2-3-3
	FET Description	2-3-4
	FET Creation Macros	2-3-9
	FILEB	2-3-9
	FILEC	2-3-10
	RFILEB	2-3-10
	RFILEC	2-3-10
	CIO - Combined Input/Output	2-3-12
	CIO Function Processing	2-3-15
	Random Processing	2-3-15
	CIO Open and Close Functions	2-3-17
	OPEN	2-3-17
	Mass Storage Operations	2-3-19
	Unlabeled Tape Processing	2-3-20
	Nonstandard Labeled Tape Processing	2-3-20
	ANSI Standard Labeled Tape Processing	2-3-20
	Extended Label Processing	2-3-21
	CLOSE	2-3-23
	CLOSER	2-3-25
	CIO Read Functions	2-3-26
	RPHR (000)	2-3-26
	READ (010)	2-3-27
	READSKP (020)	2-3-27
	READCW (200)	2-3-28
	READLS (210)	2-3-30
	RPHRLS (230)	2-3-31
	READNS (250)	2-3-32
	READN (260)	2-3-32
	READEI (600)	2-3-33

CIO Write Functions	2-3-34
WPHR (004)	2-3-34
WRITE (014)	2-3-34
WRITER (024)	2-3-35
WRITEF (034)	2-3-35
WRITECW (204)	2-3-36
REWRITE (214)	2-3-36
REWRITER (224)	2-3-37
REWRITEF (234)	2-3-37
WRITEN (264)	2-3-38
File Positioning Functions	2-3-39
BKSP (040)	2-3-39
BKSPRU (044)	2-3-40
REWIND (050)	2-3-40
UNLOAD (060)	2-3-41
RETURN (070)	2-3-42
POSMF (110)	2-3-43
Standard ANSI-Labeled Multifile Set Processing	2-3-43
Extended Label Multifile Set Processing	2-3-44
EVICT (114)	2-3-48
SKIPF (240)	2-3-48
SKIPFF (240)	2-3-49
SKIPFI (240)	2-3-50
SKIPB (640)	2-3-50
SKIPFB (640)	2-3-51
Data Transfer Macros	2-3-51
READC	2-3-55
WRITEC	2-3-55
READH	2-3-55
WRITEH	2-3-56
READO	2-3-56
WRITEO	2-3-57
READS	2-3-57
WRITES	2-3-57
READW	2-3-58
WRITEW	2-3-58
CDC CYBER Record Manager I/O	2-3-59

SECTION 4

LOCAL FILE MANAGER	2-4-1
RENAME (000)	2-4-2
ASSIGN (001)	2-4-3
COMMON (002)	2-4-4
RELEASE (004, 005, 006, 007, 016, 030)	2-4-5
LOCK (010)	2-4-6
UNLOCK (011)	2-4-7
STATUS (012)	2-4-7
STATUS (013)	2-4-7
REQUEST (014)	2-4-9
REQUEST (015)	2-4-10
SETID (017)	2-4-11
ASSIGN (020)	2-4-12
ENCSF (022)	2-4-12
PSCSF (023)	2-4-13
LABEL (024)	2-4-14
GETFNT (025)	2-4-18
PRIMARY (031)	2-4-20
FILINFO (032)	2-4-21

SECTION 5	PERMANENT FILE MANAGER	2-5-1
	Permission Modes, File Categories	2-5-6
	Auxiliary Device Request	2-5-7
	SAVE (001, CCSV)	2-5-8
	GET (002, CCGT)	2-5-9
	PURGE (003, CCPG)	2-5-10
	CATLIST (004, CCCT)	2-5-11
	PERMIT (005, CCPM)	2-5-15
	REPLACE (006, CCRP)	2-5-16
	APPEND (007, CCAP)	2-5-17
	DEFINE (010, CCDF)	2-5-19
	ATTACH (011, CCAT)	2-5-22
	CHANGE (012, CCCG)	2-5-23
SECTION 6	CONTROL POINT MANAGER	2-6-1
	SETQP (000)	2-6-1
	SETPR (001)	2-6-2
	MODE (002)	2-6-2
	SETASL (003)	2-6-2
	SETJSL (003)	2-6-3
	SETTL (003)	2-6-4
	EREXIT (004)	2-6-5
	CONSOLE (005)	2-6-7
	ROLLOUT (006)	2-6-7
	GETASL (007)	2-6-9
	GETJSL (007)	2-6-9
	SETSSM (010)	2-6-10
	ONSW (011)	2-6-11
	OFFSW (012)	2-6-11
	GETJN (013)	2-6-11
	GETQP (014)	2-6-12
	GETPR (015)	2-6-12
	GETEM (016)	2-6-13
	GETTL (017)	2-6-13
	SETUI (021)	2-6-13
	SETLC (022)	2-6-14
	SETRFL (023)	2-6-15
	GETJCR (024)	2-6-15
	SETJCR (025)	2-6-16
	SETSS (026)	2-6-16
	GETJO (027)	2-6-17
	GETJA (030)	2-6-17
	USECPU (031)	2-6-18
	USERNUM (032)	2-6-18
	GETFLC (033)	2-6-19
	PACKNAM (035)	2-6-19
	PACKNAM (036)	2-6-20
	GETSS (037)	2-6-20
	VERSION (044)	2-6-21
	GETLC (045)	2-6-21
	GETGLS (046)	2-6-22
	SETGLS (047)	2-6-23
	MACHID (050)	2-6-24
	GETMC (051)	2-6-24
	SETMFL (052)	2-6-25
	GETPFP (057)	2-6-26
	GETLOF (061)	2-6-27
	SETLOF (062)	2-6-28

SECTION 7	QUEUE FILE MANAGER	2-7-1
	RERUN (015)	2-7-2
	NORERUN (016)	2-7-3
	SUBMIT (017)	2-7-3
	Assign File to Queue Device (020)	2-7-5
SECTION 8	FILE ROUTING	2-8-1
	DSP Function	2-8-1
	ROUTE	2-8-4
	Error Processing	2-8-4
SECTION 9	SYSTEM FILE MANAGER	2-9-1
	DAYFILE (001, 002, 003, 005)	2-9-3
	ESYF (004)	2-9-4
	RDVT (006)	2-9-4
SECTION 10	JOB CONTROL	2-10-1
	Translate Control Statement	2-10-1
	CONTROL (004)	2-10-1
	EXCST (005)	2-10-2
	Checkpoint/Restart	2-10-3
	CHECKPT	2-10-3
SECTION 11	SYSTEM/LOADER REQUESTS	2-11-1
	System Requests	2-11-1
	ABORT	2-11-1
	CLOCK	2-11-1
	DATE	2-11-2
	EDATE	2-11-2
	ENDRUN	2-11-3
	ETIME	2-11-4
	JDATE	2-11-4
	MEMORY	2-11-5
	MESSAGE	2-11-7
	MOVE	2-11-9
	PDATE	2-11-9
	RECALL	2-11-10
	RTIME	2-11-10
	STIME	2-11-11
	SUBR	2-11-12
	SYSTEM	2-11-12
	TIME	2-11-13
	Loader Requests	2-11-14
	OVERLAY	2-11-14
	LOADD	2-11-18
	LOADQ	2-11-20
	Memory Allocation for Overlay Loaders	2-11-22
SECTION 12	PROGRAM WRITING TECHNIQUES	2-12-1
	Writing Programs under NOS	2-12-1
	Writing Interactive Programs	2-12-1
	Conversion Problems	2-12-1
	Default File Assignments and Special File Treatment	2-12-2
	Special Handling	2-12-2
	Other Special Handling	2-12-2

Program Control of Terminal Activity	2-12-4
Control Bytes	2-12-4
End-of-Line	2-12-4
End-of-Block (0001 or 0002)	2-12-4
Auto Input (0003)	2-12-4
Log-Off User (0004)	2-12-4
Set Transparent Input Mode (0005)	2-12-5
Set Binary Input Mode (0006)	2-12-5
Initiate Binary Output (0007)	2-12-5
End of Transaction Block (0010)	2-12-6
Initiate ASCII Output (0011)	2-12-6
End of Transaction Block with Response (0012)	2-12-6
End of String (0013)	2-12-6
Internal End of Block (0014)	2-12-6
Control of Program Execution	2-12-7
DISTC Macro	2-12-7
CSET Macro	2-12-9
PARITY Macro	2-12-10
TSTATUS Macro	2-12-10

APPENDICES

APPENDIX A	CPU COMMON DECKS	2-A-1
APPENDIX B	EXAMPLES OF RANDOM I/O	2-B-1
APPENDIX C	CODING SPECIFICATIONS	2-C-1
APPENDIX D	PROGRAM EXAMPLE	2-D-1
APPENDIX E	SPECIAL USER INFORMATION	2-E-1
APPENDIX F	SPECIAL ENTRY POINTS	2-F-1
APPENDIX G	BINARY FORMATS	2-G-1
APPENDIX H	COMPASS CONTROL STATEMENT	2-H-1

INDEX

FIGURES

2-3-1	Circular Buffer	2-3-2
2-3-2	Read Operation	2-3-3
2-3-3	Write Operation	2-3-4
2-3-4	Standard FET for Mass Storage File	2-3-4
2-3-5	Standard FET for Labeled Magnetic Tape File (CIO)	2-3-5
2-3-6	Data Transfer Buffer Arrangement	2-3-52
2-11-1	Absolute Loader Memory Assignment	2-11-22

Network Operating System (NOS) provides many utilities in the form of function processors, macros, and system routines that enable the user to perform complex operations with a minimum of coding. These routines have been thoroughly tested and optimized, and are designed to interface with the system.

FUNCTION PROCESSORS

Several NOS system routines process user requests. Sections 3 through 11 contain descriptions of each function processor, including:

- Identification of requests (function numbers)
- System macros (or common decks† containing macros) available to issue the requests
- Common decks required to issue the requests
- Information returned from the processor for the requests

A listing of error messages for function processors, macros, and common decks is contained in volume 1.

MACROS AND COMMON DECKS

Most system macros are available to COMPASS programmers and are used to issue requests to the function processors. Common decks are normally used with macros or function requests or as subroutines.

This manual provides the user with the information necessary to communicate with the system to perform the tasks that cannot be performed in the CPU. For information concerning batch usage and system processing in general, refer to volume 1. For information on the COMPASS assembly language, refer to the COMPASS Reference Manual. For information on calling the COMPASS assembler, refer to appendix H.

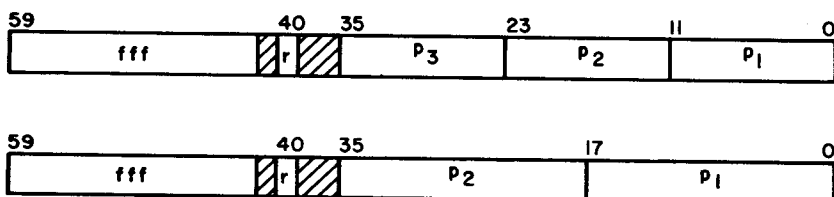
† Refer to the Modify Reference Manual for a complete description of common decks.

SYSTEM REQUESTS

All communication with the system is performed by entering a system request in location 1 (RA+1) of the field length (refer to figure 2-E-1). The system then initiates execution of that portion of the system required to satisfy the user's request. There are two types of system requests.

- Those that contain all information necessary in RA+1 (for example, RCL)
- Those that require additional areas for parameters or results from the system (for example, CIO addr)

The format of the 60-bit request is one of the following (depending on whether two or three parameters are to be passed).



fff	System request name
r	Auto recall bit (p ₁ must be specified)
p ₁ , p ₂ , p ₃	Parameters passed to the portion of the system that processes fff (p ₂ in second format may contain two parameters)

If the auto recall bit is set in a system request, CPU assignment to the job is released when the request is sensed. The CPU is not reassigned to the job until the request is complete.

REQUEST PROCESSORS

Most system requests require some area within the user's job to contain information for the requests being processed. The request processors consist of two groups.

The following request processors are associated with a file environment table (FET) (refer to section 3).

- Local file manager (LFM)
- Combined input/output (CIO)
- Permanent file manager (PFM)
- System file manager (SFM)
- Queue file manager (QFM)

The following request processors perform a job action request or provide system information.

- Control point manager (CPM)
- Exit processing request (ABT)
- Time accumulated (TIM)
- Termination request (END)
- Memory requests (RFL, MEM)
- System message processor (MSG)
- CM dump (DMP, DMD)
- Recall CPU (RCL)
- Overlay request (LDR, LDV)
- Fast dynamic loading (LDD, LDQ)
- File routing (DSP)
- Translate control statement (TCS)

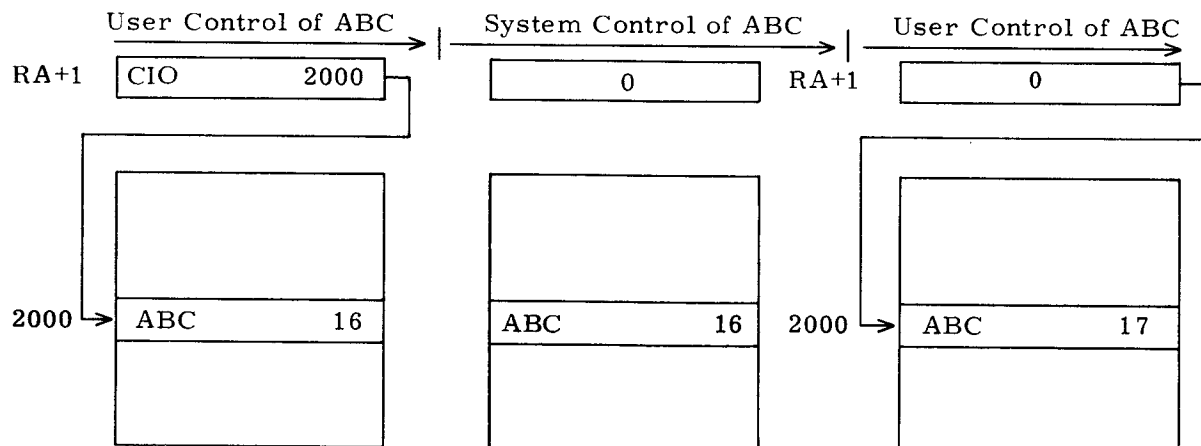
SYSTEM REQUEST PROCESSING

Whether a system request communicates with a FET or another parameter block, the first word of this area is usually the status word. Both the system and the user use the lower portion of this word to communicate the status of the request. When bit 0 is cleared (equals 0), the system is in control of the request; when it is set (equals 1), the user is in control of the request.

For example, to write on file ABC, the program must perform the following steps.

1. Check the status of ABC.
2. If ABC is busy (bit 0 cleared), the program must wait until bit 0 is set. This is done by issuing a system request to recall (RCL).
3. When ABC is idle (bit 0 set), the program must clear bit 0 and place the request in RA+1.
4. If other processing can be performed, the program proceeds.
5. If further processing depends upon ABC being completed, the program must check the status word for completion (bit 0 set by the system).

To perform this write operation on file ABC, the user issues a system request to CIO. The following diagram illustrates the user/system control when performing this operation.



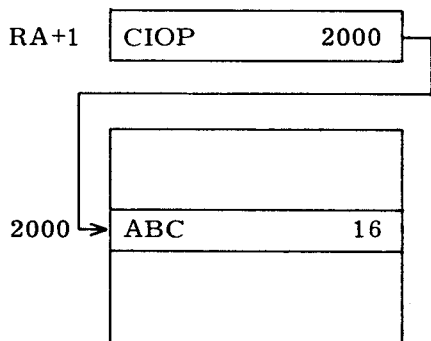
The user requests the system to take control of ABC by clearing bit 0 of the status word and entering CIO 2000 in RA+1.

The system clears RA+ 1 upon beginning processing of the request.

The system sets bit 0 of the status word upon completing the request.

In many situations, the program cannot proceed until the system request is complete (as in steps 2 and 5 when ABC is busy). When this occurs, the user can prevent execution until the status word is not busy (bit 0 set). This simplifies the programmer's job, because he does not have to check the status. It also reduces the amount of CPU time used by the job.

In the previous example, if the following request is issued:



P is the display code representation of the auto recall bit (20_8); that is, bit 40 of RA+1 is set.

the system would not allow the job to continue execution until bit 0 of word 2000 was set and the PPU completed its operation.

The steps in this procedure are:

1. Check the status of ABC.
2. If ABC is busy, wait until bit 0 is set and return to step 1. This can be done by issuing an RCLP function on word 2000.
3. Clear bit 0 of word 2000 and place the CIOP request in RA+1.

Processing can proceed with the assurance that the previous operation on ABC is completed (bit 0 of word 2000 does not have to be checked).

The user should be aware that many system requests require that the auto recall bit be set. This is noted in the description of the requests, when necessary.

ISSUING RA+1 REQUESTS

When a system request is placed in RA+1, the system may process that request at any time. The central exchange jump (CEJ) instruction (XJ), if available, provides much faster response to system requests.

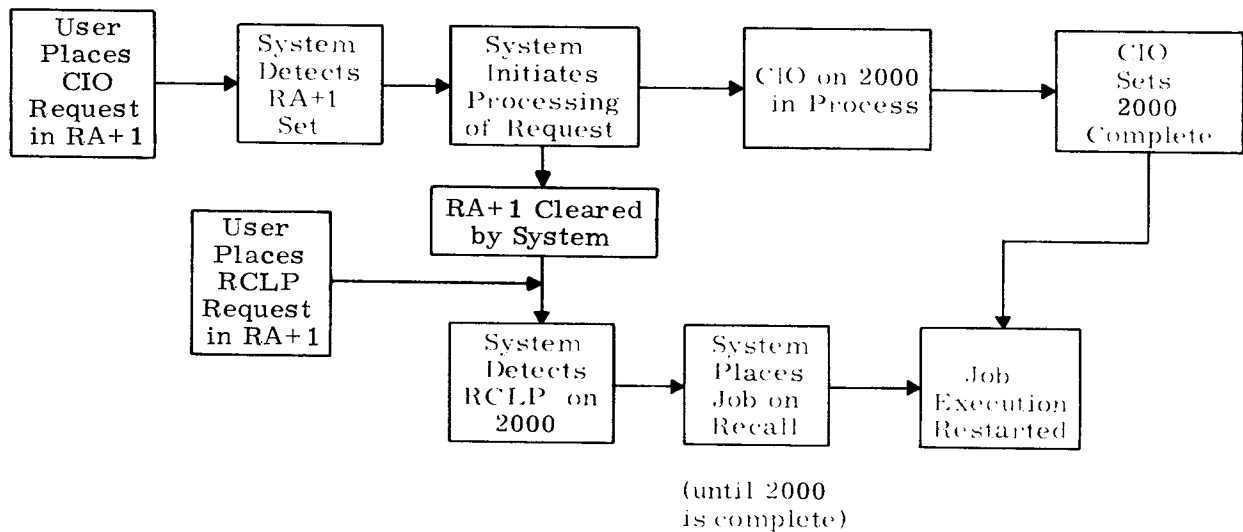
The system processes program requests by scanning location RA+1 of all user programs in the system. This is done on a periodic basis. If the system detects a request in RA+1 that can be processed, RA+1 is cleared and processing begins.

When the user program issues a request, it must check RA+1 to determine if the request is accepted by the system before it issues another request.

The following example illustrates the steps taken by the user and the system to process a system request.

1. The user issues a CIO request on word 2000 to RA+1 (CIO 2000).
2. The user proceeds with his processing.
3. The user now wishes to wait until the request is complete before continuing. He does this by issuing an RCLP request on word 2000. However, he must first check RA+1 to ensure that the request to CIO is accepted before he issues the RCLP request.

The system performs the following steps in processing this user request.



When the XJ instruction is available, the user places the system request in RA+1 and executes an XJ instruction. This causes the CPU to be exchanged to the system program CPUMTR from the user's program. The system can act upon the request immediately.

When the system initiates processing of the request, CPU control returns to the user, unless the request is made with auto recall.

The user can determine whether the XJ instruction is available by checking if bit 59 of word 66 (XJPR) of his field length is set (refer to SYSCOM macro and figure 2-E-1).

If the request in the previous example is performed in this manner, the following steps apply.

1. The user places the CIO request on word 2000 in RA+1 and executes an XJ instruction. The central processor is reassigned to the job when the request is accepted.
2. The user proceeds with his processing.
3. The user now wishes to wait until this request is completed before continuing. This is done by placing the request RCLP 2000 in RA+1 and issuing another XJ instruction. It is not necessary to determine if the previous request is accepted.

Many macros and common decks are provided to assist the programmer in performing this interaction with the system.

NOS SYSTEMS TEXTS

The following systems texts are available to the NOS user.

- SYSTEXT
- PPTEXT
- NOSTEXT
- PSSTEXT

SYSTEXT contains system communication macros that are used by the CPU COMPASS programmer. PPTEXT contains symbol definitions used by all SYSTEM PP routines for inter-communication. NOSTEXT contains all system communication macros and symbol definitions that are found in SYSTEXT and PPTEXT.

PSSTEXT contains product set support macros that are defined on system OPL common decks COMCMAC and COMCCMD (refer to appendix A).

By selecting the correct systems text (for the applications COMPASS programmer, this usually will be SYSTEXT and/or optionally PSSTEXT), the user can reduce the amount of system resources needed for assemblies.

To obtain listings of the systems texts, enter one or more of the following control statements after accessing the system OPL.

```
MODIFY(Q, CL, CS=0, Z)/*EDIT, SYSTEXT
MODIFY(Q, CL, CS=0, Z)/*EDIT, PPTEXT
MODIFY(Q, CL, CS=0, Z)/*EDIT, NOSTEXT
```

To obtain listings of the common decks on PSSTEXT, enter the following statement after accessing the system OPL.

```
MODIFY(Q, CL, Z)/*EDIT, CALLCPU
```

MACRO USAGE

Macros are available for issuing most requests to the function processors. If macros are not available, the user can define them.

A macro is a predefined sequence of code that can be used in the user's programs. † If the user wishes to use predefined macros, he may do so by specifying the location of these definitions to COMPASS with the S or G parameter. For example:

```
COMPASS(I, B, S=XYZTEXT)
```

This call causes all macro definitions in XYZTEXT to be available for assembly of the program. If no S parameter is specified, COMPASS uses the system default system text SYSTEXT. In the descriptions in this manual, unless otherwise noted, all macros are defined in SYSTEXT and NOSTEXT.

Some macros are defined in common decks; therefore, the common deck must be called into the text of the program (refer to Common Deck Usage). If the decks are named COMCMAC or COMCCMD, the user has the option of specifying the alternate systems text PSSTEXT. For example:

```
COMPASS(I, B, S, S=PSSTEXT)
```

This makes available all macro definitions in PSSTEXT (that is, those defined in common decks COMCMAC and COMCCMD) for the assembly of the program.

In addition to the macros available in SYSTEXT, an integer divide operation definition is provided for the user's convenience.

Integer Division

IXi Xj/Xk

Divide Xj by Xk and place the result in Xi

Destroys Xj, Xk, B7

When a macro parameter refers to an address, the parameter may be a register name, a relocatable address, an external symbol, or an absolute address. The user should consult the expansions of the system macros to determine the optimum use of registers when using macros. The user is responsible for ensuring that a register used as a parameter contains only the parameter (for example, if an 18-bit address is specified by an X register, the user must ensure that the upper 42 bits of the register are zero).

NOS system macros and common decks assume that the contents of the following registers are preserved.

A0, X0, A5, and X5

Also, upon exit, the contents of registers B1 and X2 are as follows:

B1 1

X2 FET address (refer to section 3) if a macro specifies the FET address as a parameter

The contents of the B1 register is assumed to be 1 upon entry only if the SYSCOM B1 macro is called or the B1=1 COMPASS pseudo-instruction is defined.

† The COMPASS Reference Manual provides instructions for defining macros.

SYSCOM

Many system common decks called from macros assume the contents of the B1 register is equal to 1. Other common decks assume B1 is equal to 1 only if the macro SYSCOM B1 or COMPASS pseudo instruction B1=1 is defined. If this macro is used, it should be set as an initial step in the program. If the B1 parameter is not included in the SYSCOM call or if there is no SYSCOM call, these common decks then generate additional code to set B1 equal to 1. If SYSCOM B1 is used, it is the user's responsibility to set the B1 register equal to 1.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	SYSCOM	B1

B1 If present, COMPASS pseudo instruction B1=1 is defined

The specification of SYSCOM (with or without specifying B1) also makes available the system communication symbols (refer to figure 2-E-1). These are:

<u>Symbol</u>	<u>Value</u>	<u>Description</u>
ARGR	2	Address of the first argument
SPPR	27 ₈	Special program parameter area (locations 27 ₈ through 47 ₈)
PGNR	64 ₈	Program name (bits 59 through 18)
ACTR	64 ₈	Argument count (bits 17 through 0)
CMUR	65 ₈	Compare move unit (CMU) available flag (bit 59)
LWPR	65 ₈	LWA+1 of the assigned program space (bits 17 through 0)
FWPR	66 ₈	FWA of the assigned program space (bits 17 through 0)
JOPR	66 ₈	Job origin type (bits 35 through 24)
XJPR	66 ₈	Central exchange available (bit 59)
CSMR	67 ₈	System character set mode flag (bit 59); set if 64 character set mode
LDRR	67 ₈	LDR completion (bit 29)
CCDR	70 ₈	Control statement image (eight locations)
LINP	60 ₁₀	Lines /printer page

COMMON DECK USAGE

A system common deck is a COMPASS subroutine or group of macro or symbol definitions that have been tested, optimized, and placed on a program library where they can be accessed by the user.

All of the common decks supplied with the system are available to any user who has access to the system OPL. The OPL is a collection of records of text which is accessed randomly by the Modify utility program (refer to Modify control statement, section 14, volume 1 or the Modify Reference Manual). Normally the system OPL is available as a direct access permanent file and the user must issue an attach command before Modify runs. The user should contact installation personnel to determine how to access the OPL.

Several classes of system common decks exist; however, the user need only be concerned with the CPU common decks. Documentation of these common decks can be obtained with the following control statements, after the system OPL is accessed.

```
MODIFY(Z)/*EDIT, CALLCPU
DOCUMENT.
```

If a complete listing of the routines is desired, the following control statement can be entered.

```
MODIFY(Q, CL, Z)/*EDIT, CALLCPU
```

Appendix A contains a list of the CPU common decks of general interest and describes their functions. Appendix C contains further information on common decks and their usage.

CPU common deck names have the following format.

```
COMCxxx

COM      Indicates a common deck
C        Specifies CPU common deck
xxx      Entry point name (sometimes defined as xxx=)
```

The typical COMPASS programmer who is writing relocatable programs is generally unaware of the common deck interface, and need only be concerned if a common deck of unique nature (for example, the common deck that converts display code to octal representations) is required, or if the specified common deck is not on the system library (SYSLIB). Refer to appendix A for a list of common decks available in relocatable form on SYSLIB.

Two common decks (COMCMAC and COMCCMD) are also available on systems text PSSTEXT. Thus, the user has the option of either calling them from the system OPL or specifying the alternate systems text PSSTEXT as described under Macro Usage.

Most system macros require that the common deck related to a function processor be available in the program; however, they need not be specifically called by the user when assembling relocatable programs, since all macros specify entries to common decks as external symbols. When the relocatable subroutines are loaded, the routines required at execution time (such as LFM= and CIO=) are loaded from SYSLIB.

For example, a subroutine uses the following macro.

```
.
.
READ    ABC, R
.
```

This macro requires routines CIO= and SYS=; however, the READ macro generates:

RJ =XCIO=

and CIO= generates:

RJ =XSYS=

Since these are flagged as external references (=X), the loader satisfies them from SYSLIB if they are not locally satisfied.

If a program is not relocatable or if the desired common deck is not on SYSLIB, then a system common deck must be accessed from the system OPL.

To use a common deck, the programmer must insert the Modify directive *CALL in the text of his program, use the COMPASS pseudo-op XTEXT, or reference it in a relocatable program so that it is loaded and linked from SYSLIB.

NOTE

When using a common deck, the user should be aware of the format of the common deck and any registers it uses.

The following example illustrates the procedure for using the *CALL directive.

```
JOB1.
USER(USERNUM,PASSWRD,FAMILY)
COPYBR(INPUT,XFILE)          COPY PROGRAM TO XFILE
ATTACH(OPL/UN=ABC123,PN=PACKC) ATTACH OPL
RFL,45000.
MODIFY(Q,CL)                  CALL MODIFY PROGRAM
LGO.                           LOAD AND EXECUTE COMPASS BINARY
-EOR-
PROG                            DECK NAME TO BE EDITED
                                IDENT  PROG,TME
                                ABS
                                ENTRY  START          BODY OF ABSOLUTE COMPASS PROGRAM
                                SYSCOM B1            THAT OUTPUTS THE CURRENT TIME
                                ORG    102B
                                TME    BSS    1
                                OBUF   BSS    101B
                                OUTPUT FILEC OBUF,101B
                                START  SB1    1
                                CLOCK  TME           CLOCK MACRO REQUIRES
                                SA5    TME           COMMON DECK COMCSYS
                                EX6    X5
                                WRITEO OUTPUT      WRITEO MACRO CALLS COMMON
                                WRITER OUTPUT      DECK COMCWTO, WRITER CALLS
                                ENDRUN              COMCCIO, ENDRUN CALLS COMCSYS
                                *CALL  COMCCIO      MODIFY DIRECTIVES TO INSERT
                                *CALL  COMCWTO      SPECIFIED COMMON DECKS
                                *CALL  COMCSYS
                                END    START
-EOR-
*REWIND XFILE                  MODIFY INPUT DIRECTIVES--
*CREATE XFILE                  REPOSITION XFILE TO BOI
*EDIT PROG                     CREATE PROGRAM LIBRARY
-EOI-                          MODIFY DECK PROG
```

After the OPL is attached, the Modify utility edits the COMPASS deck by inserting the common decks in place of the respective *CALL statements. The Q parameter on the Modify statement causes Modify to call COMPASS to assemble the resultant COMPASS program. The CL parameter specifies COMPASS list output. The COMPASS listing from this program does not contain a listing of the called common decks. Instead, the following is provided.

```

.
.
ENDRUN
CTEXT    COMCCIO - I/O FUNCTION PROCESSOR.
CTEXT    COMCWTO - WRITE ONE WORD.
CTEXT    COMCSYS - PROCESS SYSTEM REQUEST.
END      START

```

To have the specified common decks listed in the program, the user must use the COMPASS LIST pseudo-op.

The net effect of the *CALL statement is that the text for the specified common deck is inserted at that position in the program text. In the previous example, the assembler would receive the following text.

```

.
.
WRITER OUTPUT
ENDRUN
COMCCIO { CIO1  RECALL X2          WAIT COMPLETION
          ERP$  IF      -DEF,ERP$
          .
          .
          CIO=  PS              ENTRY/EXIT
          .
          .
          EQ    CIO=          RETURN
          .
          .
          WTO1  SA6   X1       STORE WORD
          SX2   A1-2
          .
          .
COMCWTO { WTO=  PS              ENTRY/EXIT
          .
          .
          RJ    =XCIO=
          .
          .
          SYSA  BSS   0
          LOC   **2
          .
          .
COMCSYS { SYS=  PS              ENTRY/EXIT
          .
          .
          .
          END   START

```

The procedure for using the COMPASS pseudo-op XTEXT to obtain common decks is detailed in the following example.

```

JOB2.
USER (USERNUM,PASSWRD,FAMILY)
ATTACH (OPL/UN=ABC123,PN=PACKC)
COMPASS.
LGO.
-EOR-
PROG
        IDENT  PROG,TME
        ABS
        ENTRY  START
        SYSCOM B1
        ORG    102B
TME     BSS    1
OBUF   BSS    101B
OUTPUT FILEC  OBUF,101B
START  SB1    1
        CLOCK  TME
        SA5    TME
        EX6    X5
        WRITEO OUTPUT
        WRITER  OUTPUT
        ENDRUN
OPL    XTEXT  COMCSYS
OPL    XTEXT  COMCWTO
OPL    XTEXT  COMCCIO
        END    START
-EOI-
```

After attaching the OPL, a call is made to the COMPASS assembler. The XTEXT pseudo instruction provides a means of obtaining source statements from a file other than that being used for input. COMPASS transfers the text from the external source and assembles it before taking the next statement from the program.

A COMPASS listing from a program using the XTEXT instruction also does not list the inserted common decks. These can be obtained with the COMPASS LIST instruction or by using list options on the COMPASS control statement.

The conflict of tags is the one problem that may arise when using common decks. All tags and routine names within common decks conform to the NOS programming specifications (refer to appendix C), and as such, the routine names relate to their particular functions. If a user's routine name conflicts with the name of the common deck being used, he should rename the routine. If a conflict still exists, he should qualify the entire common deck (refer to the COMPASS Reference Manual).

For example, if the programmer wishes to use the space-fill-name common deck, COMCSFN, he can use the method shown in the following sample program.

DUPLICT

IDENT DUPLICT
ENTRY DUPLICT

QUAL\$ EQU 1 SUPPRESS COMMON DECK QUALIFICATION

* THE *SPACE FILL NAME* COMMON DECK MUST BE QUALIFIED
* BECAUSE THE PROGRAM HAS A SUBROUTINE *SFN* AND THE
* PROGRAMMER DOES NOT WISH TO RENAME THE SUBROUTINE.

DUPLICT	SB1	1	ENTRY	
	SA1	DUPA	SET SYMBOL NAME IN MESSAGE	
	MX0	-18	CLEAR VALUE PORTION OF WORD	
	SX5	X1+	SAVE VALUE	
	BX1	X0*X1		
	RJ	/SFILL/SFN	SPACE FILL WORD	Transfers control to COMCSFN, qualified by SFILL
	SA6	DUPC		
	SX1	X5+	CONVERT VALUE	
	RJ	CDD		
	SB2	3	SHIFT VALUE 3 CHARACTERS LEFT	
	RJ	SFN		Transfers control to the user's shift register routine, SFN
	SA6	DUPD	ISSUE MESSAGE	
	MESSAGE	DUPB,,R		
	ENDRUN			

DUPA	CON	0LNAME+123456	
DUPB	CON	10H SYMBOL	
DUPC	CON	0 SYMBOL NAME	
	CON	10HHAS VALUE	
DUPD	CON	0 CONVERTED SYMBOL VALUE	
	CON	0 MESSAGE TERMINATOR	
	SPACE	4	

** SFN - SHIFT REGISTER BY *N* CHARACTERS.
*
* ENTRY (X6) = REGISTER TO SHIFT.
* (B2) = NUMBER OF CHARACTERS TO SHIFT.
*
* EXIT (X6) = SHIFTED LEFT.
*
* USES B - 2.
* X - 6, 7.

SFN	PS		ENTRY/EXIT
	SX7	B2	SET NUMBER OF BITS TO SHIFT
	SB2	B2+B2	
	LX7	2	
	SB2	B2+X7	
	LX6	X6,B2	SHIFT REGISTER
	JP	SFN	RETURN

* COMMON DECKS.

*CALL	COMCSYS	
*CALL	COMCCDD	
	QUAL	SFILL QUALIFY *SFN*
*CALL	COMCSFN	
	SPACE	4
	END	DUPLICT

The QUAL\$ tag can also be used to suppress the qualification of common decks called more than once in overlays. In the following example, the QUAL pseudo instruction is used in each of the two primary overlays to allow an unqualified reference to CDD.

```

OVER      IDENT  MAIN,MAIN,MAIN          MAIN (0,0) OVERLAY
          ABS
          TITLE MAIN (0,0) OVERLAY.
          ORG   110B

QUAL$    EQU    1          SUPPRESS COMMON DECK QUALIFICATION

*        LOAD TWO OVERLAYS - ONE AT A TIME - EACH WILL USE
*        ITS OWN COPY OF *CDD*, BUT WILL USE *SYS=* AND
*        *MSG=* THAT RESIDE IN THE (0,0) OVERLAY.

MAIN     MESSAGE MAIA,,R      * MAIN RUNNING.*
          SB1    1
          OVERLAY MAIB,0100B  LOAD *OVL1* OVERLAY
          SB2    X1          EXECUTE *OVL1*
          JP     B2
MAIL     OVERLAY MAIB,0200B  LOAD *OVL2* OVERLAY
          SB2    X1          EXECUTE *OVL2*
          JP     B2
MAI2     MESSAGE MAIC,,R      * MAIN COMPLETE.*
          ENDRUN END

MAIA     DIS     ,* MAIN RUNNING.*
MAIB     CON     0LLGO        OVERLAY FILE NAME
MAIC     DIS     ,* MAIN COMPLETE.*

*CALL    COMCSYS
*CALL    COMCOVL

OVER     BSS     0          OVERLAY AREA BASE
          TTL    PRIMARY (1,0) OVERLAY.
          EJECT
          QUAL   OVL1        DEFINE QUALIFICATION FOR THIS OVERLAY
          IDENT  OVL1,OVL1,OVL1,1,0  PRIMARY (1,0) OVERLAY
          ORG    OVER        START AT OVERLAY AREA

```

```

*          READ THE REAL TIME CLOCK AND ISSUE A DAYFILE MESSAGE
*          INDICATING WHEN OVERLAY WAS CALLED.

OV1      RTIME  OV1A          GET CURRENT TIME
        SA1   OV1A          CONVERT MILLISECONDS TO DISPLAY CODE
        MX0   -36
        BX1   -X0*X1
        RJ    CDD
        SA6   OV1C
        MESSAGE OV1B,,R      * OVL1 CALLED AT   NNNNNN*
        JP    MAIL          RETURN

OV1A     CON    0            REAL TIME CLOCK
OV1B     DATA  20H OVL1 CALLED AT
OV1C     CON    0            CONVERTED MILLISECONDS
        CON    0            MESSAGE TERMINATOR

*CALL    COMCCDD

        TTL    PRIMARY (2,0) OVERLAY.
        EJECT
        QUAL   OVL2          DEFINE QUALIFICATION FOR THIS OVERLAY
        IDENT  OVL2,OV2,OV2,2,0  PRIMARY (2,0) OVERLAY
        ORG    OVER          START AT OVERLAY AREA

*          READ THE REAL TIME CLOCK AND ISSUE A DAYFILE MESSAGE
*          INDICATING WHEN OVERLAY WAS CALLED.

OV2      RTIME  OV2A          GET CURRENT TIME
        SA1   OV2A          CONVERT MILLISECONDS TO DISPLAY CODE
        MX0   -36
        BX1   -X0*X1
        RJ    CDD
        SA6   OV2C
        MESSAGE OV2B,,R      * OVL2 CALLED AT   NNNNNN*
        JP    MAI2          RETURN

OV2A     CON    0            REAL TIME CLOCK
OV2B     DATA  20H OVL2 CALLED AT
OV2C     CON    0            CONVERTED MILLISECONDS
        CON    0            MESSAGE TERMINATOR

*CALL    COMCCDD

        END

```

SECURITY CONSIDERATIONS

Unless a job is of system origin type, or the user is validated for system origin privileges and DEBUG mode has been set at the system display console (refer to NOS Operator's Guide), the following requirements or restrictions are placed on user jobs in the interests of system security.

- If a job step does not contain an SSJ= entry point (refer to appendix F) and secure system memory (SSM) status is set, then the job step cannot request system functions through RA+ 1 calls that are processed by programs containing a DMP= special entry point (refer to appendix F).
- If a job step has SSM set, it cannot be followed by a control statement that calls a DMP= processor.

Violation of these restrictions results in the job step being aborted and the following dayfile message being issued.

SECURE MEMORY, DUMP DISABLED.

Programs containing an SSJ= entry point are permitted to make RA+ 1 calls to DMP= processors with SSM status set.

Secure system memory status is set either automatically by the system whenever a program containing SSJ= or SSM= special entry points (refer to appendix F) is loaded or by a program using a SETSSM macro (refer to section 6).

RA+ 1 calls processed by DMP= programs include the following.

- CKP - Checkpoint request
- DMP - Dump field length request
- DMD - Dump field length request with display code
- REQ - Request equipment assignment
- LFM - For the ASSIGN, LABEL, and REQUEST functions (refer to section 4)
- PFM - For any access to removable auxiliary devices (refer to section 5)

Refer to section 3, volume 1, for a list of control statements that cannot follow job steps with SSM status set.

This section describes the process of performing input/output from a COMPASS program and the creation of files to accomplish these and other tasks.

The file environment table (FET) portion describes circular buffer concepts and FET creation macros. The discussion of FETs is important, not only for input/output and file creation, but also for system routines that perform file processing in general.

The combined input/output (CIO) part includes those macros needed for file creation, read and write functions, file positioning, and data transfer.

The user can perform I/O directly through FETs using CIO, or he can use CDC CYBER Record Manager facilities that are available to COMPASS users through COMPASS macro calls. A brief description of Record Manager features is provided later in this section.

FILE ENVIRONMENT TABLE (FET)

The FET is the standard communication area or parameter block for the system file processors. The COMPASS programmer must define the FET, whereas the higher level languages (COBOL and FORTRAN, for example) automatically establish and use this area.

Depending on the processor being used, certain areas of the FET must be defined and used in communicating with that processor. The minimum length of a FET is five words.

CIRCULAR BUFFERS

All input/output is performed by passing data between a user's program circular buffers (central memory) and a peripheral device (mass storage or magnetic tapes, for example).

A circular buffer is a temporary central memory storage area that contains data during input/output operations. It is called a circular buffer because routines that process input/output treat the first word of the buffer area as contiguous to the last word of the buffer area. The buffer parameters (FIRST, IN, OUT, and LIMIT) in the FET describe the circular buffer (refer to figure 2-3-1).

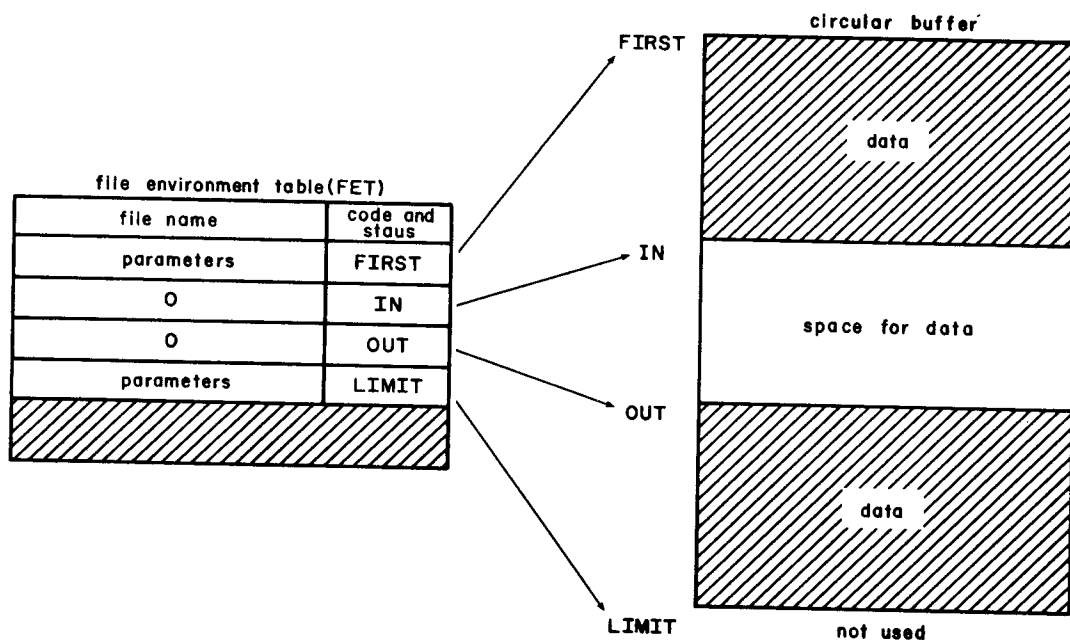


Figure 2-3-1. Circular Buffer

FIRST Address

FIRST is the first word address of the buffer area. Routines that perform input/output never change the value of FIRST.

LIMIT Address

LIMIT is the last word address plus 1 of the buffer areas. Data is not stored in LIMIT since LIMIT is not part of the circular buffer. When LIMIT is reached, the next available address for storage is FIRST. Routines that perform input/output never change the value of LIMIT.

OUT Address

OUT is the next location to read to remove data from the circular buffer. Either the system or the user's program changes OUT depending on whether the operation is a write or a read (refer to figures 2-3-2 and 2-3-3).

IN Address

IN is the next location to write data into the circular buffer. Either the system or the user program changes IN depending on whether the operation is a read or a write operation (refer to figures 2-3-2 and 2-3-3). When $IN=OUT$, the buffer is empty. When $IN=OUT-1$, or $IN=LIMIT-1$ and $OUT=FIRST$, the buffer is full.

That is, one location is left empty in a full buffer to distinguish an empty buffer from a full buffer. A buffer is normally initialized with $IN=OUT=FIRST$, and IN and OUT circle the buffer as data is inserted and extracted.

Refer to the FET creation macros in this section for a description of minimum and recommended buffer sizes.

Figure 2-3-2 is an example of a read operation.

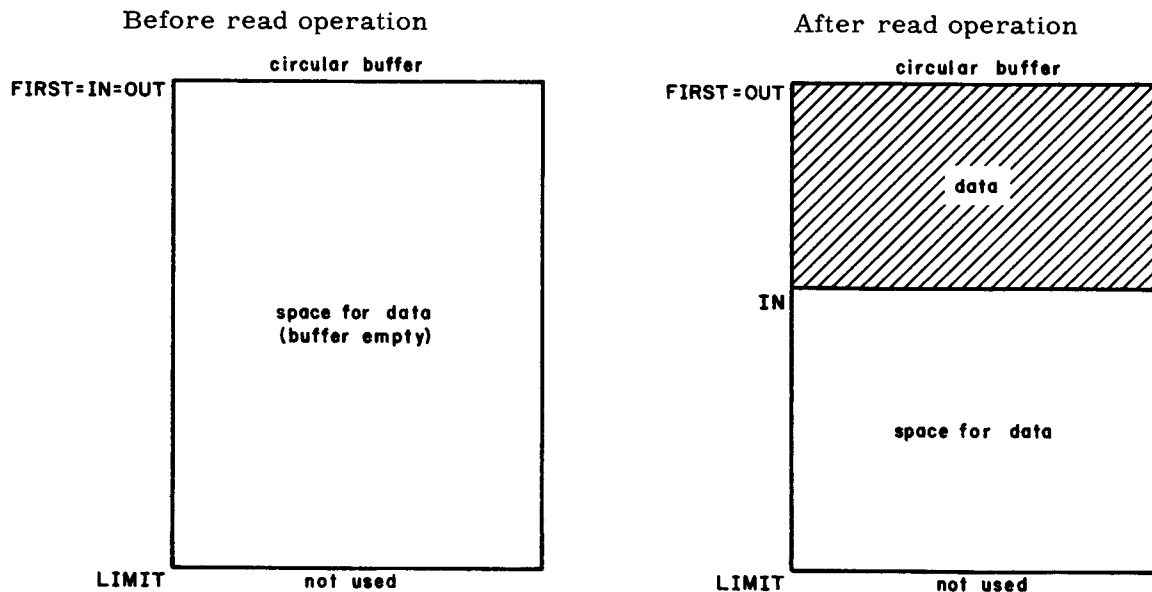


Figure 2-3-2. Read Operation

Figure 2-3-3 is an example of a write operation.

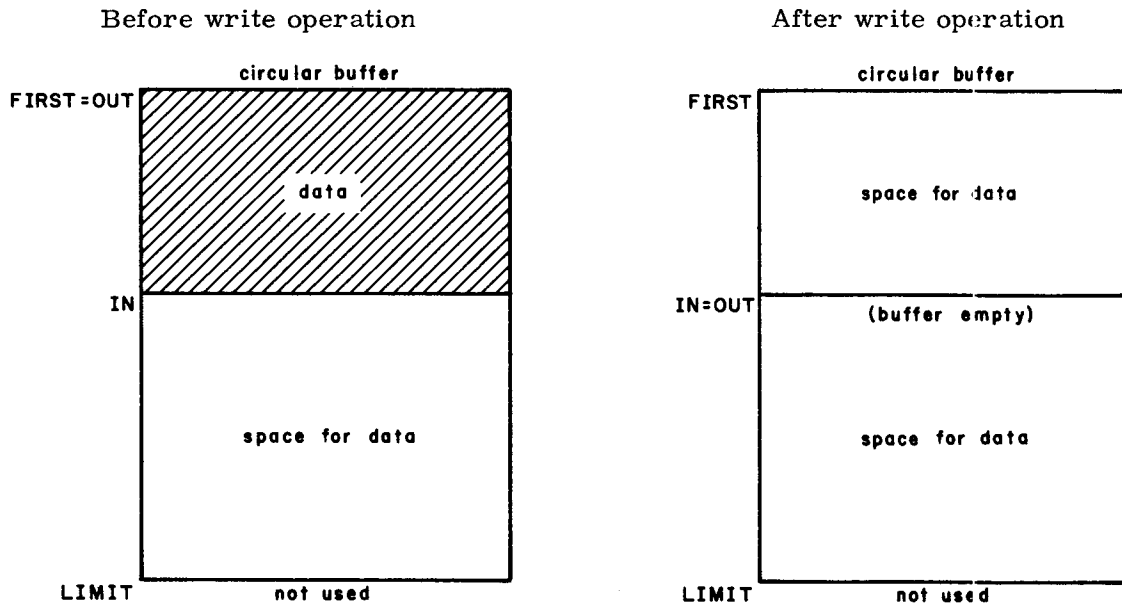


Figure 2-3-3. Write Operation

FET DESCRIPTION

There are two basic file environment table (FET) formats. Figure 2-3-4 illustrates the standard FET for mass storage files; figure 2-3-5 illustrates the standard FET for magnetic tape files. The figures are followed by a description of the FET fields. When a field is used by only one of the file processors, it is noted in the description.

	59	47	35	29	17	13	9	0	
FET+0	logical file name (lfn)						ln	at	code
+1	dt	r	u	e	l	FIRST			
+2	0						IN		
+3	0						OUT		
+4	FNT pointer		PRU size		LIMIT				
+5	fwa working storage			lwa+l working storage (la)					
+6	current random index (cri)				w	random request (rr)			
+7	index length (il)			fwa of index (if)					

Figure 2-3-4. Standard FET for Mass Storage File

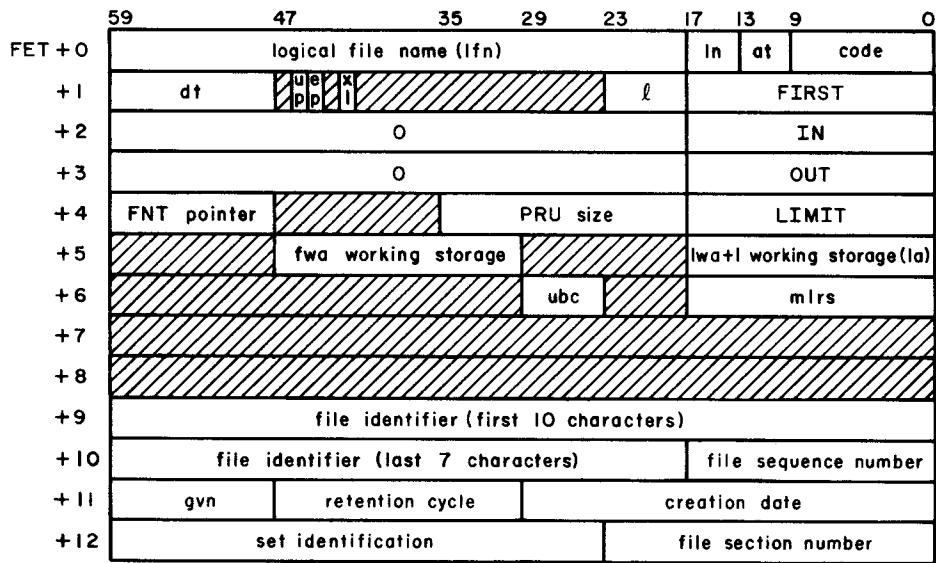


Figure 2-3-5. Standard FET for Labeled Magnetic Tape File (CIO)

Refer to the LABEL and OPEN macros for a description of the FET fields used in processing ANSI labels.

<u>Parameter</u>	<u>Word</u>	<u>Position</u>	<u>Description</u>
Logical file name (lfn)	0	59-18	The lfn field contains 1 to 7 alphanumeric display code characters, left-justified; unused characters are zero-filled. The lfn is the common reference point for all system communication concerning the file.
Level number (ln)	0	17-14	This is the level number for an EOR/EOF operation on the file. NOS uses this field for CIO operations and for distinguishing interactive input from noninteractive input (refer to CIO and the discussion on writing interactive programs, section 12).
Abnormal termination Codes (at)	0	13-10	Status information returned by the function processor when an abnormal situation or error occurs. This field is usually set by the processor when the error processing bit (ep) is set in word 1 of the FET. For some processors, at is returned in bits 17 through 10. This field is set to 11 ₈ by CIO if the ep bit is not set and an error condition is present.
Code	0	9-0	Request/return code. The user (or macro) sets this code for the request desired. The function processors alter it only if the request is not completed. For example, the user requests a read (CIO code 0010) but encounters an EOR. CIO returns a status code of 0021. These codes are detailed in the function processor descriptions.

<u>Parameter</u>	<u>Word</u>	<u>Position</u>	<u>Description</u>
			The following are subfields for the code parameter.
			Bit 9: end-of-information (eoi). This bit is set when an end-of-information is encountered on a read request.
			Bits 4-3: set to binary 10 if an end-of-record is encountered on a read request; set to binary 11 if end-of-file encountered.
			Bits 1: file mode (fm). File mode for input/output operations (S, L, or SI tape formats only):
			0 Coded
			1 Binary
			Bit 0: Interlock (ilk). FET interlock bit. Used to indicate system/user access to data associated with the file. The user sets this bit to 0 (busy or not complete) and the processor sets it to 1 when completed.
Device type (dt)	1	59-48	The 12-bit display code of the type of device on which the file is or will be residing. If bit 59 is set, it indicates a nonallocatable device (refer to appendix E). If an S, L, or SI file is opened, this field contains NOS/BE compatible return information (refer to the OPEN macro).
Random access (r)	1	47	This bit is set if random processing is to be performed on the file. If this is set, the FET must be at least seven words in length.
User processing (up)	1	45	The user sets this bit if he desires to perform his own end-of-reel or end-of-device processing. When CIO encounters an end-of-reel/end-of-device, it returns an abnormal termination code of 1 (bits 13 through 10 of word 0). For further information about end-of-reel processing, refer to the CIO CLOSER macro. The up bit is checked only if the FET is at least six words in length.
Error processing (ep)	1	44	This bit is used to indicate to the function processor that the calling program processes errors that occur, such as parity errors or errors in requests to the file managers. The function processor returns the error code in the at field of word 0 (bits 13 through 10). Function processor descriptions should be consulted for the error codes returned. If this bit is not set, the function processor either aborts the job or requests operator intervention. The ep bit is checked only if the FET is at least six words in length.

<u>Parameter</u>	<u>Word</u>	<u>Position</u>	<u>Description</u>
			<p>If an unrecovered parity or block too large error occurs during a magnetic tape read operation (with the ep bit set) or after a read parity error occurs on a mass storage read operation (with ep bit set), the following steps occur.</p> <ol style="list-style-type: none"> 1. The data in the bad block is stored in the user's circular buffer. 2. The value of the IN pointer prior to the read is stored in the next word in the circular buffer (pointer to the beginning of the bad data block). 3. The parity error code is set in FET+0. 4. The IN pointer is updated in the FET. This IN pointer value does not include the additional word (pointer to the beginning of the bad data block) stored in the buffer. 5. The FET completion bit is set. <p>The pointer to the bad data is returned on all reads processed by CIO for a mass storage file. If no data is transferred (correct PRU not read), the pointer points to itself, and no update of IN occurs.</p> <p>If tape error processing is inhibited (refer to the LABEL macro, section 4), the preceding steps are not performed regardless of whether or not the ep bit is set.</p>
Extended label processing (xl)	1	41	Specifies standard (xl = 0) or extended (xl = 1) tape label processing.
Flush bit (fb)	1	36	<p>Specifies that the file's circular buffer is to be flushed upon abnormal termination (mass storage files only).</p> <p>Files that are pointed to by the list of files (refer to the SETLOF macro, section 6) and meet the following criteria are flushed with an end of record write.</p> <ul style="list-style-type: none"> • No buffer parameter errors; that is: <ul style="list-style-type: none"> Complete FET within user's field length LIMIT .LT. FL OUT .LT. LIMIT OUT .GT. FIRST IN .LT. LIMIT IN .GT. FIRST • Write bit is set in the FET or the FET is unused (bits 9 through 3 are 0).

<u>Parameter</u>	<u>Word</u>	<u>Position</u>	<u>Description</u>
			<ul style="list-style-type: none"> • No CIO error code exists in FET. • Data is in buffer.
FET length (ℓ)	1	23-18	Specifies the additional length of the FET over normal size (five words). For example, if $\ell = 3$, FET length = 8 and FET + 7 is the last usable word. Function processors require varying lengths for particular parameters. However, it is recommended that the FET lengths be at least six words for most efficient system processing.
FIRST	1	17-0	First word address of input/output buffer.
IN	2	17-0	The next available location for entering data into the buffer. Note that the upper 42 bits should never be used since the function processors read and write the entire word.
OUT	3	17-0	The next available location for removing data from the buffer. Note that the upper 42 bits should never be used since the function processors read and write the entire word.
FNT pointer	4	59-48	Current position of the file name table (FNT) pointer. This is used by the system to reduce overhead when processing a file. It is set only if the FET length is greater than 5.
Physical record unit size	4	35-18	Number of CM words in PRU of the device to which the file is assigned. The PRU size for mass storage is always 64 CM words. The PRU size for magnetic tape varies according to the data format selected. This is set only if the file is opened using the CIO OPEN macro and if the FET length is greater than 5. Refer to the CIO OPEN macro for information on magnetic tape PRU size.
LIMFT	4	17-0	Last word address plus 1 of the buffer. Data is never placed in or removed from LIMIT.
First word address of working storage	5	47-30	First word address of working storage. Working storage is used by several of the compilers to control input/output in specific formats (blocking/unblocking). This parameter is not used by the system or the NOS common decks which refer to working storage areas. Working storage areas for use by macros (READS, READC, etc.) require the user to define his own working storage area and specify it on each macro request. Pointers to working storage can be placed here for reference.

