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RSX–11M
System Logic Manual

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VOLUME 2

RSX-11M V3.1

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APPENDIX A

RSX-11M SUPPORTED DEVICES

A.1 RSX-11M DEVICE SUPPORT

RSX-11M is a disk based real-time operating system that runs on any UNIBUS PDP-11 processor. During system generation, the user can configure RSX-11M for systems ranging in size from 16K- to 1920K-words.

The user can generate RSX-11M as either a mapped or unmapped system. A mapped system must include the KT11 Memory Management Unit. Without the KT11 Memory Management Unit, RSX-11M supports between 16K- and 28K-words of memory. With the KT11, RSX-11M supports between 24K- and 124K-words of memory on processors other than the PDP-11/70. RSX-11M provides the same primary services for both mapped and unmapped systems; however, some supplied optional features and separately orderable options require hardware configurations larger than the minimum supported system.

For complete and detailed information about minimum hardware required for the different kinds of RSX-11M distribution kits, various options, and combinations of peripherals, see the DIGITAL Software Product Description for RSX11-M, Version 3.1, Real Time Operating System and the RSX-11M System Generation Manual. The RSX-11M Operator's Procedures Manual contains a table of RSX-11M peripheral, pseudo, and null devices along with their respective identifiers (device-unit names recognized by RSX-11M).

RSX-11M supports the following:

A.1.1 Processors And Options

- Any PDP-11 processor except the LSI-11 and PDP-11/03
  - A minimum of 16K-words of memory (unmapped system)
  - Between 24K and 124K-words of memory on a system other than the PDP-11/70 (mapped system with the KT11 Memory Management Unit); and between 64K and 1920K-words on the PDP-11/70.
  - KT11 Memory Management Unit (requires a minimum of 24K-words of memory)
  - KE11-A,B Extended Arithmetic Element (on systems without a memory management unit)
  - KE11-E Extended Instruction Set
  - KE11-F Floating Instruction Set

- FP11 Floating Point Processor
- KW11-Y Watch-dog Timer Clock

A.1.2 Card Readers

- CR11 card reader
- CM11 card reader

A.1.3 Communications

- DL11-E single line interface
- DP11 synchronous line interface
- DU11 synchronous line interface
- DUP11 synchronous line interface
- DQ11 DMA synchronous line interface
- DA11-B DMA UNIBUS link
- DMC11 interprocessor link

A.1.4 Data Acquisition

One or more of the following subsystems:

- LPS11 Laboratory Peripheral System (requires LPS11-S, LPSAD-12, and LPSKW)
- AR11 Analog Real-time System
- LPA11-K Laboratory Peripheral Accelerator
- Laboratory I/O Subsystem configured using the following options:

  1. ADK11-KT 12-bit A/D converter with 16-channel multiplexer and dual clock; one per subsystem)
  2. AD11-K 12-bit A/D converter with 16-channel multiplexer; 16 per subsystem (15 if ADK11-KT is part of same subsystem)
  3. KW11-K Dual real-time clock with Schmitt triggers; 1 per subsystem (clock already included in ADK11-KT, not KW11-K required if one is present)
  4. AM11-K 48-channel A/D multiplexer with gain ranging; one per AD11-K or ADK11-KT
  5. DR11-K 16-bit digital I/O option; 16 per subsystem
  6. AA11-K 4-channel 12-bit D/A converter with scope control, 16 per subsystem

A.1.5 Disk Devices

- RX11 floppy disk system
- RF11 fixed-head disk system
- RK11 disk cartridge controller with RK05J or RK05F disk drives
- RK611 disk cartridge controller with RK06 or RK07 disk drives
- RPR02 disk pack drives (with appropriate controller)
- RP03 disk pack drives (with appropriate controller)
- RP04, RP05, or RP06 disk pack drives (with appropriate controller)
- RS03 or RS04 fixed-head disks (with appropriate controller)
- RM03 drives (with appropriate controller)
- RL11 disk cartridge controller with RL01 disk drives
- RM02 drives (with appropriate controller)