<u>Parameter</u>	<u>Word</u>	<u>Position</u>	<u>Description</u>
Working storage last word address + 1	5	17-0	Last word address plus 1 of working storage.
List address (la)	5	17-0	List address. This points to the table of the relative sector addresses for CIO READLS and RPHRLS macros.
Current random index (cri)	6	59-30	The current random index for the mass storage file being randomly accessed. The system returns the current position of the file after a random input/output request. This is in the form of a relative sector address (rsa) from the beginning of the file. For any nonrandom read or write operation, the system updates this field by adding the number of sectors transferred to the existing contents of the field. For any random access or positioning operation, the value is recalculated. cri is ignored if r (word 1) is not set.
Random rewrite request (w)	6	29	This bit is set to indicate a write-in-place operation. If not set, the write takes place at the current position with rr being the address for the return of rsa, where the write began. This is ignored if r (word 1) is not set.
Unused bit count (ubc)	6	29-24	Specifies the unused bit count for S and L format tapes (refer to Data Formats, section 10, volume 1).
Random request (rr)	6	28-0	Relative sector address (rsa) for a random input/output request. An exception is if w = 0 and it is a write request, then it is the address for the return of the starting rsa of the write (previous EOI). If the error processing bit (FET+1, bit 44) is set and an error occurs, the system returns detailed error status information in FET+6, bits 11 through 0. For further information, refer to the description of CIO. rr is ignored if r (word 1) is not set.
Maximum logical record size (mlrs)	6	17-0	Specifies the maximum physical record size for S and L format tapes. For S format, if mlrs = 0, the value of the maximum PRU is assumed to be 512 (1000 ₈) words. For L format, if mlrs = 0, the assumed maximum PRU is LIMIT-FIRST-1 for standard reads or writes. LIMIT-FIRST-2 for READN or WRITEN, and LIMIT-FIRST-3 for READCW and WRITECW. Refer to Data Formats, section 10, volume 1.
Index length (il)	7	35-18	Random index length. This must be set by the user when requesting CIO OPEN to load the random index of a file or CIO CLOSE to dump the random index of a file. If r (word 1) is not set, il is ignored.

<u>Parameter</u>	<u>Word</u>	<u>Position</u>	<u>Description</u>
Index first word address (if)	7	17-0	First word address of the index buffer. This is the area where CIO OPEN stores the index when opening a file or the area from which CIO CLOSE takes the index when closing a file. If r (word 1) is not set, it is ignored.
File identifier	9	59-0	File identifier (first 10 display code characters, left-justified with binary zero or blank fill). †
File identifier	10	59-18	File identifier (last seven display code characters, left-justified with binary zero or blank fill). †
File sequence number	10	17-0	1- to 3-digit numeric display code file sequence number (right-justified with display code zero fill). †
Generation version number (gyn)	11	59-48	1- to 2-digit numeric display code generation version number (right-justified with display code zero fill). †
Retention cycle	11	47-30	1- to 3-digit numeric display code retention cycle (right-justified with display code zero fill). †
Creation date	11	29-0	Creation date (2-digit numeric display code value for the year followed by a 3-digit numeric display code value for the day within the year). †
Set identification	12	59-24	1- to 6-character set identification (left-justified with binary zero or blank fill). †
File section number	12	23-0	1- to 4-digit numeric display code file section number (right-justified with display code zero fill). †

FET CREATION MACROS

The following four macros are defined to initialize FETs. They can be used to create sequential coded files, sequential binary files, random coded files, and random binary files.

FILEB

The FILEB macro creates a FET for a binary sequential file.

LOCATION	OPERATION	VARIABLE SUBFIELDS
lfn	FILEB	fwa, length, p ₁ , p ₂ , . . . , p _n

† Refer to appendix G, volume 1, HRD1 label.

FILEC

The FILEC macro creates a FET for a coded sequential file.

LOCATION	OPERATION	VARIABLE SUBFIELDS
lfn	FILEC	fwa, length, p ₁ , p ₂ , . . . , p _n

RFILEB

The RFILEB macro creates a FET for a binary random file.

LOCATION	OPERATION	VARIABLE SUBFIELDS
lfn	RFILEB	fwa, length, p ₁ , p ₂ , . . . , p _n

RFILEC

The RFILEC macro creates a FET for a coded random file.

LOCATION	OPERATION	VARIABLE SUBFIELDS
lfn	RFILEC	fwa, length, p ₁ , p ₂ , . . . , p _n

The following parameters apply to each FET creation macro.

lfn	File name.		
fwa	First word address of CIO buffer.		
length	Length of the CIO buffer. Because the buffer is full when IN = OUT - 1 or IN = LIMIT - 1 and OUT = FIRST, the buffer length should not be an exact multiple of PRU size. The following are the minimum and recommended buffer sizes for mass storage, tape, and terminal input/output.		
	<u>Device</u>	<u>Minimum (octal)</u>	<u>Recommended (octal)</u>
	Mass storage	101 (without control words †)	1001 to 2001 (without control words)
		103 (with control words)	1021 to 2041 (with control words)
	Tape (I, SI, and X formats)	1001 (without control words)	3n + 1 to 4n + 1, where:
		1003 (with control words)	n = 1000 (without control words)
			n = 1002 (with control words)
	Time-sharing terminal		101 for input. 301 for output

† Refer to the CIO READCW (200) request for a description of control words.

Refer to Data Formats, section 10, volume 1, for a description of PRU sizes for S, L, E, B, and F tape formats.

pi The following parameters can be used to set fields in the FET. They can be specified in any order.

DTY = dt	Sets the device type to dt. User must specify display code equivalent of dt. For example, set device type to TT by specifying DTY = 2RTT or DTY = 2424B. Refer to appendix E for legal equipment codes.
EPR	Sets the error processing bit (FET+1, bit 44).
FET = l	Sets the length of the FET to l .
IND = addr, l	Sets the index first word address to addr and the index length to l.
LBL	Sets the FET length to 13 ₁₀ for tape label processing.
OWN = iaddr, jaddr	Sets the OWNCODE EOI address to iaddr and the error exit address to jaddr. If jaddr is included, the error processing bit is also set.
UPR	Sets the user processing bit (FET+1, bit 45).
XL	Sets the extended label processing bit (FET+1, bit 41). and sets the FET length to 13 ₁₀ .
WSA = addr, l	Sets the first word address of working storage to addr and the length of working storage to l.

The following parameters are used for setting PFM communication words (refer to section 5) in the FET.

PFN=name	Sets the permanent file name
USN=usernum	Sets the optional user number usernum
PWD=passwd	Sets the permanent file password
UCW=usercon	Sets the user control bits (bit 59 must be set to indicate that the word contains user control information)
PKN=packname	Sets the packname for access to permanent files residing on auxiliary devices

The following example illustrates the use of FET creation macros to create an FET for sequential input/output operations.

BUFL	EQU	2001B
TAPE1	FILEB	BUF, BUFL
BUF	BSS	BUFL
	:	
	:	

The following example creates an FET for retrieving a file from permanent file storage, loading the index block, and performing random input/output operations.

```

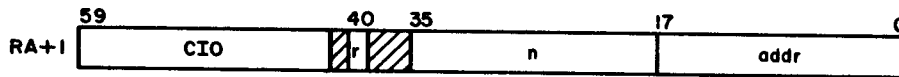
BUFL   EQU      2001B
INDXL  EQU      100B
TAPE1  RFILEB   BUF, BUFL, (FET=10D), (PFN=STOCKS), (IND=INDX, INDXL)
BUF     BSS      BUFL
INDX    BSS      INDXL
      .

```

CIO – COMBINED INPUT/OUTPUT

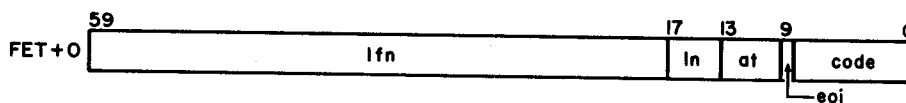
The CIO read/write requests are used to transfer data between a file and a CIO circular buffer. The read requests transfer input files from a system storage medium to a CIO circular buffer. The write requests transfer output from a CIO circular buffer to a system storage medium. Also included in this group of requests are those which open and close files, those which update records in an existing mass storage file, and those used to control positioning of the file.

The format of the call to CIO is:



r Auto recall, if desired
n Count for skip operations
addr Address of the FET

Word 0 of the FET contains the following information.



lfn Logical file name
ln Level number ($0 \leq ln \leq 17_8$) for an EOR/EOF operation on the file:
 0 EOR operation
 1-16₈ Same as level 0
 17₈ EOF operation

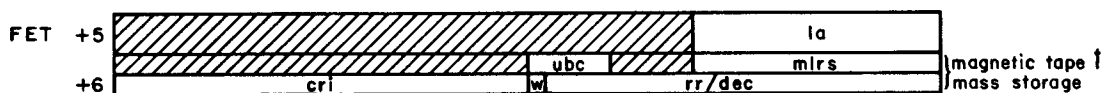
at	Abnormal termination code returned by CIO:	
	01	End-of-reel (magnetic tape) or end-of-device (mass storage)
	02	Parity error
	118	Other error (applies only to mass storage files; refer to FET+6, dec field)
eo	End of information bit	
code	Request/return code:	
	xx1 or xx3	Operation complete
	xx2	Binary operation (applies only to SI, S, and L formatted tapes)
	xx0	Coded operation (applies only to SI, S, and L formatted tapes)

The file mode (fm) bit (bit 1) of FET+0 is not actually part of the status response, although it is returned as such. The fm bit is used by tape drivers, in some cases, to determine parity (7-track) or whether conversion is required between character sets (9-track). For disk I/O the bit is carried for compatibility with tape I/O, but is meaningless. The bit is set by the FILEB or FILEC macros or directly by the user. After this it is masked in as part of the return code.

The CPU program is expected to issue an even request code (bit 0 = 0). If it does not, a completed operation may not be detected.

Words 1 through 7 of the FET contain the following information.

Words 1 through 4 and word 7 of the FET are the same as figures 2-3-4 and 2-3-5. Words 5 and 6 contain the following information.



- la Address of a list of random addresses to be used with READLS or RPHRLS mass storage operations.
- ubc Unused bit count for S and L format tapes.
- mlrs Maximum PRU size for S and L format tapes.
- cri Current random index (for mass storage files only).
- w Random rewrite request (for mass storage files only).

† These fields apply only to S and L format tapes.

rr/dec

rr

Random request (for mass storage files only):
If $rr \neq 0$, and the request is a read request,
rr is the random index.

If $rr \neq 0$, $w=0$, and the request is a write re-
quest, rr is the address for return of random
index (the write operation is at the current
position).

If $rr \neq 0$, $w=1$, and the request is a write re-
quest, rr is the random index.

dec

Detail error return code (for mass storage files
only):

<u>Code</u>	<u>Type of Error</u>
x001	Parity error
x002	Address error
x003	Device status error
x004	6681 function reject or function sent to mass storage device that timed out with no response
x005	Device reserved
x006	Device not ready
4007	Track limit (device full)

If, after a read error (with ep bit set), the sys-
tem determines that the correct PRU was read
(although it may contain incorrect data) then x
above is zero, the data is placed in the buffer,
and the file is positioned to the next PRU of the
file. If the correct PRU is not read, then x is
4, no data is placed in the buffer, and the file
is not repositioned. The cri is set as usual.

Equipment which may be accessed by CIO includes:

- Mass storage
- Magnetic tape units
- Card reader
- Card punch
- Line printers
- Communications terminals through the time-sharing executive

CIO FUNCTION PROCESSING

All of the CIO macros require two common decks for system interface.

- COMCCIO
- COMCSYS

These common decks are available to the user in relocatable form on the user library SYSLIB.

Error processing for functions issued to CIO involves processing only those errors that occur on the specified devices which includes read and write parity errors to magnetic tape. If a mass storage device returns an error status or the device driver detects an error, the system places the error status in the FET+0 status field. If the error processing bit is set in the FET+1 ep field and the FET length is greater than 5, a detail error code is returned to the user in the FET+6 dec field.

RANDOM PROCESSING

A file that resides on mass storage can be randomly accessed by the user; that is, any PRU (64 60-bit words) on the file can be read without reading the entire file. † The random address of a PRU is the number of PRUs that precede the PRU on the file. For example, on file TEST:

	TEST	BOI
	0	
A	1	
B	2	
C	3	
D	4	
E	5	
F	6	

† Refer to Accessing Files, section 2, volume 1.

Record E has random address 5. The first random address that can be read or written is address 1. Sector 0 (for mass storage, a PRU is equivalent to a sector) on all mass storage files is reserved for system use.

The user can request that the system perform the specified read or write request at the file position specified by the random request word (FET+6). If the file specified resides on mass storage and the random processing bit is set (r parameter in word 1), then random access to the file can be performed. For a random write operation, the remainder of the file (the portion following the data written) is not released. On a sequential write operation, this portion of the file is released.

The user is responsible for managing the random addresses. For any CIO operation with r set in word 1, the system returns the current random index (cri) in FET+6. The cri is the position of the file when the operation is completed.

For a write operation, if rr=0, a sequential write is performed at the current position. If rr≠0, it represents either:

- The address at which the random write is to be performed (w=1), or
- The CM address which receives the position of the file before the write operation is performed (w=0). In this case, the write operation takes place at the current EOI.

For a REWRITE operation, if rr=0, a random write is performed at the current position. If rr≠0, a random write is performed at rr.

For the random file described in section 2, volume 1, the following random requests are necessary to perform the operations described.

<u>Operation</u>	<u>rr</u>	<u>w</u>	<u>cri Returned</u>	<u>Description</u>
READ	10	0	11	Read directory
WRITER	5	1	8	} Write new record 3 in place; Word count = 138
or REWRITER	5	0	8	
WRITER	2000	0	15	Write new record at EOI. Location 2000 is set to 138 to indicate where the write occurred.
WRITEF	15	1	17	} Rewrite directory
or REWRITEF	15	0	17	

The user must account for the extra sector written for EORs and EOFs when specifying rewrite-in-place operations.

The system computes the number of sectors written as follows:†

† All numbers are in octal.

<u>Operation</u>	<u>Formula</u>	<u>Word Count</u>	<u>Example</u>	<u>PRUs Written</u>	<u>Data Remaining in Buffer</u>
Buffer write	$n/100$	243	243/100	2	43
EOR write	$\frac{(n+100)}{100}$	243	$\frac{(243+100)}{100}$	3	0
		300	$\frac{(300+100)}{100}$	4	0
EOF write	$\frac{(n+200)}{100}$	243	$\frac{(243+200)}{100}$	4	0
		300	$\frac{(300+200)}{100}$	5	0

CIO OPEN AND CLOSE FUNCTIONS

Two macros are available for opening files.

OPEN is applicable to all files

POSMF is applicable only to labeled multifile tapes

Two macros are available for closing files.

CLOSE is applicable to all files

CLOSER is applicable only to tape files

POSMF is described in the discussion of file positioning functions. OPEN, CLOSE, and CLOSER are described in the following paragraphs.

OPEN

OPEN creates a file or determines certain information about a file for a job. If the file does not exist before the request to OPEN, it is created.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	OPEN	addr, type, r

addr Address of the FET for the OPEN request.

type Type of function to be performed:

<u>Type</u>	<u>Function (With Code in Octal)</u>
READNR	Read, no rewind (100)

READ	Read and rewind (140)
WRITENR	Write, no rewind (104)
WRITE	Write and rewind (144)
NR	No rewind (120)
ALTERNR	Alter, no rewind (120)
ALTER	Alter and rewind (160)
REELNR	Read reel, no rewind (300)
REEL	Read reel and rewind (340)

If the user specifies a function type of REEL (or REELNR) and the file resides on mass storage, CIO assumes the type is READ (or READNR). If the type is not specified, ALTER is assumed. The functions listed do not change the system read/write lock on the file.

r Auto recall, if desired.

The information supplied by OPEN includes:

- The PRU size for the device to which the file is assigned (FET+4, bits 35 through 18). The PRU sizes returned for a magnetic tape file depends on the tape data format.

<u>Tape Format</u>	<u>PRU Size in Words</u>
I	1000 octal
SI	1000 octal
X	1000 octal
E	16 octal by default (136 characters rounded up) or value calculated from FC or C parameter value on ASSIGN, LABEL, or REQUEST control statement.
B	17 octal default (150 characters) or value calculated from FC or C parameter value on ASSIGN, LABEL, or REQUEST control statement.
F	Value calculated from required FC or C parameter values on ASSIGN, LABEL, or REQUEST control statement.
S	If mlrs = 0 (FET +6, bits 17 through 0), PRU size is 1000 octal; if mlrs ≠ 0, PRU size = mlrs.
L	If mlrs = 0, PRU size is LIMIT minus FIRST minus 1; if mlrs ≠ 0, PRU size is mlrs.

- The type of device on which the file resides (FET+1, bits 59 through 48). With one exception, the device types returned are the same as those returned for the STATUS macro. For magnetic tape operations, the device type returned for STATUS is either MT (7-track) or NT (9-track). For OPEN, the device type is MT or NT for I, X, E, B, and F format tapes; for SI, S, and L format tapes, the device type is:

40nn	Seven-track tape, where nn specifies the recording technique. The 6-bit binary representation of nn is:
	xxxx10 HY density (800 bpi)†
	xx00xx Unlabeled
	xx01xx Standard ANSI labels
	00xxxx SI data format
	10xxxx S data format
	11xxxx L data format
41nn	Nine-track tape, where nn specifies the recording technique. The 6-bit binary representation of nn is:
	xxxx10 HD density (800 cpi)†
	xx00xx Unlabeled
	xx01xx Standard ANSI labels
	00xxxx SI data format
	10xxxx S data format
	11xxxx L data format

This device type format is used for compatibility with the NOS/BE 1 Operating System.

The PRU size and device type are returned only when the FET length is greater than five words (refer to FET Description).

The operations performed by OPEN depend on the type of device being used.

Mass Storage Operations

For mass storage files, if random processing is specified and proper pointers are set in FET +7, the last record of the file is loaded into the buffer specified. The random index on a file that is to be OPENed is expected to be the last record before the EOI. No EOFs may intervene. No indication of the length of the index loaded is returned other than a zero word in the buffer (OPEN clears the buffer before loading the index). If the buffer is too small to accommodate the entire index, the excess data is lost. The random access bit (FET + 1, bit 47) is cleared during an OPEN operation if:

1. The last record before the EOI is empty.
2. Index area FWA is less than 2 (FET+7, bits 17 through 0).
3. The file does not reside on mass storage.

For all OPEN functions on mass storage, the index for a file is loaded into the index area specified.

† Density is always returned as 800 bpi or cpi.

Unlabeled Tape Processing

If a no rewind option is specified (codes 100, 104, 120, or 300), the tape remains at its current position. If a rewind option is specified (codes 140, 144, 160, or 340), the tape is rewound to the load point of the current volume.

Nonstandard Labeled Tape Processing

Since the system cannot write nonstandard labels, the job aborts with the following dayfile message if a WRITE (144) or WRITENR (104) function is specified.

ILLEGAL LABEL TYPE.

If a no rewind option is specified (codes 100, 120, or 300), the tape remains at its current position. If a rewind option is selected (codes 140, 160, or 340), the tape is rewound to the load point of the current volume.

Nonstandard labels are not read or returned to the CIO buffer. If the tape is at the load point, a subsequent read operation skips to the first tape mark before the read occurs.

ANSI Standard Labeled Tape Processing

When an ANSI labeled tape file is opened, the action the system takes depends on the xl bit (FET+1, bit 41). If xl is 0, standard label processing is performed; extended label processing is performed if xl is 1.

For standard label processing, all optional labels are ignored. If the FET for the file is at least 13 words long, FET+9 through FET+12 (refer to FET Description) contain the HDR1 data. These fields are described in detail in appendix G, volume 1, HDR1 label. All fields contain alphanumeric or numeric display code values. Alphanumeric fields are left-justified with binary zero or blank fill. Numeric fields contain display code numeric digits and are right-justified with display code zero fill.

The tape remains at its current position if a no rewind option is specified (codes 100, 104, 120, or 300). If a rewind option is selected (codes 140, 144, 160, or 340), the tape is rewound to the load point of the current volume.

The system reads and/or verifies the HDR1 label if the tape is at the load point and a READ, REEL, or ALTER option is selected (codes 100, 120, 140, 160, 300, or 340), with the following restrictions or requirements.

- If the FET length is less than 13 words, the system accepts standard label without verification.
- If the FET length is at least 13 words, the HDR1 data in FET+9 through FET+12 is compared with that in the HDR1 label. Binary zero fields are not compared, although the actual value read is returned to the field. If any nonzero field does not match, the job aborts and the following message is issued to the dayfile.

LABEL PARAMETER CONFLICT ON OPEN, fff AT nnn.

FIELD BEGINNING AT CHARACTER yy NO COMPARE.

In this message, fff is the file name, nnn is the FET address, and yy is the decimal character position in HDR1 at which the field begins.

A nonzero retention cycle (FET+11, bits 47 through 30) is used to calculate an expiration date that is compared with that HDR1 field on the tape.

The HDR1 label is transferred to the CIO buffer (as space permits), although IN and OUT pointers are not updated to reflect the label information in the buffer.

- All optional labels are ignored.

The system writes a new HDR1 label if the tape at load point is opened for the first time with a WRITE operation specified (codes 104 or 144), and the FET length is at least 13 words. Subsequent OPEN/WRITE operations (following an OPEN/READ or OPEN/WRITE) do not update the label information, even if the file is opened, closed, and then reopened. The following restrictions or requirements apply.

- If the FET is less than 13 words in length, the previous HDR1 label information is not changed.
- If the FET length is at least 13 words, the system uses the information in FET+9 through FET+12 for the HDR1 label. If any of the FET HDR1 fields are binary zero, the system uses the default value. The current date is used instead of the create date field in the FET. A nonzero retention cycle field is used to calculate the expiration date (default is current date).
- If a nonnumeric value is encountered in a numeric field, the job is aborted and the following message is issued to the dayfile.

ILLEGAL XL BUFFER/FET LABEL FIELD, lfn AT nnn.

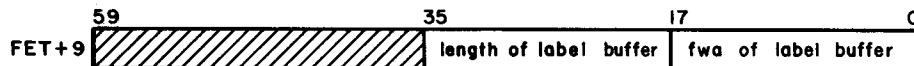
- Previous HDR1 label expiration date is enforced; if not expired, the job aborts with the following message issued to the dayfile.

LABEL NOT EXPIRED.

Extended Label Processing

For extended label processing, a user label buffer, rather than the FET, is used to hold labels for processing. Extended label processing requires a FET length of at least 10 words, and an extended label buffer. Extended label processing is disabled if these requirements are not met.

The buffer location must be specified in FET+9 as follows:



Within the buffer, each label must be preceded by a status word.



Only bits 11 through 0 should be set by the user to show the number of characters in the label. This value must be 80 (120₈). If it does not equal 80, the job is aborted and the following message is issued to the dayfile.

ILLEGAL XL BUFFER/FET LABEL FIELD, lfn AT nnn.

Remaining fields may be used by the label processor. The last label should be followed by a status word containing zeros in bits 11 through 0. Each label in the buffer appears, in display code, with the same format it has on the tape.

The tape remains at its current position if a no rewind operation is specified (codes 100, 104, 120, or 300). If a rewind option is selected (codes 140, 144, 160, or 340), the tape is rewound to the load point of the current volume.

If the tape is at the load point and READ, REEL, or ALTER is selected (codes 100, 120, 140, 160, 300, or 340), the system reads all labels to the first tape mark and verifies the HDR1 label, with the following exceptions.

- If the label buffer does not contain an HDR1 label, the system accepts the standard label without verification.
- If the label buffer contains an HDR1 label, any nonzero field in the label buffer is compared with that HDR1 field on the tape. The job aborts with the following message if any nonzero field does not match.

LABEL PARAMETER CONFLICT ON OPEN, fff AT nnn.
FIELD BEGINNING AT CHARACTER yy NO COMPARE.

In this message, fff is the file name, nnn is the FET address, and yy is the decimal character position in HDR1 at which the field begins.

- All labels from VOL1 through the first tape mark are transferred to the label buffer as space permits. Verification of additional labels are the user's responsibility.

The system writes a new HDR1 label if the tape at load point is opened for the first time with a WRITE operation specified (codes 104 or 144). If the file has been opened prior to the OPEN/WRITE, the label information is not updated, even if the file is opened, closed, and reopened. Further requirements and restrictions are as follows.

- VOL1 labels in the label buffer are ignored.
- If an HDR1 label is not present in the label buffer, the system uses default values to create the HDR1 label for the tape.
- If an HDR1 label is present in the label buffer, it is used to generate the HDR1 label on the tape. If any field in the label buffer is binary zero, the default value for that field is used. The current date is used instead of the create date in the buffer. The expiration date field is used; if zero, it defaults to the current date.
- If a numeric field in the HDR1 label contains a nonnumeric value, the job is aborted and the following message is issued to the dayfile.

ILLEGAL XL BUFFER/FET LABEL FIELD, lfn AT nnn.

- Previous HDR1 label expiration date is enforced; if not expired, the job aborts with the following message issued to the dayfile.

LABEL NOT EXPIRED.

- All user labels to be written must be present in the label buffer. All user volume labels (UVL1-9), additional file header labels (HDR2-9), and user header labels (UHL) in the label buffer are written to the tape. Nonapplicable labels are ignored.

CLOSE

CLOSE terminates operations on a file.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	CLOSE	addr, type, r

addr Address of the FET for the CLOSE request

type Type of function to be performed:

<u>Type</u>	<u>Function (With Code in Octal)</u>
NR	File is not rewound (130)
REWIND	File is rewound (150)
UNLOAD	Tape file is rewound and unloaded; mass storage file is released (170)
RETURN	Tape file is rewound and the number of tape units scheduled for the job is decreased by one; mass storage file is released (174)

If type is not specified, rewind is assumed.

r Auto recall, if desired

If the file resides on mass storage, the random processing bit is set, and the proper parameters are set in FET+7, CLOSE writes the data in the buffer specified in FET+7 at the EOI of the file. This normally is the index for the file. A random index is written at the EOI only if the file is random, the file has been written on since the last OPEN request, the file is not locked, and an index area is specified in FET+7, bits 17 through 0.

If the name of the file in FET+0 is PUNCH, PUNCHB, or P8, the file is entered in the punch queue. The file is punched in O26 or O29 mode, depending upon the origin of the job issuing the CLOSE request. If the job is not local batch origin, then the coded file is punched according to the system default keypunch mode (as specified by the installation). If the job is local batch origin, the initial keypunch mode of the job's control statement record (that is selected by the job statement or installation parameter) is the mode in which the deck is punched.

When a magnetic tape file is closed, the action the system takes depends on the last I/O operation performed.

The system responds to a CLOSE request on a magnetic tape file in the following manner.

- Step 1. Last operation: Write
 - a. If the tape is unlabeled and the data format is X, S, L, E, B, or F, the system writes four tape marks.
 - b. If the tape is unlabeled and the data format is I or SI, the system writes a tape mark, an EOF1 label, and two tape marks.
 - c. If the tape is labeled and standard label processing is in effect (xl, bit 41 of FET + 1, not set), the system writes a tape mark, an EOF1 label, and two tape marks.
 - d. If the tape is labeled and extended label processing is in effect (xl, bit 41 of FET + 1, set), the system writes a tape mark, an EOF1 label, all user end-of-file labels (EOF2-9) and user trailer labels (UTL) present in the extended label buffer, and two tape marks. All nonapplicable labels, including EOF1 and EOF2 labels, in the extended label buffer are ignored. Refer to extended label processing under the OPEN macro for a description of the label buffer.
- Step 2. Last operation: Read

If the tape is labeled, extended label processing is in effect (xl, bit 41 of FET + 1, set), and a tape mark immediately follows, all labels from this tape mark (beginning with EOF1) through the next tape mark are transferred to the extended label buffer, as space permits, beginning at the first word of the buffer.
- Step 3. No rewind option selected

Tape remains positioned at or is repositioned to the same point as before the CLOSE was issued (to prevent user from going past EOI).
- Step 4. Rewind option selected

The system rewinds the tape to the beginning of data of the current file. This operation is performed automatically even if the current file begins on another reel.
- Step 5. Unload option selected

The system rewinds and unloads the current tape reel, releasing job and file attachment.
- Step 6. Return option selected
 - a. The system rewinds and unloads the current tape reel, releasing job and file attachment.
 - b. The number of tapes scheduled for the job is decremented only if the total concurrent resource demand (tapes and packs) has been satisfied.

CLOSER

The CLOSER macro closes a magnetic tape reel.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	CLOSER	addr, type, r

addr Address of the FET

type Type of operation to be performed:

<u>Type</u>	<u>Function (With Code in Octal)</u>
NR	No rewind (330)
UNLOAD	Unload (370)
omitted	Rewind (350)

If the specified file resides on mass storage, the CLOSER 350 operation sets the file to BOI and 370 releases the file.

r Auto recall, if desired

The CLOSER macro enables the user to control end-of-reel processing. The definition of end of reel varies according to the processing option the user selects (refer to End-of-Tape/End-of-Reel Conditions, section 10, volume 1). The action the system takes in response to a CLOSER request depends on two factors:

- The last I/O operation performed
- The user processing option (FET+1, bit 45)

and is defined as follows:

Step 1. Last operation: Write

- a. If the tape is labeled, unlabeled SI, or unlabeled I format, the system writes a tape mark followed by an EOVI label and two tape marks. If the user has specified the vsn of the next reel, † an EOVI2 label containing that value is also written following the EOVI. User trailer labels present in the label buffer are written if extended label processing is in effect. Refer to Extended Label Processing, OPEN macro for a description of the label buffer.
- b. If the tape is unlabeled and the data format is X, S, L, E, B, or F (refer to section 10, volume 1), the system writes four tape marks.

Step 2. Last operation: Read

- a. If extended label processing is in effect, all labels following from EOVI1 to the next tape mark are returned to the extended label buffer.
- b. If the tape has an EOVI2 label (except for SI unlabeled tapes) and was written under NOS, the system extracts the vsn and proceeds to step 3.

† Refer to section 10, volume 1 for a description of the VSN control statement.

- c. If the user or operator has specified the vsn of the next reel, the system proceeds to step 3 or 4.
 - d. If the vsn of the next reel has not been specified and the tape has no EOVS label, the system proceeds to step 3 or 4.
- Step 3. User processing option selected.
The system returns control to the user with end-of-reel status in the FET. The tape is positioned so that if the user attempts to perform another I/O operation, the result is the same as for the previous read or write. This prevents a read or write operation from running off the end of the tape.
- Step 4. User processing option not selected.
The system sets the completion bit in the FET. In addition, if the tape is labeled and the FET length is at least 14 words, the system increments the file section number (FET+12, bits 23 through 0).
- Step 5. The system rewinds or unloads the tape as specified by the type parameter.
- Step 6. If the vsn of the next reel is known, the I/O operation continues. If the vsn is not known, the system requests the operator to supply it and then continues the operation on the next reel.

CIO READ FUNCTIONS

The following read functions are processed by CIO.

RPHR (000)

RPHR causes one PRU to be transferred into the circular buffer.

The status responses (bits 9 through 0 of word 0 of the FET) are:

0001	Full sector
0021	EOR encountered
0031	EOF encountered
1031	EOI encountered

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	RPHR	addr, r

addr Address of the FET

r If r is specified, control is returned only upon completion of the operation.

READ (010)

The READ function reads information into the circular buffer. If there is room in the buffer for at least one physical record, the system initiates reading and continues until:

- The buffer is full.
- An end of record or end of file is encountered.
- The end of information is encountered.
- For S and L format tapes, one PRU is read.

The status responses (bits 9 through 0 of word 0 of the FET) are:

0011 Buffer filled

0021 EOR encountered

0031 EOF encountered

1031 EOI encountered

Data is not transferred after an EOR or EOF mark is encountered. For tapes that do not have a defined EOI (refer to section 10, volume 1), an operation that normally would terminate at EOI terminates instead at EOF. Also, for S and L format tapes, the unused bit count is returned to FET+6, bits 29 through 24, when the read is complete.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	READ	addr, r

addr Address of the FET

r If r is specified, control is not returned until operation is complete.

READSKP (020)

READSKP performs a read function until the buffer is filled or until an EOR or EOF is encountered. If the buffer is filled before an EOR is encountered, CIO positions the file at the next EOR, EOF, or EOI, whichever is encountered first.

The status responses are:

- 0021 Buffer filled or EOR encountered
- 0031 EOF encountered
- 1031 EOI encountered

For tapes that do not have a defined EOI (refer to section 10, volume 1), an operation that normally would terminate at EOI will terminate instead at EOF.

This is the only read function that performs the read operation if less than one PRU of space is available in the buffer.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	READSKP	addr, level, r

addr Address of the FET

level Level number (0 through 17₈) specified in FET+0, bits 17 through 14; if a level number is specified, information is skipped until the occurrence of an EOR with a level number greater than or equal to the one specified:

0 After the buffer is full, skip to the next EOR.

17₈ After the buffer is full or a full record is placed in the buffer, skip to the next EOF.

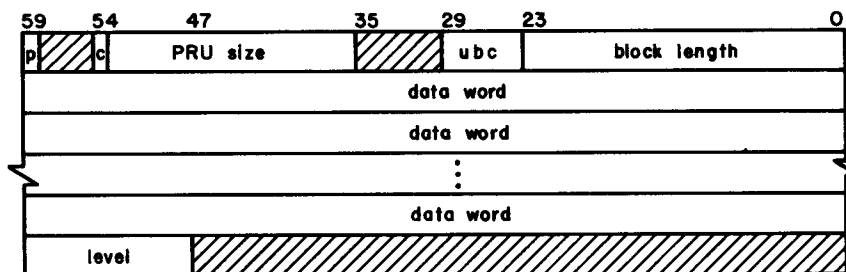
For S and L format tapes, only a request with level 17₈ is recognized; any other level in the request is ignored.

r If r is specified, control is returned only upon completion of the operation.

For S and L format tapes, the user should set the mlrs field (FET+6, bits 17 through 0) before issuing the READSKP function. If mlrs is 0, the system assumes 512 words for an S tape and LIMIT-FIRST-1 for an L tape. For L format tapes, mlrs must be set to a value at least as long as the largest block on the tape.

READCW (200)

The READCW function performs a nonstop read of PRUs bounded by control words. The PRU format is:



- p Parity error indication (is set for each block in error when reading with the ep bit set in the FET).
- c Bit 54 is set if coded operation (tape operations only).
- PRU size Number of CM words in each PRU on the device (refer to the OPEN macro for a description of PRU sizes).
- ubc Unused bit count ($0 < ubc < 11$). Ignored for mass storage files. Checked for all tape formats except I, SI, and X; for I, SI, and X format tapes, ubc must be 0. For read and write operations on tape, ubc is processed as accurately as possible within the constraints of the hardware.
- block length Count of the number of 12-bit data bytes in the PRU. For mass storage files and I, SI, and X format tapes, it must be equal to five times the number of CM words occupied by the data.
- level Logical record level number:
 - 0 or absent The PRU is an EOR
 - 17_8 The PRU is an EOF

This function allows the user to read nonstop and detect EORs and EOFs without having to recall CIO for the next sequential read. Reading terminates normally if the buffer becomes full or if the EOI is detected. If the request is made with the level number equal to 17_8 (that is, FET+0, bits 17 through 14), reading will stop at the next EOF. This function may only be used with mass storage and magnetic tape devices.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	READCW	addr, level, r

- addr Address of the FET
- level Termination level
 - 0 Continue reading over EOFs (stops at EOI or buffer full). EOFs are returned in data as zero length block with level 17_8 .
 - 17_8 Stop reading at next EOF. EOF status is returned to the FET, but no EOF data block (zero length and level 17_8) is returned to the CIO buffer.
- r If r is specified, control is returned only upon completion of the operation.

READLS (210)

The READLS function reads the group of mass storage logical records specified by a list supplied by the user. The user must supply the address of the list in the lower 18 bits of word 5 of the FET specified by addr. READLS continues reading until the list is exhausted or the buffer is filled.

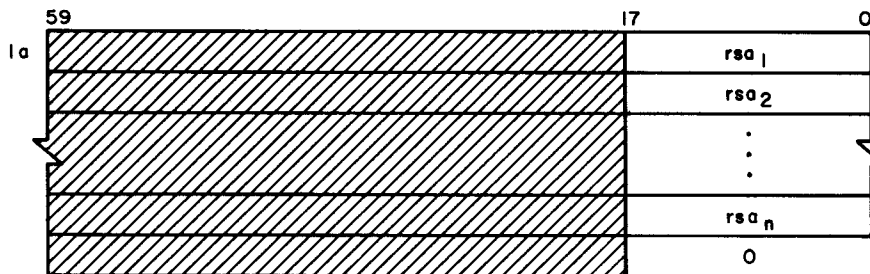
Word 5 of the FET contains the address of the list in the following format.



r Set by CIO if this is not the initial READLS call

la Address of the list

The list is in the following format.



rsa_i Random sector address

The status responses are:

- | | |
|------|---|
| 0031 | Operation complete. Entire list read. The value of la in FET+5 is set to terminator word. |
| 0211 | Operation not complete. The value of la in FET+5 is set to next entry of list to be processed. If the buffer is full, r is set to 1. If the buffer is not full, CIO has reached an internal limit and has stopped processing the list. After emptying the buffer, CIO should be called again to continue processing the list. |

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	READLS	addr, r

addr Address of the FET

r If r is specified, control is returned only upon completion of the operation.

RPHRLS (230)

The RPHRLS function reads the group of mass storage PRUs specified by a list supplied by the user. This function performs the same operation as READLS except that each address in the list specifies a single PRU instead of a record. After the single PRU specified by each list entry is placed in the buffer, the list position is advanced.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	RPHRLS	addr, r

addr Address of the FET

r If r is specified, control is returned only upon completion of the operation.

READNS (250)

The READNS function reads a file from the current position to an EOF.

The status responses are:

0251 Buffer full
0031 EOF encountered
1031 EIO encountered

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	READNS	addr, r

addr Address of the FET
r If r is specified, control is returned only upon completion of the operation.

READN (260)

The READN function reads data from an S or L format tape into the circular buffer. Reading continues until:

- The buffer is full.
- An EOF is encountered.
- The EOI is encountered.

Status responses are:

0261 Buffer full
0271 EOF encountered
1271 EOI encountered

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	READN	addr, r

addr Address of the FET

r If r is specified, control is returned only upon completion of the operation.

Before this function is issued, the mlrs field in FET+6, bits 17 through 0, must be set to the largest physical record that will be encountered. For S format, if mlrs=0, the value of the maximum block is assumed to be 512 words. For L format, if mlrs=0, the assumed maximum block is LIMIT-FIRST-2. In addition, the file mode (FET+0, bit 1) must be set.

Each physical record in the circular buffer is preceded by a header word. This word is generated by the system; it does not exist on the tape. The format of the header word is:



ubc Unused bit count. Number of bits in the last word that are not valid data; ubc may range from 0 to 55.

block size Number of CM words in the physical record

After each complete physical record has been placed in the buffer, the system moves the IN pointer to reflect both the header and the data.

READEI (600)

The READEI function reads information into the circular buffer. Reading continues until an EOI mark is encountered or the buffer is filled. The status response is EOI encountered (1031). The file is positioned at EOI.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	READEI	addr, r

addr Address of the FET

r If r is specified, control is returned only upon completion of the operation.

CIO WRITE FUNCTIONS

The following write functions are processed by CIO.

WPHR (004)

WPHR writes one physical record from the circular buffer. Unless the buffer contains at least one PRU, no operation occurs.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	WPHR	addr, r

addr Address of the FET

r If r is specified, control is not returned until the operation is complete.

WRITE (014)

WRITE transfers the contents of the circular buffer to the specified file. Writing continues until the buffer contains less than one PRU of data (a WRITER request empties the buffer).

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	WRITE	addr, r

addr Address of the FET

r Auto recall option:

*

If the symbol WRIF\$ is defined in assembly, the common decks reissue the CIO request set in the FET instead of a WRITE function. The * option sets a WRITE request (14_g) in the FET. When the * option is used, CIO is not called.

other Control is not returned until the operation is complete.

For S and L format tapes, only one record is written for each request. The length the record is determined by the value of the IN and OUT pointers.

WRITER (024)

WRITER writes the entire contents of the buffer to the file specified.† The last PRU is written as a short PRU (refer to Data Formats, section 10, volume 1). If the data exactly fills the last PRU, the system adds a PRU with no data to indicate the end of the record. A WRITER request with level 17₈ set in FET+0, bits 17 through 14, performs the same operation as a WRITEF request.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	WRITER	addr, r

addr Address of the FET

r If r is specified, control is not returned until the operation is complete.

WRITEF (034)

WRITEF writes the entire contents of the buffer to the file specified.† The last PRU written is the end of file. If data does not exactly fill the last PRU, the system writes a short PRU (refer to Data Formats, section 10, volume 1) and an EOF. If the buffer is empty and the last operation was an EOR or EOF, the system writes an EOF; otherwise a PRU with no data (EOR) and an EOF is written. For S and L format tapes, data in the buffer is transferred to tape and followed by a tape mark.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	WRITEF	addr, r

addr Address of the FET

r If r is specified, control is not returned until the operation is complete.

†The OUT pointer is updated. The IN pointer is not changed.

WRITECW (204)

The WRITECW function performs a nonstop write of PRUs bounded by control words. The PRUs are in the same format as specified for READCW. Data written using this function is stored on the device in the same format as if it had been written with any other write function (that is, the control words are not part of the data).

WRITECW may only be used with mass storage and magnetic tape devices.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	WRITECW	addr, r

addr Address of the FET

r Auto recall option:

* If the symbol WRIF\$ is defined in assembly, the common decks reissue the CIO request set in the FET instead of a WRITE function. The * option sets a WRITECW request (204_g) in the FET. When the * option is used, CIO is not called.

other Control is not returned until the operation is complete.

REWRITE (214)

REWRITE performs the same operation as the WRITE function with the exception that it causes the system to process the operation as a random function; that is, that portion of the file following the portion written is not destroyed. If the random parameters (r, rr, and w) are not specified in the FET, the write operation takes place at the current position. If the random parameters rr and w are specified, the normal random addressing procedures are followed. The file to be rewritten must reside on mass storage.

NOTE

REWRITE does not check if the record being rewritten in place is the same size or less than the original record.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	REWRITE	addr, r

addr Address of the FET

r If r is specified, control is not returned until the operation is complete.

REWRITER (224)

REWRITER performs the same task as WRITER with the exceptions noted for REWRITE. The file must reside on mass storage. If the level number is 17_g, REWRITER performs the same operation as REWRITEF.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	REWRITER	addr, r

addr Address of the FET

r If r is specified, control is not returned until the operation is complete.

NOTE

A short PRU is written even if the last PRU is exactly full.

REWRITEF (234)

REWRITEF performs the same task as WRITEF with the exceptions noted for REWRITE. The file specified must reside on mass storage.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	REWRITEF	addr, r

addr Address of the FET

r If r is specified, control is not returned until the operation is complete.

NOTE

An extra PRU is written to specify an EOF.

WRITEN (264)

The WRITEN macro writes nonstop on an S or L formatted magnetic tape. S and L formatted tapes are described in Data Formats, section 10, volume 1. Writing continues until the buffer is empty or end of reel is encountered.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	WRITEN	addr, r

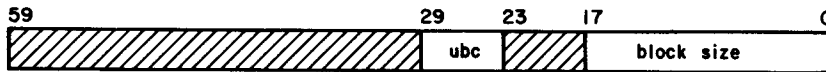
addr Address of the FET

r Auto recall option:

* If the symbol WRIF\$ is defined in assembly, the common decks reissue the CIO request set in the FET instead of a WRITE function. The * option sets a WRITEN request (264g) in the FET. When the * option is used, CIO is not called.

other Control is not returned until the operation is complete.

The user must provide a header word immediately preceding each record in the buffer. This header is not physically written on the tape. Its format is:



- ubc Unused bit count. Number of bits that are not valid data in the last word; ubc may range from 0 to 55.
- block size Number of CM words in the physical record

The system compares the mlrs and ubc fields in FET+6 using information from this header.

The OUT pointer is not changed to reflect the move until after each complete record has been written to tape.

FILE POSITIONING FUNCTIONS

The following functions control the positioning of a file. If the FET indicates that the file is being accessed randomly, the random address of the new position (cri) always returned.

BKSP (040)

BKSP causes a file to be backspaced one logical record. If BOI is encountered before backspacing is complete, a rewind status is returned (05x). If the backspace causes the file to be positioned exactly at BOI, a backspace status is returned (041).

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	BKSP	addr, r

- addr Address of the FET
- r If r is specified, control is not returned until the operation is complete.

BKSPRU (044)

BKSPRU causes the file to be backspaced the specified number of physical records. If BOI is encountered before the specified number of PRUs is backspaced, a rewind status is returned (05x). If the operation causes the file to be positioned at BOI, the backspace status is returned (045). The skip count is set in the RA+1 call to CIO. (Refer to the format of the call to CIO.)

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	BKSPRU	addr, n, r

addr Address of the FET

n Number of PRUs to backspace

r If r is specified, control is not returned until the operation is complete.

REWIND (050)

REWIND causes a mass storage file to be positioned at BOI and a magnetic tape file to be positioned at the beginning of the current file. If the file does not exist, no operation is performed.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	REWIND	addr, r

addr Address of the FET

r If r is specified, control is not returned until the operation is complete.

For a mass storage file, if the random processing bit is set in the FET, the current random index (cri) is returned as the beginning of the file (random address 1).

If the file resides on magnetic tape, the action the system takes depends on the last I/O operation performed.

The system responds to a REWIND request as follows:

- Step 1.** Last operation: Write
- a. If the tape is labeled, the system writes a tape mark, an EOF1 label, and three tape marks.
 - b. If the tape is unlabeled and the data format† is X, S, L, E, B, or F, the system writes four tape marks.
 - c. If the tape is unlabeled and the data format is I or SI, the system writes a tape mark, an EOF1 label, and three tape marks.
- Step 2.** Last operation: Read
The system proceeds to step 3.
- Step 3.** The system rewinds the tape to the beginning of data of the current file. This operation is performed automatically even if the current file begins on another reel.

UNLOAD (060)

UNLOAD causes the specified file to be rewound and unloaded. If the file resides on mass storage, UNLOAD performs the same function as RETURN.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	UNLOAD	addr, r

addr Address of the FET

r If r is specified, control is not returned until the operation is complete.

If the file resides on magnetic tape, the action the system takes depends on the last I/O operation performed.

The system responds to an unload request as follows:

- Step 1.** Last operation: Write
- a. If the tape is labeled, the system writes a tape mark, an EOF1 label, and three tape marks.
 - b. If the tape is unlabeled and the data format is X, S, L, E, B, or F, the system writes four tape marks.

† Refer to section 10, volume 1.

- c. If the tape is unlabeled and the data format is I or SI, the system writes a tape mark, an EOF1 label, and three tape marks.
- Step 2. Last operation: Read
- a. The system proceeds to step 3.
- Step 3. The system rewinds and unloads the tape.

If an end-of-reel exists (was encountered on a previous CIO function while the user processing option was selected), a subsequent UNLOAD writes the end-of-volume trailer (refer to end-of-reel processing, section 10, volume 1) before rewinding and unloading the reel.

RETURN (070)

RETURN causes the specified file to be released from control of the job. The operation performed depends on the type of file.

<u>Type</u>	<u>Operation</u>
Input	The file name is changed to INPUT*; file space is not released and file INPUT* remains attached to the job as a local file.
Print	File space and job attachment are released.
Punch	File space and job attachment are released.
Local	File space and job attachment are released.
System	Job attachment is released but file space remains.
Library	Job attachment is released but file space remains.
Primary	File space and job attachment are released.
Permanent	Job interlock (read/write) is cleared; job attachment is released; file space remains.

If the file resides on magnetic tape, the RETURN macro performs the same function as the UNLOAD macro. In addition, the RETURN of a magnetic tape file or the user's last direct access file for a particular disk pack decrements the resource demand count (as scheduled by the RESOURC control statement) only if the total concurrent resource demand (tapes and disk packs) has been satisfied. If the file is a deterred routed file (refer to section 8), the file space and job attachment are released.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	RETURN	addr, r

addr Address of the FET

r If r is specified, control is not returned until the operation is complete.

POSMF (110)

The POSMF macro opens and/or positions standard ANSI-labeled multifile magnetic tape sets to a member of the set. The file to be opened is determined by the contents of the label fields of the FET, or if the xl bit is set, the contents of the HDR1 label in the extended label buffer. The relative position of the file within the multifile set is specified by the file sequence number field.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	POSMF	addr, r

addr Address of the FET †
r If r is specified, control is not returned until the operation is complete.

Standard ANSI -Labeled Multifile Set Processing

If the FET length is less than 13 words, the job aborts with the following dayfile message.

 BUFFER ARGUMENT ERROR ON fff AT nnn.

In this message, fff is the file name and nnn is the FET address.

The PRU size (FET+4, bits 35 through 18) and device type (FET+1, bits 59 through 48) are returned to the FET as described under the OPEN macro. However, the device type returned by POSMF for SI, S, and L formatted multifile set tapes is in the following format.

42nn 7-track; recording technique same as for OPEN (40nn)
43nn 9-track; recording technique same as for OPEN (41nn)

A multifile set is positioned to read an existing file if the file sequence number in the FET is not display code 999. The following restrictions and requirements also apply.

- The tape is positioned to the first member of the multifile set whose HDR1 fields match the HDR1 data in FET + 9 through FET + 12. Binary zero fields are not compared. A nonzero retention cycle is used to calculate an expiration data that is compared with that on the tape. If all fields do not match, the search continues.

† To accommodate COBOL, if the initial name of the assigned tape file is a 6-character name (for example, ABCDEF) and a POSMF to a file named ABCDEFn (n is alpha-numeric character) is performed, the 6-character file name is automatically changed to the 7-character name. Subsequent POSMFs to other 7-character file names with the same first six characters also cause the file name to be changed. COBOL uses the first characters of the file name as the SETID.

- If the explicit or implicit position number is greater than that of the last member file (that is, the matching HDR1 was not found), POSMF is terminated, returning an end-of-set status (21 octal set in bits 13 through 9 of FET+0) and updating the file sequence number field in the FET to one greater than that of the last member file. The HDR1 for the last member file is transferred to the CIO buffer, although IN and OUT are not updated.
- If the desired file is located, the HDR1 label is transferred to the CIO buffer, as space permits, although the IN and OUT pointers are not updated to reflect the label information in the buffer. Actual values read are returned to the label FET fields.
- All optional labels are ignored.

A multifile set is positioned to write a new file if the file sequence number in the FET is display code 999. Further requirements are as follows.

- The first file of a multifile set is created if all of the following are true (refer to examples 1 and 2):
 1. The tape is positioned to the first file.
 2. The last operation was not a write.
 3. The set identification field in the initial HDR1 label on the tape is all blanks (the set identification field in the FET must be nonblank if the set is to be extended in the future).
- The multifile set is positioned to extend the set in all other cases. The tape is positioned to after the last file in the multifile set.
- The system writes a new HDR1 label to the tape with the following results.
 1. The file sequence number of the new HDR1 label is set to display code 0001 for the first file or set to the last member sequence number plus 1 for extended files.
 2. The section number in the HDR1 label is always set to display code 0001.
 3. With the above exceptions, the information in FET+9 through FET+12 is used to create the HDR1 label. The default value is used for any FET HDR1 field that is binary zero. If a numeric field contains a nonnumeric value, the job is aborted and the following message is issued to the dayfile.

ILLEGAL XL BUFFER/FET LABEL FIELD, lfn AT nnn.

The creation date field in the FET is ignored; the current date is always used.

Extended Label Multifile Set Processing

If the FET length is less than 10 words, the job aborts with the following message issued to the dayfile.

BUFFER ARGUMENT ERROR ON fff AT nnn.

In this message, fff is the file name and nnn is the FET address.

The PRU size (FET+4, bits 35 through 18) and device type (FET+1, bits 59 through 48) are returned to the FET as described under standard multifile set processing.

To avoid a fatal error, an HDR1 label must be present in the extended label buffer (refer to extended label processing under the OPEN macro for a description of the extended label buffer).

A multifile set is positioned to read an existing file if the file sequence number in the buffer HDR1 label is not display code 9999. The following requirements also apply.

- The tape is positioned to the first member of the multifile set whose HDR1 label matches that in the label buffer. Binary zero fields are not compared. If the fields do not match, the search continues.
- If the explicit or implicit position number is greater than that of the last member file (that is, the matching HDR1 was not found), POSMF is terminated, returning an end-of-status (21 octal in FET+0, bits 13 through 9).
- If the desired file is located, all labels from HDR1 through the next tape mark are transferred to the label buffer, as space permits. Verification of additional labels is the user's responsibility.

A multifile set is positioned to write a new file if the file sequence number in the buffer HDR1 label is display code 9999. Further requirements or restrictions are as follows.

- The first file of a multifile set is created if all of the following are true (refer to examples 1 and 2):
 1. The tape is positioned to the first file.
 2. The last operation was not a write.
 3. The set identification field in the existing HDR1 label on the tape is all blanks (the set identification field in the buffer HDR1 label must be nonblank if the set is to be extended in the future).
- The multifile set is positioned to extend the set in all other cases. The tape is positioned after the last file in the multifile set.
- The system writes a new HDR1 label and all additional user labels to the tape with the following results.
 1. The file sequence number in the HDR1 label of the new file is set to display code 0001 for the first file or set to the last member sequence number plus 1 for extended files.
 2. The file section number in the HDR1 label is always set to display code 0001.
 3. With the above exceptions, the information in the extended label buffer is used to generate the HDR1 label on the tape. The default value is used for any buffer HDR1 field that is binary zero. If a numeric field contains a nonnumeric value, the job is aborted and the following message is issued to the dayfile.

ILLEGAL XL BUFFER/FET LABEL FIELD, lfn AT nnn.

The creation date field in the buffer HDR1 label is ignored; the current date is always used.
 4. All additional user file header labels (HDR2-9) and user header labels (UHL) in the label buffer are written to the tape. Nonapplicable labels are ignored.

Example 1:

Step 1. BLANK(VSN=TEST,D=HY,MT)

Creates a labeled tape with SETID defaulted to blanks.

Step 2. LABEL(TAPE,VSN=TEST,LB=KL,F=S,MT)

Causes tape to be assigned and positioned at file 1.

Step 3. LGO.

Executes program where POSMF on file TAPE with recall specified is performed with sequence number set to 999 (or 9999) and a nonblank SETID set in the FET (or xl buffer). This causes the first file of the multifile set to be created using the label fields specified in the FET (or xl buffer).

Subsequent POSMFs with sequence number set to 999 (or 9999) cause the file set to be extended since the SETID field on the tape is now nonblank.

Example 2:

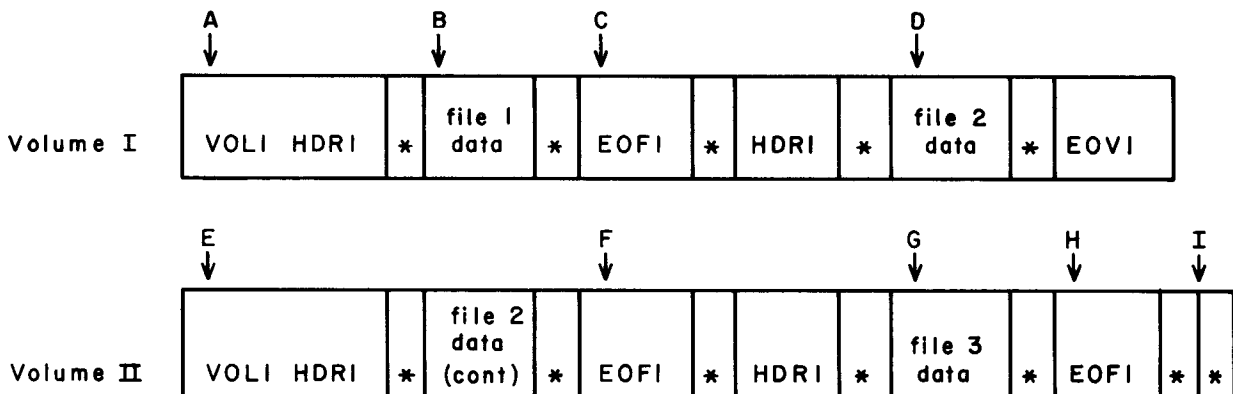
Repeat the above example except that a

LABEL(TAPE,VSN=TEST,SI=TESTAA,F=S,MT,W)

is performed at step 2. The POSMF in the third step extends the file set since the SETID is nonblank on the tape.

Example 3:

The structure of multifile labels is outlined in appendix G, volume 1. Given the following example, note the operation.



- To create this file, the following sequence is used.
 1. OPEN or LABEL With section number = 1, sequence number not specified (default is 1)
 2. Write data (File set 1)
 3. POSMF With sequence number set to 999
 4. Write data (Goes over end of reel) (file set 2)
 5. POSMF With sequence number set to 999
 6. Write data (File set 3)
 7. REWIND This causes the trailer label at H to be written. The tape is then rewound to the beginning of Volume II (position E) and then the file is positioned forward to G. The tape is not necessarily at load point following a rewind of a multifile set member, rather at the start of the multifile set member. The only means, at this point, to position to the beginning of Volume I is to issue a POSMF with sequence number 1.
- If located at the end of file set member 2 (F), a rewind positions the tape to the beginning of Volume I since file set member 2 begins on Volume I, and then positions Volume I to D.
- By writing over file set member 2, file set member 3 is destroyed.
- A POSMF 999 followed by a WRITE creates a file set member at I.
- To copy all three file set members, the following technique may be used.

OPEN with display code 001 (or 0001) sequence number and all other label fields binary zero.

READ to EOI. (C)

POSMF with display code 002 (or 0002) sequence number and all other label fields binary zero. This positions to next file set member at (D).

READ to EOI. (F)

POSMF with display code 003 (or 0003) sequence number and all other label fields binary zero.

READ to EOI. (H)

The SI (M) parameter must be present for multifile label positioning using control statements. If the QN (P) parameter is present, the multifile set is positioned to the file set member that matches the specified sequence number. If QN is not specified and the FI (L) parameter is present, the multifile set is positioned to the file set member that matches the file identifier specified. If both QN and FI are specified, a match must occur on both sequence number and file identifier. If neither QN nor FI is specified, an OPEN is done instead of a POSMF.

To extend a multifile set, QN must be set to 9999.

If the SI parameter is not specified, then file positioning is not done. The R and W parameters on the LABEL statement are ignored if SI is specified. The exception is if the W parameter is specified and $QN \leq 1$, and it is the first OPEN on the file, then an OPEN/WRITE is performed.

Although the sequence number field in the HDR1 label is four characters in length, only the rightmost three characters are used to differentiate between 999 and another valid sequence number. This is because on an open (POSMP) the FET field for sequence is only three characters. Therefore, if extended labels are not being used, a limit of 998 file set members per file set is enforced.

EVICT (114)

The EVICT macro is similar to the RETURN macro in that it releases file space for the specified file. It differs from RETURN in that EVICT does not release the file attachment to the job.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	EVICT	addr, r

addr Address of the FET

r If r is specified, control is not returned until the operation is complete.

The operation that EVICT performs depends on the file type. For permanent files, all file space except the first track is released, job attachment remains, and an EOI is written on the first sector of the first track. For all other mass storage file types, file space is released and job attachment remains. Files for which write lockout is set are returned to the system. An EVICT of a tape file performs the same functions as the UNLOAD macro.

SKIPF (240)

SKIPF causes the file to be positioned n records forward from the current position. The operation terminates when the skip count is satisfied or when EOI is encountered on a mass storage file.

The status response is:

0021 Last record skipped over was EOR

0031 Last record skipped over was EOF

1031 EOI encountered

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	SKIPF	addr, n, r

- addr Address of the FET
- n Number of records to skip; if n is omitted, 1 is assumed.
- r If r is specified, control is not returned until the operation is complete.

SKIPFF (240)

SKIPFF skips forward the specified number of files.

The status responses are:

- 0021 Last record skipped over was EOR
- 0031 Last record skipped over was EOF
- 1031 EOI encountered

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	SKIPFF	addr, n, r

- addr Address of FET
- n Number of files to skip; if n is omitted, 1 is assumed.
- r If r is specified, control is returned only upon completion of operation.

SKIPEI (240)

SKIPEI causes the file to be positioned at EOI. The skip count in RA+1 is set to 777777_8 to indicate a skip to EOI. The status returned is 103x. On magnetic tapes where no EOI is defined, the operation stops at an EOF.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	SKIPEI	addr, r

addr Address of the FET
r If r is specified, control is not returned until the operation is complete.

SKIPB (640)

SKIPB causes the file to be backspaced n logical records. If BOI is encountered before the operation is complete, a rewind status (05x) is returned. If the file is positioned exactly at BOI, backspace status is returned (64x).

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	SKIPB	addr, n, r

addr Address of the FET
n Number of records to skip backward. If n is not specified, 1 is assumed. If $n=777777_8$, file is rewind.
r If r is specified, control is not returned until the operation is complete.

SKIPFB (640)

SKIPFB causes the specified file to be backspaced n files from the current position. If the skip count specified is 777777_8 , the file is rewound. If the operation positions the file to BOI (even if it was originally at BOI), a rewind status (05x) is returned. Otherwise a skip status (02x) is returned.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	SKIPFB	addr, n, r

addr Address of the FET
n Skip count; if n is omitted, 1 is assumed.
r If r is specified, control is not returned until the operation is complete.

DATA TRANSFER MACROS

NOS provides a set of macros to aid the programmer in manipulating data that is to be processed after reading from or to be written on a file. To use the data manipulation macros with the input/output macros, the user must define input/output buffers and working buffers. The data manipulation macros enable the user to transfer data to/from the working buffer or from/to the input/output buffer without having to be concerned with the input/output buffer FET pointers. The macros and the associated common decks perform all activities involved with the circular pointers. Figure 2-3-6 illustrates a typical buffer arrangement:

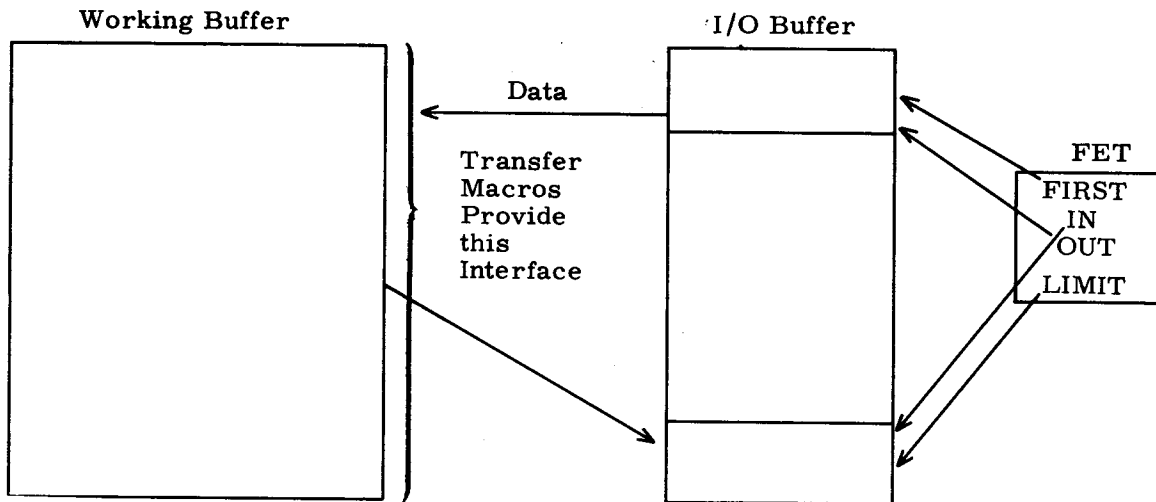


Figure 2-3-6. Data Transfer Buffer Arrangement

The working buffer is usually significantly smaller than the input/output buffer.

The user must issue the input/output functions to initiate reading or writing between the input/output buffer and the device. However, once the function is issued, the common decks called by the data transfer macros initiate the subsequent input/output requests required to maintain the data flow until the initial function is satisfied.

Macro read processors return the following information.

- (X1) = 0 if the transfer to the working buffer is complete.
- (X1) = -1 if an EOF is encountered when reading the file.
- (X1) = -2 if an EOI is encountered when reading the file.
- (X1) > 0 if an EOR is encountered on the file before the transfer to the working buffer is complete; this number is the address plus 1 in the working buffer of the last word transferred.

Data is not transferred after an EOR/EOF/EOI is encountered (for example, READEI or READNS). Depending on the read code, EOR and/or EOF may not be returned.

B6 contains the address plus 1 in the input/output buffer of the last word of data transferred.

The following sample program rewinds and copies one file to another, modifying data as desired.

```

IDENT  MANIP
ABS
ENTRY  MANIP
.
.
.
IBUFL  EQU    1001B      INPUT BUFFER LENGTH
OBUFL  EQU    2001B      OUTPUT BUFFER LENGTH
WBUFL  EQU    100B      WORKING BUFFER LENGTH

I      FILEB  IBUF,IBUFL
O      FILEB  OBUF,OBUFL

MANIP  SBI     1
        REWIND C
        REWIND I
TAG1   READ   I          INITIATE READ OF LOGICAL RECORD
        RECALL O
TAG2   READW  I,WBUF,WBUFL
        ZR    X1,TAG3     IF NOT EOR/EOF
        NG    X1,TAG4     IF EOF OR EOI ENCOUNTERED
        .           END-OF-RECORD ENCOUNTERED
        .           PERFORM DATA MANIPULATION
        .           OF DATA IN WBUF
        .
        WRITEW O,WBUF,X1-WBUF WRITE LAST PORTION OF
        WRITER O          RECORD READ
        EQ    TAG1        LOOP TO INITIATE READ OF NEXT
                           RECORD
TAG3   .
        .           PERFORM DATA MANIPULATION
        .           OF DATA IN WBUF
        .
        WRITEW O,WBUF,WBUFL LOOP TO TRANSFER MORE
        EQ    TAG2        DATA TO WORKING BUFFER

TAG4   WRITEF O          WRITE END-OF-FILE
        ENDRUN          END PROGRAM

**     BUFFERS.

WBUF   EQU    *          WORKING BUFFER
IBUF   EQU    WBUF+WBUFL INPUT BUFFER
OBUF   EQU    IBUF+IBUFL OUTPUT BUFFER

END

```

In the previous example, if the RECALL function was not specified for the output file, the following steps could occur.

1. The user program issues the REWIND O function.
2. Since auto recall is not specified, the user program continues execution.

3. At some point, the user program issues WRITEW which moves data from WBUF to the input/output buffer (O) starting at the current IN pointer in the FET. The WRITEW macro advances the IN pointer to reflect the amount of data transferred into the buffer.
4. At this point, the system completes the REWIND function and accordingly updates the FET IN and OUT pointers to point to FIRST (empty buffer). This destroys the IN pointer updated in step 3. The data placed in the buffer is ignored.
5. On subsequent EOR operations (WRITER), the same situation could occur if the RECALL function was placed elsewhere.

```

WRITER O
.
.      must place RECALL O here.
.
WRITEW O
.
.
.

```

Write requests are not issued with auto recall specified because other operations (READ) can be performed before it is necessary to have the write operation completed.

In the previous example, if an EOR or EOF mark is not detected, it is not necessary to reissue READ requests to fill the input/output buffer because the macros and the associated common decks detect when the buffer threshold is reached. If this threshold is reached, a request is automatically issued to CIO. This occurs on the READ macro when the empty space in the buffer exceeds the threshold or on the WRITE macro when data in the buffer exceeds the threshold. The threshold used is half the buffer size. That is, if the buffer is more than half empty, a read request is issued; if it is more than half full, a write request is issued.

Assuming no EOR is encountered by the fifth time through the loop, the READW function issues another CIO request to transfer data from file I to buffer IBUF; since more than 256 (400_g) words are removed from IBUF, it is now more than half empty. On the ninth time through the loop, the WRITEW function issues a WRITE request to file O since OBUF is now more than half full.

For the data transfer macros, the common decks required for absolute assemblies, in addition to those specified with each macro, are:

- COMCCIO
- COMCSYS
- COMCWTW for write functions (except WRITEO)
- COMCRDW for read functions (except READO)

For relocatable assemblies, these decks are satisfied by default from the library SYSLIB.

In all of the macros described, the following parameter definitions apply.

```

addr      Address of the FET
buf       Working buffer address
n         Working buffer word count

```


READC

The READC macro reads one coded line from the input/output buffer to the working buffer. Data is transferred until the end of the line (0000 in bits 11 through 0) is sensed or until n words are transferred.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	READC	addr, buf, n

Common deck required: COMCRDC

WRITEC

The WRITEC macro transfers a coded line image from the working buffer to the input/output buffer. Data is transferred until the end of the line (0000 in bits 11 through 0) is sensed.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	WRITEC	addr, buf

Common deck required: COMCWTC

READH

The READH macro reads a coded line with space fill from the input/output buffer to the working buffer. Data is transferred until the end of the line (0000 in bits 11 through 0) is sensed or until n words are transferred.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	READH	addr, buf, n

Common deck required: COMCRDH

WRITEH

The WRITEH macro writes a coded line, deleting all trailing spaces, from the working buffer to the input/output buffer.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	WRITEH	addr, buf, n

Common deck required: COMCWTH

READO

The READO macro reads one word from the input/output buffer to X6. (X1)=1 if an EOR is encountered.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	READO	addr

Common deck required: COMCRDO

WRITEO

The WRITEO macro writes one word from X6 to the input/output buffer.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	WRITEO	addr

Common deck required: COMCWTO

READS

The READS macro reads a line image to a character buffer. The words are unpacked and stored in the working buffer, right-justified, one character per word, until the end-of-line byte (0000) is detected. If the coded line terminates before n characters are stored, the working buffer is blank-filled.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	READS	addr, buf, n

Common deck required: COMCRDS

WRITES

The WRITES macro writes a line image from the character buffer. Characters are packed 10 characters per word. Trailing spaces are deleted before the characters are packed.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	WRITES	addr, buf, n

Common deck required: COMCWTS

READW

The READW macro fills the working buffer from an input/output buffer. READW may transfer data to beyond the end of the working buffer. This could cause the program to abort if the last word address of the buffer is within four words of FL. The n parameter must be specified.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	READW	addr, buf, n

Common deck required: COMCRDW

WRITEW

The WRITEW macro transfers data from the working buffer to the input/output buffer. WRITEW may transfer data from beyond the end of the working buffer. This could cause the program to abort if the last word address of the buffer is within four words of FL. The n parameter must be specified.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	WRITEW	addr, buf, n

Common deck required: COMCWTW

CDC CYBER RECORD MANAGER I/O

CDC CYBER Record Manager (CRM) consists of a group of routines providing input/output facilities common to several products. User programs written in several higher level languages (for example, COBOL and FORTRAN Extended) can communicate with the Record Manager through compiler language calls. COMPASS users communicate through Record Manager macros (refer to the CYBER Record Manager Reference Manual).

Features of CRM include the following.

- Consistent error checking
- Accommodation for various label checking
- Support of several file organizations

CDC CYBER Record Manager supports the following file organizations.

- Sequential files in physical order
- Word addressable files on mass storage with continuous nonblocked data
- Indexed sequential files in which records are physically and logically ordered by symbolic keys
- Direct access files containing records in fixed length blocks; record location is determined by hashing a key to identify a block
- Actual key files in which each record is stored in a location specified by the key associated with that record

For a complete description of COMPASS macros, file organizations, and record and block formats supported by CRM, refer to the CDC CYBER Record Manager Reference Manual.

LOCAL FILE MANAGER

Local file manager (LFM) performs requests associated with the control of a user's files. The user can issue requests to LFM and have control returned if certain error conditions occur. To do this, the error processor bit (ep) must be specified in word 1 of the FET. The following error codes are returned in the error code field of the FET word 0, bits 17 through 10.

<u>Error Codes</u>	<u>Description</u>	<u>Error Codes</u>	<u>Description</u>
1	File not found	14	Illegal ID code
2	File name error	15	Resource executive (RESEX) detected an error
3	Illegal file type	16	I/O sequence error
4	File empty	17	Output file limit
5	MAGNET not active	20	Local file limit
6	Duplicate library file name	21	No mass storage available
7	Illegal equipment	22	Illegal file mode
10	Equipment not available	23	Illegal change in file/origin type
11	Duplicate file name	24	FET too short
12	Illegal user access	25	GETFNT table too large
13	Illegal user number		

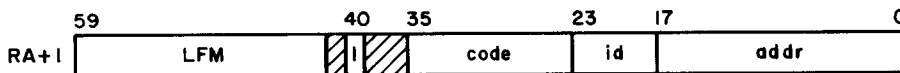
The following error causes the job to be aborted regardless of the presence of the user error processing bit in the FET.

LFM ILLEGAL REQUEST.

This message is issued if any of the following situations occur.

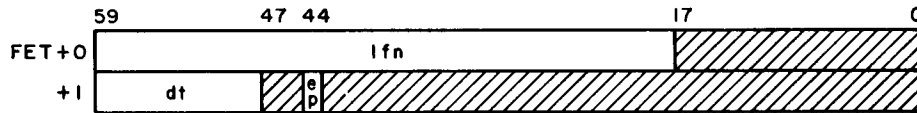
- An LFM function is issued without the auto recall bit set. All LFM calls must be specified with recall.
- An LFM function detected is not recognized as a legal function.

The format of the call to LFM is:



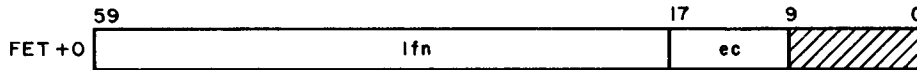
code	Function code
id	File id number (refer to SETID, function code 017)
addr	Address of the FET

LFM uses the following information from the FET.



lfn File name
 dt Device type
 ep Error processing bit

After the request is completed, the first word of the FET contains the following information.



ec Error code

The common decks required in absolute assemblies for the macros processed by LFM are:

- COMCLFM
- COMCSYS

For relocatable assemblies, these decks are satisfied by default from the library SYSLIB.

The LFM functions are described on the following pages.

RENAME (000)

The RENAME function enables the user to change the name of a file currently attached to the job to the name specified in word 6 of the FET. This does not change the names of files in the permanent file system.

If a file by the new file name already exists, it is returned to the system. However, there are certain conditions under which the file type of the old file is changed to that of the returned file.

- If the old file is a local mass storage file and the returned file is a print, punch, or primary type file, the file type of the old file is changed to that of the returned file.
- If the old file is a local mass storage file and the returned file is not a print, punch, or primary type file, the old file is renamed but its file type is not changed.
- If the old file is not a local file or does not reside on mass storage, an ILLEGAL FILE TYPE. error message is issued.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	RENAME	lfn, addr

lfn Address of the FET (FET+0 contains the old file name)
 addr Address of new file name:
 If addr = X1, X1 contains the new file name.
 If addr is not specified, word 6 of the FET contains the
 new file name.

ASSIGN (001)

The ASSIGN function enables the user to access a library file. If a file by the requested name is already local to the user's job, no action is taken. If the requested library file is not found, the following message is issued.

FILE NOT FOUND.

If the error processing bit is set, the message is not issued and error code 1 is returned.

The user must be validated to access library files or the following message is issued.

ILLEGAL USER ACCESS.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	ASSIGN	lfn

lfn Address of the FET

COMMON (002)

The COMMON macro changes the file type of the specified file to library. The file must be a locked local file residing on a mass storage device. If it is not, the following message is issued.

ILLEGAL FILE TYPE.

If a file of the same name already exists as a library file, the following message is issued.

DUPLICATE COMMON FILE NAME.

If a file by the requested name is not found, the following message is issued.

FILE NOT FOUND.

If the equipment the file is assigned to is not mass storage, the following message is issued.

ILLEGAL EQUIPMENT.

The user must be validated to access library files or the following message is issued.

ILLEGAL USER ACCESS.

The file is no longer assigned to the user's job if the operation is successful.

Macro Format: †

LOCATION	OPERATION	VARIABLE SUBFIELDS
	COMMON	lfn

lfn Address of the FET of the file to be entered as a library file

† This macro is not available in SYSTEXT. The user must call common deck COMCCMD (refer to appendix A).

RELEASE (004, 005, 006, 007, 016, 030)†

This function enables the user to release files to any of the output queues for processing before job termination.

Any of the following file types can be released.

- Local files
- Print files
- Punch files

If any other type is released or the file is not a mass storage file, the following message is issued.

ILLEGAL FILE TYPE.

If the file is unused, the following message is issued.

FILE EMPTY.

If an attempt is made to change the file type or origin type of a deferred routed file (refer to section 8), the following message is issued.

ILLEGAL CHANGE IN FILE/ORIGIN TYPE.

The file must be routed to a scratch file (DC=SC) before it can be released to the desired file and origin type.

If the number of files released to the output queue by the job has exceeded the limit for which the user is validated, the following message is issued and the job is aborted.

OUTPUT FILE LIMIT.

If the file is an execute only file, the following message is issued.

ILLEGAL FILE MODE.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	RELEASE	lfn, type, ot, un

† The user should use the ROUTE macro instead of RELEASE (refer to section 8).

lfn Address of the FET
type One of the following:

PRINT	Release file to the PRINT queue (function 004)
PUNCH	Release file to the PUNCH O26 queue (function 005)
PUNCH9	Release file to PUNCH O29 queue (function 030)
PUNCHB	Release file to the PUNCHB queue (function 006)
P8	Release file to the P8 queue (function 007)

ot Specifies disposition of output:

BC	Release file to the local batch queue (function 016)
EI	Release file to the remote batch queue (function 016)

un Address containing the user number of the remote batch user to which the file is to be disposed (ignored if ot is BC). This parameter is valid only if the user is allowed deferred batch jobs. Also, un must match the user number of the user performing the RELEASE on all character positions except those containing an asterisk (*).

If the ot and un parameters are not specified, a remote batch job disposes the file to a remote batch terminal from which the job is submitted and all other origin types dispose the file to the central site output device. If ot is BC, the un parameter is ignored and the file is disposed as usual to the central site device.

The user may release coded punch files in either O26 or O29 mode, independent of the job's initial keypunch mode (refer to appendix F, volume 1).

LOCK (010)

This function enables the user to prevent writing on a file by setting the write lockout bit for the file. The file specified must be a local file; if it is not, the following message is issued.

ILLEGAL FILE TYPE.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	LOCK	lfn

lfn Address of the FET

UNLOCK (011)

The UNLOCK function clears the write lockout bit for the specified file. The file must be a local file; if it is not, the following message is issued.

ILLEGAL FILE TYPE.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	UNLOCK	lfn

lfn Address of the FET

STATUS (012)

The STATUS macro determines if a file exists. Zero is returned in bits 11 through 1 of the FET status word if the file is not found. A nonzero quantity is returned in bits 11 through 1 if the file is found. To determine the current position and status of a file, use STATUS (013).

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	STATUS	lfn

lfn Address of the FET

STATUS (013)

This function returns the current position and status of a mass storage or magnetic tape file. This function can be used to determine the current position of the file, the type of file, and the device on which it resides. If the file is a magnetic tape file, information is returned to FET+8 as described for the LABEL macro. † If the file does not exist, the following message is issued.

FILE NOT FOUND.

The device type is returned in word 1 of the FET; if the device is a nonmass storage device, the upper bit is set. Refer to appendix E for a list of legal device types and equipment codes.

† This feature of the STATUS macro is subject to change in future versions of NOS.

In general, the device type returned for a STATUS request is the same as that returned for a CIO OPEN request. For SI, S, and L formatted tapes, however, the device type returned by OPEN differs from the MT or NT device type returned by status. For a description of this special device type format, refer to the CIO OPEN macro, section 3.

The FNT entry of the file is returned in word 5 of the FET.

The FST entry of the file is returned in word 6 of the FET. For NOS, the previous function code is not retained in the FST and the following status information from byte 4 of the FST is returned to the FET.

<u>Bit(s)</u>	<u>Description</u>
0	Set if the file is not busy
1	Set if the last operation was a write
2-3	If the last operation was a read:
	0 Incomplete (buffer full)
	1 EOR encountered
	2 EOF encountered
	3 EOI encountered
	If the last operation was a file positioning or write operation:
	0 Incomplete (no EOR/EOF or buffer exhausted)
	1 Complete
4-5	Not used
6	Set if the file is written on since attachment or creation
7	Set if the file is written on since last opened
8	Set if the file is opened
9-10	Not used
11	Set if labeled tape

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	STATUS	lfn, P, T †

- lfn Address of the FET
- P If P is specified, the current position is returned. If this parameter is omitted, LFM function 12 is executed.
- T † If T is specified (in addition to P) and lfn refers to a magnetic tape file, FET+8 receives information as described in FET+8 of the FET used by the LABEL macro (although the block size is returned in CM words, rather than frames). If lfn is not a magnetic tape file, the request for additional information is ignored. Refer to the LABEL macro description in this section for further details on the contents of the FET+8 fields.

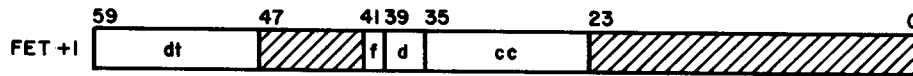
If the FET is not at least nine words in length, the following message is issued.

FET TOO SHORT.

† The T parameter is subject to change in future versions of NOS.

REQUEST (014)

The REQUEST function requests operator assignment of equipment to the file. If the file is previously assigned, the function is ignored. If dt≠0 in word 1 of the FET, the device assigned must be this type. If dt=MS, a mass storage device must be assigned. If dt=MT, the following options may be present in word 1 of the FET.



- f Format
- 0 = system
 - 1 = external BCD, line image, cc = 136D
 - 2 = external BCD, blocked, cc = 150D
- d Density
- 0 = no change
 - 1 = HI (556 bpi)
 - 2 = LO (200 bpi)
 - 3 = HY (800 bpi)
- cc Character count/record (BCD format)

These options apply only to 7-track tapes; the user should not request 9-track tape with this function. It is recommended that the programmer use the LABEL macro rather than the REQUEST macro for tape request.

The user must be validated to access the assigned equipment; if he is not, the following message is issued.

ILLEGAL USER ACCESS.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	REQUEST	lfn

lfn Address of the FET

If REQUEST is to be used for checkpoint dumps, FET+7 specifies the checkpoint mode.



cm Checkpoint† mode (left-justified); indicates that lfn is to be used as a checkpoint file:

 75_g Each time a checkpoint dump is taken, the new information is written at the BOI of lfn.

 76_g Each time a checkpoint dump is taken, the new information is written at the previous EOI of lfn.

The user can alternately write dumps on two checkpoint files by issuing two REQUESTs with cm=75_g. If cm=76_g for alternate files or if more than two checkpoint files are specified, the job is aborted and the following message is issued to the user's dayfile.

CHECKPOINT FILE ERROR.

REQUEST (015)

This function assigns a file to the specified equipment. If the file already exists, the following message is issued.

DUPLICATE FILE NAME.

The FET parameters specified for this request are the same as for function 014. The user may also specify a numeric value for the equipment ordinal. This is the EST ordinal of the device.

The job must be of system origin or the user must be validated for system origin privileges or the following message is issued.

ILLEGAL USER ACCESS.

If the user has this validation, he may use function 015 for checkpoint dumps. The checkpoint mode is specified in FET+7 in the same format as that for function 014.

† For further information, refer to the description of the CHECKPT macro, section 10.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	REQUEST	lfn, U

lfn Address of the FET
 U If U is specified, the device type in word 1 of the FET is the device to which the file is assigned. If the device type in word 1 of the FET is numeric, this is the EST ordinal to which the file is assigned. Absence of this parameter causes LFM function 014 to be issued.

For tape requests, this macro applies only to 7-track tapes; the user should not request a 9-track tape with this function. It is recommended that the programmer use the LABEL macro instead of the REQUEST macro for tape requests.

SETID (017) †

This function sets the identifier code for a file. This enables the user to direct an output file to a particular device. The output queue processors assign files to devices only if the ID codes are the same. If the file does not exist, it is created by this function. The file must be: input (INFT), print (PRFT), local (LOFT) or punch (PHFT), or the following message is issued.

ILLEGAL FILE TYPE.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	SETID	lfn, n

lfn Address of the FET
 n Identifier code; $0 \leq n \leq 67_8$

† The user should use the ROUTE macro instead of SETID (refer to section 8).

ASSIGN (020)

This function is used to access a library file. If the file is accessed from a system or library file, the return status code equals 0.

The random address of the directory is stored in word 6 of the FET.

The address bias for the directory is stored in word 7 of the FET.

This function enables the user to access user libraries that exist either on files attached to the job or the system. The local files are searched first. Because of the structure of the system file, the address bias for the directory must be specified. For example, if the directory for SYSLIB is specified at random address 2000 (FET+6) on the system file, the bias for all entries in this directory is 1777 (FET+7). This is the address to be added to the random addresses of all routines in this directory to access the routines from the system library.

If the file specified is a system procedure file, the sign bit in FET+7 is set. If the file specified is not a system file, FET+6 and FET+7 are returned as zero. If the file specified is a relocatable file, FET+6 and FET+7 are unchanged.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	ASSIGN	lfn, L

lfn Address of the FET

L If L is specified, the file is assigned from the system file. The absence of this parameter causes LFM function 001 to be issued.

ENC SF (022)

This function replaces the control statement file. If the file is not defined, the control statement file is cleared.

If the file specified is empty, the following message is issued.

FILE EMPTY.

Macro Format:†

LOCATION	OPERATION	VARIABLE SUBFIELDS
	ENCSF	addr

addr Address of the FET for the file that is to replace the current control statement file

PSCSF (023)

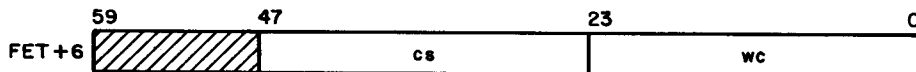
This function gives the user the ability to control the execution of the job control statements by positioning the next statement to be executed.

Macro Format:†

LOCATION	OPERATION	VARIABLE SUBFIELDS
	PSCSF	addr

addr Address of the FET for the request

Word 6 of the FET contains the parameters in the following format:



cs Statement count

wc Word count from the beginning of the file; if the word count specified exceeds the length of the file, the file is positioned at the beginning.

† This macro is not available in SYSTEXT. The user must call the common deck COMCMAC to use this macro (refer to appendix A).

LABEL (O24)

The LABEL macro assigns a file to magnetic tape and processes labeled and unlabeled tapes. LABEL uses the information in FET+8 through FET+13 to create new and access existing 7- or 9-track tape files. The FET information is defined as follows:

	59	53	47	35	29	23	0
FET +8	flags	den	cv	po	f	noise	block size
+9	volume serial number					fa	file section number
+10	file identifier (first 10 characters)						
+11	file identifier (first 7 characters)						file sequence number
+12	set identifier				gvn	generation number	
+13	expiration date				creation date		

<u>Parameter</u>	<u>Word</u>	<u>Position</u>	<u>Description</u>														
Read/write (rw)	8	59	Specifies the type of label processing to be performed. This bit is set if an OPEN/WRITE is to be performed; it is not set if an OPEN/ALTER is to be performed.														
Label (lb)	8	58	If this bit is set, the tape is labeled or is to be labeled. If the bit is not set, the tape is unlabeled.														
Nonstandard (ns)	8	57	If this bit is set, the tape has or is to have nonstandard labels. If the bit is not set and bit 58 is set, the file is or is to be an ANSI-labeled tape.														
Tracks (tr)	8	56	If this bit is set, a 9-track tape is to be used. If the bit is not set, a 7-track tape is to be used.														
Density (den)	8	53-51	Tape density: <table border="0" style="margin-left: 20px;"> <tr> <td>0</td> <td>Installation default</td> </tr> <tr> <td>1</td> <td>556 bpi (7-track)</td> </tr> <tr> <td>2</td> <td>200 bpi (7-track)</td> </tr> <tr> <td>3</td> <td>800 bpi (7-track)</td> </tr> <tr> <td></td> <td>or</td> </tr> <tr> <td></td> <td>800 cpi (9-track)</td> </tr> <tr> <td>4</td> <td>1600 cpi (9-track)</td> </tr> </table>	0	Installation default	1	556 bpi (7-track)	2	200 bpi (7-track)	3	800 bpi (7-track)		or		800 cpi (9-track)	4	1600 cpi (9-track)
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Conversion mode (cv)	8	50-48	Conversion mode for 9-track tapes: 0 Installation default 1 ASCII/USASII conversion 2 EBCDIC conversion																		
Processing option (po)	8	47-36	Processing options:†																		
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† If neither bit 36, 37, nor 38 is set, abort on read or write parity error only if the error processing bit is not set. For further information about these processing options, refer to the equipment/file assignment control statements in section 10, volume 1.

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Data format (f)	8	35-30	<p>Data format (refer to section 10, volume 1):</p> <table border="1"> <tbody> <tr><td>0</td><td>I</td></tr> <tr><td>1</td><td>SI</td></tr> <tr><td>2</td><td>X</td></tr> <tr><td>3</td><td>S</td></tr> <tr><td>4</td><td>L</td></tr> <tr><td>5</td><td>E</td></tr> <tr><td>6</td><td>B</td></tr> <tr><td>7</td><td>F</td></tr> </tbody> </table>	0	I	1	SI	2	X	3	S	4	L	5	E	6	B	7	F								
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1	SI																										
2	X																										
3	S																										
4	L																										
5	E																										
6	B																										
7	F																										
Noise	8	29-24	Noise size in frames; any block containing fewer than the specified number of frames is considered noise and is discarded by the system (refer to Data Formats in section 10, volume 1). A noise specification of zero causes the default noise size to be used.																								
Block size (PRU size)	8	23-0	Maximum block size in frames (refer to Data Formats in section 10, volume 1).																								

† For further information, refer to options 1 through 3 described in End-of-Tape/End-of-Reel Conditions, section 10, volume 1.

<u>Parameter</u>	<u>Word</u>	<u>Position</u>	<u>Description</u>
Volume serial number	9	59-24	1 to 6 display code characters that uniquely identify a reel of tape (refer to appendix G, volume 1, VOL1 label, and VSN control statement in section 10, volume 1).
File accessibility (fa)	9	23-18	1 display code character indicating who may access the tape file. †
File section number	9	14-0	15-bit binary file section number. †
File identifier	10	59-0	File identifier (first 10 display code characters, left-justified with binary zero or blank fill). †
File identifier	11	59-18	File identifier (last seven display code characters, left-justified with binary zero or blank fill). †
File sequence number	11	14-0	15-bit binary file sequence number. †
Set identifier	12	59-24	6 display code characters specifying the multifile set identifier. †
Generation version number (gvn)	12	23-15	9-bit binary generation version number. †
Generation number	12	14-0	15-bit binary generation number. †
Expiration date	13	59-30	5 display code characters specifying the expiration date. †
Creation date	13	29-0	Creation date (2-digit numeric display code value for the year followed by a 3-digit numeric display code value for the day within the year). †

The specified file is assigned to tape automatically if the volume serial number is specified either in FET+9 or via VSN control statement. If the vsn in FET+9 is zero and no VSN control statement for the file was included, the system requests the operator to assign a unit.

For ANSI-labeled tapes, FET+9 through FET+13 contain the values LABEL uses to process HDR1 labels. †

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	LABEL	addr
addr		Address of the FET

† Refer to appendix G, volume 1, HDR1 label.

If the specified file already exists, the following action is taken.

- If the file is assigned to a device other than a tape unit, no assignment is made and job processing continues. If the user wishes to assign the file to tape, he should return the existing file to the system before issuing the LABEL request.
- If the file resides on magnetic tape and FET+8, bit 59, is not set, the system verifies the HDR1 label by issuing an OPEN/ALTER request.
- If the file resides on magnetic tape and FET+8, bit 59, is set, the system checks if the volume serial number in VOL1 matches that specified by the user in FET+9 or on a VSN control statement. If the vsns do not match, the job is aborted. If the vsns match, the system writes an HDR1 label by issuing an OPEN/WRITE request.

The following error messages may be issued to the user's dayfile in response to a LABEL request.

EQUIPMENT NOT AVAILABLE.

The equipment to which the specified file was to be assigned is not available.

RESEX DETECTED ERROR.

The resource executive (RESEX) detected an error.

MT/NT CONFLICT.

The device type specified in FET+1 conflicts with the track type specified in FET+8, bit 56. A device of MT implies 7-track tape and NT implies 9-track tape. If dt=MT and bit 56 is set or if dt=NT and bit 56 is not set, this message is issued.

If the file is to be used for checkpoint dumps and the dumps are to be written on labeled tape, the checkpoint mode can be specified in FET+7, bits 59 through 56. For further information about checkpoint dumps, refer to the REQUEST macro (function 014).

GETFNT (025)

With the GETFNT macro, the user can generate a table of FNT/FST entries for his local files.

For mass storage files, bytes 2 and 3 of the FST (bits 35 through 12) can be modified with either a random index (converted from current track and sector), or the file length (number of sectors). For tape files, the FST entry can be modified with MT in byte 1 (bits 47 through 36) and the block number in bytes 2 and 3.

Macro Format:†

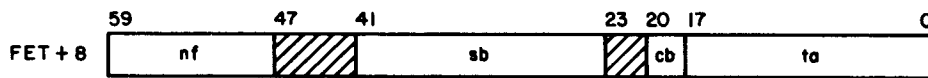
LOCATION	OPERATION	VARIABLE SUBFIELDS
	GETFNT	addr

addr

Address of the FET

†This macro is not available in SYSTEXT. The user must call common deck COMCMAC (refer to appendix A).

GETFNT obtains its input parameters from FET+8, in the following format.



nf Maximum number of 2-word FNT/FST entries to return to table. Table size must be at least $(nf*2 + 1)$. Default is 200g entries.

sb File type selection bits. A bit set implies the corresponding file type is selected for entry into the table. Bit positions and corresponding file types are as follows:

<u>Bit</u>	<u>File Type</u>	<u>Description</u>
37	LOFT	Local
36	SYFT	System
35	FAFT	Fast attach file
34	PMFT	Direct access permanent file
33	PTFT	Primary terminal
32	LIFT	Library
31	--	Reserved
30	--	Reserved
29	--	Reserved
28	TEFT	Timed/eventrollout
27	PHFT	Punch
26	PRFT	Print
25	ROFT	Rollout
24	INFT	Input
23	--	Reserved

Default (all bits set to zero) is selection of all file types.

cb Control bits:

<u>Bit</u>	<u>Significance</u>
18	If bit 18 is set, no modifications are made on the FST entries. If bit 18 is not set, pertinent modifications are made (such as the block number for tape files or that specified by bit 19 for mass storage files).
19	If bit 19 is set, mass storage file FST entries are modified with file lengths in bytes 2 and 3. If bit 19 is not set, the FST entry is modified with the random index in bytes 2 and 3. Bit 18 must be zero or bit 19 is ignored.
20	If bit 20 is not set (zero), checkpoint file FNT entries are returned in FET+9, instead of the table (FET length must be at least 13 words). If bit 20 is set, checkpoint file FNT/FST entries are returned to the table (FET length must be at least 9 words).

ta Address of table.

Upon return from GETFNT, the FET is as follows:

	59	0
FET + 8	ia	
+ 9	cfnt	
+10	cfst	
+11	acfnt	
+12	acfst	

ia ia is less than zero if an error is encountered (bit 18 of FET+8 not set)

cfnt FNT entry of the checkpoint file; cfnt is zero if there is no checkpoint file; less than zero if more than two checkpoint files encountered (bit 20 of FET+8 not set)

cfst FST entry of checkpoint file

acfnt FNT entry of the alternate checkpoint file; acfnt is zero if there is no alternate checkpoint file

acfst FST entry of the alternate checkpoint file

PRIMARY (O31)

The PRIMARY macro enables the user to create or change a primary file (refer to the Time-Sharing User's Reference Manual for a description of primary files). The current primary file (if any) is returned and the local mass storage file specified in FET+0 is made the primary file. If the specified file does not exist, an empty primary file is created.

Macro Format: †

LOCATION	OPERATION	VARIABLE SUBFIELDS
	PRIMARY	addr

addr

Address of the FET for the new primary file

† This macro is not available in SYSTEXT. The user must call common deck COMCMAC (refer to appendix A).

FILINFO (032)

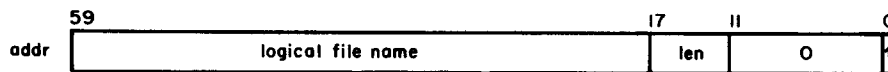
The FILINFO macro returns information about a file to a specified parameter block.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	FILINFO	addr

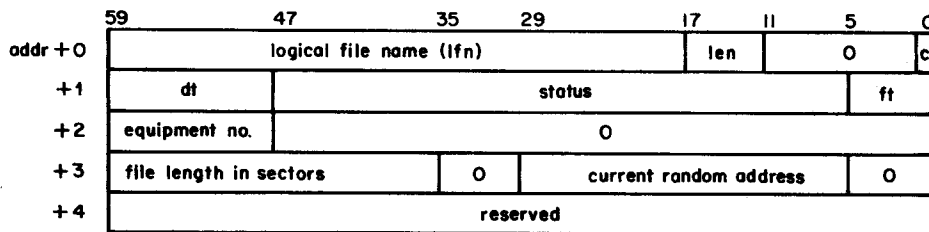
addr Address of a 5-word parameter block

Before the FILINFO macro is issued, the first word of the parameter block must contain the following.



len Length of parameter block (at least five words)

The parameter block returned has the following format.



c Completion bit (set when operation is complete)

dt The 12-bit display code of the type of device on which the file resides (refer to appendix E)

status

Status bits:

<u>Bits</u>	<u>Description</u>
47-24	Reserved
23	File at EOI
22	File at EOF
21	File at BOI
20	Labeled tape file
19	9-track tape file
18	7-track tape file
17	Reserved
16	File assigned to time-sharing terminal
15	File on mass storage
14-13	Reserved
12	File assigned in execute mode †
11	File assigned in read/append mode †
10	File assigned in read/modify mode †
9	File assigned in modify mode †
8	File assigned in append mode †
7	File assigned in write mode †
6	File assigned in read mode †

ft

File type in one of the following octal values.

<u>File Type</u>	<u>Value</u>
Local	0
Input	1
Print	2
Punch	3
Direct access	4
(Reserved)	5
Primary	6
Library	7
Others	77

File position is returned for mass storage files only. EOF status is returned if the last operation was a read, and EOF was encountered.

† Refer to Permission Modes, File Categories in section 5.

For mass storage files, bits 6 through 12 of the status field are set, depending upon the file permission mode in the file name table. For other files, only the write lockout bit in the file status table is checked. If the write lockout bit is set, read-only permission is assumed. If the write lockout bit is not set, read and write permission is set. Bits 8 through 12 apply only to mass storage files. If the following permission mode is set in the FNT, the indicated bits are set in the status field.

<u>FNT Mode</u>	<u>Status Bits Set</u>
Read	6, 12
Write	6, 7, 8, 9, 12
Append	6, 8, 12
Modify	6, 8, 9, 12
Read/modify	6, 8, 10, 12
Read/append	6, 11, 12
Execute	12

For example, if read mode is set in the FNT, the user can read (bit 6 set) or execute (bit 12 set) the file.

Word 4 (addr+4) of the parameter block is currently not used; however, it is reserved for future expansion of the FILINFO macro.

If the specified file is not local to the user's job, the following message is issued.

FILE NOT FOUND.

If any of the parameter block is beyond the user's field length, the following message is issued.

ADDRESS OUT OF RANGE.

If the length specified for the parameter block is not at least five words, the following message is issued.

FET TOO SHORT.

If this function is issued as an RA+1 request without using the FILINFO macro, the completion bit must not be set to 0. If it is, the following message is issued.

PARAMETER BLOCK BUSY.

If the file is busy (cannot be interlocked), the following message is issued.

FILE BUSY.

PERMANENT FILE MANAGER

5

Permanent file manager (PFM) processes all permanent file requests. The user can issue requests to PFM and have control returned if certain error conditions occur. To do this, the error processing bit (ep) must be specified in word 1 of the FET. The following error codes are returned in the error code field (bits 17 through 10) in word 0 of the FET.

<u>Error Codes</u>	<u>Description</u>
1	The specified direct access file is attached in the opposite mode.
2	One of the following: <ul style="list-style-type: none">• The specified permanent file could not be found.• The specified user number could not be found.• The user is not allowed to access the specified file.• The user issued an indirect access file command on a direct access file.• The user issued a direct access file command on an indirect access file. <p>If this error occurs in response to the SAVE macro, the specified local file is not attached to the control point, is a direct access file, or is an execute-only file.</p>
3	The file specified on a SAVE macro contains no data.
4	The file to be saved is not on mass storage; the first track of the file is not recognizable.
5	The user has already saved or defined a file with the name specified.
6	The user attempted to define a file that is not a local file.
7	File name contains illegal characters.
10	The user is not validated to create direct access or indirect access files or to access auxiliary devices.
11	The device type (r parameter in macro calls) specified on a request for an auxiliary device cannot be recognized or does not exist in the system. If the auxiliary device specified by the pn parameter is not the same type as the system default, the r parameter must be included; if not, this error code is returned.

Error CodesDescription

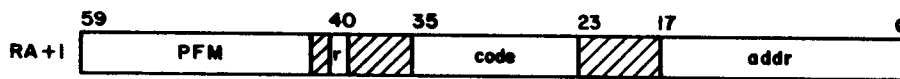
12	The local file specified for a SAVE, REPLACE, or APPEND command or macro exceeds the length allowed, or the direct access file specified for an ATTACH in WRITE, MODIFY, or APPEND mode exceeds the direct access file length limit for which the user is validated.
13	One of the following: <ul style="list-style-type: none">● Illegal function code passed to PFM● Illegal permit mode or catalog type specified● CATLIST request has permit specified without a file name● PERMIT attempted on a library file
14	Access to the permanent file device requested is not possible.
15	The device on which the file resides may not contain direct access files because: <ol style="list-style-type: none">1. The device is not specified as a direct access device in the catalog descriptor table.2. The device is not specified as ON and initialized in the catalog descriptor table.3. The device is a dedicated indirect access permanent file device.
16	Because a permanent file utility is currently active, the operation is not attempted; the user should retry the operation.
17	An error occurred in a read operation during a file transfer.
20	The number of files in the user's catalog exceeds the limit (refer to LIMITS control statement, volume 1, section 6).
21	The cumulative size of the indirect access files in the user's catalog exceeds the limit (refer to LIMITS control statement, volume 1, section 6).
22	The number of PRUs specified via the s parameter on the DEFINE macro is not available.
23	A request is attempted on a local file that is currently active. This error can occur, for example, if the user creates two FETs for the same file and issues a second request before the first is complete.
24	The job's local file limit has been exceeded by an attempt to GET or ATTACH the file.
25	The job's mass storage PRU limit is exceeded during preparation of a local copy of an indirect access file.

Error Codes

Description

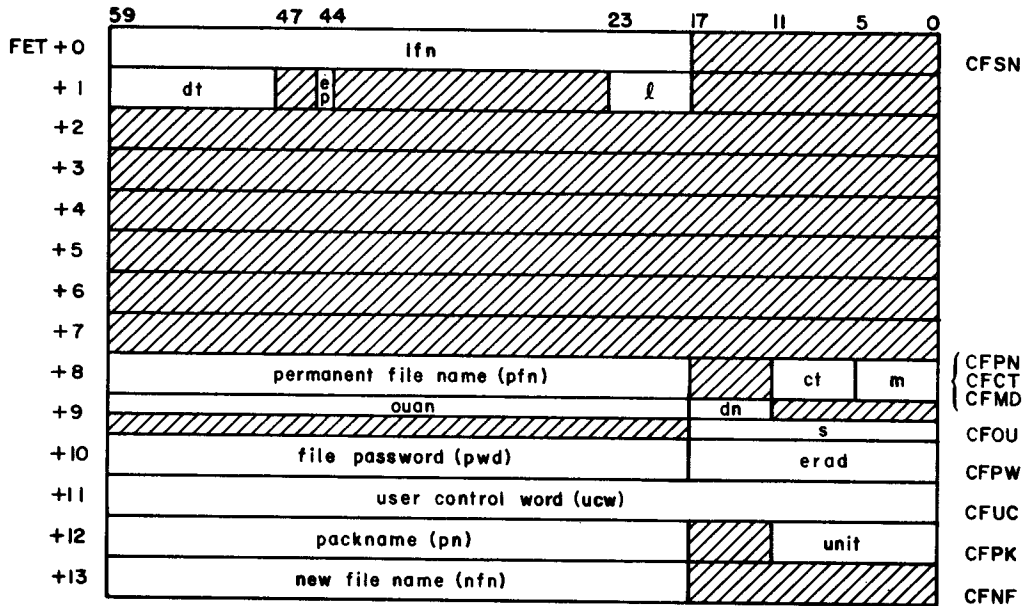
26	Permit limit is exceeded for a private file.								
30	The resource executive detected a fatal error.								
31	No allocatable tracks remain on equipment xx, where xx is the EST ordinal.								
32	The length of a file does not equal the catalog length; the action taken depends on the type of request issued. <table><thead><tr><th><u>Request</u></th><th><u>Action</u></th></tr></thead><tbody><tr><td>GET</td><td>A local file is created with length being the actual length retrieved.</td></tr><tr><td>SAVE</td><td>If file length is longer than TRT specification, file is truncated.</td></tr><tr><td>REPLACE</td><td>Same as for SAVE.</td></tr></tbody></table>	<u>Request</u>	<u>Action</u>	GET	A local file is created with length being the actual length retrieved.	SAVE	If file length is longer than TRT specification, file is truncated.	REPLACE	Same as for SAVE.
<u>Request</u>	<u>Action</u>								
GET	A local file is created with length being the actual length retrieved.								
SAVE	If file length is longer than TRT specification, file is truncated.								
REPLACE	Same as for SAVE.								
33	PERMIT random address error.								
34	The system sector data for the file does not match the catalog data.								
35	The same file is found twice during a catalog search. This error can occur for APPEND or REPLACE requests after a file is found and purged and the catalog search is continued.								
36	Error flag detected at PFM control point.								
37	An error is encountered in reading a portion of the permanent file catalog or permit information.								

The format of an RA+1 call to PFM is as follows.



r Auto recall bit (must be set)
code Function code
addr Address of the FET

The FET used by all PFM requests is of the following form. For a more detailed description, refer to the discussion of the FET in section 3.



- lfn Local file name
- dt Device type
- ep Error processing bit (bit 44)
- l FET length minus 5
- pfn Permanent file name
- ct File category (refer to Permission Modes, File Categories)
- m File access mode (refer to Permission Modes, File Categories)
- ouan Option user number
- dn Device number for CATLIST option
- s Number of PRUs (octal) desired for the file
- pwd Optional file password
- erad Error message return address
- ucw User control word
- pn Pack name of auxiliary device
- unit Number of units of multiunit device
- nfn New file name

After a request to PFM is complete, the first word of the FET contains the following information.



- lfn local file name
- ec error code
- c Bit 0 is set to 1 upon completion of the request

The FET length may be five words, if no special options are required, or up to 14 words, depending on the special options required.

When a PFM macro request is issued, the parameter values specified are placed in their corresponding fields in the FET.

If the permanent file name is not specified in a macro, word 8 of the FET contains the permanent file name. If X1 is specified, X1 contains the permanent file name left-justified and zero-filled. If word 8 does not contain a file name, the contents of word 0 is used as the permanent file name.

If the optional user number is not specified in a macro, word 9 of the FET contains the name of the alternate catalog. If X3 is specified, X3 contains the user number left-justified and zero-filled.

If the file password is not specified in a macro, word 10 of the FET contains the file password. If X2 is specified, X2 contains the file password left-justified and zero-filled.

If the user control word is not specified in a macro, word 11 of the FET contains the user control information. Bit 59 must be set if word 11 of the FET contains data for PFM to process.

If the pack name is not specified in a macro, word 12 of the FET contains the pack name.

If the new file name is not specified in the CHANGE macro, word 13 of the FET contains the new file name.

The address of the FET must be supplied in the addr parameter. The call to PFM must be made with the auto recall bit set. If the user wishes to process PFM errors, the error processing bit in the FET must be set. The error codes are returned in the abnormal termination field of the FET (word 0, bits 17 through 10). If the user specifies erad, the error message is returned at this address instead of being issued to the user's dayfile. A maximum of three central memory words are returned. System errors (error codes 30 through 37) are still issued to the system and error log dayfiles, however, even if erad is specified.

The common decks required for an absolute assembly of a program containing PFM requests are COMCPFM and COMCSYS.

PERMISSION MODES, FILE CATEGORIES

Several methods are available to the user to specify the m and/or ct parameters when they are used in PFM macros. The user can either specify a 1- or 2-character key or an address that contains an integer value that corresponds to a 1- or 2-character key. If an address is specified, the value must be right-justified and zero-filled in a 60-bit word. The values can be established with the mnemonics in the following list. The user must call common deck COMSPFM to use these mnemonics (relocatable or absolute assembly). The valid mnemonics, keys, and values for the m and ct macro parameters are listed.

<u>Parameter</u>	<u>Mnemonic</u>	<u>Key</u>	<u>Value</u>	<u>Description</u>
m				File or user permission mode:
	PTWR	W	0	Allows the user to write, read, append, execute, modify, and/or purge the file. This mode can be specified for direct or indirect access files.
	PTRD	R	1	Allows the user to read and/or execute the file. This mode can be used for direct or indirect access files.
	PTAP	A	2	Allows the user to append information to the end (EOI) of the file. This mode can be specified for direct or indirect access files.
	PTEX	E	3	Allows the user to execute the file. This mode can be specified for direct or indirect access files.
	PTNU	N	4	Removes permission previously granted via PERMIT macros. This mode can be specified for direct or indirect access files.
	PTMD	M	5	Allows the user to modify, append, read, and/or execute a direct access file. Adding new information within the existing boundaries of the file is legal, but the file size must be maintained.

<u>Parameter</u>	<u>Mnemonic</u>	<u>Key</u>	<u>Value</u>	<u>Description</u>
	PTRM	RM	6	Allows the user to read and/or execute a direct access file with the implication that another user may currently be accessing the same file in M (modify) mode. This mode can be specified only for direct access files.
	PTRA	RA	7	Allows the user to read and/or execute a direct access file with the implication that another user may currently be accessing the same file in A (append) mode. This mode can be specified only for direct access files.
ct				File category:
	FCPR	P	0	Private. Private files are available for access only by the originator or those to whom the originator has explicitly granted permission (refer to the PERMIT macro).
	FCSP	S	1	Semiprivate. Semiprivate files are available for access by all users who know the file name, user number, and password. The system records in the originator's catalog the user number of each user who accessed the file, the number of accesses, and the data and time of the last access.
	FCPB	PU	2	Public. Public files are available for access by all users who know the file name, user number, and password. The system records the number of times the file was accessed but does not record user numbers or the last access date and time.

System tags are also available in COMSPFM for the PFM functions and the FET parameter words. The function mnemonics are specified in the macro descriptions. The FET parameter words are shown in the PFM file environment table diagram.

AUXILIARY DEVICE REQUEST

Unless the user explicitly declares otherwise, all permanent files reside on family devices. As stated in section 2, volume 1, the user may wish to supplement the mass storage provided by his family devices by retaining his files on auxiliary devices. There are four parameters (pn, r, un, and pwd) that uniquely identify file lfn on an auxiliary device.

- The pn parameter specifies the 1- to 7-character system-defined pack name of the auxiliary device. The device can be either public or private, as defined by the installation.
- The r parameter specifies the type of auxiliary device on which the file resides or is to reside. An auxiliary device is any supported device which an installation defines as auxiliary; it need not be physically removable as the pack name implies.

If the device is physically removable, its device type is one of the following.

<u>r</u>	<u>Device</u>
DI _n	844-21 Disk Storage Subsystem (1 < n ≤ 8)
DJ _n	844-41/44 Disk Storage Subsystem (1 < n ≤ 8)
MD _n	841 Multiple Disk Drive (1 ≤ n ≤ 8)

If the user needs two or more physically removable auxiliary devices at any one time during his job, he must include a RESOURC control statement (refer to section 6, volume 1). An installation can provide additional continuous storage on a DI, DJ, or MD type device by combining from two to eight physical units into one logical unit. A device so defined is known as a multiunit device. To specify such a device, the r parameter must include the number of units. For example, if four 844-21 units have been combined as one multiunit device, the r parameter must be DI4. If it is not, the job is aborted and PFM error message 11 is issued to the user's dayfile.

ILLEGAL DEVICE REQUEST, AT nnn.

However, if r is DI, DJ, or MD but n is omitted, the unit count is assumed to be 1.

The r parameter is required only if the desired device has a device type different from that of the available device, and the installation has defined the desired device as removable. However, if the user always specifies the r parameter, he can be sure that he is accessing the proper device. If r is specified and it conflicts with that of the available device, PFM error message 11 is issued. For all PFM macros, if pn is specified but the device is not available, the job is aborted. By setting the error processing bit (FET+1, bit 44), the user can bypass the abort and direct the system to make available the device with packname pn and device type r.

- The un parameter specifies the 1- to 7-character optional user number. If the device is public, files are accessed in the same manner as specified for family devices. That is, the un parameter must be included only if the user wishes to access files which another user has explicitly or implicitly permitted him to use. If the device is private, there is only one owner. All other users who have the proper validation can access files on the device, but the system prevents them from creating files.
- The pwd parameter specifies the 1- to 7-character password associated with the file. As with files on family devices, the pwd parameter must be included only if the originator requires that a password be specified.

SAVE (001, CCSV)

The SAVE macro enables the user to retain a copy of a local file in the permanent file system as an indirect access file. The original file is rewound when completed.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	SAVE	lfn, pfn, pwd, ucw, ct, m, pn, r, fo

lfn Address of the FET; the local file name must be set in word 0 of the FET.

pfn Address containing the name of the file; name the file is given in the permanent file catalog.

pwd Address containing the password to be placed with the file in the permanent file catalog.

ucw Address containing user control word to be placed with the file in the permanent file catalog. Bit 59 of FET+11 must be set if this information is to be retained. If this word exists in the catalog, it is returned to FET+11 when the file is accessed (default=0).

ct File category:
 P Private file (default value)
 S Semiprivate file
 PU Public file
 If a value other than those listed is supplied, PFM assumes it is the address of the location containing the file category, right-justified, in bits 2 through 0; P is 0, S is 1, and PU is 2 (refer to Permission Modes, File Categories in this section).

m File mode. This mode defines the type of access alternate users may have for semiprivate or public files.
 W Read, write, purge, and execute (default value)
 R Read and execute
 A Append
 E Execute
 N None
 If a value other than those listed is supplied, PFM assumes it is the address of the location containing the permission mode, right-justified, in bits 3 through 0; W is 0, R is 1, A is 2, E is 3, and N is 4 (refer to Permission Modes, File Categories in this section).

pn Address containing 1- to 7-character pack name of the auxiliary device on which the file is to be saved.

r Type of auxiliary device on which the file is to be saved (refer to the DEFINE macro).

fo Family option:
 IP The pack name specified by a PACKNAM macro or pn parameter is ignored. PFM accesses the user's family.