A.1.6 Laboratory/industrial Control

- AD01-D A/D converter
- AFC11 A/D converter
- DRS/DSS11 industrial control system modules
- UDC11 Universal Digital Controller
- IDA11-AA Contact sense module
- IDA11-AB Contact sense module
- IDA11-BA Contact interrupt module
- IDA11-BB Contact interrupt module
- IDA11-CA I/O converter
- IDA11-DA Solid state AC/DC driver
- IDA11-EA Flip-flop DC driver
- IDA11-FA Single shot driver
- IDA11-GA Latching output relay
- IDA11-HA Flip-flop output relay
- IDA11-JA Single shot output relay
- IAA11-AA Multi-range A/D converter
- IAA11-BA D/A converter
- IAA11-BB D/A converter

- IAA11-BC D/A converter
- IAA11-BD D/A converter
- ICS11/ICR11 Industrial Control subsystem
- IDC-IA Isolated DC sense
- IDC-IB Isolated DC interrupt
- IDC-IC I/O counter
- IDC-ID Non-isolated DC sense
- IDC-IE Non-isolated DC interrupt
- IAC-IA Isolated AC sense
- IAC-IB Isolated AC interrupt
- IDC-OA DC flip-flop driver
- IDC-OB DC single shot driver
- IAC-OA AC flip-flop driver
- IAC-OB AC single shot driver
- IRL-OA Latching output relay
- IRL-OB Flip-flop output relay
- IDA-OB 4-channel D/A converter
- IAD-IA 8-channel A/D converter
- IMX-IA 16-channel multiplexer for IAD-IA

A.1.7 Printers

- LA35 line printer
- LA180 line printer
- LS11 line printer
- LP11 line printer
- LV11 line printer (no plotter support)

A.1.8 Tape Devices, Magnetic

- TA11 Dual drive cassette system
- TC11 DECtape controller and dual transport
- TS03 magnetic tape transport (with appropriate controller)
- TU10 magnetic tape transport (with appropriate controller)

- TE10 magnetic tape transport (with appropriate controller)
- TU16 magnetic tape transport (with appropriate controller)
- TE16 magnetic tape transport (with appropriate controller)
- TU45 magnetic tape transport (with appropriate controller)

A.1.9 Tape Devices, Paper

- PC11 paper tape reader/punch
- PR11 paper tape reader

A.1.10 Terminals

- LA30 terminal
- LA36 terminal
- LA180S terminal on the following line devices only:
  - DH11 serial line terminal multiplexer (optional with DM11-BB modem control)
  - DZ11 serial line terminal multiplexer
  - DJ11 serial line terminal multiplexer
  - DL11-A,B,C,D,W single line terminal interface
- LT33 terminal
- LT35 terminal
- VT05 terminal
- VT50 terminal
- VT52 terminal
- VT55 terminal

APPENDIX B

CODING STANDARDS AND CONVENTIONS

B.1 CODING STANDARD INTRODUCTION

This Appendix contains DIGITAL's PDP-11 Program Coding Standard. We suggest that you use this standard for you own installation when writing code, such as I/O drivers, for use with the PDP-11.

B.1.1 Line Format

All source lines consist of from one to a maximum of eighty characters (not including the audit trail added by the SLIPR (SLP in RSX-11M) editor). This program is described in the RSX-11M utilities manual.

Assembly language code lines have the following format:

1. Label field - if present, the label starts at tab stop 0 (column 1).

2. Operation field - the operation fiedl starts at tab stop 1 (column 9).

3. Operand field - the operand field starts at tab stop 2 (column 17).

4. Comments field - the comments field starts at tab stop 4 (column 33) and may continue to column 80.

Include comment lines in the code body by delimiting them with a line that contains only a semicolon. The comment lines contain a leading semicolon with the comment itself starting in column 3.

If the operand field extends beyond tab stop 4 (column 33), leave a space and start the comment. Comments that apply to an instruction but require continuation should always line up with the character that started the comment.

B.1.2 Comments

Comment all coding to convey the global role of an instruction, rather than a simple literal translation of the instruction into English. In general, this consists of a comment for each line of code. If a particularly elegant instruction sequence is used, precede that section of code with a paragraph of comments.

Delimit preface text, which describes formats, algorithms, program-local variables, etc., by the character sequence ;+ at the

start of the text and ;- at the end. These delimiters ease the extraction of the text by a program which could be designed for the purpose. The comments themselves start in column 3.