DF The pack name specified by a PACKNAM macro or pn parameter and the family name specified on the USER statement are ignored. PFM accesses the system default family. This option can be used only by programs that have an SSJ= entry point.

An example of the use of the SAVE macro is:

```

          SAVE          FILE, PF, . . . PU, R
          .
          .
FILE     FILEB         BUF, BUFL, (FET=9)
PF       VFD           24/0LDATA, 36/0

```

This sequence of code saves local file FILE in the permanent file system as a public file named DATA with read permission. The same results could be accomplished by the following.

```

          SA1          PF
          SAVE          FILE, X1, . . . FCAT, MDE
          .
          .
FCAT     CON           FCPB
MDE     CON           PTRD
FILE     FILEB         BUF, BUFL, (FET=9)
          .
          .

```

GET (002, CCGT)

The GET macro enables the user to generate a working copy of an indirect access permanent file. If a local file by the same name already exists, it is returned as if the RETURN macro had been issued even if the GET is unsuccessful. The new file is set to rewind status. No interlock is provided to prevent other users from obtaining working copies of the same file simultaneously.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	GET	lfn, pfn, un, pwd, pn, r, fo

lfn Address of the FET; the local file name must be set in word 0 of the FET.

pfn Address containing the name of the file; name the file is given in the permanent file catalog.

un Address containing the number of the alternate user whose catalog is to be searched for the file specified; if this parameter is specified, the permission mode is that which the user has been permitted for private files or that specified in the catalog for semiprivate and public files.

pwd Address containing the password of the file; required if un ≠ 0 and the file requires a password.

pn Address containing 1- to 7-character pack name of the auxiliary device from which the file is to be retrieved.

r Type of auxiliary device on which the indirect access permanent file resides (refer to the DEFINE macro).

fo Family option:

IP The pack name specified by a PACKNAM macro or pn parameter is ignored. PFM accesses the user's family.

DF The pack name specified by a PACKNAM macro or pn parameter and the family name specified on the USER statement are ignored. PFM accesses the system default family. This option can be used only by programs that have an SSJ= entry point.

PURGE (003, CCPG)

The PURGE macro enables the user to remove the specified file from the permanent file system. To purge a file in an alternate user's catalog, the user must have write permission to the file or the file must be a semiprivate or public file with write mode.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	PURGE	lfn, un, pwd, pn, r, fo

lfn Address of the FET; the local file name must be set in word 0 of the FET.

un Address containing the user number of the alternate catalog for the file to be purged.

pwd Address containing the password of the file; required if un ≠ 0 and the file requires a password.

pn Address containing 1- to 7-character pack name of the auxiliary device on which the file resides.

r Type of auxiliary device identified by the pn parameter (refer to the DEFINE macro).

fo Family option:

 IP The pack name specified by a PACKNAM macro or pn parameter is ignored. PFM accesses the user's family.

 DF The pack name specified by a PACKNAM macro or pn parameter and the family name specified on the USER statement are ignored. PFM accesses the system default family. This option can be used only by programs that have an SSJ= entry point.

An example of the use of this macro is:

```

PURGE            F
.
.
.
F            FILEB            BUF, BUFL

```

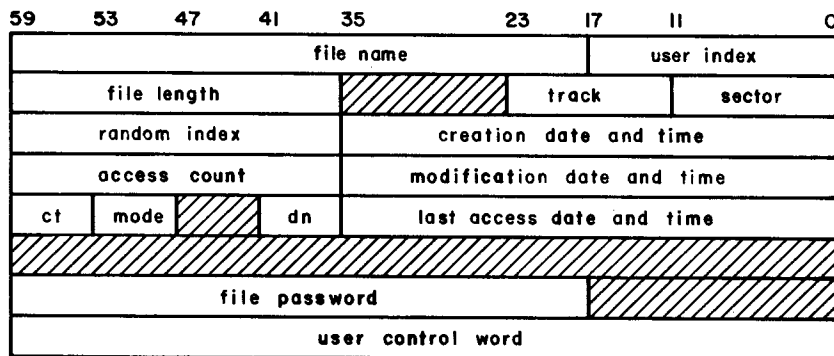
These instructions purge permanent file F.

CATLIST (004, CCCT)

The CATLIST macro enables the user to:

- Determine the contents of his permanent file catalog.
- Determine which files in the specified alternate catalog he is allowed to access.
- Determine the alternate user information for any files that an alternate user can access or has accessed in his catalog (permit data).

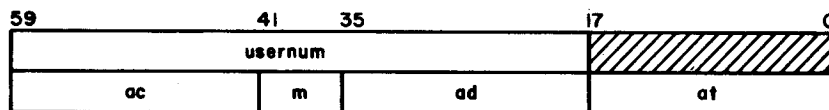
For the first type of request, the entire catalog entry is returned to the user. The format of the catalog entry is illustrated.



file name	Permanent file name
user index	User index of file creator
file length	Length in PRUs of the file
track	Beginning track of file
sector	Beginning sector of file (4xxx for a direct access file)
random index	Random disk address of permit sector
access count	Count of accesses to file
ct	File category (private, semiprivate, or public); refer to Permission Modes, File Categories in this section
mode	Mode of access for semiprivate and public files <ul style="list-style-type: none"> 0 Write, read, execute, append, modify, and/or purge 1 Read and/or execute 2 Append 3 Execute 4 Negate previous permission 5 Modify 6 Read and/or execute, allow modify 7 Read and/or execute, allow append Refer to Permission Modes, File Categories in this section.
dn	Device number (0 through 778); each device within a family of permanent file devices is identified by a device number
password	Optional password
user control word	User control information (FET+11)

For the second type of request, the entire catalog except the user index and the password is returned to the user. The user obtains the file names of all semiprivate and public files and all private files he is permitted to use.

For the third type of request, the alternate user access information for file pfn is returned in the following format.



- usernum Alternate user number
- ac Number of accesses the alternate user has made to the file
- m Permission mode (bit 40 set if this was an accounting permit and was not created by a PERMIT control statement or macro; bit 40 clear indicates an explicit permit set by PERMIT statement or macro; bits 39 through 36 are same as mode described in first type of request)

- ad The last date the user accessed the file
- at The time of day the user last accessed the file

Common deck COMSPFM is required for relocatable and absolute assemblies of this macro.

Macro Format:†

LOCATION	OPERATION	VARIABLE SUBFIELDS
	CATLIST	lfn, pfn, un, m, pn, r, fo, sr

- lfn Address of the FET for the CATLIST function
- pfn Address containing the file name; if this parameter is omitted, CATLIST information for all files is returned
- un Address containing the name of the alternate user catalog to be searched for the catalog information
- m If m is specified, access information (permit data) for user un on file pfn is returned. The pfn is required if this parameter is specified. If un is not specified, all permit data for pfn is returned.
- pn Address containing 1- to 7-character pack name of the auxiliary device that contains catalog information for all users with information on that device
- r Type of auxiliary device identified by the pn parameter (refer to the DEFINE macro)
- fo Family option:
 - IP The pack name specified by a PACKNAM macro or pn parameter is ignored. PFM accesses the user's family.
 - DF The pack name specified by a PACKNAM macro or pn parameter and the family name specified on the USER statement are ignored. PFM accesses the system default family. This option can be used only by programs that have an SSJ= entry point.
- sr Request CATLIST of files on device number dn (FET+9, bits 17 through 12).

This macro is available in common deck COMCMAC (refer to appendix A).

If the status returned in FET+0 (lfn parameter of the CATLIST macro), bits 9 through 0, is 0033 (EOF encountered), the user should reissue the CATLIST macro after the buffer of entries has been processed (refer to example 1). The user should continue this until a status of 1033 (EOI encountered) is returned. CATLIST uses the current random index field (FET+6, bits 59 through 30) to keep track of its position for continued calls. If the user changes this field, the results of a CATLIST request may be undefined.

Information is placed in the buffer starting at IN until IN = LIMIT minus 1, at which time buffer full (0033) status is set in FET+0. PFM does not process the buffer circularly; therefore the user must reset IN=OUT=FIRST before reissuing the CATLIST macro.

Example 1: The following program creates a binary file named F with CATLIST information for all files in the user's catalog. The information can be examined using the TDUMP control statement.

```

CAT
      IDENT  CAT
      ENTRY  START
      SYSCOM B1

***      COMMON DECKS REQUIRED.
*CALL    COMSPFM
*CALL    COMCMAC

F        FILEB  BUFF,101B
G        FILEB  BUFG,101B,FET=10D

START    SB1    1
          MX0    50D

STA1     CATLIST G
          SA1    G          DETERMINE ERROR CODE
          BX1    -X0*X1     (X1)=ERROR CODE
          SX1    X1-1033B
          ZR     X1,STA2    IF EOI (CATLIST COMPLETE)
          READW  G,WBUF,100B
          WRITEW F,WBUF,100B
          SA1    G+B1       RESET FET POINTERS
          SX7    X1
          SA7    A1+B1      SET IN=FIRST
          SA7    A7+B1      SET OUT=FIRST
          EQ     STA1

STA2     SA1    G+2         (X1)=IN
          SA2    A1+B1      (X2)=OUT
          IX5    X1-X2      (X5)=WORDS IN CATALOG ENTRY
          READW  G,WBUF,X5
          WRITEW F,WBUF,X5
          WRITER F
          ENDRUN

BUFF     BSS    101B
BUFG     BSS    101B
WBUF     BSS    100B

          END    START

```


Example 2:

```

CATLIST      F, PF, AUN, M
.
F           FILEB      BUF, BUFL, (FET=10D)
PF          VFD        42/OLDATA013, 18/0
AUN         VFD        42/OLUSERABC, 18/0

```

This returns all access information about the USERABC for file DATA013.

Example 3:

```

CATLIST      F,, AUN
.
F           FILEB      BUF, BUFL, (FET=10D)
AUN         VFD        42/OLUSERABC, 18/0

```

This returns a list of all files that the user can access in the catalog of user USERABC.

PERMIT (005, CCPM)

The PERMIT macro enables a user to explicitly permit another user to access a private file in his permanent file catalog. If the user wishes to remove permission previously granted, the negate mode should be selected.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	PERMIT	lfn, pfn, un, m, pn, r, fo

lfn Address of the FET; the local file name must be set in word 0 of the FET.

pfn Address containing the name of the file; name of the file is given in the permanent file catalog.

- un** Address containing the name of the user to whom permission is being granted.
- m** Mode of permission being granted; if no mode is specified, W (write) is assumed. Refer to Permission Modes, File Categories in this section.
- pn** Address containing 1- to 7-character pack name of the auxiliary device on which the specified file resides.
- r** Type of auxiliary device identified by the pn parameter (refer to the DEFINE macro).
- fo** Family option:
 - IP** The pack name specified by a PACKNAM macro or pn parameter is ignored. PFM accesses the user's family.
 - DF** The pack name specified by a PACKNAM macro or pn parameter and the family name specified on the USER statement are ignored. PFM accesses the system default family. This option can be used only by programs that have an SSJ= entry point.

An example of the use of this macro is:

```

      PERMIT      F, PF, AUN, 2
      .
      .
      .
      F          FILEB      BUF, BUFL, (FET=10D)
      PF         VFD        42/0LDATA012, 18/0
      AUN        VFD        42/0LUSERABC, 18/0
  
```

This allows user USERABC to have append permission to file DATA012.

REPLACE (006, CCRP)

The REPLACE macro enables the user to place a copy of the specified local file in the permanent file system as an indirect access file. If the specified permanent file name already exists in the catalog, that file is purged and the new file placed in the catalog as the same type of file. If the file does not exist in the catalog, the new file is placed in the catalog as a private file. Permission information and alternate user access data are not lost when the file is replaced.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	REPLACE	lfn, pfn, un, pwd, ucw, pn, r, fo

lfn Address of the FET; local file name must be set in word 0 of the FET.

pfn Address containing the name of the permanent file to be replaced in the permanent file catalog.

un Address containing the name of the alternate user's catalog where the file resides.

pwd Address containing the password of the file being replaced (required if un \neq 0); if no previous file existed, the password is saved with the file.

ucw Address containing user control word to place with the file; bit 59 of word 11 of the FET must be set to retain the word with the file in the catalog.

pn Address containing 1- to 7-character pack name of the auxiliary device on which the file is to be placed.

r Type of auxiliary device identified by the pn parameter (refer to the DEFINE macro).

fo Family option:

 IF The pack name specified by a PACKNAM macro or pn parameter is ignored. PFM accesses the user's family.

 DF The pack name specified by a PACKNAM macro or pn parameter and the family name specified on the USER statement are ignored. PFM accesses the system default family. This option can be used only by programs that have an SSJ= entry point.

APPEND (007, CCAP)

The APPEND macro enables a user to write the contents of the specified working files at the end of the specified indirect access permanent file. The logical structure of the two files is retained; that is, EORs and EOFs are appended as well as data. If the working file is appended to a file in an alternate user's catalog, a password must be supplied if one is required.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	APPEND	lfn, pfn, un, pwd, pn, r, fo

lfn Address of the FET; name of the local file to be appended must be set in word 0 of the FET.

pfn Address containing the name of the permanent file to which information is to be appended.

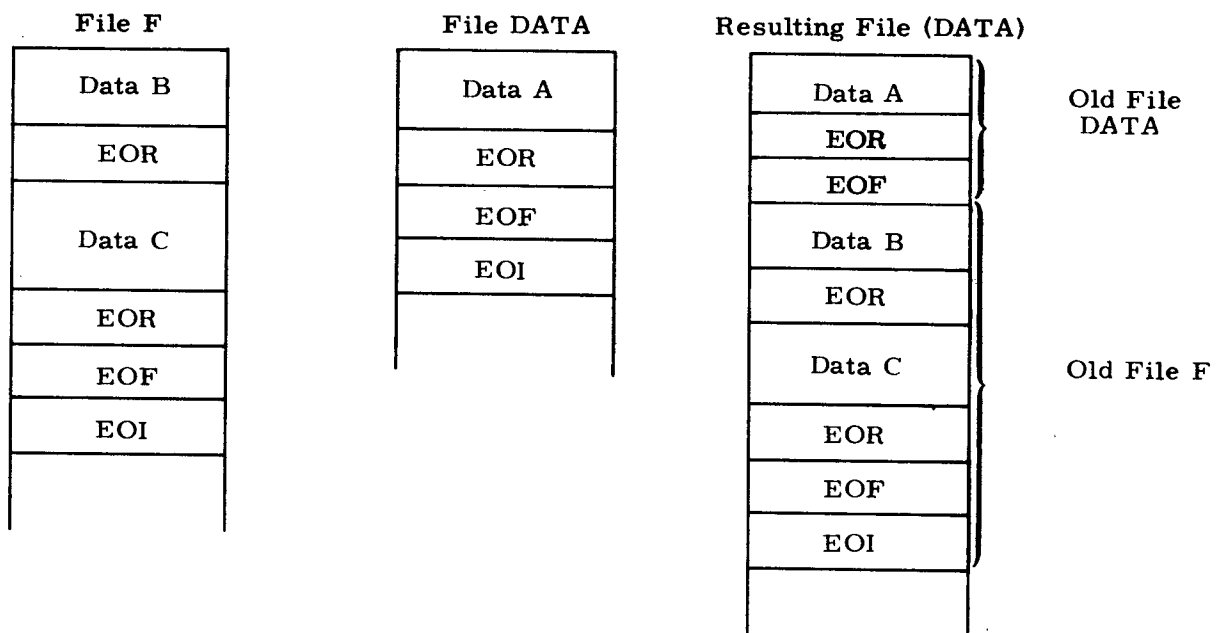
un Address containing the name of the alternate user whose catalog contains the permanent file .
pwd Address containing the password of the file to which information is to be appended. This must be specified if un ≠ 0 and the file requires a password.
pn Address containing 1- to 7-character pack name of the auxiliary device on which the specified permanent file resides.
r Type of auxiliary device identified by the pn parameter.
fo Family option:
 IP The pack name specified by a PACKNAM macro or pn parameter is ignored. PFM accesses the user's family.
 DF The pack name specified by a PACKNAM macro or pn parameter and the family name specified on the USER statement are ignored. PFM accesses the system default family. This option can be used only by programs that have an SSJ= entry point.

An example of the use of this macro is:

```

      APPEND      F
      .
      .
      .
F     FILEB      BUF,BUFL,(PFN=DATA)†
      .
      .
  
```

The following diagram illustrates the structure of file DATA after the APPEND macro is issued.



† The permanent file name can be set by FET creation macros as well as being set in the permanent file macros.

DEFINE (010, CCDF)

The DEFINE macro enables the user to specify a file as a direct access permanent file. The file specified must be a local file that resides on a permanent file device. If the file does not exist, a zero-length file is created either on the master device (refer to Permanent File Devices, section 2, volume 1, for a description of the master device), another device if the master device cannot be used, or that device specified by the r and/or pn parameters.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	DEFINE	lfn, pfn, pwd, ucw, r, ct, m, pn, s, fo

lfn Address of the FET. Word 0 of the FET must contain the name of the file to be made a direct access file; name used when the job accesses the file.

pfn Address containing the name of the permanent file entered in the catalog. If pfn=0, pfn=contents of word 0 of the FET.

pwd If pwd is specified, the password is retained with the file; all alternate users must supply this password when attaching file.

ucw Address containing user control information, bit 59 of word 11 of the FET must be set to retain this data. If this parameter is supplied, it is returned in word 11 of the FET when the file is attached.

Specifies the type of family or auxiliary device on which the permanent file resides or is to reside; r can be any of the following.

<u>r</u>	<u>Display Code</u>	<u>Device</u>
DE	0405	Extended Core Storage
DIn	0411	844-21 Disk Storage Subsystem (1≤n≤8)
DJn	0412	844-41/44 Disk Storage Subsystem (1≤n≤8)
DP	0420	Distributive Data Path to ECS
MDn	1504	841-n Multiple Disk Drive (1≤n≤8)

If r is not one of these values, the value specified represents the address that contains the display code equivalent, left-justified. If the device is a multiunit type device (DIn, DJn or MDn), n is the number of physical units which the installation has combined into one logical unit; n is converted from display code to octal and placed in FET+12, bits 11 through 0. Also, if r is DI, DJ, or MD but n is omitted, the unit count is assumed to be 1. If r is not specified, the system default device type is used.

ct File category; ct can be one of the following.

P Private file (default value)

S Semiprivate file

PU Public file (ct=L can also be used)

If a value other than those listed is supplied, PFM assumes it is the address of the location containing the file category, right-justified in bits 2 through 0; P is 0, S is 1, and PU is 2. Refer to Permission Modes, File Categories in this section.

m Access mode; this mode defines the type of access alternate users may have for semiprivate and public files.

W Write, read, append, execute, modify, and/or purge (default value)

R Read and/or execute

A Append

E Execute

N None

M Modify, append, read, and/or execute

RM Read and/or execute, allow modifications

RA Read and/or execute, allow extensions

If a value other than those listed is supplied, PFM assumes it is the address of the location containing the permission mode, right-justified in bits 3 through 0. Refer to Permission Modes, File Categories in this section.

pn Address containing the 1- to 7-character pack name of the auxiliary device on which the direct access file is to reside.

s Address containing the number of PRUs desired for the direct access file. The number of PRUs is in octal, right-justified. DEFINE places this value in FET+9, bits 23 through 0 (CFOU).

fo Family option:

IP The pack name specified by a PACKNAM macro or pn parameter is ignored. PFM accesses the user's family.

DF The pack name specified by a PACKNAM macro or pn parameter and the family name specified on the USER statement are ignored. PFM accesses the system default family. This option can be used only by programs that have an SSJ= entry point.

If lfn does not exist at the time the DEFINE request is issued, the device on which pfn resides depends on the r and s parameters.

<u>r</u>	<u>s</u>	<u>Residency</u>
Specified	Not specified	The file resides on the device of type r with the most space available.
Specified	Specified	The file resides on the device of type r with the most space available, provided that device has as many PRUs available as specified by the s parameter.
Not specified	Specified	The file resides on the device with the most space available, provided that device has as many PRUs available as specified by the s parameter.
Not specified	Not specified	The file resides on the device with the most space available.

An example of the use of the DEFINE macro is:

```

DEFINE    F,PF,,,DI,PU,R
      .
      .
F    FILEB    BUF,BUFL,(FET=9)
PF   VFD     24/OLDATA, 36/0

```

This defines file F to reside on the 844 Disk Storage Subsystem as a read-only public file. The name of the entry in the permanent file catalog is DATA. (It is assumed that the file did not exist before the DEFINE request was issued.)

The same operation could be accomplished by the following sequence of instruction.

```

      SA1      PF
      DEFINE   F,X1,,,RES,FCAT,R
      .
      .
F    FILEB    BUF,BUFL,(FET=9)
PF   VFD     24/OLDATA, 36/0
RES  VFD     12/OLDI, 48/0
FCAT CON     FCPU

```

ATTACH (011, CCAT)

The ATTACH macro enables the user to attach the specified direct access file to his control point.

A read/write interlock is provided to ensure that only one user at a time accesses the file in write mode. Several users may access the file in read mode simultaneously. The user should return the file as soon as possible to enable other users to access the file. If the working file name specified is attached to the job, it is returned as if a RETURN macro were issued.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	ATTACH	lfn, pfn, un, pwd, m, pn, r, fq, fa

lfn Address of the FET. Word 0 of the FET must contain the temporary name of the file while attached to the job.

pfn Address containing the name of the file in the permanent file catalog. If pfn=0, pfn=contents of word 0 of the FET.

un Address containing name of the alternate user catalog on which the file resides.

pwd Address containing file password; entered only if un≠0 and the file requires a password.

m Mode of access desired:

- W Write, read, append, execute, modify, and/or purge; the last modification date is updated whenever a file is attached in W mode even if the file is not altered during attachment (default).
- R Read and/or execute
- A Append
- E Execute
- N None
- M Modify, append, read, and/or execute
- RM Read and/or execute, allow modifications
- RA Read and/or execute, allow extensions

If a value other than those listed is supplied, PFM assumes it is the address of the location containing the permission mode right-justified, in bits 3 through 0. Refer to Permission Modes, File Categories in this section.

pn Address containing 1- to 7-character pack name of the auxiliary device on which the specified permanent file resides (refer to the DEFINE macro).

r Type of auxiliary device identified by the pn parameter (refer to the DEFINE macro).

- fo** **Family option:**
- IP** The pack name specified by a PACKNAM macro or pn parameter is ignored. PFM accesses the user's family.
 - DF** The pack name specified by a PACKNAM macro or pn parameter and the family name specified on the USER statement are ignored. PFM accesses the system default family. This option can be used only by programs that have an SSJ= entry point.
- fa** If this parameter is specified (any value may be used), the file being attached must be a fast attach permanent file.

If the user issues an ATTACH macro and the file is busy, the system aborts the request. The user can bypass the abort by specifying error processing (FET+1, bit 44). If ep is set and the file is busy, the system returns control to the user. He may then suspend his job by issuing the ROLLOUT macro. Normally, when a user issues a ROLLOUT macro to roll out his job subject to time/event dependencies, he must include an address specifying the time period and/or event. However, whenever file busy status is returned, PFM sets up a time/event entry for the user, specifying a default rollout time period of 360g seconds.

Refer to the ATTACH control statement for a description of the resulting current access modes when the user attempts to attach an active file.

CHANGE (012, CCCG)

The CHANGE macro allows the originator of a direct or indirect access file to alter any of several parameters without having to attach and redefine the file or retrieve and save it. The pwd, ct, and m parameters should be specified only if a change in the value associated with that parameter is desired. The pn and r parameters cannot be used to specify a new auxiliary device. They are used only to specify the auxiliary device on which ofn resides.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	CHANGE	lfn, ofn, nfn, pwd, ucw, ct, m, pn, r, fo

- lfn** Address of the FET; the local file name must be set in word 0 of the FET.
- ofn** Address containing the old permanent file name. If ofn is not specified, the contents of FET+0 is used instead.
- nfn** Address containing the new permanent file name. If nfn is not specified, no name change takes place.

pwd Address containing new password; replaces the old password or adds a new password if there was none before. If the user does not wish to change the current password, **pwd** should be set to 42/7777777777777777B,18/0.

ucw Address containing user control information; bit 59 of FET+11 must be set if this information is to be retained.

ct New file category. If this value is set in the FET, it must be entered in the format 4x where x is the new category. Refer to Permission Modes, File Categories in this section.

m New file mode. If this value is set in the FET, it must be entered in the format 4y where y is the new mode. Refer to Permission Modes, File Categories in this section.

pn Address containing the 1- to 7-character pack name of the auxiliary device on which the file resides.

r Address containing the type of auxiliary device identified by the **pn** parameter (refer to the DEFINE macro).

fo Family option:

- IP** The pack name specified by a PACKNAM macro or **pn** parameter is ignored. PFM accesses the user's family.
- DF** The pack name specified by a PACKNAM macro or **pn** parameter and the family name specified on the USER statement are ignored. PFM accesses the system default family. This option can be used only by programs that have an SSJ= entry point.

An example of the use of the CHANGE macro is:

```

CHANGE      F,PF,NF,,,,R,PKN
.
.
F      FILEB      BUF,BUFL,(FET=13)
PF     VFD        42/OLDATA,18/0
NF     VFD        42/OLFILE,18/0
PKN    VFD        42/OLPACK1,18/0
  
```

This changes file DATA on auxiliary device PACK1 to FILE with read-only access.

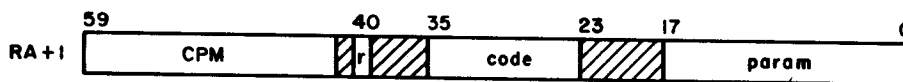
Control point manager (CPM) enables the user to alter or interrogate parameters in the job control point area which control his job in the system. All CPM functions must be issued with auto recall specified. If it is not, the following message is issued.

CPM ILLEGAL REQUEST.

All errors encountered by CPM cause the job to be aborted; no user error processing is available. Unless otherwise noted, the following message is issued upon job termination.

CPM ARG. ERROR.

The format of the call to CPM is:



- r Auto recall bit
- code CPM function code
- param Parameter for the function

Common decks required for absolute assemblies by the functions processed by CPM are COMCCPM and COMCSYS. For relocatable assemblies, these decks are satisfied by default from the library SYSLIB.

SETQP (000)

The SETQP macro allows the user to alter the queue priority of his job to the parameter specified. The queue priority controls the scheduling of the job to and from the rollout queue. Lowering the queue priority may cause the job to be rolled out more often.

Macro Format: †

LOCATION	OPERATION	VARIABLE SUBFIELDS
	SETQP	n

n Queue priority; $100_8 \leq n \leq$ current priority; ($100_8 \leq n \leq 7761_8$ for a system origin job). If n is greater than 7761, the priority is set to 7761. If n=0 is specified, the queue priority is set to the rollout upper bound for the current job origin.

† This macro is not available in SYSTEXT. The user must call the common deck COMCMAC (refer to appendix A).

SETPR (001)

The SETPR macro allows the user to alter the CPU priority of his job. The CPU priority controls the assignment of the CPU to active jobs. If the CPU priority is lower than that of other jobs, the job is assigned to the CPU only when jobs of a higher priority do not need it. The user is validated for a maximum CPU priority. If he requests a value that exceeds this value or 70_8 (the maximum CPU priority), the maximum for which he is validated is used.

Macro Format: †

LOCATION	OPERATION	VARIABLE SUBFIELDS
	SETPR	n

n CPU priority; ($1 \leq n \leq 70_8$); if n exceeds that for which the user is validated, it is reduced to that value.

MODE (002)

The MODE macro allows the user to set the exit mode flags for CPU execution of his job (refer to figure 2-E-2). Refer to the applicable hardware reference manual for a description of all bits indicated. Section 5, volume 1, contains a summary of these descriptions.

Macro Format: †

LOCATION	OPERATION	VARIABLE SUBFIELDS
	MODE	m, n

m CPU program error exit mode ($0 \leq m \leq 7$).

n CPU hardware error exit mode ($0 \leq n \leq 7$).
If n is not specified, the system assumes $n=7$.† †

SETASL (003)

The SETASL macro allows the user to specify the account block SRU limit for a job. The account block limit is the maximum number of SRUs that can be accumulated by a job. If this limit is reached, the following message is issued.

ACCOUNT BLOCK LIMIT.

Each user and each charge/project number is validated for a maximum SRU limit. If the limit is exceeded, the message

SL NOT VALIDATED.

is issued.

† This macro is not available in SYSTEXT. The user must call the common deck COMCCMD or COMCMAC (refer to appendix A).

† † Applicable to CDC CYBER 170 Series only.

If $1 \leq s \leq 77777_8$ is not satisfied, the following message is issued.

ILLEGAL USER ACCESS.

A value of $s = 77777_8$ specifies an infinite account block SRU limit.

For the time-sharing user, this function defines the number of SRUs allowed for a job before entry of another CHARGE statement is required. For batch or time-sharing jobs, s represents the maximum SRU accumulation between two CHARGE statements, or between one CHARGE statement and the end of the job. The user may not set the account block limit to a value less than the current job step limit. If this is attempted, the following message is issued.

JOB STEP EXCEEDS ACCOUNT BLOCK:

Macro Format: †

LOCATION	OPERATION	VARIABLE SUBFIELDS
	SETASL	s

s Account block SRU limit

SETJSL (003)

The SETJSL macro allows the user to specify the job step SRU limit for each step of a job, including the current job step. The job step limit is the maximum number of SRUs that can be accumulated by a single job step. If this limit is reached, the following message is issued.

JOB STEP LIMIT.

The job step limit cannot exceed the account block limit (refer to SETASL macro). If this is attempted, the job step is aborted and the following message is issued.

JOB STEP EXCEEDS ACCOUNT BLOCK.

If $1 \leq s \leq 77777_8$ is not satisfied, the following message is issued.

ILLEGAL USER ACCESS.

A value of $s = 77777_8$ specifies an infinite job step SRU limit.

† This macro is not available in SYSTEXT. The user must call common deck COMCCMD (refer to appendix A).

Macro Format: †

LOCATION	OPERATION	VARIABLE SUBFIELDS
	SETJSL	s

s Job step SRU limit

SETTL (003)

The SETTL macro changes the user's CPU job step time limit for each job step, including the current job step. The CPU job step time limit is the amount of time (in seconds) that a job step is allowed to use the CPU. If this limit is reached, the following message is issued.

TIME LIMIT.

The user is validated for a maximum time limit (refer to the LIMITS control statement, section 6, volume 1). If the maximum is exceeded, the following message is issued.

TL NOT VALIDATED.

If $1 \leq t \leq 777778$ is not satisfied, the following message is issued.

ILLEGAL USER ACCESS.

A value of $t = 777778$ specifies an infinite job step time limit.

Macro Format: †

LOCATION	OPERATION	VARIABLE SUBFIELDS
	SETTL	t

t Job step time limit ($1 \leq t \leq 777778$); t is accurate to the nearest second.

† This macro is not available in SYSTEXT. The user must call common deck COMCCMD (refer to appendix A).

EREXIT (004)

NOS allows a user program to continue execution after an error occurs (except where prohibited), if the error return address is specified in the job control point area. When an error occurs, the system clears the error exit address and restarts the job at the CPU address specified. The contents of RA returned when an error is encountered is:

59	53	47	29	23	11	5	0
0	mo	aaaaaa	ef	0	ssw	0	0

mo Mode of CPU error exit
 aaaaaa CPU address of the job when the error occurred
 ef Error flag:

<u>Error Flag</u>	<u>Mnemonic</u>	<u>Description</u>
1	TLET	Time limit. Job is allowed an additional 1 to 10 seconds of CPU time for error exit processing.
2	ARET	Arithmetic error. mo is the mode of the error. Refer to section 3, volume 1, for a description of modes.
3	PPET	PPU abort. A PPU program requested that the job be aborted (CIO, PFM, etc.).
4	CPET	CPU abort. The job issued an ABT request (error exit processing does not occur for this error).
5	PCET	PP call error. The job called a nonexistent or illegal system request.
6	ODET	The operator dropped the job.
7	PSET	A program stop was encountered by the CPU.
10B	FLET	File limit. More active files were assigned to the job than are allowed by the validation parameter.

<u>Error Flag</u>	<u>Mnemonic</u>	<u>Description</u>
11B	TKET	Track limit. The job requested mass storage space on a device with none available.
12B	SYET	System abort.
13B	FSET	Forced error.
14B	PEET	CPU or CM parity error. †
15B	ORET	Override of error condition.
16B	SSET	Subsystem abort.
17B	SRET	SRU limit. Job is allowed an additional 10 SRUs to complete error exit processing.
20B	RRET	Job rerun.
21B	OKET	Operator killed job.

SSW Status of sense switches

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	EREXIT	addr

addr Address for error exit return

As an example, the common procedure is for the program's preset routines to set the error exit processing.

```

Routine to complete processing when an error is encountered {
  ERR                      SA1              BO              READ ERROR RETURN INFO
  .
  .
  .
  ENDRUN                      TERMINATE PROGRAM
  PRS                      SUBR                      PROGRAM PRESET ROUTINE
  EREXIT                      ERR                      SET ERROR EXIT ADDRESS
  .
  .
  EQ                      PRSX
  .
  .
  END

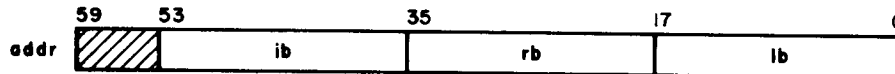
```

† Applicable to CDC CYBER 170 Series only.

CONSOLE (005)

NOS provides a method of user/operator communication through the K and L console displays. With these displays, a job can place information on the console screen and receive information from the console keyboard.

The address specified points to the request word which is formatted as follows:



- ib Keyboard buffer address. This specifies the area where data entered by the operator is placed by the system. The data is terminated by a zero word and is always entered starting at ib. A maximum of 40 characters is transferred to this buffer.
- rb Address of the specially formatted buffer to be displayed on the right screen of the console when the K or L display is assigned to the job.
- lb Address of the specially formatted buffer to be displayed on the left screen of the console when the K or L display is assigned to the job.

Examples of the use of this macro can be found in the program STAGE.

Macro Format:†

LOCATION	OPERATION	VARIABLE SUBFIELDS
	CONSOLE	addr

addr Address of the console parameter word

ROLLOUT (006)

The ROLLOUT macro enables a user to place his job in the rollout queue until a specified event occurs or for a fixed period of time. This function may be useful if a program requires a direct access permanent file that is currently busy.

† This macro is not available in SYSTEXT. The user must call the common deck COMCMAC (refer to appendix A).

Macro Format:†

LOCATION	OPERATION	VARIABLE SUBFIELDS
	ROLLOUT	addr

addr Address containing the time and/or event dependencies; if addr is not specified, the job is rolled out without time or event dependencies.

The format of addr is:



evd Event descriptor. System programs use the EESET macro†† to make entries in a system event table indicating the occurrence of an event. The job scheduler compares the specified descriptor, evd, with events recorded in the table. If a match is detected, the scheduler initiates rollin.

evd≠0 evd and rtp are placed in the control point area (TERW). When the job rolls out, the scheduler waits for the occurrence of evd or for the time period, rtp, to elapse before initiating rollin. Because the job may roll in for two different reasons, it is the user's responsibility to verify whether the specified event actually occurred.

evd=0 The job scheduler checks rtp in RA+addr and evd in the control point area. This option allows the user to roll out while waiting for a system-specified event.

evd=7700xx₈ Specifies extended time rollout with no event dependency. The job rolls out for 7777*xx+rtp₈ seconds.

rtp Rollout time period in job scheduler delay intervals (assume 1-second intervals) where

0 ≤ rtp ≤ 7777₈
rtp=0

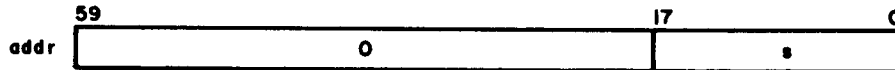
The job rolls out for a time determined by the system to ensure that the job will be rolled in even if the specified event is not detected or never occurs.

† This macro is not available in SYSTEXT. The user must call the common deck COMCMAC (refer to appendix A).

†† Use the DOCUMENT control statement to obtain internal documentation of the EESET macro and the ROLLOUT macro for a description of valid event descriptors.

GETASL (007)

The GETASL macro returns the account block SRU limit for the job (refer to SETASL macro) to the specified address.



s Account block SRU limit

Macro Format: †

LOCATION	OPERATION	VARIABLE SUBFIELDS
	GETASL	addr

addr Address to receive account block SRU limit

GETJSL (007)

The GETJSL macro returns the job step SRU limit for the current job step (refer to SETJSL macro) to the specified address.



s Job step SRU limit

Macro Format: †

LOCATION	OPERATION	VARIABLE SUBFIELDS
	GETJSL	addr

addr Address to receive job step SRU limit

† This macro is not available in SYSTEXT. The user must call common deck COMCMAC (refer to appendix A).

SETSSM (010)

The SETSSM macro enables the user to set or clear the secure system memory (SSM) flag. Setting this flag prevents the dumping of any portion of the job field length. This flag is automatically set for programs containing an SSJ= or SSM= entry point (refer to appendix F). If a request is made to clear SSM status by an SSM= program, the job step is aborted and the following message is issued.

CPM ILLEGAL REQUEST.

NOTE

While the SSM flag is set, no programs with a DMP= special entry point (refer to appendix F) can be called to the control point (refer to Security Considerations, section 2) unless the calling program contains an SSJ= entry point.

Macro Format:†

LOCATION	OPERATION	VARIABLE SUBFIELDS
	SETSSM	p

p Clear SSM flag if p = 0; set SSM flag if p ≠ 0

† This macro is not available in SYSTEXT. The user must call common deck COMCMAC (refer to appendix A).

ONSW (011)

The ONSW macro enables the user to set the sense switches for his program (refer to figure 2-E-1). This allows the user to set switches for options for subsequent tasks in the job.

The sense switches reside both in the user's control point area and in bits 11 through 6 of RA+0 of the job field length. These two fields are maintained separately. The only transfer of information occurs at the start of each job step and when an error flag is detected. At these times the control point area field is copied into RA+0. The field in RA+0 is used when the user reads sense switch settings. An ONSW (or OFFSW) request updates both fields separately.

The bit position specifies the switch to be set.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	ONSW	n

n Switches to be set; $0 \leq n < 778$; bit 0 corresponds to switch 1, bit 1 corresponds to switch 2, etc. If a bit is set, the corresponding switch is set; for example, ONSW 52g sets switches 2, 4, and 6. If $n=778$, all switches are set. If $n=0$, all switches remain unchanged.

OFFSW (012)

The OFFSW macro enables the user to clear the sense switches in RA. Refer to the description of the ONSW macro for a discussion of sense switch settings.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	OFFSW	n

n Switches to be cleared; $0 \leq n < 778$; bit 0 corresponds to switch 1, bit 1 corresponds to switch 2, etc. If a bit is set, the corresponding switch is cleared; for example, OFFSW 52g clears sense switches 2, 4, and 6. If $n=778$, all switches are cleared. If $n=0$, all switches remain unchanged.

GETJN (013)

The GETJN function allows the user to determine the job name of the job. For the format of the job name, refer to section 3, volume 1.

Macro Format:†

LOCATION	OPERATION	VARIABLE SUBFIELDS
	SETUI	ui

ui User index; $0 \leq ui < 377777_8$

SETLC (022)

The SETLC macro enables the user to set the loader control word for subsequent loader requests. The format of the loader control word is:



v Map validation bit. If bit is not set, default map option is used.

mc Map control bits (octal):

- 00 No map is produced
- 01 Statistics and errors
- 02 Block assignments
- 03 Partial map providing statistics, errors, and block assignments
- 04 Entry points
- 14 External references and entry points
- 17 Full map providing information given individually by control bits 01, 02, 03, and 14

n Prevent field length reduction after relocatable load.

g Global library set indicators.

The global library set indicators, contained in the loader control word (location LB1W in the user's control point area), are maintained by the SETLC macro. The user should call the GETLC macro before using the SETLC macro to avoid destroying the library set information. With the GETLC macro, the user can obtain the current loader control word and include bits 23 through 0 in the control word used by SETLC.

Macro Format†

LOCATION	OPERATION	VARIABLE SUBFIELDS
	SETLC	addr

addr Address of the loader control word to be set

† This macro is not available in SYSTEXT. The user must call the common deck COMCMAC (refer to appendix A).

SETRFL (023)

The SETRFL macro sets the initial field length for a job step. This value is used unless the system encounters one of the following.

- A routine with an RFL= or MFL= special entry point (refer to appendix F).
- A routine that specifies the amount of field length required in a 54 loader table.
- An MFL or RFL control statement (refer to section 6, volume 1) or a subsequent SETRFL macro.

If the user does not issue the SETRFL function or the RFL control statement, the operating system determines how much field length to assign initially for each job step. If the user attempts to set the field length above that for which he is validated, the following message is issued.

CM NOT VALIDATED.

The field length is rounded upward to a multiple of 100₈ words.

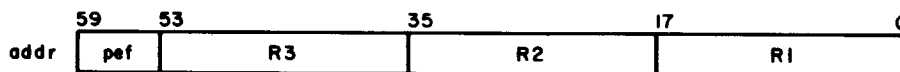
Macro Format: †

LOCATION	OPERATION	VARIABLE SUBFIELDS
	SETRFL	n

n New field length restoration parameter

GETJCR (024)

The GETJCR macro enables the user to interrogate the job control registers associated with his job (refer to the description of the system control language, section 4, volume 1). The last error flag encountered can also be determined. Information is returned in the following format.



pef The last error flag encountered (refer to the EREXIT function for the values)

R1 Job control register 1

R2 Job control register 2

R3 Job control register 3

† This macro is not available in SYSTEXT. The user must call the common deck COMCCMD (refer to appendix A).

Macro Format:†

LOCATION	OPERATION	VARIABLE SUBFIELDS
	GETJCR	addr

addr Address for return of the job control registers

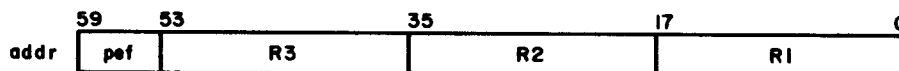
SETJCR (025)

The SETJCR macro enables the user to set the job control registers for the job. Refer to the description of the GETJCR macro for the format of the word.

Macro Format:†

LOCATION	OPERATION	VARIABLE SUBFIELDS
	SETJCR	addr

addr Address of the word containing the job control registers to be set



pef Previous error flag
 R1 Job control register 1
 R2 Job control register 2
 R3 Job control register 3

SETSS (026)

The SETSS macro enables the user to specify the subsystem under which he is currently executing, provided he is validated for that subsystem. If he is not, then the operation is aborted and the user is issued the following error message.

ILLEGAL USER ACCESS.

†This macro is not available in SYSTEXT. The user must call common deck COMCMAC (refer to appendix A).

Macro Format:†

LOCATION	OPERATION	VARIABLE SUBFIELDS
	SETSS	SS

SS Subsystem ordinal (refer to the TSTATUS macro, section 12, for a description of subsystem ordinals)

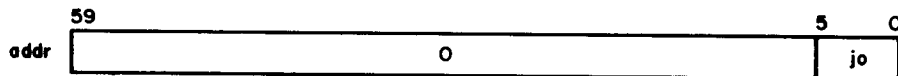
GETJO (027)

This function reads the job origin code from the user's control point area and returns the code right-justified at the address specified by the user.

Macro Format:†

LOCATION	OPERATION	VARIABLE SUBFIELDS
	GETJO	addr

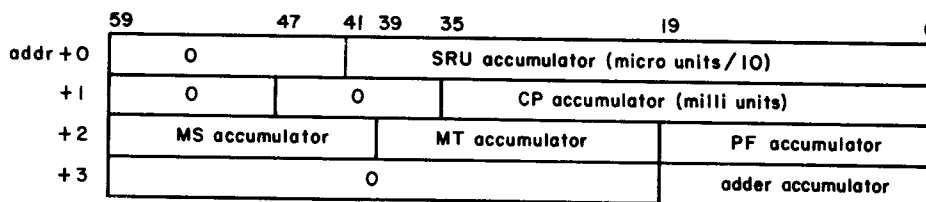
addr Address to return job origin code. Refer to appendix E for legal job origin codes.



jo Job origin code

GETJA (030)

This function transfers the job accounting information to the address specified by the user. The data is returned in the following form.



† This macro is not available in SYSTEXT. The user must call the common deck COMCMAC (refer to appendix A).

Macro Format:†

LOCATION	OPERATION	VARIABLE SUBFIELDS
	GETJA	addr

addr Address to receive job accounting data

USECPU (031)

The USECPU macro specifies which central processor is to be used when more than one is available.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	USECPU	n

n=0 Either central processor can be used
n=1 CPU 0 is to be used (the CPU with functional units on a
6700 or CDC CYBER 74-2x)
n=2 CPU 1 is to be used (the CPU without functional units on a
6700 or CDC CYBER 74-2x)

USERNUM (032)

The USERNUM macro returns the user number the job is running under to the specified address.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	USERNUM	addr

addr Address to receive the user number, left-justified and
zero-filled

† This macro is not available in SYSTEXT. The user must call the common deck COMCMAC (refer to appendix A).

GETFLC (033)

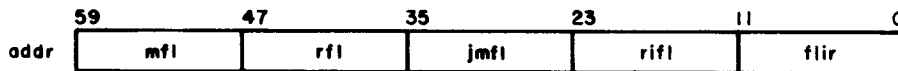
The GETFLC macro returns the field length control word from the user's control point area to the specified address.

Macro Format: †

LOCATION	OPERATION	VARIABLE SUBFIELDS
	GETFLC	addr

addr Address to receive the field length control word

The field length control word is returned in the following format.



- mfl Maximum field length for the current job step. This value may be reset with the MFL control statement (refer to section 6, volume 1).
- rfl Initial running field length for a job step. This value is always less than or equal to mfl and is set with the RFL control statement or SETRFL macro. A value of 0 indicates that the system controls the field length.
- jmfl Maximum field length for the entire job. The jmfl represents the upper bound on mfl.
- rifl Field length for the job when it is to be rolled in.
- flir Field length increase requested.

PACKNAM (035)

The PACKNAM 035 request places the specified pack name in the user's control point area. It allows the user to omit the pn parameter from PFM requests for files residing on the auxiliary device. However, if permanent files on another auxiliary device are to be accessed, the pn parameter can be specified in the request or another PACKNAM macro can be issued.

† This macro is available only in COMCMAC (refer to appendix A).

Macro Format: †

LOCATION	OPERATION	VARIABLE SUBFIELDS
	PACKNAM	addr

addr Address containing the pack name of the auxiliary device to be accessed in subsequent PFM requests; if the pack name is set to zero, the current default pack name in the control point area is cleared. The user can then access permanent files residing on the normal system.

PACKNAM (036)

The PACKNAM 036 request obtains the default pack name from the control point area and returns it to the specified address.

Macro Format: †

LOCATION	OPERATION	VARIABLE SUBFIELDS
	PACKNAM	addr, N

addr Address to which the pack name is to be returned
N Indicates that the pack name is to be returned

GETSS (037)

With this macro a user can determine the current subsystem. The subsystem ordinal is returned to an address specified by the user.

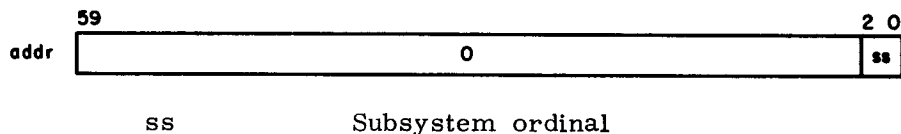
Macro Format: †

LOCATION	OPERATION	VARIABLE SUBFIELDS
	GETSS	addr

addr Address to receive subsystem ordinal (refer to TSTATUS macro, section 12, for a description of subsystem ordinals)

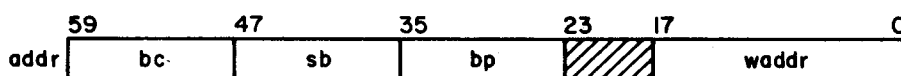
† This macro is not available in SYSTEXT. The user must call common deck COMCCMD or COMCMAC (refer to appendix A).

The subsystem ordinal is returned in the following format.



VERSION (044)

The VERSION macro returns the version name of the operating system from central memory to a location specified by the user. Location addr contains parameters specifying the disposition of the version name.



bc Number of bytes to return (1 to 10 from 2-word entry)

sb Byte in source field (CM location containing version name) to begin transfer at (0 to 9); the sum of bc and sb must be less than 11

bp Byte position within receiving field (waddr) to begin transfer at (0 to 4)

waddr Address of first word to receive data

Macro Format: †

LOCATION	OPERATION	VARIABLE SUBFIELDS
	VERSION	addr

addr Address of word containing macro parameters

GETLC (045)

The GETLC macro enables the user to determine the loader control word. Refer to the SETLC macro for the format of the loader control word.

Macro Format: †

LOCATION	OPERATION	VARIABLE SUBFIELDS
	GETLC	addr

addr Address to receive the loader control word

† This macro is not available in SYSTEXT. The user must call the common deck COMCCMD or COMCMAC (refer to appendix A).

GETGLS (046)

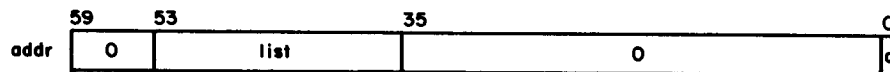
The GETGLS macro returns the global library set from the user's control point area. Refer to the CDC CYBER Loader Reference Manual for a discussion of global library sets. A parameter word is used to specify where a list of logical file names is to be placed.

Macro Format:†

LOCATION	OPERATION	VARIABLE SUBFIELDS
	GETGLS	addr

addr Address of parameter word

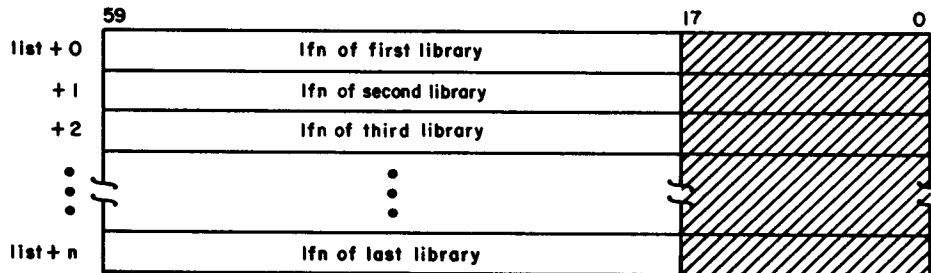
Parameter word format:



list Beginning address to which the logical file names (left-justified) contained in the global library set are written. The value of this parameter is updated to the address of the last library (list+n) upon completion.

c Completion bit.

Upon return from the GETGLS macro, locations list through list+n are updated as follows:



n The number of libraries minus one defined in the global library set

†This macro is not available in SYSTEXT. The user must call common deck COMCMAC (refer to appendix A).

SETGLS (047)

The SETGLS macro enables the user to define the global library set indicators in the user's control point area. Refer to the CDC CYBER Loader Reference Manual for a discussion of global library sets. A parameter word specifies where the list of logical file names used to define the global library set is located.

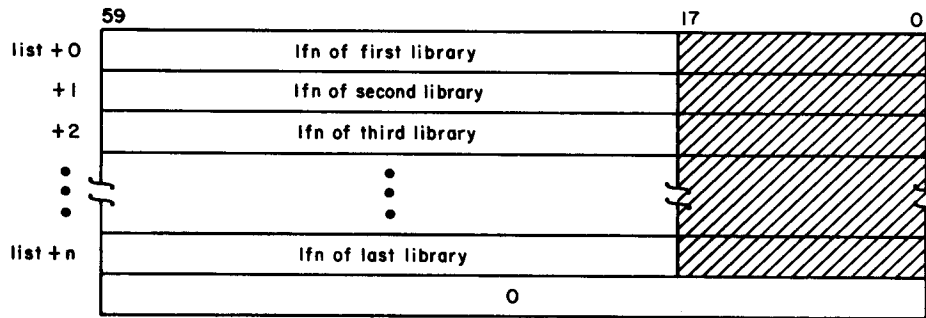
Macro Format:†

LOCATION	OPERATION	VARIABLE SUBFIELDS
	SETGLS	addr

addr Address of parameter word

Refer to the GETGLS macro for the format of the parameter word.

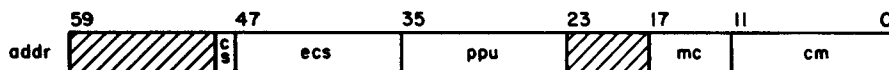
Before calling the SETGLS macro, locations list through list+n+1 must be as follows:



n The number of libraries minus one in the global library set

†This macro is not available in SYSTEXT. The user must call common deck COMCMAC (refer to appendix A).

The machine characteristics are returned in the following format.



cs If bit 48 is set, system is operating in 64 character set,
 and 63 character set if bit 48 is clear

ecs Extended core storage (ECS) size/1000

ppu Number of PPUs in system

mc Machine characteristics

<u>Bit No.</u>	<u>Description</u>
17	Unused
16	Set if machine is CDC CYBER 170
15	Set if compare move unit (CMU) option is present
14	Set if CEJ/MEJ option is present
13	Set if CPU0 has instruction stack
12	Set if CPU1 is present

cm Central memory size/100

SETMFL (052)

The SETMFL macro enables the user to change the job maximum field length boundary (refer to GETFLC and SETRFL macros for discussion of maximum field length limit).

Macro Format: †

LOCATION	OPERATION	VARIABLE SUBFIELDS
	SETMFL	n, m

n New maximum central memory field length limit for entire job

m New maximum ECS FL/1000g limit for job † †

† This macro is not available in SYSTEXT. The user must call common deck COMCCMD (refer to appendix A).

† † Currently not supported.

GETPFP (057)

The GETPFP macro enables the user to read his permanent file parameters (current family name, pack name, user number, and user index).

Macro Format: †

LOCATION	OPERATION	VARIABLE SUBFIELDS
	GETPFP	addr

addr Address to receive 3-word table containing permanent file parameters

The current permanent file parameters are returned in the following format.

	59	17	0
addr +0	family name		0
+1	pack name		0
+2	user number		user index

† This macro is not available in SYSTEXT. The user must call common deck COMCMAC (refer to appendix A).

GETLOF (061)

The GETLOF macro returns the address of the list of files from the user's control point area to the specified address. The address of the list of files is set in the control point area with the SETLOF macro.

Macro Format: †

LOCATION	OPERATION	VARIABLE SUBFIELDS
	GETLOF	addr

addr Address to receive the list of files pointer

Upon return from the GETLOF macro, location addr has the following format.



pointer Address of list of files table established with the SETLOF macro

c Completion bit

If the system returns 0 in the pointer field, no list of files address has been previously set (refer to description of SETLOF macro).

† This macro is not available in SYSTEXT. The user must call common deck COMCCMD (refer to appendix A).

SETLOF (062)

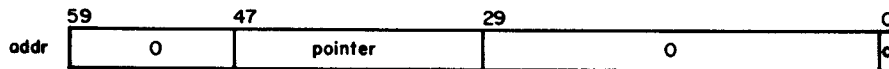
The SETLOF macro enables the user to specify a pointer to a list of files whose circular buffers will be flushed at job step abort or for terminal files, when the job is rolled out.

Macro Format:†

LOCATION	OPERATION	VARIABLE SUBFIELDS
	SETLOF	addr

addr Address containing the pointer to the list of files table

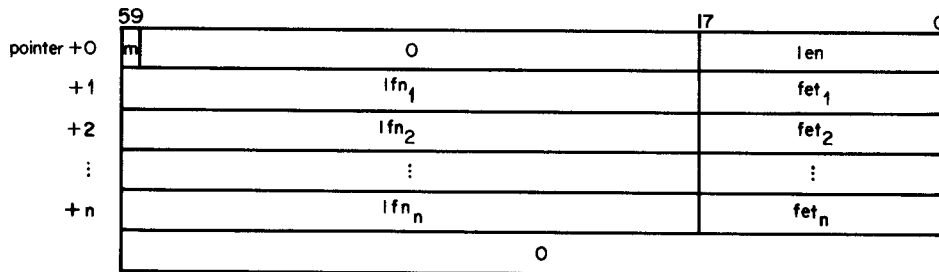
The format of location addr before issuing the SETLOF macro must be as follows:



pointer Address of list of files table

c Completion bit

The list of files table has the following format.



m Common memory manager (CMM) block indicator; setting this bit indicates that the file list is CMM controlled

len Length of the list of files table

lfn_i File name

fet_i FET address

† This macro is not available in SYSTEXT. The user must call common deck COMCCMD (refer to appendix A).

The length of the list of files list must be less than the length of the FNT. If the list length exceeds the length of the FNT, the following warning message is issued when the system processes the list.

LIST OF FILES LENGTH TOO LONG.

When used with a time-sharing job step, the first file in the list must be the terminal output file.

During job step completion and after an error condition has occurred, the system uses the list of files to determine which files to complete for the user. If the file name is OUTPUT or the FET has the flush bit set and the flushing criteria are met (refer to the description of the flush bit, FET Description in section 3), the data in the circular buffer is written to the specified file.

Queue file manager (QFM) performs functions associated with queue and dayfile protection. The majority of the QFM functions are for special system jobs (require SSJ= entry points; refer to appendix F). Thus, only those functions available to the typical user are discussed in this section. These include user requests to:

- Allow a job to be rerun or not rerun in the event of a system failure
- Release a file from a job to either the remote or local batch input queues
- Assign a file to a queue device

The following QFM functions require SSJ= entry points.

<u>Function Code</u>	<u>Description</u>
001	Attach preserved file
002	Detach preserved file
003	Purge preserved file
004	Set IQFT file (preserved queue file)
005	Initialize IQFT file
006	Requeue FNT/FST list
007	Release FNT/FST list
010	Dequeue FNT/FST list
011	Attach queued file
012	Read system sector
013	Attach inactive queued file
014	Requeue inactive queued file

To obtain documentation of these functions, enter the following control statements, after accessing the system OPL.

```
MODIFY(Z)/*EDIT,QFM
DOCUMENT.
```

Enter the following control statement to obtain an entire listing of QFM.

```
MODIFY(Q,CL,Z)/*EDIT,QFM
```

Input/output queue protection identifies all I/O queue files and system dayfiles (system, account, and error log) as preserved files and retains them during system deadstart. Because queue protection can be inhibited at deadstart time, the user should contact installation personnel to determine if it is in effect.

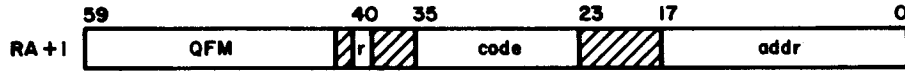
All requests to QFM must be made with the auto recall bit set; if it is not, the job is aborted and the following message is issued.

```
QFM ILLEGAL REQUEST.
```

If the parameter addresses are not within the user's field length, the job is aborted and the following message is issued.

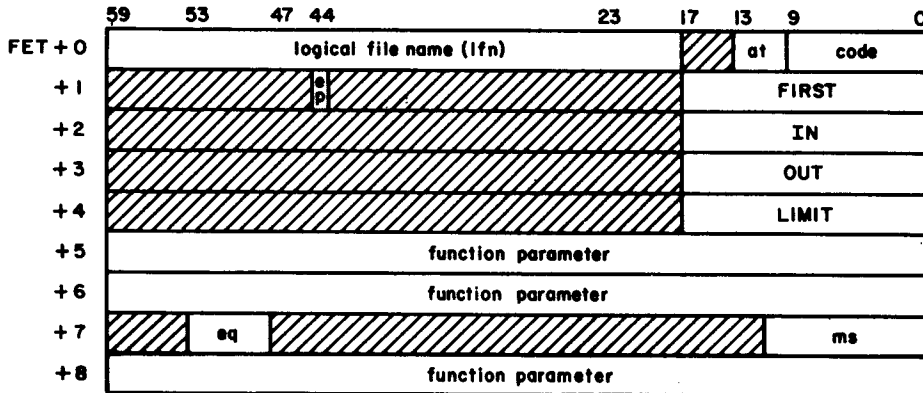
```
QFM ARGUMENT ERROR.
```

The format of the call to QFM is:



r Auto recall bit
code Function code
addr Address of the FET for the file

The format of the FET used by QFM is:



at Abnormal termination code
code Completion code
ep Error processing bit
eq Equipment number
ms Mass storage error code

RERUN (015)

The RERUN macro sets the job rerun status, indicating that the job may be rerun in the event of system failure. This macro need not be used unless queue protection was disabled by a previous NORERUN macro, since all jobs in the input queue are initially given rerun status. The RERUN macro has no effect if used from a time-sharing origin job unless it is used in conjunction with the SUBMIT macro or SUBMIT control statement (refer to section 6, volume 1).

Macro Format: †

LOCATION	OPERATION	VARIABLE SUBFIELDS
	RERUN	

† This macro is not available in SYSTEXT. The user must call common deck COMCMAC (refer to appendix A).

NORERUN (016)

The NORERUN macro clears the job rerun status (initially enabled) and prevents a job from being rerun as the result of queue protection. With this macro the user can specify when a job may be safely rerun. For example, if a job has just updated a critical data base, it is probably desirable not to rerun the job. Hence, the user can use the NORERUN macro to prevent this. This macro affects input files only. The NORERUN macro has no effect if used from a time-sharing origin job unless it is used in conjunction with the SUBMIT macro or SUBMIT control statement (refer to section 6, volume 1).

Macro Format:†

LOCATION	OPERATION	VARIABLE SUBFIELDS
	NORERUN	

SUBMIT (017)

The SUBMIT macro enables the user to release a file from a job to either the remote or local batch input queues. The user must be validated to use this function (refer to the DB field of validation limits in section 6, volume 1), but does not need system origin privileges. This file must have the normal job file format. If the user wishes to reformat a file before submitting it for processing, he should use the SUBMIT control statement (refer to section 6, volume 1).

If a submitted job contains an illegal first USER statement, the job entering the SUBMIT function is aborted via a system error (no exit processing) and the following messages are issued to the user dayfile.

ILLEGAL USER CARD.
SYSTEM ABORT.

The following message is issued to the account dayfile.

SIUN, usernum.

Terminal users are immediately logged off with no dayfile message and without recovery.

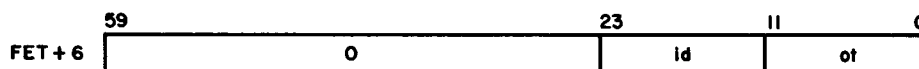
† This macro is not available in SYSTEXT. The user must call common deck COMCMAC (refer to appendix A).

The occurrence of an illegal user statement also decrements the security count for the user number of the job that initiated the SUBMIT function. The security count is the number of security violations a user number has remaining before it is denied access to the system. If a user number's security count is exhausted, the following message is issued at job initiation.

ILLEGAL USER NUMBER - CONTACT SITE OPR.

The security count for the user number must be reset before access to the system is allowed for that user number.

Entry condition:



A FET buffer of at least 1 PRU must be provided to allow QFM to read first sector for job control statement translation.

id	Identification code to be assigned to the job
ot	Origin type of the job to be submitted; must be local batch (BCOT,1) or remote batch (EIOT,2)

The job name given to the deferred job is returned in bits 59 through 18 of word 6 of the FET. This job name is derived from the user number specified on the user statement of the submitting job. This is the same as the method used for time-sharing and remote batch origin jobs (refer to section 3, volume 1).

This macro requires the common decks COMCQFM and COMCSYS.

Macro Format:†

LOCATION	OPERATION	VARIABLE SUBFIELDS
	SUBMIT	addr

addr Address of the FET that specifies the file to be submitted

† This macro is not available in SYSTEXT. The user must call common deck COMCMAC (refer to appendix A).

ASSIGN FILE TO QUEUE DEVICE (020)

Function 020 enables the user to assign a file to a queue device (a device to which queue type files are assigned). A queue file of the specified type is assigned to the mass storage device specified in the mass storage allocation (MSAL) entry.

Entry condition:



qt Queue type. The qt field contains the queue-type value.

Type	Value
INFT	0
PRFT	2
PHFT	3

No macro is available for this function. The user should call it with the SYSTEM macro in the following manner.

```
SYSTEM  QFM, R, addr, 2000B
        R              Auto recall bit (must be set)
        addr           Address of the FET
        2000B          Function code (020) * 1008
```

If the MSAL control is set (refer to the NOS Operator's Guide for a discussion of MSAL), the specified file is assigned to the device. Otherwise, no action is taken.

DSP FUNCTION

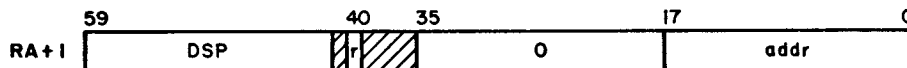
File routing under NOS is performed by the dispose processor (DSP). DSP is called by an RA+1 call or the ROUTE macro. Similar file routing capabilities are available with the SUBMIT and RELEASE macros, but ROUTE provides many more features.

The DSP function places a file in an input or output queue of either the central site or a remote batch site. The function can be issued from jobs of any job origin type.

NOTE

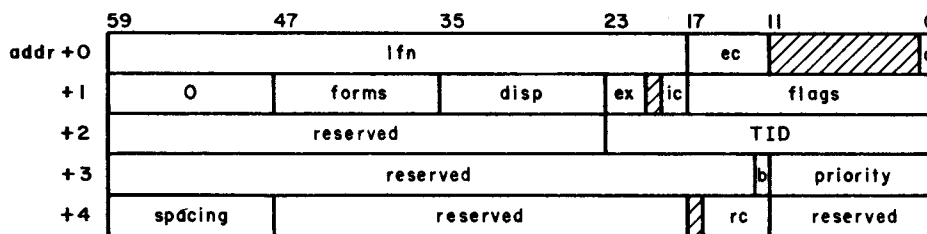
If a file is routed to an input queue, it must contain a valid user statement or the job initiating the route will be aborted without exit processing. Refer to the SUBMIT macro, section 7, for further information concerning illegal user statements.

The format of the call to DSP is:



r Auto recall bit (must be set)
 addr First word address of parameter block

The user must define a parameter block as described below before issuing the DSP call or ROUTE macro.



lfn Local file name of file to be routed (must be a print, punch, input, or local file; must not reside on a removable device; and must have read permission).
 ec Error code returned by system when bit 12 of flags field is set (error codes described later in this section).

c Completion bit (must be zero when function is issued; system sets bit to one when operation complete).

forms Forms code or input flags. Two display code characters or specific bits set identifying the forms to be used for this file or other processing options. If file is routed to input queue, this field is defined as follows.

<u>Bits</u>	<u>Description</u>
47-46	Unused
45	Do not protect input file
44	Reserved
43	Send file to input queue even if job statement error
42-36	Reserved

Forms codes are two alphanumeric characters and are assigned by each installation. The user should contact installation personnel to determine what forms codes are available (if any).

disp Disposition code. Two alphanumeric characters specifying the disposition of the routed file.

<u>Code</u>	<u>Description</u>
IN	Release file to input queue
LP	Print on any line printer
LQ	Print on 512 line printer
LR	Print on 580-12 line printer
LS	Print on 580-16 line printer
LT	Print on 580-20 line printer
PB	Punch system binary
PH	Punch coded
PR	Same as LP
PU	Same as PH
P2	Same as LQ
P8	Punch 80 column binary
SB	Same as PB
SC	Rescind prior routing and change file type to local (LOFT)

ex External characteristics (bits 23 through 21) code translated as follows.

<u>Value</u>	<u>Print File</u>	<u>Punch File</u>
0	(default)	(default)
1	Unused	SB
2	A4	80COL
3	B4	Unused
4	B6	O26
5	A6	O29
6,7	Reserved	Reserved

The mnemonics in the above table are defined as follows.

<u>Mnemonic</u>	<u>Description</u>
A4	ASCII 48-character set
A6	ASCII 64-character set

<u>Mnemonic</u>	<u>Description</u>
B4	Display code 48-character set
B6	Display code 64-character set
O26	Punch O26 mode
O29	Punch O29 mode
SB	Punch system binary
80COL	Punch 80-column binary

ic Internal characteristics (bits 19 through 18) code translated as follows:

<u>Value</u>	<u>Description</u>
0	Display code
1	ASCII code
2	Binary
3	Reserved

flags Each bit set indicates that a parameter is specified.

<u>Bit</u>	<u>Description</u>
17	File name assigned by system is returned to addr+0, bits 59 through 18
16	Unused
15	Spacing code
14	Repeat count
13	Reserved
12	No dayfile message and return error code to addr+0, bits 17 through 12
11	Reserved
10	Forms code
9	Priority
8	Internal characteristics
7	External characteristics
6-5	Reserved
4	Disposition code
3	Reserved
2	TID
1	Route to central site
0	End-of-job (deferred ROUTE)

TID For routing to an export/import queue, the TID should contain the complement of the address of a two-word block. The first word of the block contains the family name and the second word contains the user number (both left-justified and zero-filled). This is the user number that must be used to log in at a remote terminal to get the routed file.

For routing to the local batch queue, the TID contains an ID code (right-justified).

b Must be set if priority specified

priority If job priority is greater than 7760 octal, the specified priority is used for output files (otherwise field is ignored)

spacing Spacing code for output files (580 print format control support)

rc Repeat count

ROUTE

The format of the ROUTE macro is as follows:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	ROUTE	addr, r

addr
r

Address of parameter block
Auto-recall

ERROR PROCESSING

When an error occurs in processing a ROUTE macro or DSP call, either a dayfile message explaining the error is issued, or an error code is returned in bits 17 through 12 of addr+0. If the address of the parameter block is outside the field length of the job or if the completion bit is set when the function is issued, the job aborts. For all other errors, the function is not executed, but error processing continues. If bit 12 of the flags field is set, an error code is returned and no dayfile message is issued. If bit 12 is not set, a dayfile message is issued and no error code is returned.

When a diagnostic is issued for the ROUTE macro, the message

ERROR IN ROUTE FUNCTION LFN = lfn.

is issued, followed by the message describing the error.

The error codes that can be returned are as follows:

<u>Error Codes</u>	<u>Description</u>
1	File name error
2	File not on mass storage
3	Illegal file type
4	Output file limit
5	Route to input not immediate
6	Immediate routing - no file
7	Invalid disposition code
10	Reserved
11	Reserved
12	Illegal request (unconditional abort)
13	Reserved
14	Reserved
15	Reserved
16	Cannot route job input file
17	Completion bit already set (unconditional abort)
20	File on removable device
21	Invalid TID
22	Forms code not alphanumeric
23	Reserved
24	Reserved
25	Reserved
26	This routing not allowed

<u>Error Codes</u>	<u>Description</u>
27	FNT/device full
30	Local file limit
31	I/O sequence error (unconditional abort)
32	Job statement error
33	Too many deferred batch jobs
34	Illegal user statement
35	Device unavailable
36	Illegal file mode
37	Invalid external characteristics
40	Illegal origin type

For a complete listing of error messages, refer to the NOS Reference Manual, volume 1, appendix B.

System file manager (SFM) performs functions for CPU programs that access files that are not accessible using the CIO and LFM function processors. Most SFM functions require that the job be of system origin or that the user be validated to have system origin privileges. Several SFM functions require that the job be a special system job (the program must have an SSJ= entry point; refer to appendix F). These are:

<u>Function Code</u>	<u>Description</u>
000	Terminate active dayfile
007	Protect active dayfile
010	Clear dayfile byte
011	Enter local fast attach file
012	Delete fast attach file (local and global)
014	Attach inactive dayfile
015	Enter global fast attach file

SFM functions requiring SSJ= entry points are not discussed in this section since they are not available to the typical user. To obtain documentation of these functions, enter the following control statements after accessing the system OPL.

```
MODIFY(Z)/*EDIT,SFM  
DOCUMENT.
```

Enter the following control statements to obtain a complete listing of SFM.

```
MODIFY(Q,CL,Z)/*EDIT,SFM
```

All requests to SFM must be made with the auto recall bit set; if it is not, the job is aborted and the following message is issued.

```
SFM ILLEGAL REQUEST.
```

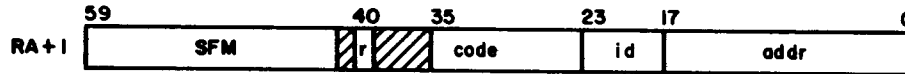
If the parameter addresses are not within the user's field length, the job is aborted and the following message is issued.

```
SFM ARGUMENT ERROR.
```

Errors encountered by SFM cause the job to abort; no user error processing is provided. Those operations that use central memory buffers do not treat the buffers as circular buffers, storing at IN and reading from OUT. All data is read from or entered at FIRST.

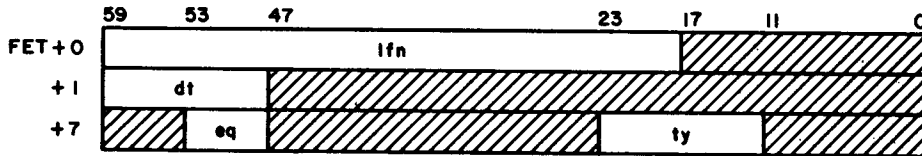
Common decks required by all SFM macros are COMCSFM (relocatable and absolute assemblies) and COMCSYS (absolute assembly).

The format of the call to SFM is:



r Auto recall bit
code Function code
id File identification number
addr Address of the FET for the file

The format of the FET used by SFM is:



lfn File name
dt Device type (refer to STATUS macro, section 4)
eq Equipment number
ty Dayfile type:
 1 System dayfile
 2 Account dayfile
 3 Error log dayfile

DAYFILE (001, 002, 003, 005)

The DAYFILE macro enables the user to access the dayfiles available in the system. This is useful for on-line accounting programs and dayfile dumps. A FET of at least seven words must be specified for this function.

A portion of the dayfile specified resides in the system central memory buffers. This is transferred to the buffer in the user's field length specified in the FET (FIRST). The user must ensure that the buffer specified is large enough to accommodate the central memory portion of dayfile. Since buffer sizes can vary (deadstart parameter), the user should check with installation personnel for the buffer size of the desired dayfile. If the buffer is too small, the following message is issued.

SFM ARGUMENT ERROR.

That portion of the dayfile that resides on mass storage is made available to the user as a library file attached to the control point in read-only mode. If the file name specified already exists, it is returned. The file is positioned at BOI. If the dayfile specified does not exist, the following message is issued.

SFM ILLEGAL REQUEST.

The user must be validated for system origin privileges or the job must be a system origin job for all dayfile types except USER (SFM function 005).

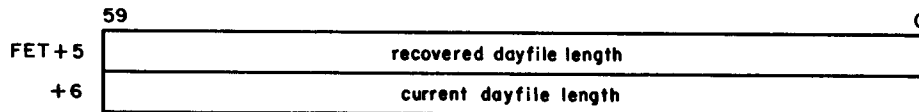
The track interlock is left set for all dayfile types except USER. The track interlock is cleared when the dayfile is returned to the system.

Macro Format:†

LOCATION	OPERATION	VARIABLE SUBFIELDS
	DAYFILE	lfn, type

lfn	Address of the FET for the call; name given to the mass storage portion of the file
type	DAYFILE (function 001); attach system dayfile ACCOUNT (function 002); attach account dayfile ERRLOG (function 003); attach error log dayfile USER (function 005); attach user's dayfile. This is the dayfile of the job currently running.

The reply to this macro for functions 001, 002, and 003 is:



† This macro is available in COMCMAC (refer to appendix A).

For examples of the use of these macros, refer to a listing of DAYFILE.

ESYF (004)

The ESYF macro enables the user to enter a file attached to his control point as a system file. This is a read-only file that contains special system information. The job must be of system origin or the user must be validated for system origin privileges to issue this macro. If the file specified already exists as a system file, the old file is released and the new file is entered.

Macro Format:†

LOCATION	OPERATION	VARIABLE SUBFIELDS
	ESYF	addr

addr Address of the FET for the request to SFM

RDVT (006)

The RDVT macro allows the user to determine the type of device on which the specified file resides.

Macro Format:†

LOCATION	OPERATION	VARIABLE SUBFIELDS
	RDVT	addr, dt

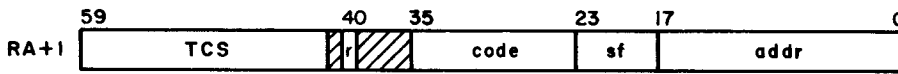
addr Address of the FET for the file
 dt The device number; if the dt parameter is set in word 1 of the FET, this parameter is not required.

† This macro is available only in COMCMAC (refer to appendix A). For system origin jobs or users with system origin privileges.

TRANSLATE CONTROL STATEMENT

Translate control statement (TCS) processes user requests to read a control statement from or place a control statement in the control statement stream. The only common deck required for absolute assembly is COMCSYS.

The format of the RA+1 call is:



r Auto recall bit

code Function code:

<u>Code</u>	<u>Macro</u>
004	CONTROL
005	EXCST

sf Subfunction code for the CONTROL macro. This field is not used for the EXCST macro.

<u>sf</u>	<u>Action</u>
00	Read the next control statement and advance the control statement pointer.
01	Read the next control statement only if it is not a local file call. Do not advance the control statement pointer.
02	Read the next control statement even if it is a local file call. If the statement is a local file call, set bit 17 of RA+64 ₈ .
4x	If the system determines that the next control statement must be processed in product set format, sf is set to 4x, where x can be 0, 1, or 2, corresponding to one of the above options. If bit 23 of RA+1 is not set, control statement parameters are to be processed in NOS format.

addr First word address of the buffer in which the control statement is to be stored or from which the control statement is to be read.

CONTROL (004)

The CONTROL macro allows the user to read the next control statement in the control statement stream and transfer it to the address specified. The control statement is checked for syntax errors, and all parameters are stored as if a program load had actually taken place. (Refer to section 5, volume 1 for a description of the manner in which parameters are stored.) If no control statement exists or if the next control statement is a comment line of the form:

*comments

a zero statement is stored.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	CONTROL	addr, rss, lf, nbf

addr First word address of the buffer in which the next control statement is to be stored. The user should allow room for 10_g words (80 characters). If addr+7 is not less than the job's field length, the following message is issued to the user's dayfile.

BUFFER ARG. ERROR.

rss If rss is specified (any value may be used), the control statement pointer is not advanced. This allows the user to determine what the next statement is and still allow it to be processed. If rss is not specified, the control statement pointer is advanced as if the statement had been processed.

lf If lf is specified (any value may be used), the next control statement is read even if the statement calls for the execution of a local file; the control statement pointer is not advanced. If lf is specified and the call is for a local file, the system sets bit 17 in RA+64_g (ACTR). If lf is not specified, the next control statement is read only if it is not a local file call. The rss parameter is required if the lf parameter is specified.

nbf If nbf is specified, parameters are unpacked in NOS/BE format.

EXCST (005)

With the EXCST macro the user specifies a buffer containing a control statement. Control is transferred from the calling program to the system, which reads the control statement, places it in the control statement stream, and processes it. Control is not returned to the calling program. The control statement must conform to NOS control statement format conventions described in section 5, volume 1.

Macro Format: †

LOCATION	OPERATION	VARIABLE SUBFIELDS
	EXCST	addr

addr First word address of the buffer containing the control statement to be processed. The system begins reading at addr and continues until the end of statement (zero byte) or end of buffer (80 characters) is reached. The control statement must be left-justified with zero fill. If the buffer extends past the job's field length, the following message is issued to the user's dayfile.

BUFFER ARG. ERROR.

† This macro is not available in SYSTEXT. The user must call the common deck COMCMAC (refer to appendix A).

CHECKPOINT/RESTART

A job may be terminated at any time as the result of system, operator, or programmer error. For some jobs it becomes more advantageous to accept the overhead of checkpoint procedures than to run the risk of losing the entire job output. The checkpoint/restart feature is implemented through the CKP control statement or CHECKPT macro and the RESTART control statement. Refer to section 12, volume 1, for discussions of the CKP and RESTART control statements.

CHECKPT

The CHECKPT macro is used for taking checkpoint dumps. The dump is written on the tape or mass storage checkpoint file specified on a REQUEST, ASSIGN, or LABEL control statement or REQUEST or LABEL macro. For a general description of checkpoint dumps, refer to section 12, volume 1. The CHECKPT macro provides the user greater control than the CKP control statement in specifying the type of copy to be performed.

Macro Format:†

LOCATION	OPERATION	VARIABLE SUBFIELDS
	CHECKPT	param, sp

param Address of the parameter list identifying the files to be checkpointed

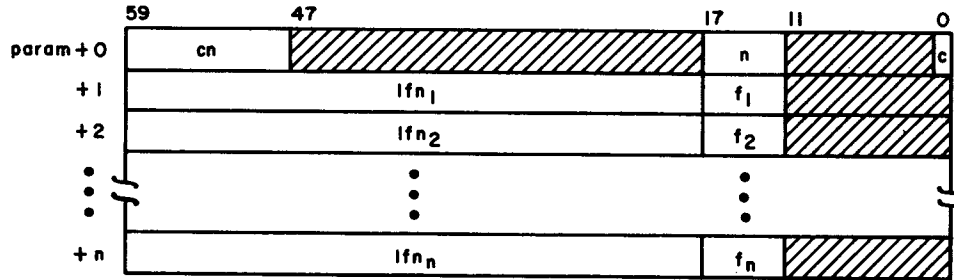
sp Flag indicating whether or not all files assigned to the job are to be checkpointed:

 sp = 0 All files are to be checkpointed.

 sp ≠ 0 The files identified in the parameter list are to be checkpointed.

† This macro is not available in SYSTEXT. The user must call common deck COMCMAC (refer to appendix A).

Parameter List Format:



cn Latest checkpoint number

n Octal number of entries in the parameter list: ($0 \leq n \leq 77g$)

c Completion bit; set by CHECKPT when the checkpoint is complete

lfn_i Identifies file to be checkpointed; lfn_i is left-justified

f_i Specifies the manner in which lfn_i is to be copied:

f_i=0 The file is copied from the BOI to its position at checkpoint; only that portion is available for restart. RESTART positions the file at the latter point.

f_i=1 The file is copied from its position at checkpoint to the EOI; only that portion is available for restart. RESTART positions the file at the former point.

f_i=2 The entire file is copied. RESTART sets the file to its position at checkpoint time.

f_i=3 The last operation on the file determines how the file is copied.

Last Operation

f Selected

Write

f_i = 0

Read (EOI detected)

No copy

Read (EOI not detected)

f_i = 2

f_i=4 The information table associated with the file is copied but the file itself is not copied. The information table contains FNT/FST information and the random address of the file. RESTART retrieves the file and sets it to its position at checkpoint time. If f_i=4 and the file is a mass storage file, RESTART assumes it is an indirect access file and issues a GET macro to obtain a working copy.

The following list shows the type of operation CHECKPT performs as sp and n vary.

<u>sp</u>	<u>n</u>	<u>Operation</u>
sp=0	n=0	All files assigned to the job at checkpoint time are copied according to the last operation performed.
sp≠0	n=0	All files assigned to the job at checkpoint time are copied according to the last operation performed.
sp=0	n≠0	All files assigned to the job at checkpoint time are copied. The n files included in the parameter list are copied according to their respective f values. All other files are copied according to the last operation performed.
sp≠0	n≠0	The n files specified in the parameter list are copied according to their respective f values.

The INPUT, OUTPUT, PUNCH, PUNCHB, and LGO files are always checkpointed; they are copied according to the last operation performed (refer to $f_1=3$), regardless of the sp and n values.

For all other files except direct access files, the default copy type is f=4 when n≠0. For direct access files, the type of copy CHECKPT makes depends on the access mode.

	<u>Mode</u>	<u>User Option</u>	<u>Default</u>
W	Write	Any type of copy†	Copied (f=3)
R	Read-only	Any type of copy	Not copied (f=4)
E	Execute-only	Only f=4	Not copied (f=4)
A	Append-only	Any type of copy†	Copied (f=3)
M	Modify	Any type of copy†	Copied (f=3)
RA	Read and append	Any type of copy†	Copied (f=3)
RM	Read and modify	Any type of copy†	Copied (f=3)

For a random file the copy type must be f=2 or it will be copied according to the last operation performed (f=3).

†If f=4 is selected, the user must retrieve the file himself at restart time and select the NA and FC options on the RESTART control statement (refer to section 12, volume 1).

SYSTEM REQUESTS

The following requests enable the user to perform miscellaneous tasks associated with his job. Most of the requests are processed by the system monitor directly rather than by a specific function processor. The calling format is shown for each macro. Unless otherwise noted, the only common deck required is COMCSYS.

ABORT

The user can request the monitor to set the error flag at the control point when a program error occurs by using the ABORT function. If the control statement record of the job deck contains an EXIT statement, the system continues job processing with the control statement that immediately follows the EXIT statement.

The format of the RA+1 call for this function is:

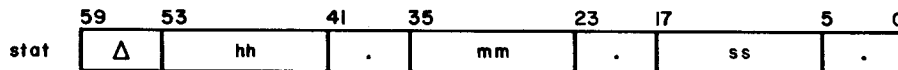


Macro Format:

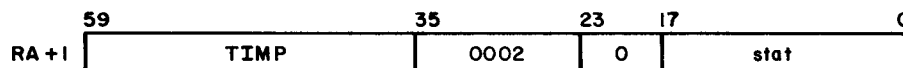
LOCATION	OPERATION	VARIABLE SUBFIELDS
	ABORT	

CLOCK

In response to the CLOCK function, the system returns the current time of day in display code in location stat.



The format of the RA+1 call for this function is:



Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	CLOCK	stat

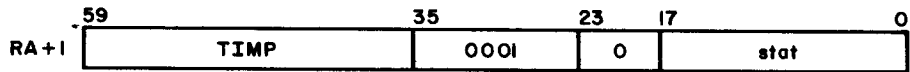
stat Address to receive the clock reading

DATE

In response to the DATE function, the system returns the current date in display code format in location stat.



The RA+1 call for this function is:



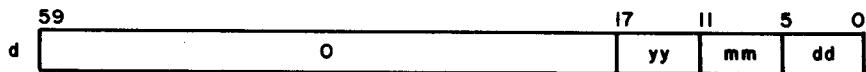
Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	DATE	stat

stat Address to receive the date

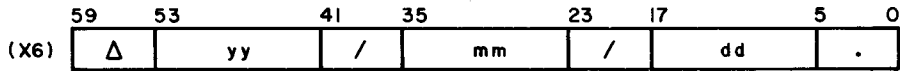
EDATE

EDATE takes the packed date and converts it to display code.



yy Year minus 1970
 mm Month
 dd Day

Upon completion, X6 contains the following.



Macro Format:†

LOCATION	OPERATION	VARIABLE SUBFIELDS
	EDATE	d

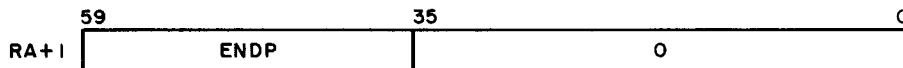
d Packed date to be converted

This macro requires the common deck COMCEDT.

ENDRUN

The ENDRUN function requests normal termination of a program. NOS examines the control statement record of the job deck and begins execution with the next unused control statement. If there are no more control statements or if the next statement is an EXIT statement, the system terminates the job.

The format of the RA+1 call for this function is:



Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	ENDRUN	

† This macro is available in COMCMAC (refer to appendix A).

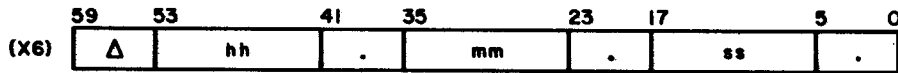
ETIME

ETIME takes the packed time and converts it to display code.



hh Hours
 mm Minutes
 ss Seconds

Upon completion, X6 contains the following.



Macro Format:†

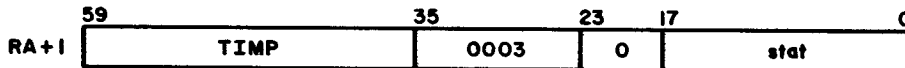
LOCATION	OPERATION	VARIABLE SUBFIELDS
	ETIME	ptime

ptime Packed time to be converted

This macro requires the common deck COMCEDT.

JDATE

JDATE returns the current Julian date in stat. The format of the RA+1 call for this function is:



† This macro is available in COMCMAC (refer to appendix A).



yy Julian year
 ddd Julian day

Macro Format:

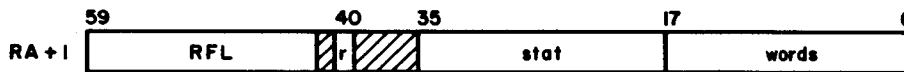
LOCATION	OPERATION	VARIABLE SUBFIELDS
	JDATE	stat

stat Address which receives the Julian date

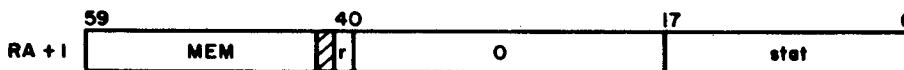
MEMORY

Using the MEMORY function, the user can determine or change the amount of central memory assigned to his control point or determine the maximum amount of memory he can request.

The format of the RA+1 call for this function is:



Alternate call format: †



Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	MEMORY	type, stat, r, words, na

type CM or null for central memory; either is legal. ECS for extended core storage. ††

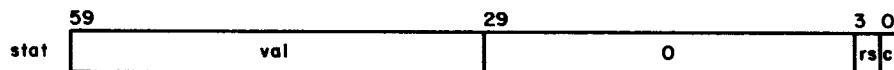
stat Status word address. May be omitted only if the words parameter is specified and na is null.

† To maintain compatibility with NOS/BE.

†† Not currently implemented. ECS size is zero and cannot be changed.

- r If specified, control is not returned until the request is complete. If omitted, control may be returned before the request is complete. In this case, bit 0 of the stat word is set to indicate completion.
- words Desired new field length which, if specified, overrides the stat word. If words is specified, the MEMORY macro sets the upper 30 bits of the stat word to the value of words. A negative value may not be used for words.
- na If null, the program is aborted if the user's request exceeds the current maximum which he is allowed. If this parameter is specified, the program is not aborted if the request exceeds the current maximum. Instead, the macro does not change the field length, and sets the stat word as defined below.

The stat word (if used) has the following format.



- val Prior to the macro call, val is used to specify the desired new field length (words parameter can override this value). If val (or words) is +0, then the current field length for the specified type is returned in this field. If bit 47 of val is set and specified type is CM, a memory reduction is honored even if no reduce has been selected (that is, no reduce override is in effect). † If val is -1, then the current maximum field length for the specified type is returned. If val (or words) is greater than zero for the macro call, it contains the actual value assigned upon return. If val is -0 and type is ECS, the field length is set to 0.
- rs These bits are reserved for system usage.
- c Completion bit. The system sets this bit when the request is complete.

If a request is given for an amount greater than the current maximum (refer to the Installation Handbook for a description of the current maximum field length) and if na is specified, then no field length change occurs and control is returned with val set to the current field length value.

If the reserved bits (rs) in the status word are used, the MEMORY request or a subsequent MEMORY request may be aborted with the following dayfile message.

ILLEGAL COMMON MEMORY MANAGER REQUEST.

†Refer to the REDUCE (-) control statement in the CYBER Loader Reference Manual.

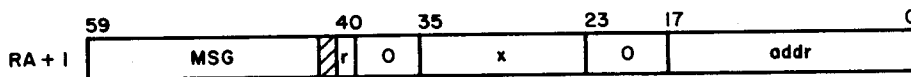
MESSAGE

The MESSAGE function allows the user to display a message on the system console display and enter it in a dayfile.

If the job is of system origin, the message may be flashed on the B display by including a dollar sign as the first character of the message.

The maximum length of a message is 80 characters; up to 40 characters per line are displayed. The message ends with either the first word containing 12 bits of zeros in any byte or at the eightieth character. Before issuing the MESSAGE function, the user must pack the display coded message in sequential locations, beginning at location *addr*.

The format of the RA+1 call for this function is:



Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	MESSAGE	<i>addr</i> , <i>x</i> , <i>r</i>

<i>addr</i>	Beginning address of the message. If the upper 12 bits of the location specified by this address are zero, then the next 18 bits (bits 47 through 30) of this location are assumed to contain the beginning address of the message.
<i>x</i>	Message routing option
<i>x</i> =0	Message is placed in the system dayfile, the user dayfile, and displayed at line 1 of the control point
<i>x</i> =1	Message is displayed at line 1 of the control point
<i>x</i> =2	Message is displayed at line 2 of the control point
<i>x</i> =3	Message is placed in the user dayfile and displayed at line 1 of the control point
<i>x</i> =4	Message is placed in the error log dayfile if job is special system job (that is, has an SSJ= entry point) or is of system origin; or user dayfile if not SSJ= or system origin
<i>x</i> =5	Message is placed in the account dayfile if job is special system job or is of system origin; or user dayfile if not SSJ= or system origin
<i>x</i> =6	Message is placed in the system dayfile, the user dayfile, and displayed at line 1 of the control point†
<i>x</i> =7	Message is placed in the user dayfile and displayed at line 1 of the control point†

† Provided for compatibility with NOS/BE.

If x is not specified or is an illegal value, x=0 is assumed. If x is not defined, x=1 is assumed. If x is the character string LOCAL, x=3 is used.

The control point message areas (lines 1 and 2) provide the user with the ability to display concurrently messages that enter the dayfile and those that require operator action. Line 2 is normally used to display information about the current status of the executing program; for example,

```
SKIPPING lfn
COPYING lfn
ASSEMBLING TEST
      :
```

Only messages that are of interest to other than the job, such as the control statements processed and compilers used, should be placed in the system dayfile (x=0). All messages of interest to the job, such as the path taken by the programs and the number of records copied, should be placed only in the user dayfile (x=3). All messages placed in the user dayfile (x=0 and x=3) are counted by the system. If the number of messages issued by the job exceeds the limit for which the user is validated, the following error message is issued to the user dayfile and the job is aborted.

MESSAGE LIMIT.

r If r is specified, control is not returned until the operation is complete.

MOVE

The MOVE macro moves a block of data from $addr_1$ to $addr_2$. This macro requires the common deck COMCMVE for absolute assemblies.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	MOVE	count, $addr_1$, $addr_2$

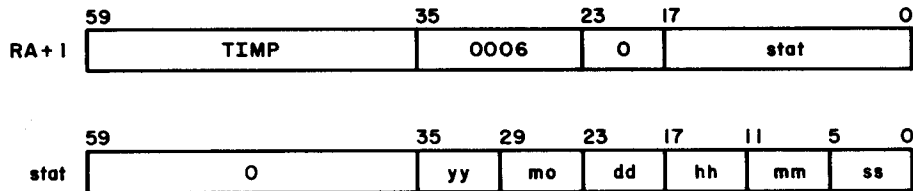
count Number of words in the block to be moved
 $addr_1$ Address of the first word of the block to be moved
 $addr_2$ Address of the first word of the destination

MOVE allows overlap in data moves; in other words, $addr_2$ can be less than $addr_1$ plus count.

PDATE

PDATE returns the current date and time in binary packed format. The user can unpack the parameters or use the EDATE and ETIME macros to do the unpacking.

The format of the RA+1 call for this function is:



yy Year minus 1970
mo Month
dd Day
hh Hours
mm Minutes
ss Seconds

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	PDATE	stat

stat Address to receive the packed date

RECALL

The RECALL function enables the user to relinquish the CPU until a function is completed or the CPU recall time has elapsed (delay time is set by the installation, usually 1/2 second). If the stat parameter is included in the call, control is not returned to the program until bit 0 of the word specified by stat is set. If stat is not included in the macro call, the program relinquishes the CPU only until the next pass through the recall loop.

The format of the RA+1 call for this function is:



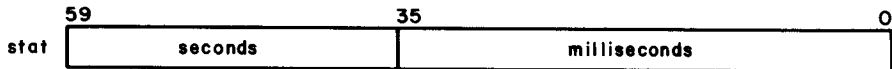
Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	RECALL	stat

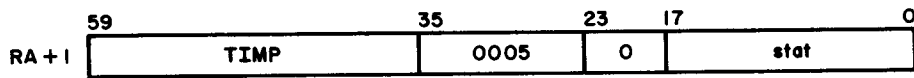
stat If this parameter is present, control is returned to the program when bit 0 of the word specified by the address stat is set.

RTIME

In response to the RTIME function, the system returns the real-time clock reading in location stat. This is the elapsed time since deadstart.



The format of the RA+1 call for this function is:



Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	RTIME	stat

stat Address to receive the clock reading

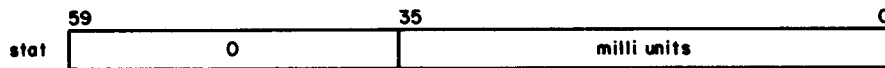
STIME

With the STIME macro, the user can determine his accumulated system resource units (SRU). Refer to the NOS Installation Handbook for a description of SRUs.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	STIME	stat

stat Address to receive SRU value



milliunits Accumulated system resource units/1000

SUBR

The subroutine macro enables the user to distinguish between entering a subroutine and exiting from a subroutine even though control is transferred to the same address. Transfers to the subroutine are of the form:

RJ tag

Exits from the subroutine are of the form:

EQ tagX

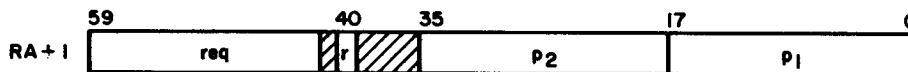
Macro Format:†

LOCATION	OPERATION	VARIABLE SUBFIELDS
tag	SUBR	

SYSTEM

With the SYSTEM function, the user can request the system to process any three-character requests. This can be either the functions that MTR performs, such as TIM, or a PPU program, such as CIO (refer to File Environment Table, section 3, for a list of request processors). The SYSTEM function destroys the contents of X2. A PPU program can be called from a CPU program if the first character of the name is alphabetic. Documentation of these programs (refer to DOCUMENT statement, section 7, volume 1) should be consulted for the functions available (for example, LFM, CPM). These should be used when macros do not exist to issue the functions desired.

The format of the RA+1 call is:



† This macro is available in COMCMAC (refer to appendix A).

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	SYSTEM	req, r, p ₁ , p ₂

req Three-character system request
r If specified, control is returned only after the request is completed.
p₁ Bits 17 through 0 of the request
p₂ Bits 35 through 18 of the request

Example 1:

If the user wishes to dump the contents of locations 1000 to 4000 and recall the CPU when the dump is completed, the SYSTEM request is:

SYSTEM DMP,R,4000B,1000B

Example 2:

If the user wishes to dump the display code equivalent of the data dumped in example 1, the SYSTEM request is:

SYSTEM DMD,R,4000B,1000B

Example 3:

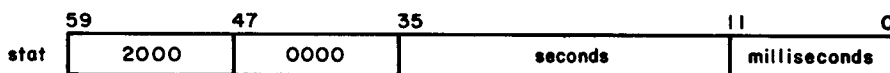
If the user wishes to issue a CIO function request, he can do so with the following SYSTEM request:

SYSTEM CIO,r,n,addr

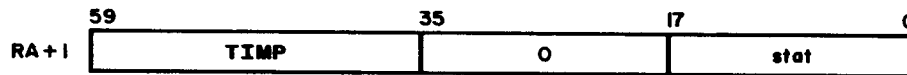
where addr is the address of the FET for the file being read and n is the count for skip operations. If r is specified, the request is made with auto recall. When performing a CIO request in this manner, the user must set the function code in FET+0.

TIME

The TIME function returns the accumulated central processor time used by the job in location stat.



The format of the RA+1 call for this function is:



Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	TIME	stat

stat Address to receive the CPU time

LOADER REQUESTS

- The system provides routines to aid the user in loading overlays or capsules at specific points during program execution. The overlays or capsules can reside on files attached to the user's job or in system libraries.

OVERLAY

The OVERLAY macro processes a system request to the LDR processor. LDR provides the ability to load overlays to specified areas of the user's program area. Depending on the parameters specified and the level of the overlay, control may or may not be returned to the calling program.

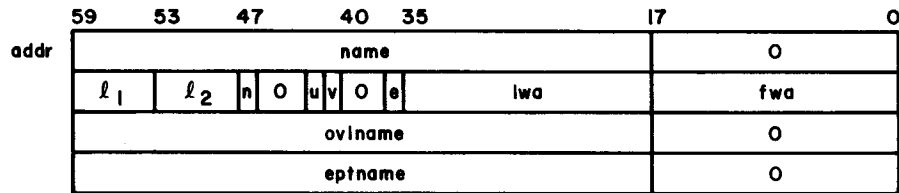
- The format of the RA+1 call for this function is: †



r Auto recall, if desired
 addr Address of the request

The load request consists of two to four words. The two- to four-word block must be defined by the user for RA+1 calls, but is defined by the system when called from the OVERLAY macro (only two words used).

† LDV is processed by the system as the LDR call. This is to provide compatibility with the common product set.



name	Source of name depending on the u and n options
l_1	First overlay level
l_2	Second overlay level
n	Number of words in request-2 (bits 47-46)
u	Load option (bit 42)
v	Overlay flag (must be set to 1) (bit 41)
e	Call completion flag (bit 36)
lwa	Last word address available for load
fwa	First word address of the overlay
ovlname	Name of overlay to be loaded (if n≠0)
eptname	Entry point name when loading multiple entry point overlay (if n=2)

The operation performed depends on the value of u, n, fwa, l_1 , and l_2 .

1. If u=0, n is ignored and name is the name of the file containing the overlay (l_1 and l_2 are required).
2. If u=1 and n=0, name is the name of the overlay from the system library (l_1 and l_2 are ignored).
3. If u=1 and n≠0, ovlname is the name of the overlay from the system library (l_1 and l_2 are ignored).
4. If fwa=0, the overlay is loaded at the address specified by the overlay.
5. If $l_1=l_2=0$, the (0,0 overlay) control is returned to the called overlay; otherwise, control is returned to the caller with fwa=entry address.
6. If e=1, control transfers to the specified entry point, eptname, in the overlay.

Upon completion of the load, information is returned to addr as follows:

addr	59	53	47	17	0
	name				0
	<i>l</i> ₁	<i>l</i> ₂	0		eptaddr
	ovlname				0
eptname				0	

eptaddr Entry point address of the overlay; if n=2, eptaddr is the address of eptname.

Macro Format:

LOCATION	OPERATION	VARIABLE SUBFIELDS
	OVERLAY	nam, lev, SYSTEM, fwa

nam Address of file name in L format (display code, left-justified)

lev Level of overlay. If not specified, level 0,0 is assumed and control is automatically transferred to transfer address encountered on overlay load. (Usually specified on IDENT instruction of ABS programs.) For overlay level (i, j), level is defined as: $lev=i*100_8+j$.

SYSTEM If SYSTEM is specified, file is loaded from system library and nam is name of overlay desired.

fwa If this parameter is specified, fwa is the address where the overlay is to be loaded. The file is loaded at the address specified on the overlay if this parameter is not specified.

LOADD

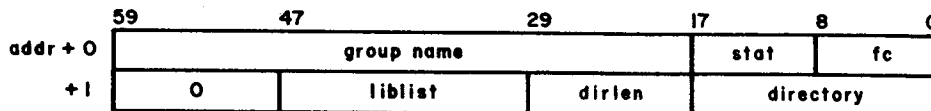
The LOADD macro allows the user to locate fast dynamic load (FDL) capsules and have pertinent information returned to a specified address. Fast dynamic loading is a method of loading preprocessed binary routines.

The format of the RA+1 call for this function is:



r Auto recall bit
 addr Address of parameter block

The parameter block consists of two words in the following format.



group name Name of the group of capsules for which a directory is requested
 stat Status of call (ignored during request). Upon completion of call, stat is set to one of the following values.

<u>Value</u>	<u>Description</u>
0	Function completed without error
1	Illegal function code
2	Bad directory address or length (address plus length must be less than or equal to field length)
3	Bad liblist address or length

The following errors may be combined with those above.

10g	An entry in the library list did not correspond to any known local or system library name, or an entry specified the name of a file which was not a mass storage library
20g	The specified directory space was not large enough to contain the entire directory

fc Function code (must be zero during request). LDD sets bit zero to one when the request is complete.

liblist Address of a list of libraries to be searched after the global library set. Zero if no set is specified.

length Length of the capsule, including header, code image, and relocation and linking information, but excluding the prefix table.

Macro Format: †

LOCATION	OPERATION	VARIABLE SUBFIELDS
	LOADD	addr, r

addr Address of parameter block
r Auto recall

LOADQ

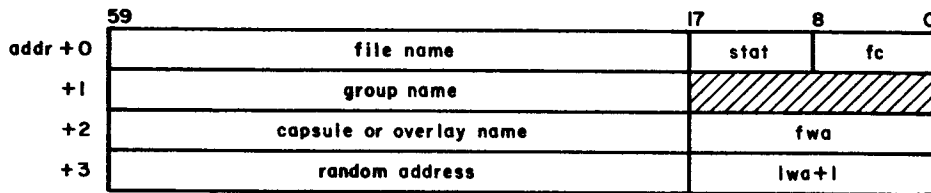
The LOADQ macro loads fast dynamic load (FDL) capsules or overlays from specified files.

The format of the RA+1 call for this function is:



r Auto recall bit
addr Address of parameter block

The four-word parameter block must be defined as follows.



file name Name of file containing capsule or overlay
stat Status of LDQ call (ignored during request). Upon completion of call, stat is set to one of the following values.

Value	Description
0	Function completed without error
1	Illegal function code

† This macro is not available in SYSTEXT. The user must call common deck COMCMAC (refer to appendix A).

<u>Value</u>	<u>Description</u>
2	Bad address (must have fwa<lwa+1<field length)
3	Nonexistent file or file not on mass storage
4	Bad disk address (out of file bounds)
5	Capsule or overlay not found at specified location
6	Insufficient space provided for capsule or overlay

If either error 5 or 6 occurs, the contents of the loadable area are undefined.

fc Function code:

0	Load capsule
2	Load overlay

LDQ sets bit zero to one when the request is complete.

group name Name of capsule group; zero for overlay load

capsule or overlay name Name of desired capsule or overlay

fwa First word address of the area into which the capsule or overlay is to be read

random address Location of capsule or overlay on specified file

lwa+1 Last word address plus 1 of area for capsule or overlay

LDQ reads a capsule or overlay from the specified mass storage location, removing the prefix table, but not altering the record otherwise. LDQ ensures that the location contains a capsule (56 table), if a capsule load is requested, or an overlay (50, 51, 53, or 54 table), if an overlay load is requested. LDQ also determines that the entire capsule or overlay fits into the specified area and that the name is correct.

Macro Format: †

LOCATION	OPERATION	VARIABLE SUBFIELDS
	LOADQ	addr, r

addr Address of parameter block

r Auto recall

† This macro is not available in SYSTEXT. The user must call the common deck COMCMAC to use this macro (refer to appendix A).

MEMORY ALLOCATION FOR OVERLAY LOADERS

The overlay loaders load records into core. COS-type overlays are always loaded at RA, and the program address is set to the number of parameters plus three. If a record begins with an overlay table (50g-, 51g-, and 53g- identification word), it is loaded according to the relative address given in the table (figure 2-11-1). The beginning load address must be greater than 100g. For a 50g single entry point overlay, loading starts at origin minus one; for a 51g multiple entry point overlay, loading starts at origin minus wc minus one, where wc is the number of entry points.

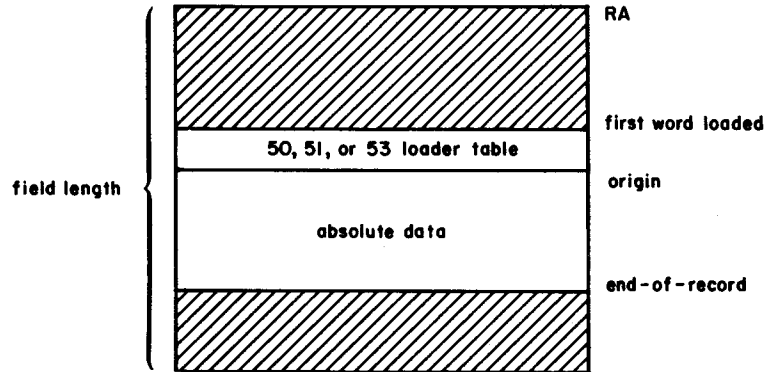


Figure 2-11-1. Absolute Loader Memory Assignment

WRITING PROGRAMS UNDER NOS

To observe the techniques necessary to use the features described, the user should read programs that use the macros and common decks. Appendix D contains a listing of the COPYB program that illustrates the use of these macros. Other programs that use common decks and macros can be cross-referenced by the KRONREF control statement.

If the user follows the coding specifications described in appendix C, the documentation utilities can be used to document his program. These specifications are supplied as a guide to enable the user to understand the format of system programs and to give him an idea of how to structure programs.

The programmer should organize his program area, buffers, and working storage areas in a manner that uses the least amount of memory for the shortest period of time. This provides him with better performance and more efficient use of system resources. Areas of code that are used once, such as preset routines, should be overlaid with buffers that are used later in the program. All main programs should be set to load past location 100g since areas before this address contain program and system parameters. † Placing FETs, table pointers, and other critical data areas at the beginning of the program aids in debugging because these areas do not change addresses as code in the program is changed.

WRITING INTERACTIVE PROGRAMS

As a terminal user becomes more familiar with the use of NOS, he may wish to write interactive programs in languages other than those oriented specifically to the terminal (for example, COMPASS). He may also desire to convert some batch application programs to interactive programs. The following description of system conventions acquaint the user with potential problem areas in performing this conversion or in writing interactive programs.

CONVERSION PROBLEMS

The major difference between an interactive job and a batch job is in the handling of files assigned to a terminal. Since the system is designed with a common control interface to all types of equipment, the programmer need not be concerned about the specific piece of equipment with which he is communicating.

Control Data application programs not written with terminal interaction in mind may present problems to the user who attempts to convert them to interactive programs. These problems are:

- Each line of terminal input is considered a logical record. This causes two basic problems: First, any program that terminates input processing on an EOR processes only one line of input. Second, programs that read ahead on input place a special significance on an EOR, and therefore, cannot effectively interact while accepting these one-line records.

This problem is minimized by the design of NOS input/output. However, when the problem does occur, it is fatal to program execution.

† Refer to appendix E.

- Many programs output more than 72 characters per line. This may result in unacceptable output; however, this is easily corrected by using the LO72 control statement or by reformatting the output in the program.
- Many programs place format control in column 1 which is printed at the terminal. Again, although this may cause unacceptable output, it is easily corrected.
- Many programs perform unnecessary write requests on output. This can cause high system overhead.

Portions of the NOS standard product set are modified to correct these last three problems.

DEFAULT FILE ASSIGNMENTS AND SPECIAL FILE TREATMENT

All jobs interacting with a terminal normally have input and output files assigned to the terminal unless the user assigns them to a different device. A user may assign a file to the terminal by assigning a file to equipment TT using the ASSIGN control statement or REQUEST macro; conversely, the user may assign his terminal input or output file to mass storage by specifying a device type of MS.

Normally, an interactive program need not check for EOI on INPUT; however, INPUT file status should be checked for EOI if INPUT has been assigned to mass storage.

SPECIAL HANDLING

When a read request is made on a terminal input file, an output file's circular buffer can be automatically flushed (with an EOR write) before the system issues the read request.

The system uses one of the following methods in determining when output data is to be sent to the terminal.

- FET pointers can be stored in RA+2 through RA+63₈, which specify the files to be flushed. The FET pointer is the file name left-justified with zero-fill in bits 59 through 18 and the address of the FET in bits 17 through 0.
- A list of files can be specified (refer to the SETLOF macro, section 6) from which the system determines the appropriate file name.

In using either of the previous methods, the system uses the first file that meets the following criteria.

- The file must either be assigned to the terminal (device type equals TT in the FET) or if unassigned must be named OUTPUT.
- The file must meet the conditions described under the flush bit (refer to description of flush bit, FET Description in section 3).

OTHER SPECIAL HANDLING

The following additional considerations should be noted by those attempting to write interactive programs.

- An EOR or EOF write on a terminal file has no special significance except that it ensures that the buffer is dumped to the terminal.

- When terminal input data is passed to an executing program, the following convention is followed.

If an odd number of characters is entered, the last character plus 1 is a space.

If the input data consists of data followed by a carriage return, the program has a five-word FET, the system supplies an EOR level of zero (level number is in bits 17 through 14 of the FET code and status word). If the program has a six-word or larger FET, the system supplies an EOR level of 1. If there is no data input but only a carriage return, an EOF is supplied by the system.

Thus, a program can determine if input is from a terminal by using six-word or longer FETs and by sensing an EOR level of 1. The system input/output macros and common decks are coded to handle this case properly. Thus, most of the system utilities interact with a terminal. It should be noted that this interaction for FORTRAN may depend on the library used to satisfy externals (SYSLIB is the FORTRAN object-time library that supports interactive communication).

Input to an executing program is handled in the same manner as the CIO READSKP request. If the user's buffer is not large enough to accommodate a full line of input, the data is truncated and the excess is lost.

- A program that is interacting with a terminal should not do a recall on OUTPUT if it does an EOF write on OUTPUT to clear the buffer (do not specify the r option on WRITEF macro). If recall is specified, an extra rollout of the program is required before the program terminates. If the conventions mentioned earlier concerning the status of output are followed, it is not mandatory to write an EOF to clear the buffer; however, if it is done (to remain compatible for batch use, for example) as the last thing before placing END in RA+1 (ENDRUN macro) without recall, little system overhead is incurred.
- If the conventions for special handling are followed, a job being time-sliced by the system on either a CPU or central memory usage has all data in the output buffer sent to the terminal.
- If a job terminates because an error flag is set, the contents of the control point area's first message buffer is sent to the terminal as part of the output. When the user is in the BATCH subsystem, this message buffer is always sent to the terminal on job termination. Messages can be placed in this area using the MESSAGE macro. Messages longer than 48 characters are truncated to 48 characters.
- If a buffer argument error is detected on an output buffer when output is being issued automatically, the output is ignored and the FET is not acted on. This error usually indicates that the executing program has destroyed part of its own field length.
- If the user program destroys its input FET after the FET has been validated by CIO, but before the data is actually passed, the input request is ignored. The probability of either of these occurrences is extremely remote, and if the CIO request is made with recall, it is impossible.
- A COMPASS program can determine whether it is interacting with a terminal by checking the origin type that is passed or by checking the type of equipment to which the file was assigned (byte 0 of word 1 of the FET). Refer to the common deck COMCSTF, appendix A.

PROGRAM CONTROL OF TERMINAL ACTIVITY

The user can design an interactive program to control terminal activity in two ways.

- Include control bytes in his output to control the positioning of the printing element, define alternate input modes, etc.
- Issue a DISTC macro to disable the terminal operator's control of his program during critical phases of execution.

CONTROL BYTES

A control byte is a 12-bit quantity, right-justified in bit positions 0, 12, 24, 36, or 48 of a CM word.

NOTE

The user must be careful that data is not mistaken for a control byte. For example, the characters :D typed at the end of a line may log-off the user, since the code 0004 is transmitted.

The following paragraphs describe the bytes available to the user and their functions.

End-of-Line

End-of-line generates a carriage return and line feed, positioning the terminal printing element at the beginning of the next line. An end-of-line consists of 12 to 66 bits of zero, right-justified in one or two central memory words.

End-of-Block (0001 or 0002)

This byte prevents the positioning of the terminal printing element at the beginning of the next line. An end-of-block byte can be used to allow the terminal operator to enter input on the same line as the input request is printed. This byte must be followed by an end-of-line. If not followed immediately by a read request, any output following this byte may be lost.

Auto Input (0003)

This byte is intended for use by the time-sharing executive for auto mode input,† but the user may include it in his output. The preceding characters in the word in which this byte occurs are sent to the terminal and are also retained as the first characters of the input line. This byte must be followed by an end-of-line. The next terminal operation must be an input request. The terminal prompt (a question mark) is suppressed.

Log-Off User (0004)

This byte disconnects the terminal user's telephone lines. This byte must be the first byte of a line and must be followed by an end-of-line.

† Refer to the NOS Time-Sharing User's Reference Manual for further information about auto mode input.

Set Transparent Input Mode (0005)

This byte changes the input mode from normal or ASCII (refer to appendix F, volume 1) to transparent mode. A 0005 byte directs the driver to translate all characters to the 6/12 bit internal codes as in ASCII mode. Also, no input control characters except RETURN and INTERRUPT (delete, backspace, STEXT, and ETEXT) are processed. Rather, all characters are passed to the program as data. INTERRUPT is passed as NULL followed by end-of-line. RETURN is passed as end-of-line. End-of-line terminates transparent input mode. This byte must be the first byte of the first word of a line and must be followed by an end-of-line.

Set Binary Input Mode (0006)

This byte changes the input mode from normal or ASCII (refer to appendix F, volume 1) to binary mode. The control byte must be byte 0 of the first word of a line and must be followed by an end-of-line. Bytes 1 and 2 are defined as follows:

- Byte 1 Specifies the maximum number (octal) of characters to be received before input is terminated. Byte 1 cannot exceed 150. If byte 1 is 0 or is greater than 150, the number is assumed to be 1.

- Byte 2 Specifies the termination code. When a character is received from the terminal that matches the lower 7 bits of this byte, the input operation is terminated. If bit 11 of this byte is set, no termination character is assumed. The eighth bit (parity bit) is not checked.

This conversion mode packs the 8 bits of data as the lower 8 bits of a 12-bit byte and sets the upper bit (bit 11). The exhaustion of the character count or the occurrence of the termination code causes the end-of-line condition to be set. A 0007 byte is forced as the first byte of input so the data is transmitted as binary if it is listed.

Initiate Binary Output (0007)

This byte initiates binary output. If the user wishes to output data formatted as described for binary input, a 0007 byte must precede the data. This mode continues until an end-of-line or nonbinary output data byte is detected. Termination by an end-of-line, however, does not cause a carriage return and line feed. The 0007 byte must be byte 0 (bits 59 through 48) of the first word of a line.

A binary output data byte is in the format 4xxx octal, where xxx is the 8-bit octal code for the character being printed. The upper 4 bits of a binary data byte are always set to 1000₂. If this pattern is not detected, the terminal is switched to standard output mode. Thus, the user can output standard mode data immediately following binary mode data without explicitly specifying a termination (end-of-line). Note that the characters 5, 6, 7, and 8 (display codes 40, 41, 42, and 43 octal) match the binary mode bit pattern when in the upper half of a byte and are interpreted as binary data. Therefore, these characters cannot be used to terminate binary output. Once binary output mode is terminated it remains cleared unless resumed by a 0007 control byte.

The following word, when output from a time-sharing terminal, produces a line feed and prints a question mark. There is no carriage return or line feed after the question mark.

0007 4012 4077 0000 0000

The 4012 byte produces a line feed (012 is the eight-bit octal code for ASCII standard print) and 4077 is the question mark. The binary output is terminated by the 24 bits of trailing zeros, constituting an end-of-line. The same output can be obtained with the following.

0007 4012 7100 0000 0000

Here 71 is the display code for a question mark and 7100 is a nonbinary data byte. Binary output is terminated at the question mark and the end-of-line produces a carriage return and line feed.

A control byte (0003, 0005, 0006) that changes the terminal input mode prevents the system from printing a question mark in response to a program request for input. However, in all other cases, a read request on the input buffer causes the system to print a question mark at the terminal.

End of Transaction Block (0010)

This byte is used by the transaction subsystem (TAF/TRANEX) to indicate the end of a transaction block. This byte must be followed by an end-of-line.

Initiate ASCII Output (0011)

This byte is used to initiate ASCII output. This byte must be byte 0 (bits 59 through 48) and applies only to the line currently being output.

End of Transaction Block with Response (0012)

This byte is used by the transaction subsystem to indicate the end of a transaction block with a completion response to be sent back to the transaction subsystem. This byte must be followed by an end-of-line.

End of String (0013)

This control byte allows a user to terminate a line of output data without repositioning the terminal carriage. This byte must be followed by an end-of-line (which is ignored) and output continues with subsequent data.

Internal End-of-Block (0014)

This control byte is the first byte of a word and is followed by an end-of-line. This byte is reserved by NOS and should not be used since it may cause loss of data.

CONTROL OF PROGRAM EXECUTION

By entering various keys or commands, the terminal user can exercise control over an interactive program during all phases of execution. The following is a list of these keys and commands and their effect on the executing program.

<u>Phase</u>	<u>Key/Command</u>	<u>Effect</u>
Waiting for Input	STOP	The program is terminated and the terminal is placed in command mode. All other entries are passed to the program as data. For all input modes except binary, carriage return is passed as end-of-line. If no data is entered, a null input line is passed to the program. STOP is not detected in binary input mode.
Generating Output†	S	The S key has the same effect as the STOP command in the input phase.
	I	The output operation ceases and the terminal is placed in suspended mode. The time-sharing executive recognizes only: <ul style="list-style-type: none">• The P key causing a return to program control, discarding any data in the program buffer prior to the entry of the I key.• A carriage return causing output to be continued and program control to continue normally. Part of the current line of output may be lost when output is suspended.• Any other key is interpreted as the STOP command.
	INTERRUPT or BREAK	This key has the same effect as the I key.
Executing†	STOP	This command has the same effect as the STOP command in the input phase.
	INTERRUPT or BREAK	INTERRUPT has the same effect as the I key during output.

DISTC MACRO

The DISTC macro enables an interactive program to prevent the time-sharing executive from processing terminal control keys and commands.

† Certain correspondence code terminals do not allow any input except INTERRUPT during output or execution.

Macro Format:†

LOCATION	OPERATION	VARIABLE SUBFIELDS
	DISTC	st, addr, INT

st **Control status:**
 ON Activates program terminal control
 OFF Deactivates program terminal control

addr Specifies an interrupt address which the system uses to inform the program that a terminal operator attempted to terminate the program. This parameter is valid only if st=ON. If addr is not specified, the program is not notified of attempted terminal control.

INT If INT is specified when terminal control is attempted, the system copies the program operating registers (exchange package)†† to the 20g-word area starting at addr. The program address is changed to addr + 20g. If INT is not specified, the contents of addr are set to one. The program can then check the location periodically to determine if the terminal operator has attempted to interrupt or terminate the program.

The interrupt address remains the same after the program is notified of an attempted interrupt. Once a terminal control is set or cleared, that status remains in effect until:

- The program issues a DISTC macro that changes the status.
- The program terminates, which returns the terminal to command mode.
- The user logs off or disconnects the terminal. If the terminal was disconnected, the user may recover. If the executing program is continued after recovery, the terminal control status remains as it was prior to the disconnect. If the executing program is not continued, the interrupt address is cleared.

† This macro is not available in SYSTEXT. The user must call the common deck COMCMAC.

†† A system request, XJR, allows the user to restore the operating registers and resume normal processing after the interrupt processing has been completed.

The following is a list of the same keys and commands described previously and their effect when the user selects the disable terminal control feature.

<u>Phase</u>	<u>Key/Command</u>	<u>Effect</u>
Waiting for Input	STOP	The user may enter this command at the beginning of any input line unless binary input mode has been selected. STOP is passed to the program via the input file. If an interrupt address was specified, the program is notified of attempted control.
	S	If an interrupt address was specified, the program is notified of attempted control. If the program issued an input request before the operator attempted terminal control, the system takes the same action as during the input phase.
Generating Output	I	Same as for S.
	INTERRUPT	Same as for S.
Executing	STOP	If an interrupt address was specified, the program is notified of attempted control.
	INTERRUPT	Same as for STOP.

CSET MACRO

The CSET macro sets the terminal's initial and current character set mode to either ASCII or NORMAL.

Macro Format: †

LOCATION	OPERATION	VARIABLE SUBFIELDS
	CSET	arg, C

arg

Argument:

<u>Mode</u>	<u>Description</u>
ASCII	Set extended character set mode
NORMAL	Set 64/63 character set mode
RESTORE	Set current terminal character mode to initial terminal character mode

C Change initial and current terminal character mode to that specified; if C is omitted, only the current mode is changed.

NOTE

The use of this macro may cause the character mode of the terminal to switch prior to the printing of all previous output. This can be prevented by preceding the macro call with an input request.

† This macro is not available in SYSTEXT. The user must call the common deck COMCMAC (refer to appendix A).

PARITY MACRO

The PARITY macro sets the terminal to the indicated parity.

Macro Format: †

LOCATION	OPERATION	VARIABLE SUBFIELDS
	PARITY	arg

arg EVEN selects even parity; ODD selects odd parity.

NOTE

The use of this macro may cause the parity of the terminal to switch prior to all previous output being printed at the terminal. This can be prevented by preceding the macro call with an input request.

TSTATUS MACRO

The TSTATUS macro returns the status of the terminal. Information returned includes terminal type, subsystem being used, the terminal number, parity, character set information, duplex and tape mode status, and the current interrupt address.

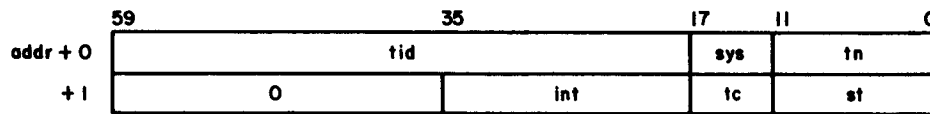
Macro Format: †

LOCATION	OPERATION	VARIABLE SUBFIELDS
	TSTATUS	addr

addr Address of 2-word status return buffer.

† This macro is not available in SYSTEXT. The user must call the common deck COMCMAC (refer to appendix A).

Exit conditions:



tid Left-justified, zero-filled display code terminal type identification:

<u>Type</u>	<u>Description</u>
TTY	ASCII code terminal with standard print
TTYD	TTY with 61 character set
MEMAPL	Memorex® 1240 (ASCII code) terminal with APL print
MEMAPLD	MEMAPL with 61 character set
CORAPL	Correspondence code terminal with APL print
CORAPLD	CORAPL with 61 character set
COR	Correspondence code terminal with standard print
CORD	COR with 61 character set
BLKEDT	Block transmission (ASCII code) terminal with standard print.
BLKEDTD	BLKEDT with 61 character set

sys Subsystem ordinal:

<u>Code</u>	<u>Description</u>
0	NULL subsystem
1	BASIC subsystem
3	FTNTS subsystem
4	EXECUTE subsystem
5	BATCH subsystem
6	ACCESS subsystem
7	TRANACT subsystem

tn Terminal number (octal)

int Current interrupt address, if set (refer to DISTC)

tc

Transmission code:

<u>Code</u>	<u>Description</u>
0	ASCII terminal
1	Correspondence terminal
2	NIXDORF terminal

st

Terminal status bits:

<u>Code</u>	<u>Description</u>
0	Parity (odd if set)
1	Initial character set (ASCII if set)
2	Current character set (ASCII if set)
3	Set indicates full duplex
4	Set indicates tape mode

CPU COMMON DECKS

A

Appendix A lists the CPU common decks of general interest to the COMPASS programmer, including a list of those common decks that are available in relocatable form on the system library (SYSLIB). The user can obtain documentation of all CPU common decks by entering the following control statement after accessing the system OPL.

```
MODIFY(Z)/*EDIT, CALLCPU  
DOCUMENT.
```

In addition, by using the KRONREF utility to determine which common decks are associated with which programs, the user can determine the program listings to obtain for examples of the use of particular common decks.

Since common decks are continually being changed or updated, it is impossible to maintain a complete and current description of each common deck in this appendix. Thus, the user should consult system listings as described above for specific information.

COMCMAC

The COMCMAC common deck contains macros (not available in SYSTEXT) for issuing system functions for system-oriented programs. The common decks for the processors used must also be called by the user.

The macros defined in common deck COMCMAC are available in systems text PSSTEXT. Therefore, the user can access these macros either through the system OPL or by specifying the alternate systems text PSSTEXT.

The following COMCMAC macros are described in the indicated sections.

<u>Macro Name</u>	<u>Description</u>	<u>Section</u>
CATLIST	Catalog user's permanent files	5
CHECKPT	Create checkpoint dump	10
CONSOLE	Set K display control	6
CSET	Set terminal character set mode	12
DAYFILE	Access dayfile	9
DISTC	Disable terminal control	12
EDATE	Edit packed date	11
ENCSF	Enter new control statement file	4
ESYF	Enter system file	9
ETIME	Edit packed time	11
EXCST	Execute control statement	10
GETASL	Get account block SRU limit	6
GETFLC	Read field length control word	6
GETFNT	Read FNT/FST entry table	4
GETGLS	Get global library set	6
GETJA	Read job accounting words	6
GETJCR	Read job control registers	6

<u>Macro Name</u>	<u>Description</u>	<u>Section</u>
GETJN	Read job name	6
GETJO	Read job origin code	6
GETJSL	Get job step SRU limit	6
GETLC	Get loader control word	6
GETMC	Read machine characteristics	6
GETPFP	Get permanent file parameters	6
GETPR	Read CPU priority	6
GETQP	Read job queue priority	6
GETSS	Get subsystem	6
GETTL	Read time limit	6
LOADD	Load fast dynamic load capsule directory	11
LOADQ	Load fast dynamic load capsules	11
NORERUN	Clear rerun status	7
PARITY	Set terminal parity	12
PRIMARY	Make file primary	4
PSCSF	Position control statement file	4
RDVT	Return device type	9
RERUN	Set rerun status	7
ROLLOUT	Roll out job	6
SETGLS	Set global library set	6
SETJCR	Set job control registers	6
SETLC	Set loader control word	6
SETPR	Set CPU priority	6
SETQP	Set queue priority	6
SETSS	Set subsystem	6
SETSSM	Set secure system memory	6
SETUI	Set user index	6
SUBMIT	Enter job in input queue	7
SUBR	Create subroutine tag	11
TSTATUS	Return terminal status	12

COMCCMD

The COMCCMD common deck contains macros (not available in SYSTEXT) for issuing special job control and accounting function requests.

The macros defined in common deck COMCCMD are available in systems text PSSTEXT. Therefore, the user can access these macros either through the system OPL or by specifying the alternate systems text PSSTEXT.

The following COMCCMD macros are described in the indicated sections.

<u>Macro Name</u>	<u>Description</u>	<u>Section</u>
COMMON	Change file type to library (LIFT)	4
GETEM	Read current exit mode	6
GETLOF	Get list of files pointer	6
MACHID	Read machine identification	6
MODE	Set exit mode flags	6
PACKNAM	Request pack name	6
SETASL	Set account block SRU limit	6
SETJSL	Set job step SRU limit	6
SETLOF	Set list of files pointer	6
SETMFL	Set job maximum field length	6
SETRFL	Set job step initial field length	6
SETTL	Set job step time limit	6
VERSION	Read operating system version name	6

OTHER COMMON DECKS

The following common decks are also available to the user.

<u>Common Deck</u>	<u>Description</u>
COMCARG	Processes an argument list by the use of an equivalence table
COMCARM	Processes multiple word arguments
COMCCDD	Converts decimal digits to display code with leading zero suppression
COMCCFD	Converts a 30-bit integer to display code in FORTRAN F10.3 format
COMCCIO	Performs I/O functions through the PPU program CIO
COMCCOD	Converts octal digits to display code with leading zero suppression
COMCCPM	Calls the PPU program CPM to perform tasks involving control point activity
COMCDXB	Converts one word of display code digits to a binary value
COMCEDT	Edits an 18-bit packed date or time into a 10-character display coded date or time
COMCFCE	Edits a permanent file catalog entry into a two-line output format
COMCLFM	Processes requests for the PPU program LFM
COMCMTM	Contains macros for generation, allocation, and processing of managed tables

<u>Common Deck</u>	<u>Description</u>
COMCMTP	Contains routines for processing managed tables
COMCMVE	Moves a block of data
COMCOVL	Requests the PPU program LDR to load a specified overlay
COMCPFM	Performs permanent file action functions by calls to the PPU program PFM
COMCPOP	Obtains parameters from a string buffer
COMCQFM	Processes requests for the PPU program QFM
COMCRDC	Reads one coded line from a CIO buffer to a working buffer
COMCRDH	Reads one coded line from a CIO buffer to a working buffer with trailing space fill
COMCRDO	Reads one word from a CIO buffer to the X6 register
COMCRDS	Reads one coded line from a CIO buffer to a working buffer where it is stored one character per word
COMCRDW	Reads the specified number of words from a CIO buffer to a working buffer
COMCSFM	Processes requests for the PPU program SFM
COMCSFN	Replaces trailing 00 codes with 55 codes in a word
COMCSRT	Identifies the format of a record from the first 64 words located in a working buffer
COMCSSN	Skips a sequence number on a coded line if present
COMCSST	Sorts a table into ascending order using a shell-sorting technique
COMCSTF	Determines if a file is, or will be, assigned to a terminal
COMCSYS	Contains routines for processing certain system requests
COMCUPC	Unpacks a control statement to individual parameters
COMCWOD	Converts a word to octal display code by an in-line sequence of shifts and masks
COMCWTC	Transfers one coded line in C format from a working buffer to a CIO buffer
COMCWTH	Transfers one coded line in H format from a working buffer to a CIO buffer; trailing spaces are deleted
COMCWTO	Writes one word to a CIO buffer from X6
COMCWTS	Transfers one coded line from a string buffer to a CIO buffer with trailing space suppression
COMCWTW	Transfers data from a working buffer to a CIO buffer
COMCZTB	Replaces all 00 codes with 55 codes in a word

SYSLIB

The following common decks are available in relocatable form on the system library SYSLIB.

<u>Common Deck</u>	<u>Entry Points</u>	<u>Description</u>
COMCCIO	CIO=	I/O function processor
COMCCPM	CPM=	Control point manager processor
COMCLFM	LFM=	Local file manager processor
COMCMVE	MVE=	Move block of data
COMCOVL	OVL=	Overlay load processor
COMCPFM	PFM=	Permanent file processor
COMCRDC	RDC=	Read coded line, -C- format
COMCRDH	RDH=	Read coded line, -H- format
COMCRDO	RDO=	Read one word
COMCRDS	RDS=	Read coded line to string buffer
COMCRDW	LCB=, RDW=, RDX=	Read words to working buffer
COMCSYS	MSG=, RCL=, SYS=, WNB=	Process system request
COMCWTC	WTC=	Write coded line, -C- format
COMCWTH	WTH=	Write coded line, -H- format
COMCWTO	WTO=	Write one word
COMCWTS	WTS=	Write coded line from string buffer
COMCWTW	DCB=, WTW=, WTX=	Write words from working buffer

EXAMPLES OF RANDOM I/O

B

Appendix B contains several programs that perform the following random I/O operations.

- Create a random file
- Read a random file with list
- Write (replacing records) on a random file

The COMPASS program illustrated in figure 2-B-1 reads the input deck in figure 2-B-2 and creates a random file in the format illustrated in figure 2-B-3. The resulting index directory record is also illustrated.

An example of a program which uses the READLS (read with list) macro to retrieve (read) a list of records from the same random file is illustrated in figure 2-B-4.

Figure 2-B-5 illustrates two ways of writing (replacing) records on a random file. The new record 1 is written at EOI; that is, at the same random address. Record 3 is written to the file by using the REWRITER macro, which rewrites in place.

```

CREATE
    IDENT  CREATE,FWA
    ABS
    SST
    TITLE  CREATE - CREATE RANDOM FILE.
    ENTRY  CREATE
    ENTRY  RFL=
    SYSCOM B1
*COMMENT  CREATE RANDOM FILE.
          COMMENT COPYRIGHT CONTROL DATA 1976.
          SPACE 4
***      CREATE - CREATE RANDOM FILE.
*        PROGRAMMER NAME. 76/3/8.
          SPACE 4
***      THIS PROGRAM CREATES A RANDOM FILE AND DIRECTORY FROM
*        DATA SUPPLIED ON FILE INPUT.
*        FORMAT OF INPUT -
*          CARD 1      COLUMN 1-2      RECORD NUMBER RIGHT JUSTIFIED
*          CARD 1      COLUMN 11-20    RECORD NAME
*          CARD 2-N    COLUMN 1-80    RECORD DATA
*          CARD N      EOR
*          REPEAT SEQUENCE -
*          MAX. 64 RECORDS
*
*        FILE IS WRITTEN TO RANFILE.
          SPACE 4
***      DAYFILE MESSAGES.
*
*        * INDEX OUT OF RANGE.* = INDEX INPUT .GE. 64.
*        * RANDOM FILE CREATED.* = PROGRAM COMPLETE.
          SPACE 4
**       PROGRAM CONSTANTS.

IBUFL   EQU    101B      INPUT BUFFER LENGTH
INDL    EQU    101B      INDEX LENGTH
WBUFL   EQU    10B       WORKING STORAGE BUFFER LENGTH
RBUFL   EQU    1001B     FILE CREATION BUFFER
TITLE   MAIN PROGRAM.
ORG     103B

FWA     BSS    0
I       BSS    0          INPUT FET
INPUT   FILEB  IBUF,IBUFL
R       BSS    0
RANFILE RFILEB RBUF,RBUFL,(IND=INDEX,INDL)
MAXI    CON    0          MAXIMUM INDEX

CREATE  SB1     1
        REWIND R
CRI     READ   I,R        READ NEXT RECORD
        READO  I
        NG    X1,CR4     IF END OF FILE
        MX0   12
        BX5   X0*X6

```

Figure 2-B-1. COMPASS Program to Create a Random File (Sheet 1 of 3)


```

SB7      B0          SET OCTAL CONVERSION
RJ       DXB        CONVERT DIGIT
NZ       X4,ERR     IF ERROR IN RECORD NUMBER
BX5      X6         SAVE RECORD NUMBER

RECALL R
READO I          READ RECORD NAME
NG       X1,CR4   IF END OF FILE
MX0      42       SET ADDRESS OF RECORD IN INDEX
SA1      R+6
LX1      30
BX6      X0*X6
BX1      -X0*X1
BX6      X6+X1
SA6      INDEX+X5
SA1      MAXI
IX1      X1-X5
PL       X1,CR2   IF NOT LARGEST INDEX
BX6      X5       SET NEW MAX. INDEX
SA6      A1
CR2      READC I,WORK,WBUFL
NG       X1,CR4   IF END OF FILE
NZ       X1,CR3   IF END OF RECORD
WRITEC R,WORK,WBUFL
EQ       CR2
CR3      WRITER R
EQ       CR1      READ NEXT RECORD

**       WRITE INDEX.

CR4      RECALL R
SA1      MAXI
WRITEW R,INDEX,X1+1
WRITER R,R
WRITEF R,R
REWIND R
MESSAGE (=C*RANDOM FILE CREATED.),,R
ENDRUN

ERR      MESSAGE (=C*INDEX OUT OF RANGE.),,R
ABORT
SPACE 4
**       COMMON DECKS.

*CALL   COMCRDO
*CALL   COMCCIO
*CALL   COMCWTW
*CALL   COMCWTC
*CALL   COMCRDC
*CALL   COMCSYS
*CALL   COMCRDW
*CALL   COMCDXB

```

Figure 2-B-1. COMPASS Program to Create a Random File (Sheet 2 of 3)

```

      USE      LITERALS
**      BUFFERS.

INDEX  BSSZ  INDL      INDEX BUFFER
IBUF   EQU   *        INPUT BUFFER
RBUF   EQU   IBUF+IBUFL  RANDOM FILE BUFFER
WORK   EQU   RBUF+RBUFL  WORKING BUFFER
RFL=   EQU   WORK+WBUFL  JOB FL
      END

```

Figure 2-B-1. COMPASS Program to Create a Random File (Sheet 3 of 3)

```
10          RECOR10
REC10
THIS IS RECORD NUMBER 10.
-EOR-
03          RECORD3
REC3
THIS IS RECORD NUMBER 3.
-EOR-
07          RECORD7
REC7
THIS IS RECORD NUMBER 7.
-EOR-
02          RECORD2
REC2
THIS IS RECORD NUMBER 2.
-EOR-
05          RECORD5
REC5
THIS IS RECORD NUMBER 5.
-EOR-
01          RECORD1
REC1
THIS IS RECORD NUMBER 1.
-EOR-
04          RECORD4
REC4
THIS IS RECORD NUMBER 4.
-EOR-
06          RECORD6
REC6
THIS IS RECORD NUMBER 6.
-EOR-
-EOI-
```

Figure 2-B-2. Input File for Program Creating a Random File (Figure 2-B-1)

RECORD 10
RECORD 3
RECORD 7
RECORD 2
RECORD 5
RECORD 1
RECORD 4
RECORD 6
INDEX
EOF
EOI

Random File Format

Record Name	RSA
RECORD 1	6
RECORD 2	4
RECORD 3	2
RECORD 4	7
RECORD 5	5
RECORD 6	10
RECORD 7	3
RECORD 10	1
0 ————— 0	
	.
	.
	.

Index Record

Figure 2-B-3. Structure of the Random File Created

```

RLIST
IDENT  RLIST,FWA
ABS
SST
TITLE  RLIST - READ SELECTED LIST FROM RANDOM FILE.
ENTRY  RLIST
ENTRY  RFL=
SYSCOM B1
*COMMENT READ LIST OF RANDOM FILE.
COMMENT COPYRIGHT CONTROL DATA 1976.
SPACE 4
***
RLIST - READ SELECTED LIST FROM RANDOM FILE.
*
PROGRAMMER NAME. 76/2/14.
SPACE 4
***
THIS PROGRAM READS A SELECTED LIST OF RECORDS
*
FROM RANDOM FILE AND WRITES THEM TO FILE OUTPUT.
*
SELECTED LIST IS -
*
3
*
7
*
4
*
10
SPACE 4
***
DAYFILE MESSAGES.
*
*
*
*INDEX OVERFLOW.* = INDEX BUFFER OVERFLOWED.
*
*LIST COPIED.* = PROGRAM COMPLETE.
SPACE 4
**
PROGRAM CONSTANTS.

INDL EQU 101B INDEX LENGTH
RBUFL EQU 101B RANDOM FILE BUFFER LENGTH
OBUFL EQU 101B OUTPUT BUFFER LENGTH
WBUFL EQU 10B WORKING BUFFER LENGTH
TITLE MAIN PROGRAM.
ORG 103B

FWA BSS 0

R BSS 0
RANFILE RFILEB RBUF,RBUFL,(IND=INDEX,INDL)
O BSS 0
OUTPUT FILEB OBUF,OBUFL
LIST BSSZ 10B LIST TO READ

RLIST SB1 1
SKIPEI R,R POSITION TO INDEX
EKSP R,R
BKSP R,R
READ R,R READ INDEX
READW R,INDEX,INDL
ZR X1,ERR IF INDEX TOO LARGE

**
SET LIST OF RECORDS.

```

Figure 2-B-4. COMPASS Program using READLS Macro to Retrieve a List of Records from a Random File (Sheet 1 of 2)

```

MX0      42
SA1      INDEX+3      RECORD 3
BX6      -X0*X1
SA6      LIST
SA1      INDEX+7      RECORD 7
BX6      -X0*X1
SA6      A6+B1
SA1      INDEX+4      RECORD 4
BX6      -X0*X1
SA6      A6+B1
SA1      INDEX+10B    RECORD 10
BX6      -X0*X1
SA6      A6+B1
SX6      LIST          SET ADDRESS OF LIST
SA6      R+5

```

** READ LIST.

```

RLI1     READLS R,R
RLI2     READW  R,WORK,WBUFL
          NG    X1,RLI3      IF END OF FILE
          WRITEW O,WORK,WBUFL
          EQ    RLI2

```

```

RLI3     SX1     B6-WORK
          WRITEW O,WORK,X1
          WRITER O
          REWIND R
          MESSAGE (=C*LIST COPIED.),,R
          ENDRUN

```

```

ERR      MESSAGE (=C*INDEX OVERFLOW.),,R
          ABORT
          SPACE 4

```

** COMMON DECKS.

```

*CALL    COMCCIO
*CALL    COMCWTW
*CALL    COMCRDW
*CALL    COMCSYS
          SPACE 4
          USE    LITERALS

```

** BUFFERS.

```

INDEX    EQU    *          INDEX BUFFER
RBUF     EQU    INDEX+INDL  RANDOM FILE BUFFER
OBUF     EQU    RBUF+RBUFL  OUTPUT BUFFER
WORK     EQU    OBUF+OBUFL  WORKING BUFFER
RFL=     EQU    WORK+WBUFL  DEFAULT FL
          END

```

Figure 2-B-4. COMPASS Program using READLS Macro to Retrieve a List of Records from a Random File (Sheet 2 of 2)

```

REWRITE
  IDENT  REWRITE,FWA
  ABS
  SST
  TITLE  REWRITE - REWRITE RANDOM FILE.
  ENTRY  REWRITE
  ENTRY  RFL=
  SYSCOM B1
*COMMENT REWRITE RANDOM FILE
  COMMENT COPYRIGHT CONTROL DATA 1976.
  SPACE 4
***
  REWRITE - REWRITE RANDOM FILE.
*
  PROGRAMMER NAME. 76/2/14.
  SPACE 4
***
  THIS PROGRAM UPDATES RECORDS ON A RANDOM FILE.
*
  RECORD 3 IS UPDATED IN PLACE
*
  RECORD 1 IS REWRITTEN AT EOI
*
  THE DIRECTORY IS ALSO REWRITTEN
  SPACE 4
***
  DAYFILE MESSAGES.
*
  *INDEX OVERFLOW.* = INDEX TOO LARGE FOR BUFFER
  SPACE 4
**
  PROGRAM CONSTANTS.

  INDL  EQU 101B INDEX LENGTH
  RBUFL EQU 101B RANDOM FILE BUFFER LENGTH
  TITLE MAIN PROGRAM.
  ORG 103B

  FWA BSS 0

  R BSS 0
  RANFILE RFILEB RBUF,RBUFL,(IND=INDEX,INDL)
  INDS CON 0

  REWRITE SB1 1
           SKIPEI R,R POSITION TO INDEX
           BKSP R,R
           BKSP R,R
           READ R,R READ INDEX
           READW R,INDEX,INDL
           ZR X1,ERR IF INDEX TOO LARGE
           BX6 X1 SAVE INDEX SIZE
           SA6 INDS

**
  CHANGE RECORD 3 IN PLACE.

  SA1 INDEX+3 SET ADDRESS OF RECORD 3
  MX0 42
  BX6 -X0*X1
  SA6 R+6
  WRITEC R,(=C*REC3-1*)
  WRITEC R,(=C*THIS IS UPDATED RECORD 3.*)
  REWRITER R,R

```

Figure 2-B-5. COMPASS Program to Replace Certain Records on a Random File (Sheet 1 of 2)

```

**          REWRITE RECORD 1 AT EOI.

          SKIPEI R,R          POSITION FILE AT EOI
          SA1      R+6
          MX0      42
          LX1      30
          SA2      INDEX+1
          BX6      X0*X2          PICK RECORD NAME
          BX1      -X0*X1
          BX6      X1+X6          REWRITE NEW ADDRESS
          SA6      A2

          WRITEC R,(=C*RECI-1*)

          WRITEC R,(=C*THIS IS UPDATED RECORD 1.*)
          WRITEC R,(=C*WRITTEN AT EOI BECAUSE LENGTH IS EXTENDED.*)
          WRITER R,R

**          REWRITE INDEX.

          SA1      INDS
          WRITEW R,INDEX,X1
          WRITER R,R
          WRITEF R,R
          REWIND R
          MESSAGE (=C*RANFILE UPDATED.),,R
          ENDRUN

          ERR      MESSAGE (=C*INDEX OVERFLOW.),,R
          ABORT
          SPACE 4

**          COMMON DECKS.

*CALL      COMCCIO
*CALL      COMCWTC
*CALL      COMCRDW
*CALL      COMCWTW
*CALL      COMCSYS
          SPACE 4
          USE      LITERALS

**          BUFFERS.

          INDEX   EQU      *
          RBUF    EQU      INDEX+INDL  RANDOM FILE BUFFER
          RFL=    EQU      RBUF+RBUFL  DEFAULT FL

          END

```

Figure 2-B-5. COMPASS Program to Replace Certain Records on a Random File (Sheet 2 of 2)

All software product documentation produced under NOS follows a prescribed set of standards and specifications. Appendix C briefly describes these standards and specifications.

INTERNAL AND EXTERNAL DOCUMENTATION

NOS documentation is of two types.

- External Produced for the general user
- Internal Describes the internal characteristics of a program (such as register usage, subroutine entry, and exit conditions)

For a detailed explanation of how to obtain internal and external documentation, refer to the description of the DOCUMENT control statement in section 7, volume 1.

DOCUMENT ON COMMENT STATEMENTS

The following rules apply to the format of comment statements for documentation.

- All comment statements begin with an asterisk in column 1. The text of the comment is contained in columns 11 through 72. If a comment statement has an asterisk in column 1 only, it is a continuation of internal and external documentation, or it is a comment statement not included in formal documentation.
- Comment statements with asterisks in columns 1, 2, and 3 indicate that this statement and all following comment statements are internal and external documentation.
- Comment statements with asterisks in columns 1 and 2 indicate internal documentation.
- A statement with four asterisks beginning in column 1 indicates that all following statements are internal documentation (whether they are comment statements or not). Documentation ends when another comment statement containing four asterisks is encountered. This can be used to describe tables.
- All stand-alone comment statements are preceded and followed by a blank line and are terminated by a period.
- Comments describing the function of a section of a code appear on the first line of a sentence.

Figure 2-C-1 is an example of external documentation for program COPYB. Figure 2-C-2 is an example of internal documentation for COPYB.

COPYB - BINARY FILE COPIES.
G. R. MANSFIELD. 70/12/20.
J. C. BOHNHOFF. CPD. 73/03/01.
R. E. TATE. CPD. 73/04/03.

DAYFILE MESSAGES.

- * ILLEGAL COUNT.* = OPTIONAL RECORD/FILE COUNT ILLEGAL FORMAT.
- * ILLEGAL TERMINATION CONDITION.* = ILLEGAL FORMAT ON RECORD TERMINATOR FOR *COPYX*.
- * END OF INFORMATION ENCOUNTERED.* = END OF INFORMATION WAS ENCOUNTERED BEFORE THE SPECIFIED COPY OPERATION WAS COMPLETED.

COPY (IFILE,OFIL,V,C)
COPY FILES FROM MEDIUM TO MEDIUM IN BINARY MODE
THROUGH AN EMPTY FILE.

IFILE	INPUT FILE NAME.
OFIL	OUTPUT FILE NAME.
V	IF PRESENT, REWIND AND VERIFY BOTH FILES. JOB WILL ABORT IF VERIFY ERRORS
C	COPY IN CODED FORMAT (SI,S,L FORMAT TAPES)

IF IFILE = OFIL, FILES ON IFILE ARE SKIPPED.

ASSUMED PARAMETERS.
IFILE = *INPUT*
OFIL = *OUTPUT*
V NOT PRESENT
C NOT PRESENT

COPYBF (IFILE,OFIL,N,C)
IFILE NAME OF INPUT FILE.
OFIL NAME OF OUTPUT FILE.
N NUMBER OF FILES TO COPY.
C COPY IN CODED FORMAT (SI,S,L FORMAT TAPES)

IF IFILE = OFIL, FILES ON IFILE ARE SKIPPED.

ASSUMED PARAMETERS.

CONTROL DATA CORPORATION DOCUMENTATION.

Figure 2-C-1. External Documentation of COPYB (Sheet 1 of 3)

IFILE = *INPUT*
OFILE = *OUTPUT*
N = 1
C NOT PRESENT

COPYBR (IFILE,OFILE,N,C)
COPY RECORDS FROM MEDIUM TO MEDIUM IN BINARY MODE.
A FILE MARK IS COUNTED AS A RECORD.

IFILE INPUT FILE NAME.
OFILE OUTPUT FILE NAME.
N NUMBER OF RECORDS TO BE COPIED.
C COPY IN CODED FORMAT (SI,S,L FORMAT TAPES)

IF IFILE = OFILE, RECORDS ON IFILE ARE SKIPPED.

ASSUMED PARAMETERS.

IFILE = *INPUT*
OFILE = *OUTPUT*
N = 1
C NOT PRESENT

COPYEI (IFILE,OFILE,V,C)
COPY FILES FROM MEDIUM TO MEDIUM IN BINARY MODE TO END-OF-
INFORMATION.

IFILE INPUT FILE NAME.
OFILE OUTPUT FILE NAME.
V IF PRESENT, REWIND AND VERIFY BOTH FILES.
JOB WILL ABORT IF VERIFY ERRORS.
C COPY IN CODED FORMAT (SI,S,L FORMAT TAPES)

IF IFILE = OFILE, IFILE IS SKIPPED TO EOI.

ASSUMED PARAMETERS -

IFILE = *INPUT*
OFILE = *OUTPUT*
V NOT PRESENT.
C NOT PRESENT

COPYX (IFILE,OFILE,TERM,BKSP,C)
COPYX (IFILE,OFILE,TYPE/NAME,BKSP,C)

COPY RECORDS FROM MEDIUM TO MEDIUM IN BINARY MODE

CONTROL DATA CORPORATION DOCUMENTATION.

Figure 2-C-1. External Documentation of COPYB (Sheet 2 of 3)

UNTIL A SPECIFIED TERMINATION CONDITION IS REACHED.

IFILE	INPUT FILE NAME.
OFILE	OUTPUT FILE NAME.
TERM	TERMINATION CONDITION. *00* = ZERO RECORD *N* = N RECORDS *NAME* = NAME OF A RECORD
TYPE	MNEMONIC FOR RECORD TYPE.
NAME	RECORD NAME.
BKSP	BACKSPACE CONTROL. *0* = NO BACKSPACE *1* = BACKSPACE FIRST MEDIUM *2* = BACKSPACE SECOND MEDIUM *3* = BACKSPACE BOTH MEDIA
C	COPY IN CODED FORMAT (SI,S,L FORMAT TAPES)

IF IFILE = OFILE, RECORDS ON IFILE ARE SKIPPED.

ASSUMED PARAMETERS.

IFILE = *INPUT*
OFILE = *OUTPUT*
TERM = 1
BKSP = 0
C NOT PRESENT

CONTROL DATA CORPORATION DOCUMENTATION.

Figure 2-C-1. External Documentation of COPYB (Sheet 3 of 3)

COPYB - BINARY FILE COPIES.
G. R. MANSFIELD. 70/12/20.
J. C. BOHNHOFF. CPD. 73/03/01.
R. E. TATE. CPD. 73/04/03.

DAYFILE MESSAGES.

- * ILLEGAL COUNT.* = OPTIONAL RECORD/FILE COUNT ILLEGAL FORMAT.
- * ILLEGAL TERMINATION CONDITION.* = ILLEGAL FORMAT ON RECORD TERMINATOR FOR *COPYX*.
- * END OF INFORMATION ENCOUNTERED.* = END OF INFORMATION WAS ENCOUNTERED BEFORE THE SPECIFIED COPY OPERATION WAS COMPLETED.

ASSEMBLY CONSTANTS.

BUFL	EQU	100B	WORKING BUFFER LENGTH
BUFLC	EQU	1003B	WORKING BUFFER LENGTH FOR CONTROL WORDS
IBUFL	EQU	4011B	
OBUFL	EQU	4011B	

COPY (IFILE,OFILE,V,C)
COPY FILES FROM MEDIUM TO MEDIUM IN BINARY MODE
THROUGH AN EMPTY FILE.

IFILE	INPUT FILE NAME.
OFILE	OUTPUT FILE NAME.
V	IF PRESENT, REWIND AND VERIFY BOTH FILES. JOB WILL ABORT IF VERIFY ERRORS
C	COPY IN CODED FORMAT (SI,S,L FORMAT TAPES)

IF IFILE = OFILE, FILES ON IFILE ARE SKIPPED.

ASSUMED PARAMETERS.
IFILE = *INPUT*

CONTROL DATA CORPORATION DOCUMENTATION.

Figure 2-C-2. Internal Documentation of COPYB (Sheet 1 of 5)

OFFILE = *OUTPUT*
V NOT PRESENT
C NOT PRESENT

COPY9F (IFILE,OFFILE,N,C)
IFILE NAME OF INPUT FILE.
OFFILE NAME OF OUTPUT FILE.
N NUMBER OF FILES TO COPY.
C COPY IN CODED FORMAT (SI,S,L FORMAT TAPES)

IF IFILE = OFFILE, FILES ON IFILE ARE SKIPPED.

ASSUMED PARAMETERS.
IFILE = *INPUT*
OFFILE = *OUTPUT*
N = 1
C NOT PRESENT

COPY8R (IFILE,OFFILE,N,C)
COPY RECORDS FROM MEDIUM TO MEDIUM IN BINARY MODE.
A FILE MARK IS COUNTED AS A RECORD.

IFILE INPUT FILE NAME.
OFFILE OUTPUT FILE NAME.
N NUMBER OF RECORDS TO BE COPIED.
C COPY IN CODED FORMAT (SI,S,L FORMAT TAPES)

IF IFILE = OFFILE, RECORDS ON IFILE ARE SKIPPED.

ASSUMED PARAMETERS.
IFILE = *INPUT*
OFFILE = *OUTPUT*
N = 1
C NOT PRESENT

COPYE1 (IFILE,OFFILE,V,C)
COPY FILES FROM MEDIUM TO MEDIUM IN BINARY MODE TO END-OF-
INFORMATION.

IFILE INPUT FILE NAME.
OFFILE OUTPUT FILE NAME.
V IF PRESENT, REWIND AND VERIFY BOTH FILES.
JOB WILL ABORT IF VERIFY ERRORS.
C COPY IN CODED FORMAT (SI,S,L FORMAT TAPES)

CONTROL DATA CORPORATION DOCUMENTATION.

Figure 2-C-2. Internal Documentation of COPYB (Sheet 2 of 5)

IF IFILE = OFILE, IFILE IS SKIPPED TO EOI.

ASSUMED PARAMETERS -

IFILE = *INPUT*
 OFILE = *OUTPUT*
 V NOT PRESENT.
 C NOT PRESENT

COPYX (IFILE,OFILE,TERM,BKSP,C)
 COPYX (IFILE,OFILE,TYPE/NAME,BKSP,C)

COPY RECORDS FROM MEDIUM TO MEDIUM IN BINARY MODE
 UNTIL A SPECIFIED TERMINATION CONDITION IS REACHED.

IFILE	INPUT FILE NAME.
OFILE	OUTPUT FILE NAME.
TERM	TERMINATION CONDITION.
	00 = ZERO RECORD
	N = N RECORDS
	NAME = NAME OF A RECORD
TYPE	MNEMONIC FOR RECORD TYPE.
NAME	RECORD NAME.
BKSP	BACKSPACE CONTROL.
	0 = NO BACKSPACE
	1 = BACKSPACE FIRST MEDIUM
	2 = BACKSPACE SECOND MEDIUM
	3 = BACKSPACE BOTH MEDIA
C	COPY IN CODED FORMAT (SI,S,L FORMAT TAPES)

IF IFILE = OFILE, RECORDS ON IFILE ARE SKIPPED.

ASSUMED PARAMETERS.

IFILE = *INPUT*
 OFILE = *OUTPUT*
 TERM = 1
 BKSP = 0
 C NOT PRESENT

CCF - COPY CONTROL WORD FORMAT FILE.

ENTRY NONE.

EXIT (X1) < 0 IF EOI ENCOUNTERED.
 (X5) = NUMBER OF RECORDS COPIED.

USES ALL.

CONTROL DATA CORPORATION DOCUMENTATION.

Figure 2-C-2. Internal Documentation of COPYB (Sheet 3 of 5)

CALLS RDW=,MES,WTW=.

CPR - COPY RECORD.

ENTRY (X1) = FIRST BLOCK STATUS.

EXIT (X1) < 0 IF EOI.
(X1) = 0 IF EOF.

USES X - 2.
B - NONE.
A - 2.

CALLS NONE.

END - END PROGRAM.

MES - MESSAGE HEADER.
FINDS RECORD NAME IN *BUF*, ISSUES MESSAGE AND INCREMENTS
RECORD COUNT.

ENTRY (X5) = WORD COUNT IN *BUF*.

EXIT (MESA) = RECORD COUNT.
(X0) = SAME AS ENTRY.

SEM - SEND EOI MESSAGE.

ENTRY NONE.

EXIT (EI) = 1 = MESSAGE SENT.

BUFFERS.

PRS - PRESET PROGRAM.

CONTROL DATA CORPORATION DOCUMENTATION.

Figure 2-C-2. Internal Documentation of COPYB (Sheet 4 of 5)

EXIT (B7) = REMAINDER ARGUMENT COUNT.
 (A5) = LAST ARGUMENT ADDRESS.
 (X7) = 0 IF COPY CAN BE DONE WITH CONTROL WORDS.

CDT - CHECK DEVICE TYPE.

ENTRY (X1) = (FET+1).

EXIT (X7) = 0 IF CONTROL WORD READ/WRITE NOT SUPPORTED ON
 DEVICE.

USES B - NONE.
 A - 2.
 X - 0,1,2,6,7.

CALLS NONE.

STC - SET TERMINATION CONDITION.

ERR - PROCESS ERRORS.
 CONTROL DATA CORPORATION DOCUMENTATION.

Figure 2-C-2. Internal Documentation of COPYB (Sheet 5 of 5)

SPECIAL DOCUMENTATION STATEMENTS

The following points describe special statements used to produce documentation.

- Documentation statements containing cE in columns 1 and 2 cause the page to be ejected.
- Documentation statements containing cT in columns 1 and 2 produce a table.

The character c preceding an E or T statement is the key character specified by the C parameter on the DOCUMENT control statement (the default is an asterisk).

The cE and cT statements are recognized only if they appear within a set of consecutive statements beginning with ccc (external) or cc (internal), where c is the key character.

For example, the statement

*T EXAMPLE 24/PP PROGRAM, 18/PARAMETER 1, 18/PARAMETER 2

generates the following table.

```

          5         4         3         2         1
    98765432109876543210987654321098765432109876543210
-----

```

```

EXAMPLE /PP PROGRAM          /PARAMETER 1      /PARAMETER 2      /
-----

```

The bit position header is generated each time a new block of *T statements is encountered. The header is not listed for consecutive table statements or for any statement containing a nonblank character in column 3 of the first *T statement in a block. The identifier EXAMPLE is optional.

In the statement format shown, a slash must immediately follow a bit count field; however, spaces before the bit count are ignored. All bit counts for field widths can be specified in either octal or decimal. Decimal counts are assumed in the absence of a post radix B. All table entry description statements within an *T block represent the same total number of bits as the first statement. A maximum table width of 60 bits is allowed.

The slash separates fields in the table. The bit position that the slash occupies is included in the field to its left. Single bit fields are not listed with a slash separator. Instead, they have a + below the field position. If only one table entry is listed, the + is listed both above and below the field position.

- All loader control statements (overlay, section, etc.) are considered special, and their images are placed with the page number at the foot of each subprogram to which the directive applies.
- All END statements are considered special since they terminate a chapter.
- In COMPASS, the first TITLE statement has special meaning. Its contents (if non-blank) replace the page header. All subsequent TITLE statements are ignored.
- In COMPASS, the LIST statement has special meaning. The parameters X and L on a COMPASS control statement are processed normally. If a -L is encountered, however, all documentation is suppressed until a LIST, L statement is encountered. If a -X is encountered, no documentation is processed on common test CTEXT until a LIST, X statement is found.

The maximum number of these LIST statements that can be processed by DOCUMENT is 24. If more than 24 LIST X, -X, L, or -L statements are encountered, the following message is issued.

LIST CARD LIMIT - CARD IGNORED.

- The CTEXT and ENDX statements are bracket statements surrounding common text. No documentation is listed unless a LIST, X statement is encountered.

COMPASS OPERATION STATEMENTS

COMPASS coding standards are:

- Location field begins in column 2
- Operation field begins in column 11
- Address field begins in column 18
- Comment field is in columns 30 through 72

If a field extends into the next field, two blank columns separate the fields. If a field is filled exactly, one blank separates it from the next field.

Avoid using column 72 when possible. Information in column 72 abuts the line sequence number and causes difficulty in reading comments.

COMMENT FIELD DOCUMENTATION

Beginning in column 30 of the program instructions, the programmer defines the purpose of the instruction. Every instruction need not be documented in this manner; however, as many comments as possible should be included.

HEADER DOCUMENTATION

The variable field of TITLE statement is terminated with a period. The assembler inserts the field in the header line of the COMPASS listing. The location field of the SPACE statement and the variable field of the USE statement are also inserted in the header line.

The first two comment statements in the program are the routine name, and the author's name and the date. These are followed by a SPACE 4 statement. For example:

```
***      XXX - PROGRAM NAME AND DESCRIPTION.  
*        PROGRAMMER NAME.   YY/MM/DD.  
        SPACE 4
```

The body of the documentation includes the:

- Function of the routine
- Method used (if applicable)
- Entry conditions
- Exit conditions
- Messages issued
- Data areas used
- Routines called
- Registers used or saved for each entry point (CP programs)

This information appears in the order specified, with a SPACE 4 statement separating each section. An EJECT or TITLE statement follows this documentation.

Each subroutine has a header describing entry and exit conditions, registers used and routines called. The header is followed by two blank lines and the subroutine text. For example:

```
**          SFS - SEARCH FILE FOR STRING.
*
*          ENTRY (X0) = 0 SEARCH BEFORE WRITE/READ.
*                   .NE. 0 WRITE/READ BEFORE SEARCH.
*                   (X6) = STRING POINTER ADDRESS.
*
*          EXIT   (X7).NE. 0 IF STRING FOUND.
*                   = 0 IF EOF.
*
*          USES  A - 0, 2, 4, 6, 7.
*                   B - 2, 6, 7.
*                   X - 0, 2, 4, 5, 6, 7.
*
*          CALLS RDC=, SLS, WTC=.
```

If a field is not used, it is omitted rather than specifying NONE. If all of a type of CPU registers are used, list ALL rather than each register. For example:

```
*          USES  A - 0, 2, 4, 6.
*                   X - ALL.
```

PROGRAM TEXT

The program text documentation includes the:

- Local macro definitions.
- Definition of local symbols.
- Main loop of the routine.
- Primary subroutines in the routine: a header describing the entry/exit conditions, registers used or saved, and the memory locations used. This is followed by two blank statements and the subroutine text.
- Secondary and utility subroutines in the routine: a header describing the entry/exit conditions, registers used or saved, and the memory locations used. This is followed by two blank statements and the subroutine text.

ROUTINE NAME CONVENTIONS

The conventions followed in naming routines are:

- Peripheral processor routine names are three-character mnemonics.
- Central processor routine names are any length up to seven characters, preferably four or more characters to distinguish them from peripheral processor routines.
- Routine names are mnemonics which pertain to the function of the routines.

RESERVED NAME CONVENTIONS

In the following list, the x parameter represents any legal character, and n is any digit. Any conflict between user name categories and system name categories is resolved in favor of the user name categories.

- Ux Reserved for user equipment types
- 6xx Reserved for PP resident-callable mass storage drivers
- 7xx Reserved for mass storage driver error processing overlays
- 0xx Reserved for location-free overlays
- Uxx Reserved for user PP program names (CPU-callable) or for user-defined PP resident entry points
- nUx Reserved for user PP program names (PPU-callable) or overlay names
- UxxL, UxxM, UxxP, and UxxW Reserved for user PPCOM symbols
- 9AA - 9Z9 Used by the system
- 90A - 929 Used by diagnostics

SUBROUTINE TAG CONVENTIONS

Subroutine tags conform to the following standards.

- Subroutine names consist of three-character mnemonics.
- Jump tags consist of the subroutine name with 1 through 99 appended, in sequential order, with no gaps in numbering. The exception to this is when the exit point of a return jump is the subroutine name appended with an X (refer to SUBR macro, section 11). In cases where modifications are made and it becomes necessary to insert new tagged instructions, it is sometimes permissible to use fractional numbers following the tag (for example, PCL1.1). However, this practice is not recommended.
- Local data tags consist of the subroutine name with an A through Z appended, in alphabetical order, with no gaps in lettering.
- System tags (defined when the SST statement is used in the program) are used instead of constants whenever possible. This prevents problems when system routines such as PPR and mass storage drivers are referenced.
- Common decks used must avoid conflict with names in user's programs.

DATA TAG CONVENTIONS

Data tags conform to the following standards.

- Temporary M core constants (locations other than direct locations in PP code) and data names are four alphabetic characters to distinguish them from direct locations and entry point tags.
- Table tags begin with a T and have a three-character table name appended.
- Table length tags have an L appended to the table tag.
- Peripheral processor direct location tags are two characters in length. Permanent direct location assignments are defined in PPCOM and are called by the SST pseudo-op at the beginning of the program. Other direct locations are defined with the EQU pseudo-op in one block of code at the beginning of the program immediately following the initial documentation.
- Assembly option names, micro names, and names of items used to control code generation are five characters in length.

GENERAL CONSIDERATION FOR ALL PROGRAMS

The following items apply to all programs.

- Major subroutines are preceded by a TITLE statement (subtitle) so that they are completely separated from other subroutines.
- Each subroutine is headed by comment statements for documentation purposes. This documentation heading is followed by two blank statements and the text of the subroutine.
- Subroutines not on separate pages are separated by SPACE 4 statements. SPACE 4 statements have a tag in the tag field for COMPASS header purposes.
- SPACE 1 and SPACE 2 statements are not used. One or two blank statements are used instead.
- Jumps are not made to addresses like `*+3`. A tag is used. An exception to this is in very short delay loops. For example:

```
LCN      0          DELAY
SBN      1
NJN      *-1
```

- Comments on jump instructions are the if condition. For example:

```
MJN      TAG      IF TABLE FULL
```
- A comment describing a block of code appears at the beginning of that block.
- All display code data (character data) is in one of the allowable forms for specifying character data. Octal values are not used.
- Numeric data is specified in its natural form (that is, readable and understandable). If conversion considerations make this impossible, the comment field contains the natural form.
- Statement tags should reference actual instructions, not BSS 0 instructions.

- Only one piece of data is specified per line of code. Placing several pieces of data after a DATA pseudo-op makes the listing difficult to read. The same consideration applies to the ENTRY pseudo-op.

- The VFD pseudo-op does not contain more fields than required to generate one word (60 bits) of data. For example:

```
VFD      10/V1,10/V2,10/V3,10/V4,2/V5,18/V6
```

is acceptable while

```
VFD      60/TAG1,60/TAG2
```

is not acceptable.

- The EXT pseudo-op is not used. References to external names are =Xname.
- Macros for code generation are used sparingly to aid readability. When they are used, macros are structured to make use of data already in the registers. Extensive use of macros makes code difficult to read.
- Literals are used for data that is referenced only once.
- Shift counts used for testing bits in a field are of the form:

```
value+bit      or      value-bit
```

where bit is the bit number in the register, word, or field to be tested, and value is whatever expression is necessary to specify the correct shift count. For example, to test the upper bit of byte 1 of the central X3 register (bit 47), instead of using an

```
LX3      12
```

instruction, the following instruction is used.

```
LX3      59-47
```

Further, assume that one desires to test original bit 58 of the shifted X3 register. The following instruction can be used for this purpose.

```
LX3      59+ 47-58
```

COMMON DECK USAGE

Common decks enable a set of code to be used in several routines. They can be used whenever the code is in a form acceptable to the editing routines (Modify or Update). To insert a common deck into a program, a

```
*CALL      xxxxxxxx
```

card is needed, and common deck, xxxxxxxx, must be available to the editing routine. The common deck name begins in column 11. For further information concerning common deck usage, refer to section 2 and appendix A.

Common decks are used:

- To increase efficiency in writing code. If there is a need for code which was written for other applications, and the same code can be used in a new application, there is no need to regenerate the same code. It can be inserted into the new program by use of common deck calls and editing programs.
- To ensure uniformity of code. Since the code in the common deck is to be used without modification, it is completely uniform whenever the common deck is used.

- To decrease debugging time. System routines such as CIO have been thoroughly checked out and provide all of the necessary interface with the system, and therefore, need no debugging.

SYSTEM MACROS

Macros are available whenever a program communicates with another part of the system. For example, when issuing a monitor function in PP code, the macro MONITOR DTKM performs the following.

```
LDN    DTKM
RJM    FTN
```

Extensive CP code macros are available to perform input/output or issue system requests (such as requesting storage or requesting common files).

SYSTEM INTERFACE RULES

The following rules apply when writing central processor (CP) and peripheral processor (PP) routines for system interface.

- PP routines should be efficient and their use held to a minimum.
- PP programs that interface with CP programs should have some form of validation to ensure proper calling procedures or parameters. An example of this is CIO which checks all buffer parameters before performing any of the tasks requested. Great care should be taken to ensure that errors in arguments set up by the CP program do not cause the PP program to destroy an area other than the local FL of the calling program.
- PP routines waiting for some system resource to become available always pause for storage relocation to allow other system processing to proceed.
- Use of other PPs to assist in performing the assigned task is a practice that should be used only when absolutely necessary and with great caution. The fact that other PPs may not be available must be considered. The situation in which several PPs are waiting for pool processors should be prevented. The only sure way to do this is not to request helper PPs.
- PP overlays can be used without difficulty. The advantage of overlays is that a minimal amount of coding is loaded (from disk or CMR) every time a program is executed. Areas of programs that are used infrequently can be made overlays (for example, error processors). Certain system overlays are available for use by any program and are designed to be location-free (refer to programs OBF and ODF). For use of the overlays, refer to the SEGMENT pseudo-op.
- PP memory cells 70 through 73 and 75 through 77 are set when PPR is loaded. Care should be taken not to destroy these cells, as these locations are not initialized after each program load. Cell 74 (CP) is set by PPR when a program is loaded through an input register request.

- PP routines preparing for input/output to allocatable devices should request mass storage space needed before reserving the channel. Also, when input/output is complete, the channel should be dropped before indicating which area of mass storage was not used.
- PP routines doing input/output to a device should perform all housekeeping possible before operation is initiated. Unnecessary reservation of channels prevents other programs from using that channel for input/output.
- Buffers used by PP and CP programs should be defined by EQU statements at the end of the program text and not made part of the text by using BSS statements. This eliminates loading of the core area.
- PP programs or overlays are loaded from disk. The last sector of a program or overlay must be loaded at an address above that which causes wrap-around.

PROGRAM EXAMPLE

D

Appendix D contains a listing of the system program COPYB. This listing is supplied for two basic reasons.

- To illustrate the use of many of the system macros described in this manual
- To illustrate the format and documentation standards used in system programs

COPYB — BINARY FILE COPIES

COPYB - BINARY FILE COPIES.

```
IDENT COPYB,FETS
ABS
ENTRY COPY
ENTRY COPYBF
ENTRY COPYBR
ENTRY COPYEI
ENTRY COPYX
ENTRY RFL=
SYSCOM B1          DEFINE (B1) = 1
COMMENT 73/05/24. 74/11/23. BINARY FILE COPIES.
COMMENT COPYRIGHT CONTROL DATA CORP. 1970.
```

```
*** COPYB - BINARY FILE COPIES.
* G. R. MANSFIELD. 70/12/20.
* J. C. BOHNHOFF. CPD. 73/03/01.
* R. E. TATE. CPD. 73/04/03.
```

```
*** DAYFILE MESSAGES.
*
*
* * ILLEGAL COUNT.* = OPTIONAL RECORD/FILE COUNT ILLEGAL FORMAT.
*
* * ILLEGAL TERMINATION CONDITION.* = ILLEGAL FORMAT ON
* RECORD TERMINATOR FOR *COPYX*.
*
* * END OF INFORMATION ENCOUNTERED.* = END OF INFORMATION WAS
* ENCOUNTERED BEFORE THE SPECIFIED COPY OPERATION WAS
* COMPLETED.
```

COPYB - BINARY FILE COPIES.
COMMON DATA

**** ASSEMBLY CONSTANTS.

BUFL	EQU	100B	WORKING BUFFER LENGTH
BUFLC	EQU	1003B	WORKING BUFFER LENGTH FOR CONTROL WORDS
IBUFL	EQU	4011B	
OBUFL	EQU	4011B	

COMPASS 3-74259. 75/01/20. 15.20.14.
DATA

FETS	ORG	120B	
	BSS	0	
I	BSS	0	
INPUT	RFILEB	IBUF,IBUFL,(FET=8)	
O	BSS	0	
OUTPUT	RFILEB	OBUF,OBUFL,(FET=8)	
CT	CON	1	COUNT
EI	CON	0	END OF INFORMATION MESSAGE SENT
SK	CON	0	SKIP FLAG
VF	CON	0	VERIFY FLAG
TM	CON	1S59	COPYX TERMINATION
RN	CON	0	RECORD NAME
	CON	1S59	RECORD TYPE
BK1	CON	0	FILE 1 BACKSPACE
BK2	CON	0	FILE 2 BACKSPACE

**COPYB - BINARY FILE COPIES.
MAIN PROGRAMS.**

```

*** COPY (IFILE,OFILE,V,C)
* COPY FILES FROM MEDIUM TO MEDIUM IN BINARY MODE
* THROUGH AN EMPTY FILE.
*
* IFILE INPUT FILE NAME.
* OFILE OUTPUT FILE NAME.
* V IF PRESENT, REWIND AND VERIFY BOTH FILES.
* JOB WILL ABORT IF VERIFY ERRORS
* C COPY IN CODED FORMAT (SI,S,L FORMAT TAPES)
*
* IF IFILE = OFILE, FILES ON IFILE ARE SKIPPED.
*
* ASSUMED PARAMETERS.
* IFILE = *INPUT*
* OFILE = *OUTPUT*
* V NOT PRESENT
* C NOT PRESENT

```

```

COPY SB1 1 (B1) = 1
RJ PRS PRESET PROGRAM
BX5 X7 SAVE CONTROL WORD FLAG
ZR B7,CPY1 IF NO VERIFY REQUESTED
SA2 ARGR+2
ZR X2,CPY1 IF NULL PARAMETER
SX6 B1 SET VERIFY FLAG
SA6 VF
REWIND I
REWIND 0

```

```

CPY1 NZ X5,CPY4 IF CONTROL WORD COPY

```

* COPY RECORDS.

```

CPY2 SX5 0 CLEAR EOF FLAG
CPY3 READ I BEGIN READ
RECALL 0
WRITE 0,* PRESET WRITE FUNCTION
READW I,BUF,BUFL READ FIRST BLOCK
RJ CPR COPY RECORD
ZR X1,CPY2 IF NOT EOF/EOI
NG X1,CPY7 IF EOI
NZ X5,CPY7 IF LAST RECORD WAS EOF
SX5 1 SET EOF FLAG
JP CPY3 LOOP TO EMPTY FILE/EOI

```

* COPY FILES WITH CONTROL WORDS.

```

CPY4 RECALL 0 PRESET WRITE FUNCTION
WRITECH 0,*
CPY5 READCH I,178 BEGIN READ
RJ CCF COPY CONTROL WORD FILE
NG X1,CPY6 IF EOI
ZR X5,CPY7 IF EMPTY FILE
WRITEW 0,CPYC,B1+B1 WRITE END OF FILE TO BUFFER
JP CPY5

```

COPYB - BINARY FILE COPIES.
 MAIN PROGRAMS.

```

  CPY6   RJ      SEM      SEND EOI MESSAGE
*
  *      PROCESS VERIFY OPTION FOR COPY AND COPYEI.
  CPY7   SA2     VF        CHECK VERIFY REQUESTED
        ZR      X2,END    IF NO VERIFY REQUESTED
        RECALL I
        RECALL 0
        MX0     42
        SA1     I
        BX6     X0*X1
        SA6     ARGR
        SA1     CPYA      COPY ARGUMENTS
        BX6     X1
        SA6     ARGR+2
  CPY8   SA1     A1+B1
        BX6     X1
        SA6     A6+B1
        NZ      X1,CPY8  IF MORE ARGUMENTS
        SX7     6        ARGUMENT COUNT = 6
        SA7     ACTR
        MESSAGE CPYB,1,R
        SYSTEM LDR,R,CPYB EXECUTE VERIFY
        PS      0
  CPYA   CON     1LN+1R=
        CON     0LO
        CON     0LA
        CON     0LR
        CON     0        END OF ARGUMENTS
  CPYB   CON     0LVERIFY
        CON     140BS36
  CPYC   CON     0        END OF FILE CONTROL WORDS
        VFD     12/17B,48/B
  
```

```

***
COPYBF (IFILE,OFIL,N,C)
*      IFILE      NAME OF INPUT FILE.
*      OFILE      NAME OF OUTPUT FILE.
*      N          NUMBER OF FILES TO COPY.
*      C          COPY IN CODED FORMAT (SI,S,L FORMAT TAPES)
*
*      IF IFILE = OFILE, FILES ON IFILE ARE SKIPPED.
*
*      ASSUMED PARAMETERS.
*      IFILE = *INPUT*
*      OFILE = *OUTPUT*
*      N = 1
*      C NOT PRESENT
  
```

```

COPYBF  SB1     1        (B1) = 1
        RJ      PRS     PRESET PROGRAM
  
```

COPYB - BINARY FILE COPIES.
 MAIN PROGRAMS.

	SA7	CBFA	SAVE CONTROL WORD FLAG
	ZR	B7,CBF1	IF NO 3RD ARGUMENT
	SA2	ARGR+2	
	ZR	X2,CBF1	IF NULL PARAMETER
	SA5	A5+1	CONVERT FILE COUNT
	RJ	DXB	
	NZ	X6,ERR1	IF ILLEGAL COUNT
	ZR	X6,ERR1	IF COUNT = 0
	SA6	CT	SET FILE COUNT
CBF1	SA1	CBFA	CHECK CONTROL WORD COPY
	NZ	X1,CBF3	IF CONTROL WORDS
* COPY RECORDS.			
CBF2	READ	I	BEGIN READ
	RECALL	0	
	WRITE	0,*	PRESET WRITE FUNCTION
	READM	I,BUF,BUFL	COPY RECORD
	RJ	CPR	
	ZR	X1,CBF2	IF NOT EOF/EOI
	NG	X1,END	IF EOI
	SA2	CT	DECREMENT FILE COUNT
	SX6	X2-1	
	SA6	A2+	
	NZ	X6,CBF2	LOOP FOR REQUESTED FILE COUNT
	JP	END	
* COPY FILES WITH CONTROL WORDS.			
CBF3	WRITECH	0,*	PRESET WRITE FUNCTION
CBF4	READCH	I,178	BEGIN READ
	RJ	CCF	COPY CONTROL WORD FILE
	SA2	SK	
	SX5	X1	
	NZ	X2,CBF5	IF SKIPPING
	WRITEW	0,CPYC,B1+B1	WRITE EOF
	WRITECH	0	FLUSH BUFFER
CBF5	NG	X5,CBF6	IF EOI
	SA2	CT	DECREMENT FILE COUNT
	SX6	X2-1	
	SA6	A2+	
	ZR	X6,END	IF ALL FILES COPIED
	JP	CBF4	
CBF6	RJ	SEM	SEND EOI MESSAGE
	JP	END1	
CBFA	CON	0	

*** COPYBR (IFILE,OFILE,N,C)
 * COPY RECORDS FROM MEDIUM TO MEDIUM IN BINARY MODE.
 * A FILE MARK IS COUNTED AS A RECORD.
 *

**COPYB - BINARY FILE COPIES.
MAIN PROGRAMS.**

```

*           IFILE      INPUT FILE NAME.
*           OFILE      OUTPUT FILE NAME.
*           N          NUMBER OF RECORDS TO BE COPIED.
*           C          COPY IN CODED FORMAT (SI,S,L FORMAT TAPES)
*
* IF IFILE = OFILE, RECORDS ON IFILE ARE SKIPPED.
*
* ASSUMED PARAMETERS.
*           IFILE = *INPUT*
*           OFILE = *OUTPUT*
*           N = 1
*           C NOT PRESENT

```

```

COPYBR  SB1      1          (B1) = 1
        RJ      PRS        PRESET PROGRAM
        ZR      B7,CBR1    IF NO 3RD ARGUMENT
        SA2     ARGR*2
        ZR      X2,CBR1    IF NULL PARAMETER
        SA5     A5*B1      CONVERT COUNT
        RJ      DXB
        NZ      X4,ERR1    IF ILLEGAL COUNT
        ZR      X6,ERR1    IF COUNT = 8
        SA6     CT        SET COUNT

```

```

CBR1    READ     I          BEGIN READ
        RECALL  0
        WRITE   0,*        PRESET WRITE FUNCTION
        READW   I,BUF,BUFL
        RJ      CPR        COPY RECORD
        NG      X1,END      IF EOI
        SA2     CT        DECREMENT COUNT
        SX6     X2-1
        SA6     A2
        NZ      X6,CBR1    LOOP FOR ALL RECORDS
        EQ      END        TERMINATE PROGRAM

```

```

***      COPYEI (IFILE,OFILE,V,C)
*      COPY FILES FROM MEDIUM TO MEDIUM IN BINARY MODE TO END-OF-
*      INFORMATION.
*
*           IFILE      INPUT FILE NAME.
*           OFILE      OUTPUT FILE NAME.
*           V          IF PRESENT, REMIND AND VERIFY BOTH FILES.
*                   JOB WILL ABORT IF VERIFY ERRORS.
*           C          COPY IN CODED FORMAT (SI,S,L FORMAT TAPES)
*
* IF IFILE = OFILE, IFILE IS SKIPPED TO EOI.
*
* ASSUMED PARAMETERS -
*           IFILE = *INPUT*
*           OFILE = *OUTPUT*
*           V NOT PRESENT.
*           C NOT PRESENT

```


**COPYB - BINARY FILE COPIES.
MAIN PROGRAMS.**

COPYEI **SB1** **1** **(B1)= 1**
 RJ **PRS** **PRESET PROGRAM**
 BX5 **X7** **SAVE CONTROL WORD FLAG**
 ZR **B7,CEI1** **IF NO VERIFY REQUESTED**
 SA2 **ARGR+2**
 ZR **X2,CEI1** **IF NULL PARAMETER**
 SX6 **B1** **SET VERIFY FLAG**
 SA6 **VF**
 SA2 **=8L999999** **SET INFINITE FILE COUNT**
 BX6 **X2**
 SA6 **CPYA+1**
 REWIND I
 REWIND 0

CEI1 **NZ** **X5,CEI3** **IF CONTROL WORD COPY**

*** COPY RECORDS.**

CEI2 **READ I** **BEGIN READ**
 RECALL 0
 WRITE 0,* **PRESET WRITE FUNCTION**
 READW I,BUF,BUFL **READ FIRST BLOCK**
 RJ **CPR** **COPY RECORD**
 PL **X1,CEI2** **IF NOT EOI**
 JP **CEI4**

*** COPY FILES WITH CONTROL WORDS.**

CEI3 **RECALL 0**
 WRITECH 0,* **PRESET WRITE FUNCTION**
 READCH I **BEGIN READ**
 RJ **GCF** **COPY CONTROL WORD FILE**

*** CHECK VERIFY OPTION.**

CEI4 **SA2** **VF**
 ZR **X2,END** **IF NO VERIFY REQUESTED**
 JP **CPY7** **PROCESS VERIFY CALL**

*** COPYX (IFILE,OFIL,TERM,BKSP,C)**
*** COPYX (IFILE,OFIL,TYPE/NAME,BKSP,C)**
*** COPY RECORDS FROM MEDIUM TO MEDIUM IN BINARY MODE**
*** UNTIL A SPECIFIED TERMINATION CONDITION IS REACHED.**
*** IFILE INPUT FILE NAME.**
*** OFIL OUTPUT FILE NAME.**
*** TERM TERMINATION CONDITION.**
*** *00* = ZERO RECORD**
*** *N* = N RECORDS**
*** *NAME* = NAME OF A RECORD**
*** TYPE MNEMONIC FOR RECORD TYPE.**
*** NAME RECORD NAME.**

**COPYB - BINARY FILE COPIES.
MAIN PROGRAMS.**

```

*           BKSP           BACKSPACE CONTROL.
*                               *0* = NO BACKSPACE
*                               *1* = BACKSPACE FIRST MEDIUM
*                               *2* = BACKSPACE SECOND MEDIUM
*                               *3* = BACKSPACE BOTH MEDIA
*           C             COPY IN CODED FORMAT (SI,S,L FORMAT TAPES)

```

IF IFILE = OFILE, RECORDS ON IFILE ARE SKIPPED.

ASSUMED PARAMETERS.

```

*           IFILE = *INPUT*
*           OFILE = *OUTPUT*
*           TERM = 1
*           BKSP = 0
*           C NOT PRESENT

```

```

COPYX  SB1    1           (B1) = 1
        RJ    PRS        PRESET PROGRAM
        ZR    B7,CPX1    IF NO 3RD ARGUMENT
        SA2   ARGR+2
        ZR    X2,CPX1    IF NULL PARAMETER
        RJ    STC        SET TERMINATION CONDITION

```

```

CPX1   READ   I           BEGIN READ
        RECALL 0
        WRITE  0,*        PRESET WRITE FUNCTION
        READW  I,BUF,BUFL
        PL     X1,CPX2    IF NO EOF
        SX7   1
        SA7   EI
        MESSAGE (=C* END OF FILE ENCOUNTERED.*)
        SA2   SK
        NZ    X2,END      IF SKIPPING
        WRITEF 0
        EQ    END

```

```

CPX2   BX6    X1          SAVE EOR STATUS
        SA2   TM          CHECK TERMINATION CONDITION
        SA6   CPXA

```

* PROCESS ZERO RECORD.

```

        NZ    X2,CPX3    IF NOT ZERO RECORD REQUEST
        SB6   BUF        CHECK WORD COUNT OF READ
        SB7   X1
        SX6   B1
        NE    B6,B7,CPX5 IF NOT ZERO RECORD
        SA6   CT        SET TERMINATION
        EQ    CPX5

```

* PROCESS RECORD NAME.

```

CPX3   NG     X2,CPX5    IF NOT RECORD NAME
        SX2   BUF
        RJ    SRT        SET RECORD TYPE
        SA1   RN        CHECK RECORD NAME

```

**COPY8 - BINARY FILE COPIES.
MAIN PROGRAMS.**

	BX2	X7-X1	
	SA3	A1+B1	
	NZ	X2,CPX5	IF NO MATCH
	NG	X3,CPX4	IF NO TYPE REQUESTED
	SX2	X6	CHECK TYPE
	BX7	X2-X3	
	NZ	X7,CPX5	IF NO MATCH
CPX4	SX6	B1	SET TERMINATION
	SA6	CT	
* COPY RECORD.			
CPX5	SA1	CPXA	RESTORE EOR STATUS
	RJ	CPR	COPY RECORD
	SA1	CT	DECREMENT COUNT
	SX6	X1-1	
	SA6	A1	
	NZ	X6,CPX1	LOOP FOR ALL RECORDS
	SA1	BK1	
	ZR	X1,CPX6	IF NO BACKSPACE FOR FILE 1
	BKSP	I	
CPX6	SA2	SK	
	SA1	BK2	
	NZ	X2,END	IF SKIPPING RECORDS
	ZR	X1,END	IF NO BACKSPACE FOR FILE 2
	BKSP	0	
	EQ	END	
CPXA	CON	0	

**COPYB - BINARY FILE COPIES.
SUBROUTINES.**

```

**      CCF - COPY CONTROL WORD FORMAT FILE.
*
*      ENTRY  NONE.
*
*      EXIT   (X1) < 0 IF EOI ENCOUNTERED.
*            (X5) = NUMBER OF RECORDS COPIED.
*
*      USES   ALL.
*
*      CALLS  RDW=,MES,WTM=.

```

```

CCF10.1  ZR      X0,CCF11  IF NO DATA IN BUFFER
          SA4     0+4
          BX5     X1
          SX3     5
          AX4     18
          IX7     X0*X3
          SX4     X4
          LX4     36
          BX6     X7+X4
          SA6     BUF
          WRITEN  0,A6,X0+2

```

```

CCF11     SX0     X1+1
          SA1     SK
          NZ      X1,CCF12  IF SKIPPING
          WRITECH 0        FLUSH BUFFER

```

```

CCF12     SX1     X0+
          SA5     MESA      SET RECORD COUNT

```

```

CCF       PS
          SA1     CCFA     ENTRY/EXIT
          SX6     B0       CHECK MEDIUM FLAG
          SX7     -B1      CLEAR RECORD COUNT
          SA6     MESA     SET EOR FLAG
          SA7     CCFB
          NG      X1,CCF4  IF NOT TAPE TO TAPE OR DISK TO DISK

```

```

*      COPY RECORD DISK TO DISK OR TAPE TO TAPE.

```

```

CCF1     READW   I,BUF,B1  READ CONTROL WORD
          NZ      X1,CCF11  IF EOF/EOI
          SA1     BUF      FIND BLOCK SIZE
          SX2     5
          SX3     X1+4     ROUND UP
          IX5     X3/X2
          READM   I,BUF+1,X5+B1 READ FIRST BLOCK
          SA1     CCFB
          PL      X1,CCF2   IF LAST BLOCK NOT EOR
          RJ      MES      DISPLAY RECORD NAME
CCF2     SA1     SK
          NZ      X1,CCF3   IF SKIP SET
          WRITEN  0,BUF,X5+2
CCF3     SA1     BUF      SET EOR FLAG
          AX1     36
          SX2     X1
          IX6     X5-X1

```

**COPYB - BINARY FILE COPIES.
SUBROUTINES.**

```

SA6      CCFB
JP       CCF1

*        COPY DISK TO TAPE OR TAPE TO DISK.

CCF4     SX0      B0+
CCF5     READW   I, BUF, B1      READ CONTROL WORD
NZ       X1, CCF10.1          IF EOF/EOI
SA1      BUF              FIND WORD COUNT
SX2      5
SX3      X1+4              ROUND UP
IX5      X3/X2              WORD COUNT IN BLOCK
READW   I, BUF+1+X0, X5+B1    READ REST OF BLOCK
SA1      CCFB
PL       X1, CCF6           IF LAST BLOCK NOT EOR
RJ       MES              DISPLAY RECORD NAME

CCF6     SA1      BUF
SA2      0+4              GET BLOCK SIZE FOR FILE
IX0      X0+X5            INCREMENT BUFFER WORD COUNT
AX1      36
IX6      X5-X1
AX2      18
SX3      X2
IX4      X0-X3
SA6      CCFB              SAVE EOR FLAG
NG       X6, CCF7          IF EOR
NG       X4, CCF5          IF DATA READ .LT. OUTPUT BLOCK SIZE
CCF7     SA5      SK              PRESET WORDS WRITTEN
NZ       X5, CCF4          IF SKIPPING
CCF8     SA1      0+4              GET BLOCK SIZE FOR OUTPUT
IX2      X0-X5            REMAINING WORDS TO WRITE
AX1      18
NZ       X2, CCF9          IF MORE WORDS TO WRITE
SA3      CCFB
PL       X3, CCF4          IF NOT EOR ON INPUT
CCF9     SX1      X1              SET OUTPUT BLOCK SIZE
IX3      X2-X1            WORDS REMAINING - BLOCK SIZE
NG       X3, CCF10         IF EOR BLOCK
BX4      X1              BUILD CONTROL WORD
LX1      36
SX3      5                CALCULATE BYTE COUNT
IX7      X4+X3
BX6      X1+X7            CONTROL WORD
SA6      BUF+X5          STORE CONTROL WORD
SX4      X4
IX5      X5+X4            UPDATE WORD COUNT
WRITEW  0, A6, X4+B1
WRITEW  0, CCF8, B1      WRITE TRAILER CONTROL WORD
JP       CCF8

CCF10    LX1      36
SX3      5
IX4      X2*X3            CALCULATE BYTE COUNT
BX6      X1+X4            CONTROL WORD
SA6      BUF+X5          STORE CONTROL WORD
WRITEW  0, A6, X2+2
JP       CCF4

```

**COPYB - BINARY FILE COPIES.
SUBROUTINES.**

CCFA	CON	0	MEDIUMS COMPARISION FLAG
CCFB	CON	-0	EOR FLAG
CCFC	CON	0	CONTROL WORD

```

**      CPR - COPY RECORD.
*
*      ENTRY (X1) = FIRST BLOCK STATUS.
*
*      EXIT (X1) < 0 IF EOI.
*           (X1) = 0 IF EOF.
*
*      USES X - 2.
*           B - NONE.
*           A - 2.
*
*      CALLS NONE.

```

CPR	PS		ENTRY/EXIT
	NG	X1,CPR5	IF EOF
	SX2	BUF	
	BX6	X1	SAVE EOR STATUS
	SA6	CPRA	
	RJ	SRT	SET RECORD TYPE
	SA7	CPRB+1	ENTER NAME IN MESSAGE
		MESSAGE A7-B1,1	
	SA1	CPRA	RESTORE EOR STATUS
	NZ	X1,CPR3	IF EOR
CPR1	SA2	SK	
	NZ	X2,CPR2	IF SKIP SET
	WRITEW	0,BUF,BUFL	
CPR2	READW	1,BUF,BUFL	
	ZR	X1,CPR1	LOOP IF NO EOR/EOF
	NG	X1,CPR5	IF EOF
CPR3	SA2	SK	
	NZ	X2,CPR4	IF SKIP SET
	WRITEW	0,BUF,X1-BUF	
	WRITER	0	END RECORD
CPR4	SX1	B0	RETURN WITH EOR
	EQ	CPR	
CPR5	SA2	SK	
	NZ	X2,CPR6	IF SKIP SET
	WRITEF	0	
CPR6	SA2	I	CHECK FILE STATUS
	LX2	59-9	
	SX1	B1	SET EOF
	PL	X2,CPR	RETURN IF NOT EOI
	RJ	SEM	SEND EOI MESSAGE
	SX1	-B1	SET EOI
	EQ	CPR	

**COPYB - BINARY FILE COPIES.
SUBROUTINES.**

CPRA CON 0 EOR STATUS

CPRB DATA 10H COPYING
 CON 0.0

** END - END PROGRAM.

END SA1 EI
 NZ X1,END1 IF EOI MESSAGE SENT
 MESSAGE (=C* COPY COMPLETE.*)
END1 ENDRUN

** MES - MESSAGE HEADER.
* FINDS RECORD NAME IN *BUF*, ISSUES MESSAGE AND INCREMENTS
* RECORD COUNT.
*
* ENTRY (X5) = WORD COUNT IN *BUF*.
*
* EXIT (MESA) = RECORD COUNT.
* (X0) = SAME AS ENTRY.

MES PS ENTRY/EXIT
 SA1 MESA INCREMENT RECORD COUNT
 BX6 X0 SAVE X0
 SX7 X1+B1
 SA6 MESB
 SX1 X5 WORD COUNT IN *BUF*
 SA7 A1
 SX2 BUF+1
 RJ SRT
 SA7 CPRB+1
 MESSAGE A7-B1,1 DISPLAY RECORD NAME
 SA1 MESB
 BX0 X1
 JP MES

MESA CON 0 RECORD COUNT
MESB CON 0

** SEM - SEND EOI MESSAGE.
*
* ENTRY NONE.
*
* EXIT (EI) = 1 = MESSAGE SENT.

**COPYB - BINARY FILE COPIES.
SUBROUTINES.**

```
SEM      PS      0          ENTRY/EXIT
        SX7     1
        SA7     EI
        MESSAGE (=C* END OF INFORMATION ENCOUNTERED.*)
        EQ      SEM      RETURN
```

* COMMON DECKS.

```
WRIFS   EQU      1          SELECT *RE-ISSUE CURRENT WRITE*
        CTEXT  COMCCIO - I/O FUNCTION PROCESSOR.
        CTEXT  CONCRDW - READ WORDS TO WORKING BUFFER.
        CTEXT  COMCSRT - SET RECORD TYPE.
        CTEXT  COMCSYS - PROCESS SYSTEM REQUEST.
        CTEXT  COMCWTW - WRITE WORDS FROM WORKING BUFFER.
```

** BUFFERS.

```
BUFFERS BSS      0
        USE      //
        SEG
        BUF      BSS      BUFLC
        IBUF     BSS      IBUFL
        OBUF     BSS      OBUFL
        RFL=    BSS      0
```

** PRS - PRESET PROGRAM.

```
*
* EXIT      (B7) = REMAINDER ARGUMENT COUNT.
*           (A5) = LAST ARGUMENT ADDRESS.
*           (X7) = 0 IF COPY CAN BE DONE WITH CONTROL WORDS.
```

```
ORG      BUF
```

```
PRS3    OPEN   I,READNR,R CHECK CONTROL WORD COPY POSSIBLE
        OPEN   0,ALTERNR,R
        SA1    I+1      CHECK INPUT DEVICE TYPE
        SA2    0+1
        BX6    X2-X1    SET DEVICE COMPARISON FLAG
        SA6    CCFA
        RJ     CDT
        ZR     X7,PRS   RETURN - IF CONTROL WORDS NOT SUPPORTED
        SA1    0+1      CHECK OUTPUT DEVICE TYPE
        RJ     CDT
```


**COPYB - BINARY FILE COPIES.
SUBROUTINES.**

PRS	PS		ENTRY/EXIT
	SX6	IBUF	ENTER POINTER TO INPUT BUFFER
	SA6	0	
	SA1	ACTR	CHECK ARGUMENT COUNT
	MX4	42	
	SB7	X1	
	ZR	B7,PRS3	IF NO ARGUMENTS
	SB6	B7-ARGR-2	
	NG	B6,PRS0.2	IF NO CODED PARAMETER
	SA1	PRS	CHECK IF COPYX CALL
	AX1	30	
	SX2	X1-COPYX-1	
	NZ	X2,PRS0.1	IF NOT COPYX
	ZR	B6,PRS0.2	IF NO CODED PARAMETER
	SA1	ARGR+2	CHECK FOR COPYX *TYPE/NAME* PARAMETER
	SX2	X1-1R/	
	SB6	B6-B1	
	NZ	X2,PRS0.1	IF COPYX *TERM* PARAMETER
	SB6	B6-B1	
	NG	B6,PRS0.2	IF NO CODED PARAMETER
PRS0.1	SA1	I	
	SA2	0	
	SX3	B1+B1	
	BX6	-X3*X1	
	BX7	-X3*X2	
	SA6	A1	
	SA7	A2+	

*** PROCESS IFILE NAME.**

PRS0.2	SA5	ARGR	GET FILE NAME
	SA2	I	
	BX7	X4*X5	
	SX3	X2	
	ZR	X7,PRS1	IF BLANK ARGUMENT
	IX7	X7+X3	
	SA7	A2	

*** PROCESS OFILE NAME.**

PRS1	SB7	B7-B1	
	ZR	B7,PRS2	IF 1 ARGUMENT
	SA5	A5+B1	SET OFILE NAME
	SA2	0	
	BX7	X4*X5	
	SB7	B7-B1	
	ZR	X7,PRS2	IF BLANK ARGUMENT
	IX7	X7+X3	
	SA7	A2	

*** CHECK FILE NAMES.**

PRS2	SA1	I	CHECK FILE NAMES
	SA2	0	
	IX7	X1-X2	
	NZ	X7,PRS3	IF IFILE * OFILE
	SX6	B1	SET SKIP FLAG

**COPYB - BINARY FILE COPIES.
SUBROUTINES.**

SA1 PRSA
BX7 X1
SA6 SK
SA7 CPRB
JP PRS3

PRSA DATA 18H SKIPPING

** CDT - CHECK DEVICE TYPE.
*
* ENTRY (X1)= (FET+1).
*
* EXIT (X7)= 0 IF CONTROL WORD READ/WRITE NOT SUPPORTED ON
* DEVICE.
*
* USES B - NONE.
* A - 2.
* X - 0,1,2,6,7.
*
* CALLS NONE.

CDT2 LX1 12 CHECK *TT*
BX6 -X0*X1
SX7 X6-2RTT

CDT PS ENTRY/EXIT
MX0 -12
PL X1,CDT2 IF ALLOCATABLE
LX1 12
SA2 CDTA SEARCH DEVICE TABLE
SX7 0 ASSUME NO FIND
CDT1 ZR X2,CDT RETURN - IF NOT FOUND
BX6 X1-X2
AX2 12
BX6 X2*X6
SA2 A2+B1
NZ X6,CDT1 IF NOT MATCH
SX7 1 INDICATE CONTROL WORD POSSIBLE
JP CDT RETURN

CDTA VFD 36/,12/7703B,12/4002B
VFD 36/,12/7703B,12/4102B
VFD 36/,12/7777B,12/2RMT+4000B
VFD 36/,12/7777B,12/2RNT+4000B
CON 0

** STC - SET TERMINATION CONDITION.

STC PS ENTRY/EXIT

**COPYB - BINARY FILE COPIES.
SUBROUTINES.**

	SA5	A5+B1	TERMINATION CONDITION
	SA1	=2L00	
	BX6	X1-X5	
	ZR	X5,STC5	IF BLANK ARGUMENT
	ZR	X6,STC4	IF *00*
	RJ	DXB	CONVERT NUMBER
	NZ	X4,STC1	IF ASSEMBLY ERROR
	ZR	X6,ERR1	IF COUNT = 0
	SA6	CT	SET COUNT
	EQ	STC5	
STC1	SA5	A5	SET NAME
	MX0	42	
	SX3	X5-1R/	CHECK SEPARATOR
	BX6	X0*X5	
	MX7	1	
	NZ	X3,STC3	IF NO TYPE SPECIFIED
	SB7	B7-B1	
	SA5	A5+B1	RECORD NAME
	LX3	X6	
	SA2	STCA	CHECK TYPE
STC2	BX6	X0*X5	
	ZR	X2,ERR2	IF TYPE NOT IDENTIFIED
	BX7	X2-X3	
	SA2	A2+B1	
	NZ	X7,STC2	
STC3	SX7	A2-STCA-1	SET TYPE
	SA6	RN	SET RECORD NAME
	SA7	A6+B1	SET TYPE
	SX6	B1	
STC4	SA6	TH	SET TERMINATION CONDITION
	MX7	1	SET HIGH COUNT
	SA7	CT	
* PROCESS BACKSPACE CONTROL.			
STC5	SB7	B7-B1	
	ZR	B7,STC	RETURN IF 3 ARGUMENTS
	SA1	A5+B1	CHECK BACKSPACE ARGUMENT
	AX1	54	
	SB2	X1-1R0	
	ZR	X1,STC	IF BLANK ARGUMENT
	ZR	B2,STC	RETURN IF ZERO
	NG	B2,ERR2	IF ALPHA
	SX6	B0	
	SX7	B0	
	SB2	B2-B1	
	NZ	B2,STC6	IF NOT *1*
STC6	SX6	B1	SET FILE 1 BACKSPACE
	SB2	B2-B1	
	NZ	B2,STC7	IF NOT *2*
STC7	SX7	B1	SET FILE 2 BACKSPACE
	SB2	B2-B1	
	NZ	B2,STC8	IF NOT *3*
	SX6	B1	SET BOTH FILES BACKSPACE
	SX7	B1	
STC8	SA6	BK1	
	SA7	BK2	

**COPY8 - BINARY FILE COPIES.
SUBROUTINES.**

	EQ	STC	RETURN
STCA	BSS	0	
	CON	0LTEXT	
	CON	0LPP	
	CON	0LCOS	
	CON	0LREL	
	CON	0LOVL	
	CON	0LULIB	
	CON	0LOPL	
	CON	0LOPLC	
	CON	0LOPLD	
	CON	0LABS	
	CON	0LPPU	
	CON	0	

**** ERR - PROCESS ERRORS.**

ERR1	SX0 EQ	ERRA ERR
ERR2	SX0	ERRB
ERR	MESSAGE X0 ABORT	
ERRA	DATA	C* ILLEGAL COUNT.*
ERRB	DATA	C* ILLEGAL RECORD TERMINATION.*

*** COMMON DECKS.**

CTEXT CONCDXB - DISPLAY CODE TO BINARY CONVERSION.

END

SPECIAL USER INFORMATION

E

Appendix E provides special information available to the applications programmer. The following topics are described.

- Job communication area
- Exchange package area
- File types and job origin codes
- Equipment codes

JOB COMMUNICATION AREA

Figure 2-E-1 illustrates the first 101_8 words of the user's field length.

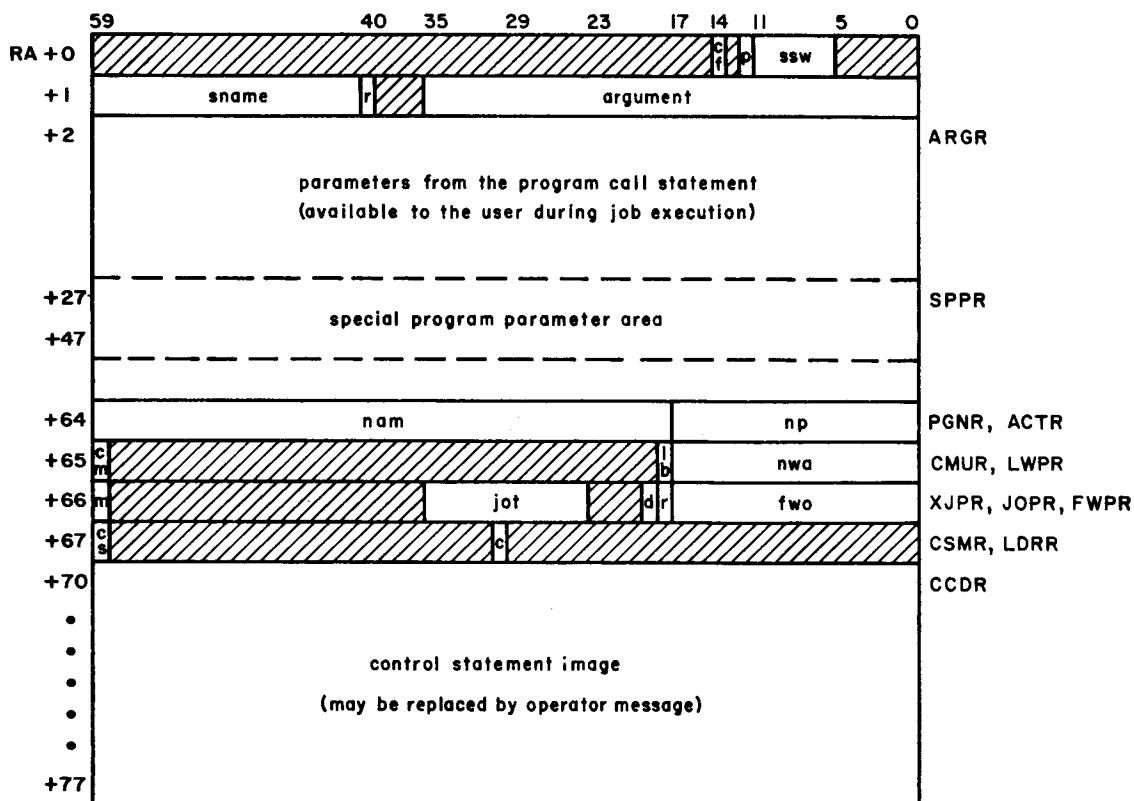


Figure 2-E-1. Job Communication Area

<u>Word</u>	<u>System Identifier</u>	<u>Bits</u>	<u>Field</u>	<u>Significance</u>
RA+0		59-15 14 13 12 11-06 05-00	reserved cf reserved p ssw reserved	Reserved CFO bit Reserved Pause flag Sense switches Reserved
RA+1		59-41 40 39-36 35-00	sname r unused arguments	System request name (such as CIO) Auto recall flag Reserved for future system use Parameters passed to that portion of the system that processes the sname request
RA+2 through RA+63 ₈	ARGR	59-00	params	Parameters from the program call statement; available to the user during execution
RA+27 ₈ through RA+47 ₈	SPPR	59-00	params	Special program parameter area used by SSJ= entry point programs to store parameter blocks. Any job step can use this area for its own purpose, but if it is followed by an SSJ= program, the contents may be destroyed.
RA+64 ₈	PGNR	59-18	nam	Name of program called by control statement
	ACTR	17-00	np	Number of parameters in control statement call
RA+65 ₈	CMUR	59	cm	Set if the compare/move unit (CMU) is present
	LWPR	58-19 18	unused lb	Reserved for future system use Library flag: 0 Load from a file 1 Load from library
		17-00	nwa	Address of next word available for loading
RA+66 ₈	XJPR	59	m	Indicates if hardware feature CEJ/MEJ is available: 1 Available 0 Not available
	JOPR	58-36 35-24 23-20 19 18	unused jot unused d r	Reserved for future system use Job origin type Reserved for future system use DIS flag RSS flag
	FWPR	17-00	fwo	First word of object program
RA+67 ₈	CSMR	59	cs	Set if system is running in 64 character set mode
	LDRR	58-30 29	unused c	Reserved for future system use Completion flag: 0 Load not completed 1 Load completed
		28-00	unused	Reserved for future system use
RA+70 ₈ through RA+77 ₈	CCDR	59-00	control statement image	Image of control statement currently being executed

EXCHANGE PACKAGE AREA

Figure 2-E-2 illustrates the exchange package area.

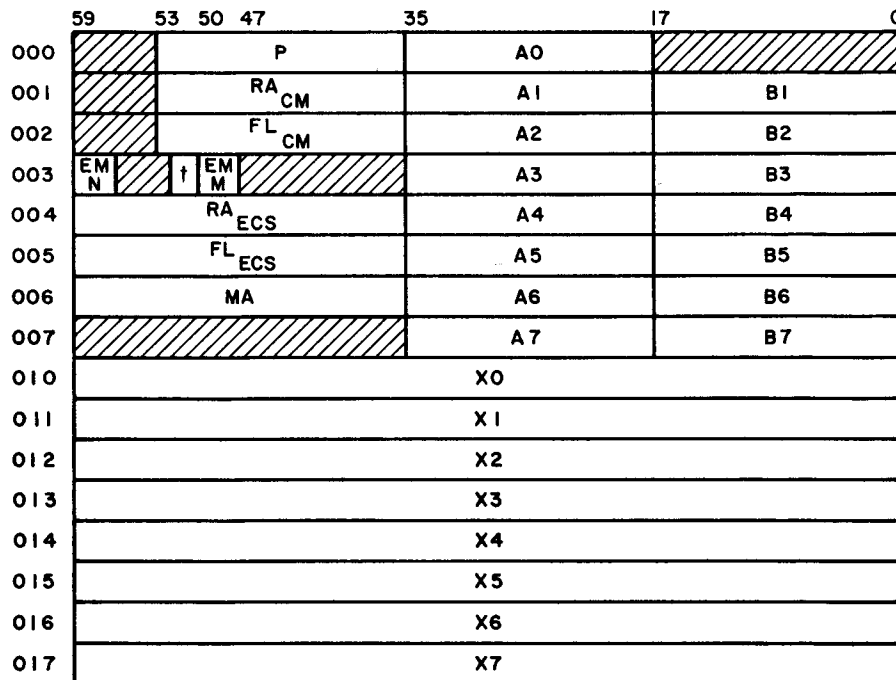


Figure 2-E-2. Exchange Package Area

P	Program address
A _i	Address registers
RA(CM)	Reference address central memory
B _i	Increment registers
FL(CM)	Field length for central memory
EM-N	CPU hardware exit mode (CDC CYBER 170 series only):
	0 Disable hardware exit mode
	1 ECS flag register operation parity error
	2 CMC input error
	3 1 or 2
	4 CM data error
	5 1 or 4
	6 2 or 4
	7 1 or 2 or 4
EM-M	CPU program exit mode:
	0 Disable program exit mode
	1 Address out of range
	2 Operand out of range
	3 1 or 2
	4 Indefinite operand
	5 1 or 4
	6 2 or 4
	7 1 or 2 or 4

† Bits 52 and 51, hardware error exit status bits on CDC CYBER 70 Model 74.

RA(ECS)	Reference address ECS
FL(ECS)	Field length for ECS
MA	Monitor address
Xi	Operand registers

FILE TYPES AND ORIGIN CODES

The following file types and origin codes are used in many NOS system routines.

The queue file types are:

<u>Type</u>	<u>Value</u>	<u>Description</u>
INFT	0	Input
ROFT	1	Rollout
PRFT	2	Print
PHFT	3	Punch
TEFT	4	Timed/event rollout
--	5	Reserved
--	6	Reserved
--	7	Reserved

Other file types include:

<u>Type</u>	<u>Value</u>	<u>Description</u>
LIFT	10	Library
PTFT	11	Primary terminal
PMFT	12	Direct access permanent file
FAFT	13	Fast attach file
SYFT	14	System
LOFT	15	Local
--	16	Reserved

Following are the job origin codes.

<u>Type</u>	<u>Value</u>	<u>Description</u>
SYOT	0	System
BCOT	1	Local batch
EIOT	2	Remote batch (Export/Import)
TXOT	3	Time-sharing
MTOT	4	Multiterminal

EQUIPMENT CODES

Equipment codes for device types supported by NOS are as follows.

<u>Code</u>	<u>Equipment</u>
CP	415 Card Punch
CR	405 Card Reader
DE	Extended core storage
DI-n	844-21 Disk Storage Subsystem (1 to 8 units)
DJ-n	844-41/44 Disk Storage Subsystem (1 to 8 units)
DP	Distributive data path to ECS
DS	Display console
LP	512 or 580 Line Printer
LQ	512 Line Printer
LR	580-12 Line Printer
LS	580-16 Line Printer
LT	580-20 Line Printer
MD-n	841 Disk Drive (1 to 8 units)
MS	Mass storage device
MT	7-track magnetic tape drive
NE	Null equipment
NP	2550 Host Communications Processor
NT	9-track magnetic tape drive
ST	6671 or 2550-100 multiplexer
TT	6676, 6671, or 2550-100 multiplexer

SPECIAL ENTRY POINTS

F

The following entry points enable the ABS type system programs that contain them to perform special functions. These functions are independent of user control. They are described here only to provide background information to discussions of entry points elsewhere in the manual. COMPASS users should note that their programs may contain entry points of the same name as those described in this appendix, but that no special functions will be performed.

NOTE

Either the RFL= or the MFL= entry point is required in any program that uses special entry points.

- ARG= System programs that do their own processing of control statement parameters contain an ARG= entry point. The parameters are not stored in the user's field length beginning at RA+2 (ARGR) as would normally occur, but rather are passed to RA+70₈ (CCDR). In addition to the parameters, the control statement image at RA+70 includes the statement name (such as PERMIT) and any prefix options (\$ or /). This allows certain control statements to contain parameters that do not conform to the normal constraints of NOS control statement syntax.
- DMP= Certain system programs called to perform special functions (for example, manage tapes or packs, checkpoint a job, etc.) contain a DMP= entry point. When such a program is loaded, the user's control point area, all or a portion of his central memory, and optionally his FNT/FST entries are dumped to a special rollout file. When the operation is completed, NOS transfers the contents of the rollout file back into central memory and resumes job processing.
- MFL= System programs use the MFL= entry point to specify the minimum field length they require for execution. This entry point differs from RFL= in that RFL= always changes the running field length to the specified value. If the value of MFL= is greater than 200000, the program field length is set to the last job statement field length (byte 1, word FLCW of the control point area) or the value of MFL= (minus 200000), whichever is greater. If the value of MFL= is less than 200000, the program field length is set to the greater of the existing field length or the value of MFL=.
- RFL= When a system program with an RFL= entry point is loaded, the running field length for the job is changed to the value of RFL=, rounded to the next highest multiple of 100₈.

- SDM= System programs that issue their own dayfile messages contain an SDM= entry point. This allows NOS to ensure that privileged information such as a user's password does not appear in the dayfile.
- SSJ= Programs that contain an SSJ= entry point are defined as special system jobs. A special system job is able to perform functions beyond the user's normal validation. It transfers the user's validation information from the control point area into a temporary storage area within its field length and then makes the necessary changes to the control point area. After the special job completes its operation, it restores the user's validation information to the control point area.
- When a program that contains an SSJ= entry point is loaded, secure system memory (SSM) status is set (refer to Security Considerations, section 2).
- SSM= When a program that contains an SSM= entry point is loaded, secure system memory (SSM) status is set (refer to Security Considerations, section 2). SSM status cannot be cleared by any program containing an SSM= entry point.
- VAL= For jobs of any origin type except SYOT, if user validation is enabled (that is, a USER statement must be included), NOS allows only those system programs containing VAL= entry points to execute. The system uses this feature to ensure that the USER statement, and if required, CHARGE statement are properly processed.

BINARY FORMATS

G

Appendix G describes the following binary formats.

PP	CDC CYBER 170/70 or 6000 series PPU absolute
OPL	Modify old program library deck
OPLD	Program library directory
ULIB	User library group
TEXT	Unrecognized as binary

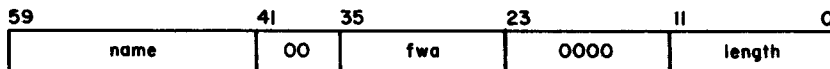
For binary formats of loader tables, refer to the CDC CYBER Loader Reference Manual.

PP — CDC CYBER 170/70 OR 6000 SERIES PPU ABSOLUTE

Binary output for a CDC CYBER 170/70 or 6000 series PPU program or overlay is a logical record that may contain the following.

Prefix table
CDC CYBER 170/70 or 6000 series PPU program control table
PPU text in five PPU words per 60-bit CPU word

The format of the control table is:



<u>Bits</u>	<u>Field</u>	<u>Description</u>
59-42	name	Program name, 1-to 3-display code characters, left-justified with zero fill.
41-36	none	Reserved for future system use.
35-24	fwa	Origin minus 5; address at which the header word is loaded.
23-12	none	Reserved for future system use.
11-0	length	Number of CPU words in program image (1/5 the number of PPU words).

OPL – MODIFY OLD PROGRAM LIBRARY DECK

A Modify old program library deck is a record on a Modify library file (figure 2-G-1) consisting of a prefix table, a modification table, and text. The prefix table contains the library creation date in word 2 and the latest modification date in word 3.

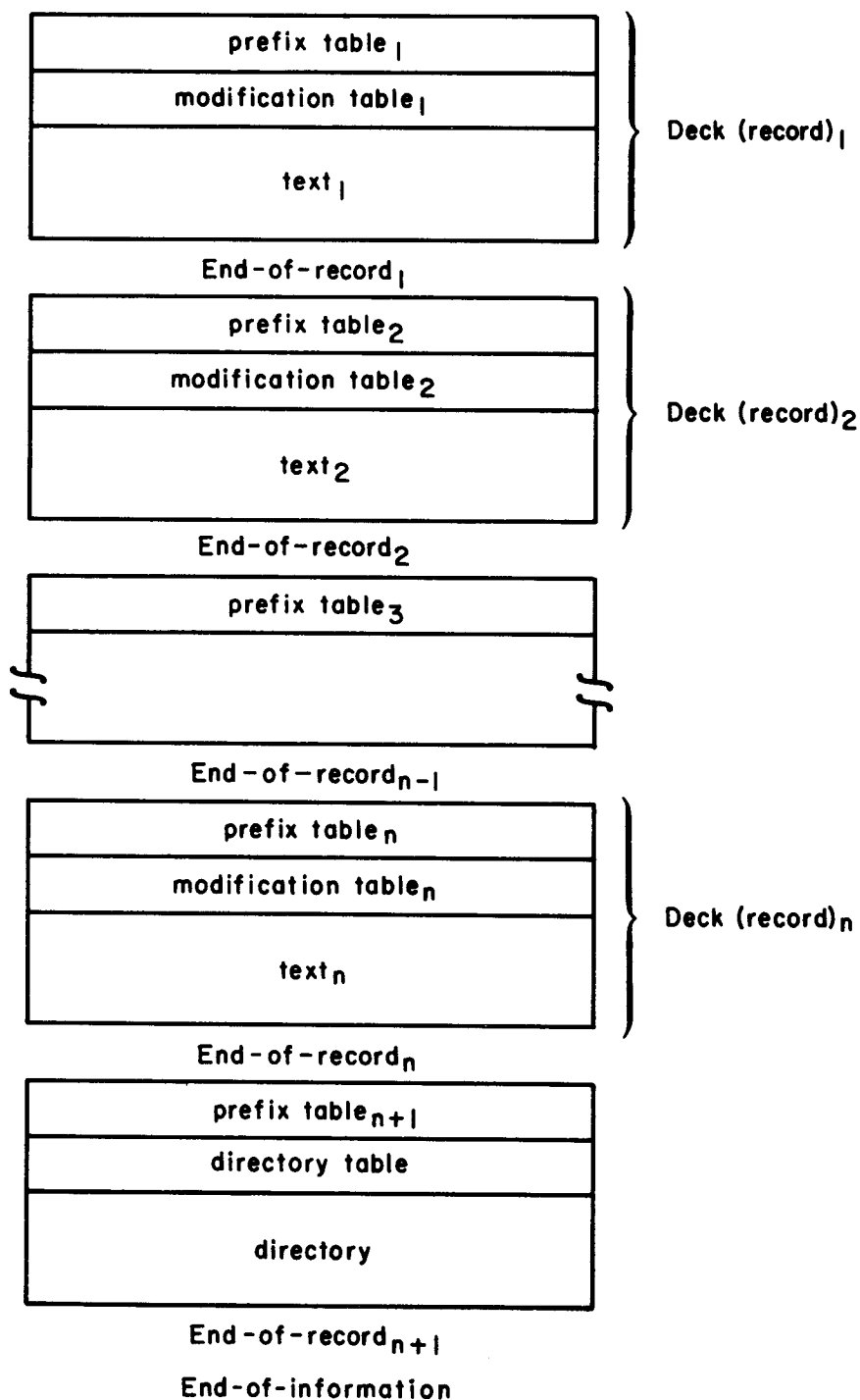


Figure 2-G-1. Modify Library File Format

MODIFICATION TABLE FORMAT

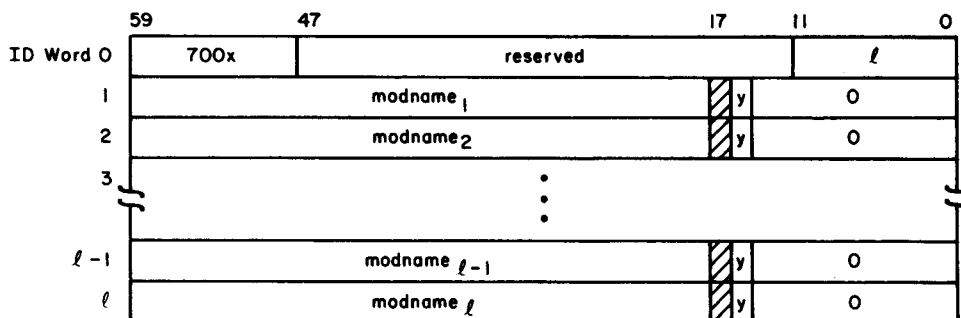


Figure 2-G-2. Modification Table Format

<u>Word</u>	<u>Bits</u>	<u>Field</u>	<u>Description</u>
ID	59-48	700X	Identifies Modify deck. Least significant digit indicates whether or not the deck is common as follows: 1 Deck is not common 2 Deck is common
	47-12	none	Reserved for future system use.
	11-0	l	Number of modification names in table.
word _i	59-18	modname _i	1-to 7-character modification set name. Each modification to a deck causes a new entry in this table.
	16	y _i	YANK flag: 0 Modifier not yanked 1 Modifier yanked

TEXT FORMAT

Text is an indefinite number of words that contain a modification history and the compressed image of each line in the deck. Text for each line is in the following format.

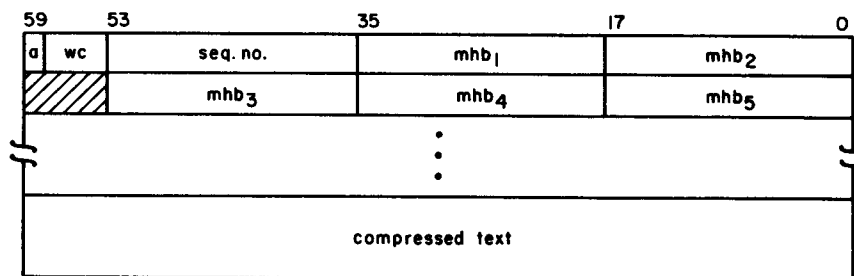
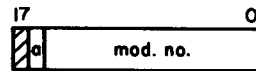


Figure 2-G-3. Modify Text Format

<u>Bits</u>	<u>Field</u>	<u>Description</u>
59	a	Activity bit: 0 Line is inactive 1 Line is active
58-54	wc	Number of words of compressed text.

<u>Bits</u>	<u>Field</u>	<u>Description</u>
53-36	seq.no.	Sequence number of card (octal) according to the position in the deck or modification set.
35-18 and subsequent 18-bit bytes	mhb _i	Modification history byte. Modify creates a byte for each modification set that changes the status of the card. Modification history bytes continue to a zero byte. Since this zero byte could be the first byte of a word and the compressed card image begins a new word, the modification history portion of the text could terminate with a zero word.

The format of mhb_i is:



a Activate bit:

- 0 Modification set deactivated the card
- 1 Modification set activated the card

mod.no. Index to the entry in the modification table that contains the name of the modification set that changed the card status.

Following the modification history bytes is the compressed image of the card in display code. A single space is represented by 55₈; it is not compressed. Two or more embedded spaces are replaced in the image as follows:

- 3 spaces replaced by 0002
- 4 spaces replaced by 0003
- · ·
- · ·
- · ·
- 64 spaces replaced by 0077₈
- 65 spaces replaced by 007755₈
- 66 spaces replaced by 00770001₈
- 67 spaces replaced by 00770002₈, etc.

Trailing spaces are not considered as embedded and are not included in the card image. A 12-bit zero byte marks the end of the card.

NOTE

Existing 63 character set program libraries may have two spaces represented as a 0001 byte.

OPLD – PROGRAM LIBRARY DIRECTORY

The library file directory contains an identification table followed by a table containing a two-word entry for each deck in the library. Directory entries are in the same sequence as the decks on the library.

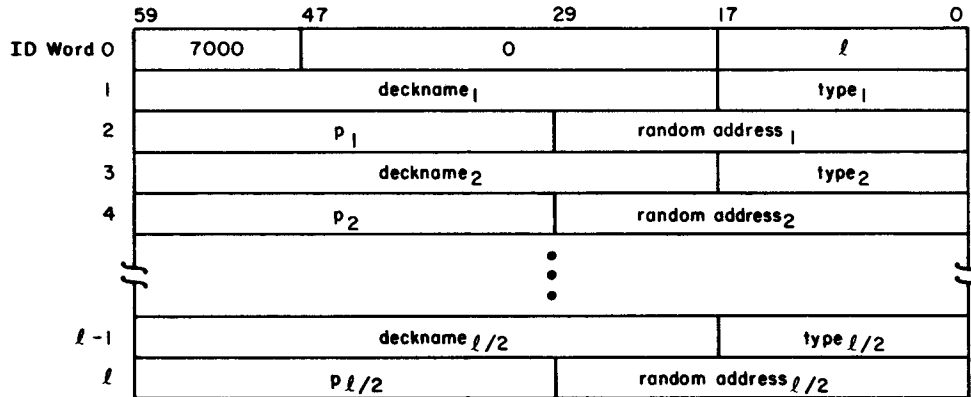


Figure 2-G-4. Library File Directory Table

<u>Word</u>	<u>Bits</u>	<u>Field</u>	<u>Description</u>						
ID	59-48	Table type	Identifies the table as a program library directory.						
	17-0	l	Directory length excluding ID word.						
1, 3, ...,	59-18	deckname _{i}	Name of the program library deck; 1 to 7 characters, left justified. If type _{i} equals 16 ₈ , this field contains the capsule name.						
$l-1$	17-0	type _{i}	Type of record (octal). <ul style="list-style-type: none"> 0 Unrecognizable as binary program (TEXT) 1 CDC CYBER 170/6000 peripheral processing unit program (PPU) 3 Relocatable central processor program (REL) 4 Central processor overlay (OVL) 5 User library program (ULIB) 6 Old program library deck (OPL) 7 Old program library common deck (OPLC) 10 Old program library directory (OPLD) 11 Multiple entry point overlay (ABS) 16 Fast dynamic load capsule (CAP) 						
2, 4, ..., l	59-30	p _{i}	Zero for all record types except CAP (16 ₈). If type _{i} equals 16 ₈ this field is defined as follows. <table border="1" style="margin-left: 40px;"> <thead> <tr> <th><u>Bits</u></th> <th><u>Description</u></th> </tr> </thead> <tbody> <tr> <td>59-48</td> <td>Ordinal to group name in ULIB record (refer to ULIB record)</td> </tr> <tr> <td>47-30</td> <td>Length of capsule</td> </tr> </tbody> </table>	<u>Bits</u>	<u>Description</u>	59-48	Ordinal to group name in ULIB record (refer to ULIB record)	47-30	Length of capsule
<u>Bits</u>	<u>Description</u>								
59-48	Ordinal to group name in ULIB record (refer to ULIB record)								
47-30	Length of capsule								
	29-0	random address _{i}	Address of the deck relative to the beginning of the file						

ULIB — USER LIBRARY GROUP

A user library group (figure 2-G-7) consists of all records beginning with a ULIB-type record through the next OPLD-type record.

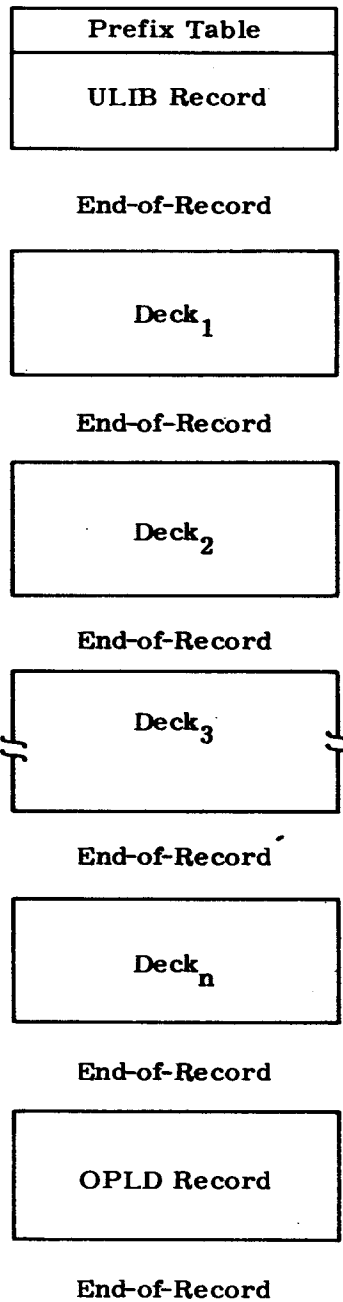
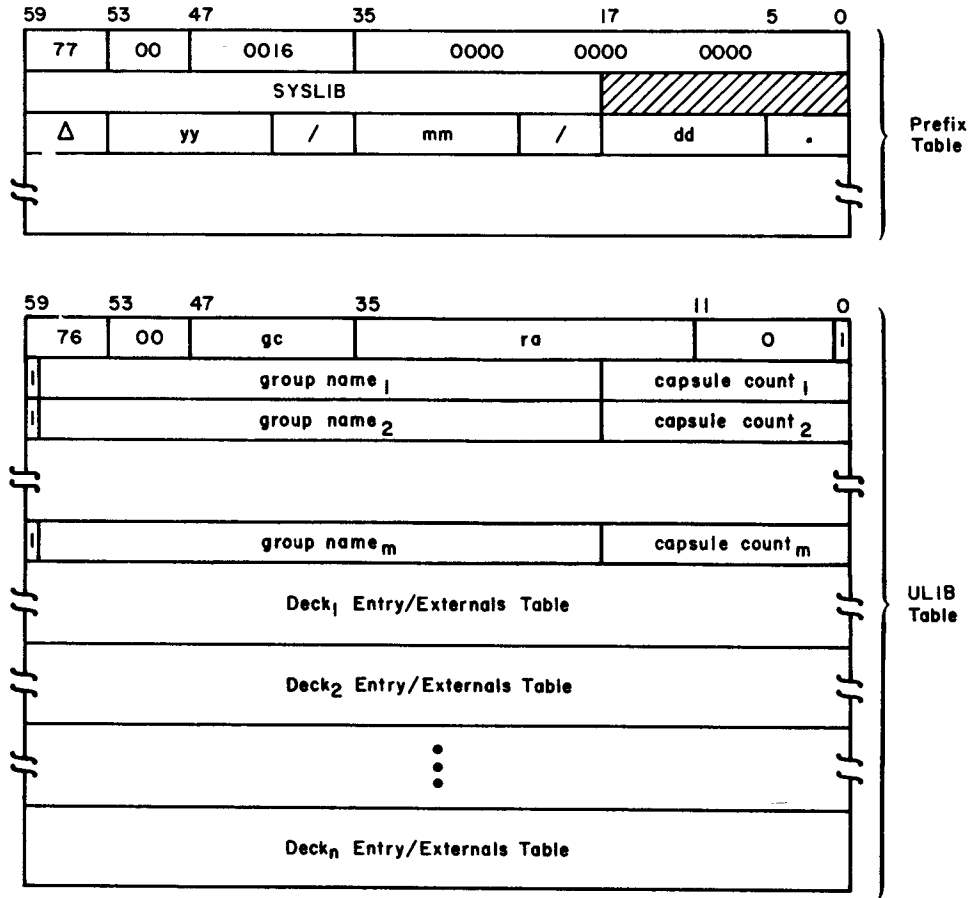


Figure 2-G-5. User Library (ULIB) Format



- gc Group count (count of different group names in ULIB) equal to m
- ra Random address of OPLD
- i Cross reference flag
 - 0 ULIB table contains cross references.
 - 1 ULIB table does not contain cross references.
- group name_j Name of group
- capsule count_j Number of capsules with group name_j

Figure 2-G-6. ULIB Record Format

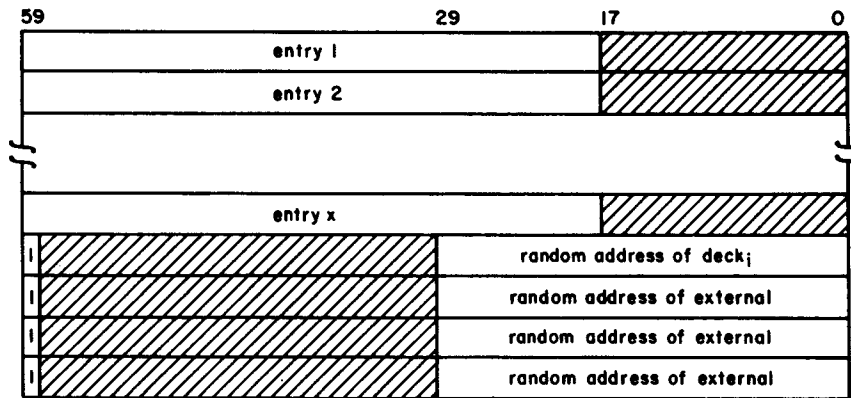


Figure 2-G-7. ULIB Deck Entry/Externals Format

TEXT – UNRECOGNIZED AS BINARY

A text record consists of a one-word header containing the record name in display code, left-justified with zero fill. Text immediately follows. The record is terminated by an end-of-record mark.

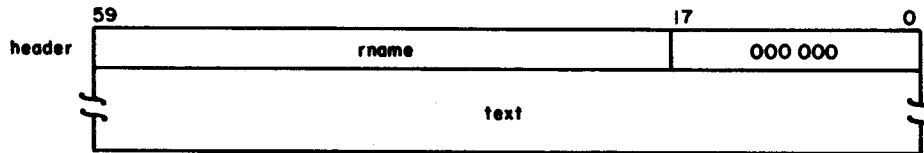


Figure 2-G-8. Text Record Format

rname 1 to 7 alphanumeric characters, left-justified with zero fill.

COMPRESSED COMPILE FILE

A compressed compile file has a one-word header.

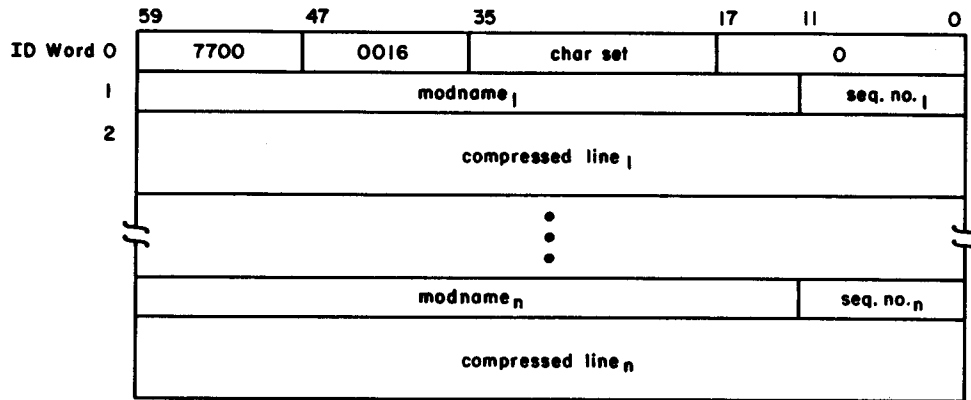


Figure 2-G-9. Compressed Compile File Format

- CS = 0 63 character set compressed compile file
- CS = 64 64 character set compressed compile file

COMPASS CONTROL STATEMENT

H

The COMPASS control statement calls the COMPASS assembler to the control point. The minimum memory requirement for a COMPASS assembly is 42,000 octal locations.

The control statement format is:

COMPASS(p_1, p_2, \dots, p_n)

p_i Parameters are order-independent and can be in the following format.

a

a = fname

a = 0

a = chars

The following parameters can be supplied.

<u>Option</u>	<u>Meaning</u>
A	Abort to EXIT control statement if assembly errors are detected. If no A parameter is supplied and assembly errors are detected, job processing continues.
B	Object code is written on file LGO. If no B parameter is supplied, this option is assumed.
B=fname	Object code is written on file fname.
B=0	No object code is generated.
D	Object code is generated and written on the file specified by the B parameter even if assembly errors occur. D is ignored if B=0. If the D parameter is omitted, assembly errors inhibit object code generation.
F	Specifies that the COMPASS assembler was called by a COMPASS control statement. If this parameter is omitted, COMPASS is assumed.
F=n	n = 0 COMPASS was called by the COMPASS control statement. n = 2 COMPASS was called by the FORTRAN Extended (FTN) compiler.
F=name	The above options can be specified by supplying the names COMPASS or FTN.
G	Use system text from local file SYSTEXT.
G=fname†	System text is first overlay on local file fname. If G is omitted or G=0, no system text is loaded.

†A maximum of seven G parameters is allowed.

<u>Option</u>	<u>Meaning</u>
G=fname/ovl	System text is the named overlay, ovl, on local file fname.
I	Source deck is to be read from file COMPILE. If this parameter is omitted, the source deck is read from file INPUT.
I=fname	Source deck is to be loaded from file fname.
L	Writes full assembly listing on file OUTPUT. When the L parameter is omitted, this option is assumed.
L=fname	Lists output on the specified file. When the full list is on a different file from that specified for the short list, the listing for each subprogram is written as a single logical record preceded by a one-word header consisting of an asterisk and the first six characters of the subprogram name. This header identifies the subprogram as a convenience for sorting and cataloging. Also, refer to the O option.
L=0	No full list is generated.
LO=0	Selects list options B, L, N, and R only. If the LO parameter is omitted, these options are assumed.
LO	Selects list options C, F, G, and X and deselects R.
LO=\$\$\$\$	Selects all options.
LO=chars	Selects or deselects a maximum of nine of the following list options. Inclusion of B, L, N, and R deselects the corresponding option; otherwise, inclusion of the character selects the specified option.
A	Lists statements actually assembled. When A is not selected, a line containing concatenation and micro substitution marks is listed containing the marks exactly as presented to the assembler. When the A option is selected, however, the assembler lists the line before and after the editing takes place. Selecting A also causes the listing of lines of code resulting from the R= pseudo-instruction.
B	Lists binary control statements. When B is selected, the listing includes SEG, SEGMENT, IDENT, and END pseudo-instructions.
C	Lists control statements. When C is selected, the listing includes EJECT, SPACE, TTL, and TITLE pseudo-instructions. A listing instruction that causes an EJECT is listed as the first line of the new page after the EJECT takes place.
D	Includes details. Selection of the D option causes listing of the following items not normally listed. <ul style="list-style-type: none"> Second and subsequent lines of DATA and DIS Code assembled remotely when HERE or END causes its assembly Literals block Default symbols

Option

Meaning

- E Includes echoed lines. Selection of E causes a listing of all iterations of code duplicated as a result of DUP and ECHO.
- F Lists IF-skipped lines. When F is selected, the listing includes all lines skipped by IF, IFop, IFC, IFPP, IFCP, SKIP, and ELSE. In addition, the symbolic reference table contains references to symbols in IF statements.
- G Lists generated code. Selection of this option causes a listing of all code generating lines regardless of list controls other than L. Instructions listed include symbolic machine instructions and BSS, BSSZ, CON, DATA, DIS, R=, and VFD.
- L Master list control. This option is normally selected. When L is canceled, the long list contains error-flagged lines, an error directory, and LIST and END pseudo-instructions only, regardless of selection of any other options.
- M Lists macros and opdefs. Selection of M causes all lines generated by calls to macros and opdefs other than those defined by the system to be listed.
- N Lists nonreferenced symbols. This option is normally selected. Cancellation of this option causes any nonsystem symbol for which no reference has been accumulated (for example, all occurrences are in IF statements with the F option deselected or are between CTEXT or ENDX with the X option deselected) to be omitted from the symbolic reference table.
- R Accumulates and lists references. This option is normally selected. When R is canceled, COMPASS does not accumulate references. R should not be canceled if a complete symbolic reference table is desired. If R is canceled at assembly end, no symbolic reference table is produced.
- S List system macros and opdefs. Selection of S causes all lines generated by calls to system-defined macros and opdefs to be listed.
- T List nonreferenced system symbols. Selection of this option causes a symbol defined through SST to be included in the symbolic reference table even if there are no accumulated references.
- X List XTEXT lines. When X is selected, all statements assembled as a result of an XTEXT pseudo instruction are listed. CTEXT and ENDX provide means of alternately turning this external designator off and on.

<u>Option</u>	<u>Meaning</u>
ML	MODLEVEL is equal to JDATE. When ML is omitted, this option is assumed.
ML=chars	MODLEVEL is equal to the 9-character string, chars.
N	No eject; suppresses ejects caused by normal listing control. If this option is omitted, normal page ejects occur.
O	Short list; suppressed if full list is directed to the same file or if no assembly errors occur. However, if the full list and short list are on different files (for example, the full list is written on OUTPUT and the short list is written on the named file), the short list contains all statements having error flags. If an error line is generated by a macro call, the macro call may also be in the short list.
O=fname	Short list is written on file fname.
O=0	No short list is provided.
PC	PCOMMENT micro is 30 blanks. When PC is omitted, this option is assumed.
PC=chars	PCOMMENT is the 30-character string, chars.
P	Selects consecutive page numbering. When P is omitted, page numbering begins with 1 at the start of each subprogram.
S	Text is SYSTEXT.
S=ovl†	Text is named overlay, ovl. If S is omitted and G is not specified, text is on SYSTEXT overlay. S=0 indicates no system text.
S=lib/ovl	Text is named overlay, ovl, on the specified library, lib.
X	External text is on file OPL. When X is omitted, XTEXT is satisfied from file OLDPL.
X=fname	External text is to be obtained from file fname.

† A maximum of seven S parameters is allowed.

INDEX

- Abnormal termination codes 2-3-5
- Abort CPU 2-6-5; 2-11-1
- Abort job 2-4-15; 2-11-1
- ABORT macro 2-11-1
- Abort PPU 2-6-5
- Absolute record type 2-G-5
- ABS 2-G-5
- ABT 2-2-2
- Access mode 2-5-2, 6, 20, 22
- ACCESS subsystem 2-12-11
- Account block SRU limit 2-6-2, 8
- Account dayfile 2-9-3
- Accounting information 2-6-17
- ACTR symbol 2-2-6.1; 2-E-2
- Address
 - Error, CIO 2-3-14
 - Out of range 2-E-3
 - Registers 2-E-3
- ALTER, OPEN function 2-3-18
- ALTERNR, OPEN function 2-3-18
- ANSI labels 2-3-20, 43; 2-4-14, 17
- APPEND macro 2-5-17
- Appending information to a file 2-5-17
- Applications programs, converting 2-12-1
- ARET error 2-6-5
- ARG= entry point 2-F-1
- ARGR symbol 2-2-6.1; 2-E-2
- Argument address 2-2-6.1; 2-E-2
- Arithmetic error 2-6-5
- ASCII/display code conversion 2-4-15
- ASCII mode 2-12-6, 9
- ASCII output byte 2-12-6
- ASCII terminals 2-12-9
- Assign file to queue device 2-7-5
- ASSIGN macro 2-4-3, 12
- Assigning
 - Equipment 2-4-9
 - Files 2-4-10, 14; 2-7-5
 - Nonallocatable devices 2-4-9
 - Packs 2-4-9
 - Resources 2-4-9
 - Tape units 2-4-9
- Assignment, file 2-12-2
- ATTACH macro 2-5-22
- Auto input byte 2-12-4
- Auto recall 2-2-1
 - CIO 2-3-12
 - DSP 2-8-1
 - LFM 2-4-1
 - PFM 2-5-3
 - SFM 2-9-1
 - *option 2-3-34, 36, 38
- Automatic file flushing 2-3-6.1; 2-6-28; 2-12-2
- Automatic tape assignments 2-4-17
- Auxiliary device requests 2-5-7
- Auxiliary devices 2-5-7, 19
- B format tape 2-3-18
- Backspacing a file 2-3-39, 50
- BASIC subsystem 2-12-11
- Batch origin type 2-E-4
- BATCH subsystem 2-12-11
- BCOT 2-E-4
- Binary
 - File mode bit 2-3-6
 - Formats 2-G-1
 - Input mode 2-12-5
 - Output mode 2-12-5
 - Random file, FET creation 2-3-10
 - Sequential file, FET creation 2-3-9
- BKSP macro 2-3-39
- BKSPRU macro 2-3-40
- Block size 2-4-16
- Blocked data format 2-4-16
- Buffer
 - Circular 2-3-2, 12
 - Empty, defined 2-3-3
 - Full, defined 2-3-3
 - Pointers 2-3-2
 - Sizes 2-3-10
 - Working 2-3-51
- *CALL directive 2-2-8; 2-C-15
- CAP record type 2-G-5
- Capsules, fast dynamic load 2-11-14, 18, 20
- Carriage control, terminal 2-12-4, 7
- Catalog information 2-5-11
- Category, file 2-5-6
- CATLIST macro 2-5-11; 2-A-1
- CCAP symbol 2-5-17
- CCAT symbol 2-5-22
- CCCG symbol 2-5-23
- CCCT symbol 2-5-11
- CCDF symbol 2-5-19
- CCDR symbol 2-2-6.1; 2-E-2
- CCGT symbol 2-5-9
- CCPG symbol 2-5-10
- CCPM symbol 2-5-15
- CCRP symbol 2-5-16
- CCSV symbol 2-5-8
- CEJ/MEJ option 2-E-2
- Central exchange jump/monitor exchange
 - jump 2-2-4, 6; 2-E-2

Central memory
 Dumps 2-2-14; 2-11-13
 Field length 2-6-15
 Central processor
 Abort 2-11-1
 Priority 2-6-2, 12
 Selection 2-6-18
 Time 2-6-2, 4, 13
 CHANGE macro 2-5-23
 Character sets 2-2-6.1; 2-12-9; 2-E-2
 Checkpoint
 Dumps 2-4-10; 2-10-3
 Files 2-10-3
 Messages 2-10-3
 Option 2-10-3
 Checkpoint/restart 2-10-3
 CHECKPT macro 2-10-3; 2-A-1
 CIO 2-3-12
 Circular buffer 2-3-2, 12
 Common decks 2-3-15
 Detail error return codes 2-3-14
 FET format 2-3-13
 Function processing 2-3-12, 15
 Random processing 2-3-15
 Read functions 2-3-26
 Write functions 2-3-34
 Circular
 Buffers 2-3-2, 12
 Read operation 2-3-3
 Write operation 2-3-4
 Circular buffer flushing 2-3-6.1; 2-6-28;
 2-12-2
 CLOCK macro 2-11-1
 CLOSE macro 2-3-23
 CLOSER macro 2-3-25
 Closing a file 2-3-23, 25
 CM
 Data error 2-E-3
 Dumps 2-2-14; 2-11-12
 Parity error 2-6-6
 CMC input error 2-E-3
 CMU option 2-2-6.1; 2-E-2
 CMUR symbol 2-2-6.1; 2-E-2
 Coded
 File mode 2-3-6
 Random file, FET creation 2-3-10
 Sequential file, FET creation 2-3-10
 Coding specifications 2-C-1
 Combined input/output 2-3-12
 COMCARG 2-A-3
 COMCCDD 2-A-3
 COMCCFD 2-A-3
 COMCCIO 2-A-3
 COMCCMD 2-2-7; 2-A-3
 COMCCOD 2-A-3
 COMCCPM 2-A-3
 COMCDXB 2-A-3
 COMCEDT 2-A-3
 COMCFCE 2-A-3
 COMCLFM 2-A-3
 COMCMAC 2-2-7; 2-A-1
 COMCMTM 2-A-3
 COMCMTP 2-A-4
 COMCMVE 2-A-4
 COMCOVL 2-A-4
 COMCPFM 2-A-4
 COMCRDC 2-A-4
 COMCRDH 2-A-4
 COMCRDO 2-A-4
 COMCRDS 2-A-4
 COMCRDW 2-A-4
 COMCSFM 2-A-4
 COMCSFN 2-A-4
 COMCSRT 2-A-4
 COMCSSN 2-A-4
 COMCSST 2-A-4
 COMCSTF 2-A-4
 COMCSYS 2-A-4
 COMCUPC 2-A-4
 COMCWOD 2-A-4
 COMCWTC 2-A-4
 COMCWTH 2-A-4
 COMCWTO 2-A-4
 COMCWTS 2-A-4
 COMCWTW 2-A-4
 Comment field 2-C-11
 COMMENT statement 2-C-1
 Common Decks 2-1-1; 2-2-7; 2-A-1; 2-C-15
 CIO 2-3-15
 CPM 2-6-1
 Data transfer macros 2-3-54
 Defined in SYSLIB 2-A-5
 LFM 2-4-2
 PFM 2-5-5
 QFM 2-7-1
 Relocatable 2-A-5
 SFM 2-9-2
 SYSLIB 2-A-5
 System requests 2-11-1
 TCS 2-10-1
 COMMON macro 2-4-4; 2-A-3
 Compare/move unit 2-E-2
 COMPASS statement 2-H-1
 COMSPFM 2-5-6
 Conflict of tags 2-2-10
 Console, display a message 2-6-7; 2-11-7
 CONSOLE macro 2-6-7; 2-A-1
 Control Bytes 2-12-4
 Control Point
 Area 2-6-1
 Dayfile 2-9-3
 Manager 2-6-1
 Control Statement
 Buffer 2-10-2
 Execute 2-10-2
 File 2-14-12, 13; 2-10-1
 Image 2-2-6.1; 2-10-1; 2-E-2
 Input buffer 2-10-2
 Parameters 2-10-1; 2-E-2
 Processing 2-10-1

Control words, PFM 2-5-4
 CONTROL macro 2-10-1
 Conversion mode 2-4-15
 Converting applications programs 2-12-1
 COPYB listing 2-D-1
 CPET error 2-6-5
 CPM 2-6-1
 CPM, common decks 2-6-1
 CPU
 Abort 2-6-2,5; 2-11-1
 Common decks 2-2-7; 2-A-1
 Error exit 2-6-2,5; 2-E-3
 Hardware error exit mode 2-6-2
 Parity error 2-6-6
 Priority 2-6-2,12
 Program error exit mode 2-6-2,5,13;
 2-E-3
 Select 2-6-18
 Time 2-11-13
 Time limit 2-6-4
 CPUMTR 2-2-4
 Creating
 Direct access file 2-5-19
 Files 2-3-1
 Indirect access file 2-5-8,16
 Labeled tape 2-4-14
 Library file 2-4-4
 Random file 2-B-1
 Creation date 2-4-17
 CRM I/O 2-3-59
 CSET macro 2-12-9; 2-A-1
 CSMR symbol 2-2-6.1; 2-E-2
 Current
 Date 2-11-2,4,9
 Random index 2-3-8
 Time 2-11-1,4

 Data
 Format 2-4-16
 Tag conventions 2-C-14
 Transfer macros 2-3-51
 Date, current 2-11-2,4,9
 DATE macro 2-11-2
 Date, packed 2-11-2
 Dayfile, displaying information 2-11-7
 DAYFILE macro 2-9-3; 2-A-1
 Dayfile messages 2-11-7
 Deferred batch jobs 2-7-3
 Deferred file routing 2-8-3
 DEFINE macro 2-5-19
 Density, tape 2-4-14
 Detail error return code 2-3-14
 Device
 Auxiliary 2-5-7
 Not ready error 2-3-14
 Reserved error 2-3-14
 Status errors 2-3-14
 Type 2-3-6,11,19; 2-4-7,21; 2-9-4;
 2-E-5
 Direct access files
 Attaching 2-5-22
 Defining 2-5-19
 PRUs desired 2-5-4
 Purging 2-5-10
 Type 2-E-4
 Disable
 CM dumps 2-2-14
 Hardware exit mode 2-6-2; 2-E-3
 Program exit mode 2-6-2, 2-E-3
 Disconnect terminal 2-12-4
 Display code conversion 2-4-15
 Display code dumps 2-11-13
 Dispose processor 2-8-1
 Disposition code 2-8-2
 DISTC macro 2-12-7; 2-A-1
 Distributive data path 2-E-5
 Division, integer 2-2-6
 DMD request 2-2-2; 2-11-13
 DMP= entry point 2-F-1
 DMP= processors 2-2-14
 DMP request 2-2-2; 2-11-13
 DOCUMENT statement 2-C-1
 Documentation cards 2-C-1,11
 DSP function 2-2-2; 2-8-1
 DTY parameter 2-3-11
 Dumping central memory 2-2-14; 2-11-13
 Dumps 2-2-14; 2-11-13
 Duplicate library file names 2-4-4

 *E directive 2-C-9
 E format tape 2-3-18; 2-4-16
 ECS Flag register operation parity error
 2-E-3
 EDATE macro 2-11-2; 2-A-1
 EIOT 2-E-4
 EM-M 2-6-2; 2-E-3
 EM-N 2-6-2; 2-E-3
 Empty buffer, defined 2-3-3
 ENCSF macro 2-4-12; 2-A-1
 END 2-2-2
 End-of-block byte 2-12-4
 End-of-device status 2-3-13
 End-of-file 2-3-5,6,52
 End-of-information 2-3-6,52
 End-of-line 2-12-4
 End-of-record 2-3-5,6,52
 End-of-reel, defined 2-3-13,25; 2-4-16
 End-of-string byte 2-12-6
 End-of-tape, defined 2-4-16
 End-of-tape processing 2-4-15
 End-of-transaction block 2-12-6
 End-of-transaction block with response
 2-12-6
 ENDRUN macro 2-11-3
 EOF 2-3-5,6,52

EOF1 label 2-3-24,25
 EOF2-9 labels 2-3-24, 25
 EOI 2-3-5,52
 EOR 2-3-5,52
 EOVI label 2-3-24, 25
 EOVI label 2-3-25
 EPR parameter 2-3-14
 Equipment file assignment 2-4-10
 Equipment codes 2-E-5
 Equipment number 2-4-21
 EREXIT macro 2-6-5
 ERRLOG 2-9-3
 Error
 Control 2-6-2,5
 Exit address 2-6-5
 Exit mode 2-6-2, 5, 13; 2-E-3
 Flag 2-6-5; 2-11-1
 Processing 2-3-6, 15; 2-4-15; 2-8-4
 Processing bit 2-3-6
 Error codes
 DSP 2-8-4
 LFM 2-4-1
 PFM 2-5-1
 Error log dayfile 2-9-3
 ESYF macro 2-9-4; 2-A-1
 ETIME macro 2-11-4; 2-A-1
 Event descriptor 2-6-8
 EVICT macro 2-3-48
 Evicting a file 2-3-48
 Exchange jump 2-2-4
 Exchange package 2-12-8; 2-E-3
 EXCST macro 2-10-2; 2-A-1
 EXECUTE subsystem 2-12-11
 Exit mode 2-6-2, 5, 13
 Expiration date 2-4-17
 Export/Import origin type 2-E-4
 Extended label processing 2-3-6.1, 21, 44
 External
 Characteristics, routed file 2-8-2
 Data format 2-4-16
 Documentation 2-C-1

 F format tape 2-3-18; 2-4-16
 FAFT file type 2-E-4
 Family name 2-6-26
 Fast attach file 2-E-4
 Fast dynamic load 2-2-2; 2-11-18, 20
 FCPB category 2-5-7
 FCPR category 2-5-7
 FCSP category 2-5-7
 FDL 2-11-18, 20
 FDL capsules 2-11-18, 20
 FET 2-3-1
 Creation macros 2-3-9
 Description 2-3-4
 LABEL macro 2-4-14
 Length 2-3-7, 11
 Parameters 2-3-11

Position in field length 2-12-1
 FET formats 2-3-4
 CIO requests 2-3-13
 LFM requests 2-4-1
 PFM requests 2-5-4
 QFM requests 2-7-2
 SFM requests 2-9-2
 Field length 2-6-15, 19, 25; 2-11-5
 Control word 2-6-19
 Reducing 2-6-15, 25; 2-11-5
 File
 Accessibility 2-4-17
 Assigning 2-4-10; 2-7-5
 Assignments, terminals 2-12-2
 Backspacing 2-3-29, 40, 50
 Binary 2-3-6, 9
 Category 2-5-6, 20
 Coded 2-3-6, 10
 Creation 2-3-1
 Deferred routed 2-8-1
 Direct access 2-5-19, 22
 FET format 2-3-4
 Flushing 2-3-6.1; 2-6-28; 2-12-2
 Identifier 2-4-17
 Information 2-4-21
 Length 2-4-21
 Limit error 2-6-5
 Local 2-4-1
 Magnetic tape 2-3-18; 2-4-18
 Mode 2-3-6; 2-5-6
 Name 2-3-5; 2-5-4
 Password 2-5-4
 Permission mode 2-4-23; 2-5-6, 20
 Positioning 2-3-39; 2-4-8
 Private 2-5-6.1
 Processors 2-2-1
 Public 2-5-6.1
 Purging 2-5-10
 Random 2-3-10
 Replacing 2-5-16
 Residency 2-5-7, 19
 Returning 2-3-42
 Rewinding 2-3-40
 Routing 2-8-1
 Saving 2-5-8
 Section number 2-3-9; 2-4-17
 Semiprivate 2-5-6.1
 Sequence number 2-4-17
 Sequential 2-3-9
 Skipping 2-3-49, 51
 Space, releasing 2-3-42, 48
 Status 2-4-21
 Types 2-4-19, 21; 2-E-4
 File environment table 2-3-1
 FILEB macro 2-3-9
 FILEC macro 2-3-10
 FILINFO macro 2-4-21

FIRST pointer 2-3-3, 7
 FLET error 2-6-5
 Flush bit 2-3-6.1; 2-6-29; 2-12-2
 FNT entry 2-4-8, 19
 FNT pointer 2-3-7
 Foreign data format 2-4-16
 Forms code 2-8-2
 FSET error 2-6-6
 FST entry 2-4-8, 19
 FTNNTS subsystem 2-12-11
 Full buffer, defined 2-3-3
 Function processors 2-1-1
 FWPR symbol 2-2-6.1; 2-E-2

 Generation number 2-4-17
 Generation version number 2-4-17
 GET macro 2-5-9
 GETASL macro 2-6-9; 2-A-1
 GETEM macro 2-6-13; 2-A-3
 GETFLC macro 2-6-19; 2-A-1
 GETFNT macro 2-4-18; 2-A-1
 GETGLS macro 2-6-22; 2-A-1
 GETJA macro 2-6-17; 2-A-1
 GETJCR macro 2-6-15; 2-A-1
 GETJN macro 2-6-11; 2-A-2
 GETJO macro 2-6-17; 2-A-2
 GETJSL macro 2-6-9; 2-A-2
 GETLC macro 2-6-21; 2-A-2
 GETLOF macro 2-6-27; 2-A-3
 GETMC macro 2-6-24; 2-A-2
 GETPFM macro 2-6-26; 2-A-2
 GETPR macro 2-6-12; 2-A-2
 GETQP macro 2-6-12; 2-A-2
 GETSS macro 2-6-20; 2-A-2
 GETTL macro 2-6-13; 2-A-2
 Global library set indicators 2-6-22, 23
 Group, capsules 2-11-18, 20

 Hardware error exit mode 2-6-2; 2-E-3
 HDR1 label 2-3-20, 43; 2-4-17
 Header documentation 2-C-11

I format tape 2-3-18; 2-4-16
 ID code 2-4-11
 ID, machine 2-6-24
 Identification code 2-4-11
 Illegal user statement 2-7-3
 IN pointer 2-3-3, 4, 7
 Increment registers 2-E-3
 IND parameter 2-3-11
 Indefinite operand 2-E-3
 Index length 2-3-9, 11
 Index, random 2-3-8
 Indirect access files, 2-5-8, 9, 16
 Accessing 2-5-9
 Appending information 2-5-17

Changing parameters 2-5-23
 Creating 2-5-8, 16
 Purging 2-5-10
 Replacing 2-5-16
 Saving 2-5-8, 16
 Working copy 2-5-9
 Infinite operand 2-E-3
 INFT type files 2-E-4
 Inhibit error processing 2-4-15
 Initiate ASCII output 2-12-6
 Input, binary 2-12-5
 INPUT* file 2-3-42
 INPUT file, terminal 2-12-2
 Input file type 2-E-4
 Releasing 2-3-42
 Returning 2-3-42
 Input/output buffers 2-3-51
 Input/output, COMPASS 2-3-1
 Input/output queue protection 2-7-1
 Input/output, record manager 2-3-59
 Interactive I/O 2-12-1
 Internal characteristics, routed file 2-8-3
 I/O sequence error 2-4-1
 Irrecoverable parity error 2-4-15

JDATE macro 2-11-4
 Job
 Abort 2-11-1
 Accounting information 2-6-17
 Communication area 2-E-1
 Control 2-10-1
 Control registers 2-6-15, 16
 Field length 2-6-15, 19, 25; 2-11-5
 Name 2-6-11
 Origin 2-6-17
 Origin type 2-2-6.1; 2-E-4
 Priority 2-6-1, 2, 12
 Rerun error 2-6-6
 SRU limit 2-6-2, 3, 8
 Step limit 2-6-3, 8
 Submitting 2-7-3; 2-8-1
 JOPR symbol 2-2-6.1; 2-E-2
 Julian date 2-11-4

K display messages 2-6-7
 Keyboard buffer address 2-6-7

L display messages 2-6-7
 L format tapes 2-3-18; 2-4-16
 Reading 2-3-32
 Writing 2-3-34, 38
 Label
 Bit 2-4-14
 Buffer 2-3-21, 44
 Verification 2-3-20, 45

LABEL macro 2-4-14
 Label processing 2-3-6; 2-4-15
 Extended 2-3-21, 44
 Standard 2-3-20
 Labeled tape 2-4-14
 LBL parameter 2-3-11
 LDD processor 2-2-2; 2-11-18
 LDQ processor 2-2-2; 2-11-20
 LDR completion 2-2-6.1; 2-E-2
 LDR processor 2-2-2; 2-11-14
 LDRR symbol 2-2-6.1; 2-E-2
 LDV processor 2-2-2; 2-11-14
 Length of FET 2-3-7, 11
 Length of index 2-3-9, 11
 Level number 2-3-5, 12
 LFM 2-4-1
 Call format 2-4-1
 Common decks 2-4-2
 Error codes 2-4-1
 FET format 2-4-1
 Library file type 2-3-42; 2-4-3, 4; 2-E-4
 Library, system default 2-2-7
 LIFT type files 2-E-4
 LIMIT pointer 2-3-3, 7
 Line feed, suppress 2-12-4, 6
 Lines/printer page 2-2-6.1; 2-E-2
 LNP symbol 2-2-6.1; 2-E-2
 List address 2-3-8
 List of files 2-6-27
 LOADD macro 2-11-18
 Loader control word 2-6-14, 21
 Loader requests 2-11-14
 Loading overlays 2-11-14
 LOADQ macro 2-11-20
 Local file manager 2-4-1
 Local file type 2-E-4
 Local file type, returning 2-3-42
 Local files, releasing 2-3-42, 48; 2-4-5
 LOCK macro 2-4-6
 Locked files 2-4-6
 LOFT type files 2-E-4
 Logical file name 2-3-5
 Logical record 2-3-8, 18
 Log-off user 2-12-4
 LWPR symbol 2-2-6.1; 2-E-2

 MACHID macro 2-6-24; 2-A-3
 Machine characteristics 2-6-24
 Machine ID 2-6-24
 Macro usage 2-1-1; 2-2-5
 Magnetic tape files
 Buffer size 2-3-10
 Closing 2-3-23, 25
 Evicting 2-3-48
 Labeling 2-4-14
 Multifile set 2-3-43
 Opening 2-3-20
 Requesting 2-4-9, 14
 Returning 2-3-42
 Standard FET 2-3-5
 Unloading 2-3-41
 Map flags, loader 2-6-14
 Mass storage files
 Assignment 2-4-10
 Buffer size 2-3-10
 Closing 2-3-23
 Evicting 2-3-48
 Opening 2-3-19
 Returning 2-3-42
 Rewinding 2-3-40
 Standard FET 2-3-4
 Unloading 2-3-41
 Maximum field length 2-6-15, 19, 25
 Maximum logical record size 2-3-8, 18
 MEM 2-2-2
 MEMORY macro 2-11-5
 Memory, releasing 2-11-5
 MESSAGE macro 2-11-7
 MFL= entry point 2-F-1
 Minimum buffer size 2-3-10
 Mode, error exit 2-6-2, 5; 2-E-3
 Mode, file 2-3-6
 Mode, file access 2-5-4, 6
 MODE macro 2-6-2; 2-A-3
 Modify library file format 2-G-2
 MOVE macro 2-11-9
 MSG 2-2-2
 MTOT 2-E-4
 MTR functions 2-11-12
 Multifile
 Reels 2-3-43
 Sets 2-3-43
 Tape, positioning 2-3-43
 Multireel files 2-3-43
 Multiterminal origin type 2-E-4
 Multiunit device 2-5-7

 Name change, file 2-4-2
 Name conventions 2-C-13
 Name, logical file 2-3-5
 New file name 2-5-4, 23
 New password 2-5-23
 New permanent file name 2-5-23
 Noise size 2-4-16
 Nonstandard label bit 2-4-14
 Nonstandard labels 2-3-20; 2-4-14
 Nonstop read 2-3-32
 Nonstop write 2-3-38
 NORERUN macro 2-7-3; 2-A-2
 NOS labeled tape 2-4-14
 NOS unlabeled tape 2-4-9, 14
 NOSTEXT file 2-2-5
 NR function 2-3-18, 23
 NULL subsystem 2-12-11

ODET error 2-6-5
OFFSW macro 2-6-11
OKET error 2-6-6
Old password 2-5-4,23
Old permanent file name 2-5-23
ONSW macro 2-6-11
Open for read 2-3-17
Open for write 2-3-18
OPEN macro 2-3-17
Opening a file 2-3-17
Operand out of range 2-E-3
Operand registers 2-E-3
Operating registers, restoring 2-12-8
Operator assignment of equipment 2-4-9
Operator assignment of tapes 2-4-17
Operator drop 2-6-5,6
Operator/user communication 2-6-7
OPL common decks 2-2-7; 2-G-3
OPL format 2-G-2
OPL record type 2-G-5
OPLC record type 2-G-5
OPLD format 2-G-5
OPLD record type 2-G-5
Optional user number 2-5-4
ORET error 2-6-6
Origin type
 Batch 2-E-4
 Multiterminal 2-E-4
 Remote batch 2-E-4
 System 2-E-4
 Time-sharing 2-E-4
OUT pointer 2-3-3,7
Output, automatic 2-12-2
Output, binary 2-12-5
Output file terminal 2-12-2
Output problems, terminals 2-12-2
Overlay 2-11-14; 2-G-5
OVERLAY macro 2-11-14
Override error condition 2-6-6
OVL record type 2-G-5
OWN parameter 2-3-11
OWNCODE address 2-3-11
O26 mode 2-3-23; 2-4-6
O29 mode 2-3-23; 2-4-6

Pack name 2-5-4,7; 2-6-19,20,26
Packed date 2-11-2,9
Packed time 2-11-4,9
PACKNAM macro 2-6-19,20; 2-A-3
Parameters, control statement 2-E-2
Parameters, RA+1 call 2-2-1
Parity errors 2-3-14; 2-6-6
PARITY macro 2-12-10; 2-A-2
Parity, terminal 2-12-10
Password, changing 2-5-23
Password, file 2-3-11; 2-5-4,7
PCET error 2-6-5

PDATE macro 2-11-9
PEET error 2-6-6
Permanent file 2-5-1
 Catalog 2-5-11
 Devices 2-5-7
 Direct access 2-5-19
 Indirect access 2-5-8,16
 Information 2-5-11
 Manager 2-5-1
 Name 2-3-11; 2-5-4
 Name, changing 2-5-23
 Parameters 2-6-26
 Permission 2-5-12,15
 Purging 2-5-7
 Releasing 2-4-5
 Returning 2-3-42,48
 System 2-5-1
Permission, file 2-5-15
Permission information 2-5-12
Permission modes 2-4-23; 2-5-6
PERMIT macro 2-5-15
PFM 2-5-1
 Common decks 2-5-6
 Communication words 2-3-16
 Error codes 2-5-1
 FET format 2-5-4
 RA+1 call 2-5-3
 Registers used 2-5-5
PFM parameter 2-3-11
PGNR symbol 2-2-6; 2-E-2
PHFT type files 2-E-4
Physical record unit, magnetic tape 2-3-18
Physical record unit, mass storage 2-3-7
PKN parameter 2-3-11
PMFT type files 2-E-2
Positioning a file 2-3-39
Positioning the control statement file
 2-4-13
POSMF macro 2-3-43
PP absolute overlay 2-G-1
PP call error 2-6-5
PPET error 2-6-5
PPTXT file 2-2-5
PPU abort 2-6-5
PPU record type 2-G-5
PRFT type files 2-E-4
PRIMARY macro 2-4-20; 2-A-2
Primary terminal file type 2-E-4
Primary terminal type file, returning
 2-3-42
Print type files, releasing 2-4-6
Print type files, returning 2-3-42
Priority, CPU 2-6-2,12
Priority, queue 2-6-1,12
Private file 2-5-6.1
Processing, error 2-3-6
Processing, user 2-3-6
Processing tape requests 2-3-20; 2-4-9,14

- Product set support text macros 2-2-5; 2-A-1
- Program
 - Address 2-E-3
 - Control of terminal activity 2-12-4
 - Error exit mode 2-6-2; 2-E-3
 - Example 2-D-1
 - Parameter area 2-2-6; 2-E-2
 - Stop 2-6-5
 - Termination 2-11-3
 - Text documentation 2-C-12
- Program/system communication 2-2-1
- PRU
 - Magnetic tape 2-3-18
 - Mass storage 2-3-7
 - Reading 2-3-26
 - Size 2-3-7, 18; 2-4-16
 - Writing 2-3-34
- PSCSF macro 2-4-13; 2-A-2
- PSET error 2-6-5
- Pseudo-sense switches 2-6-11; 2-E-2
- PSSTEXT file 2-2-5
- PTAP mode 2-5-6
- PTEX mode 2-5-6
- PTFT type files 2-E-4
- PTMD mode 2-5-6
- PTNU mode 2-5-6
- PTRA mode 2-5-7
- PTRD mode 2-5-6
- PTRM mode 2-5-7
- PTWR mode 2-5-6
- Public file 2-5-6.1
- Punch file
 - Type 2-E-4
 - Releasing 2-4-6
 - Returning 2-3-42
- PUNCHB 2-4-6
- PUNCH9 2-4-6
- PURGE macro 2-5-10
- Purging files 2-5-10
- PWD parameter 2-3-11
- P8 2-4-6

- QFM 2-2-1; 2-7-1
- QUAL pseudo instruction 2-2-12
- QUAL\$ tag 2-2-12
- Qualifying common decks 2-2-10
- Queue
 - Device assignment 2-7-5
 - File manager 2-7-1
 - Priority 2-6-1, 12
 - Protection 2-7-1
 - Rollout 2-6-8
 - Type files 2-E-4

- RA 2-E-1
- RA+1 requests 2-2-1, 4

- Random
 - Access 2-3-15
 - Access bit 2-3-6
 - Address 2-3-15; 2-4-21
 - File, sample 2-B-1, 7
 - Index 2-3-8, 16
 - I/O, examples 2-B-1
 - Processing 2-3-15
 - Request 2-3-8, 16
 - Rewrite request 2-3-8
- RCL 2-2-2, 3
- RDVT macro 2-9-4; 2-A-2
- READ function 2-3-18
- Read functions 2-3-26
- READ macro 2-3-27
- Read nonstop 2-3-32
- Read/write, random 2-3-16
- Read/write interlock 2-5-22
- READC macro 2-3-55
- READCW macro 2-3-28
- READEI macro 2-3-33
- READH macro 2-3-55
- Reading ANSI labels 2-4-14
- Reading labels 2-4-14
- READLS macro 2-3-30
- READN macro 2-3-32
- READNS macro 2-3-32
- READNR function 2-3-17
- READO macro 2-3-56
- READS macro 2-3-57
- READSKP macro 2-3-27
- READW macro 2-3-58
- Real-time clock 2-11-10
- Recall 2-2-2, 3
- RECALL macro 2-11-10
- Record manager I/O 2-3-59
- Record types 2-G-5
- Records, skipping 2-3-48, 50
- REEL function 2-3-18
- REELNR function 2-3-18
- Registers, job control 2-6-15, 16
- Registers, restoring 2-12-8
- REL record type 2-G-5
- RELEASE macro 2-4-5
- Releasing
 - File space 2-4-5
 - Files to output queues 2-4-6
 - Job attachment 2-3-42, 48
 - Local files 2-4-5; 2-7-1
 - Memory 2-11-5
- Relocatable record type 2-G-5
- Remote batch origin type 2-E-4
- RENAME macro 2-4-2
- Renaming a file 2-4-2
- REPLACE macro 2-5-16
- Replacing files 2-5-16
- Request code 2-3-5
- REQUEST macros 2-4-9, 10

Request processor 2-2-1
 Request/return codes 2-3-5
 Requests, system 2-2-1; 2-11-12
 RERUN macro 2-7-2; 2-A-2
 Rerun status 2-7-2,3
 Reserved name conventions 2-C-13
 Residency, file 2-5-19
 Restarting a job 2-10-3
 Retention cycle 2-3-9
 Return code 2-3-5
 RETURN
 Function 2-3-23
 Macro 2-3-42
 vs EVICT macros 2-3-48
 vs UNLOAD macros 2-3-41
 Returning a pack 2-3-42
 Returning a tape file 2-3-42
 REWIND function 2-3-23
 REWIND macro 2-3-40
 Rewinding a file 2-3-40
 REWRITE macro 2-3-36
 REWRITEF macro 2-3-37
 REWRITER macro 2-3-37
 RFILEB macro 2-3-10
 RFILEC macro 2-3-10
 RFL 2-2-2
 RFL= entry point 2-F-1
 ROFT files 2-E-4
 Rollout
 Control 2-6-7
 File type 2-E-4
 Queue 2-6-7
 Time period 2-6-8
 ROLLOUT macro 2-6-7; 2-A-2
 ROUTE macro 2-8-4
 Routine name conventions 2-C-13
 Routing files 2-8-4
 RPHR macro 2-3-26
 RPHRLS macro 2-3-31
 RRET error 2-6-6
 RTIME macro 2-11-10
 Running field length 2-6-15,19; 2-11-5

 S format tape 2-3-18; 2-4-16
 Reading 2-3-27
 Writing 2-3-34
 SAVE macro 2-5-8
 Saving a file 2-5-8
 SDM= entry point 2-F-2
 Security considerations 2-2-14
 Security count 2-7-3
 Secure system memory 2-2-14; 2-6-10;
 2-F-2
 Semiprivate files 2-5-6.1
 Sense switch 2-6-11; 2-E-2
 Sequence error 2-4-1
 Set binary input mode 2-12-5
 Set identification 2-3-9

 Set identifier 2-4-17
 Set transparent input mode byte 2-12-5
 SETASL macro 2-6-2; 2-A-3
 SETGLS macro 2-6-23
 SETID macro 2-4-11
 SETJCR macro 2-6-16; 2-A-2
 SETJSL macro 2-6-3; 2-A-3
 SETLC macro 2-6-14; 2-A-2
 SETLOF macro 2-6-28; 2-A-3
 SETMFL macro 2-6-25; 2-A-3
 SETPR macro 2-6-2; 2-A-2
 SETQP macro 2-6-1; 2-A-2
 SETRFL macro 2-6-15; 2-A-3
 SETSS macro 2-6-16; 2-A-2
 SETSSM macro 2-6-10
 SETTL macro 2-6-4; 2-A-3
 SETUI macro 2-6-13; 2-A-2
 SFM 2-9-1
 Call format 2-9-1
 Common decks 2-9-2
 FET format 2-9-2
 SI tape format 2-3-18; 2-4-16
 SKIPB macro 2-3-50
 SKIPEI macro 2-3-50
 SKIPF macro 2-3-48
 SKIPFB macro 2-3-51
 SKIPFF macro 2-3-49
 SPPR symbol 2-2-6.1; 2-E-2
 SRU 2-11-11
 SRU limit
 Account block 2-6-2,8
 Error 2-6-6
 Job step 2-6-3,8
 SSET error 2-6-6
 SSJ= entry point 2-F-1
 SSM= entry point 2-F-2
 SSM status 2-2-14
 Standard label processing 2-3-6,20,43
 Status information 2-3-5
 Status information, CIO 2-3-13
 STATUS macros 2-4-7
 Status of terminal 2-12-10
 STIME macro 2-11-11
 SUBMIT macro 2-7-3; 2-A-2
 Submitting jobs 2-7-3; 2-8-1
 SUBR macro 2-11-12; 2-A-2
 Subroutine tag conventions 2-C-13
 Subsystem abort error 2-6-6
 Subsystem control 2-6-16,20
 Subsystem type 2-12-11
 SYET error 2-6-6
 SYFT type files 2-E-4
 Symbols, system communications 2-2-6.1
 2-E-2
 SYOT 2-E-4
 SYSCOM macro 2-2-6.1
 SYSLIB 2-2-7; 2-A-5

System

- Abort 2-6-6; 2-7-3
- Communication symbols 2-2-6.1; 2-E-2
- Dayfile 2-9-3
- Default library 2-2-7
- File manager 2-9-1
- Files 2-9-4; 2-E-4
- Interface rules 2-C-16
- Internal data format 2-4-16
- Library 2-2-7
- Origin type 2-E-4
- Request processing 2-2-2
- Requests 2-11-1
- Resource units 2-6-2, 3, 9; 2-11-11
- Type file, returning 2-3-42
- SYSTEM macro 2-11-12
- System texts 2-2-5
- SYSTEXT file 2-2-5

*T directive 2-C-9

Tags, conflict of 2-2-10

Tape

- Access restrictions 2-4-14
- CIO buffer size 2-3-10
- Density 2-4-14
- Formats 2-3-18
- Label processing 2-3-20
- Labels 2-4-14
- Requests 2-3-20; 2-4-9, 14

Tape files (refer to magnetic tape files)

- Accessing 2-4-9, 14
- Assignment 2-4-14, 17
- Block size 2-4-16
- Creating 2-4-9, 14
- Evicting 2-3-48
- Returning 2-3-42
- Rewinding 2-3-40
- Unloading 2-3-41

TCS 2-2-2; 2-10-1

TEFT file 2-E-4

Terminal

- Buffer sizes 2-3-10
- Carriage control 2-12-4, 7
- Identification 2-8-3; 2-12-11
- Output problems 2-12-2
- Parity 2-12-10
- Print position 2-12-4
- Status 2-12-10
- Suspended 2-12-7
- Type 2-12-11

Termination, program 2-11-3

Text format 2-G-8

TID code 2-8-3

TIM 2-2-2

Time, accumulated CPU 2-11-13

Time limit 2-6-4, 13

Control 2-6-4

Error 2-6-5

TIME macro 2-11-13

Time of day 2-11-1, 4, 9

Time-sharing origin type 2-E-4

Time-sharing terminal, buffer sizes 2-3-10

Timed/event rollout file 2-E-4

TKET error 2-6-6

TLET error 2-6-5

Track limit error 2-3-14, 19; 2-6-6

Track mode 2-4-14

Tracks bit 2-4-14

TRANACT subsystem 2-12-11

Translate control statements 2-10-1

Transparent mode 2-12-5

TSTATUS macro 2-12-10; 2-A-2

TXOT 2-E-4

UCW parameter 2-3-11

ULIB record type 2-G-6

Unlabeled tape 2-3-20; 2-4-14

UNLOAD function 2-3-23

UNLOAD macro 2-3-41

UNLOCK macro 2-4-7

Unused bit count 2-3-8, 13

up bit 2-3-6

UPR parameter 2-3-11

USASII conversion 2-4-15

USECPU macro 2-6-18

User

Control word 2-5-1

Control point dayfile 2-9-3

Dayfile 2-9-3

Index 2-6-13, 26

Label buffer 2-3-21, 44

Libraries 2-G-6

Number 2-3-11; 2-6-18, 26

Number, optional 2-5-4, 7

Permission 2-5-6

Processing 2-3-6, 11

Processing bit 2-3-6, 11

User/operator communication 2-6-7

USERNUM macro 2-6-18

USN parameter 2-3-11

VAL= entry point 2-F-2

VERSION macro 2-6-21; 2-A-3

Volume serial number 2-4-17
VOL1 2-3-22; 2-4-17
VSN 2-4-17

Working buffers 2-3-51
Working copy of a file 2-5-9
Working storage 2-3-7, 11
WPHR macro 2-3-34
WRIF\$ symbol 2-3-34, 36, 38
Write functions, CIO 2-3-34
WRITE function 2-3-18
Write lockout bit 2-4-7
WRITE macro 2-3-34
Write, nonstop 2-3-38
WRITEC macro 2-3-55
WRITECW macro 2-3-36
WRITEF macro 2-3-35
WRITEH macro 2-3-56
WRITEN macro 2-3-38
WRITENR function 2-3-18

WRITEO macro 2-3-57
WRITER macro 2-3-35
WRITES macro 2-3-57
WRITEW macro 2-3-58
Writing ANSI labels 2-4-14
Writing interactive programs 2-12-1
Writing labels 2-4-14
WSA parameter 2-3-11

X format tape 2-3-18; 2-4-16
XJ instruction 2-2-4
XJPR symbol 2-2-4, 6.1; 2-E-2
XJR system request 2-12-8
xl bit 2-3-6, 11, 21, 44
XL parameter 2-3-11
XTEXT common deck call 2-2-8, 10

6681 function reject error 2-3-14

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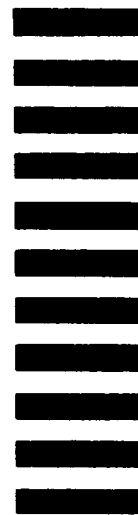
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