For example:

```
;+
; THE INVERT ROUTINE ACCEPTS
; A LIST OF RANDOM NUMBERS AND
; APPLIES THE KOLMOGOROV ALGORITHM
; TO THEM
;-
```

B.1.3 Naming Standards

B.1.3.1 Register Standards -

B.1.3.1.1 **General Purpose Registers** - The following names are the only ones permitted for register names and may not be used for other purposes:

```
R0=0                    ;REG 0
R1=1                    ;REG 1
R2=2                    ;REG 2
R3=3                    ;REG 3
R4=4                    ;REG 4
R5=5                    ;REG 5
SP=6                    ;STACK POINTER (REG 6)
PC=7                    ;PROGRAM COUNTER (REG 7)
```

B.1.3.1.2 **Hardware Registers** - Name hardware registers identically to the hardware definition. For example, PS and SWR.

B.1.3.1.3 **Device Registers** - Device registers are symbolically and identically named to the hardware notation. For example, the control status register for the RK disk is RKCS. You may use only this symbolic name to refer to this register.

B.1.3.2 **Processor Priority** - Use the following bits to test or alter processor priority:

```
PR0, PR1, PR2, ......PR7
```

The system equates thes bits to their corresponding bit pattern.

B.1.3.3 **Other Symbols** - Make frequently-used bit patterns, such as CR and LF, conventional symbols on an as-needed basis.

B.1.3.4 **Using the Standard Symbols** - Register standards are defined within the assembler. All other standard symbols appear in a file and are linked prior to program execution.

B.1.4 Symbols

B.1.4.1 **Global Symbols** - You can easily recognize global symbols by their format. The following standards apply and completely define symbol standards for PDP-11 Medium/Large software products.

Figure B-1 describes the difference among global and local symbols.

	Character Positions						
Symbol	1	2	3	4	5	6	Length
Non global symbol	L, AN	AN or null	AN or null	AN or null	AN or null	AN or null	>=1
Global symbol	$ or .	AN or null	AN or null	AN or null	AN or null	AN or null	>=1
Global offset	L	$ or .	AN	AN or null	AN or null	AN or null	>=3
Global bit pattern	L	AN	$ or .	AN	AN or null	AN or null	>=4
Local symbol	N *	$					>=2

where:

L is a letter

AN is an alphanumeric character

null is no character

$ is a dollar sign (reserved for DEC-supplied software)

. is a period (reserved for DEC-supplied software)

N is a number in the range of 0 through 65535

* means that branch targets in the form of x$, where x is a number, are also called labels.

Figure B-1 Difference Among Global and Local Symbols

B.1.4.2 **Symbol Examples** - Non-global Symbols

A1B

ZXCJ1

INSRT

Global Address Symbols

$JIM

.VECTR

$SEC

Global Absolute Offset Symbols

A$JIM

A$XT

A.ENT

Global Bit Pattern Symbols

A1$20

B3.6

JI.M

Local Symbols

37$

271$

6$

B.1.4.3 **Program-Local Symbols** - Self-relative address arithmetic (.+n) is absolutely forbidden in branch instructions. It must not be used in other contexts if at all possible.

Target labels (symbols) for branches that exist only for positional reference use local symbols of the form:

<num>$:

Restrict use of global symbols to cases where reference to the symbol occurs external to the code. The assembler formats local symbols to proceed sequentially down the page and from page to page.

B.1.4.4 **Macro Names** - The last two characters in a macro name have special significance. The next to last character is a $ and the last character specifies the mode of the macro. (The last character may also be a null character.)

For example, three macro forms exist: in-line, stack, and p-section. The in-line form has no suffix (the $ is last). The stack has an S as the last character. The p-section has a C as the last character. Thus, the QUEUE I/O macro can be written in any one of the three following ways:

```
QIO$

QIO$S

QIO$C
```

The letters S and C are not reserved but the form of the macro is standard.

B.1.5 Program Modules

B.1.5.1 **General Comments on Programs** - In DEC software, a program provides a single distinct function. No limits exist on size, but the single function limitation makes large modules a rarity. Because any software may exploit the memory capacity of the 11/40, 11/45, or 11/70, programs should maintain a dense reference locus (branching should occur over short address distances).

All code is read only. Code and data areas are distinct and each contains explanatory text. Read-only data should be segregated from read-write data.

B.1.5.2 **Module Preface** - Each program module in the system exists as a separate file. The filename reflects the name of the module and the extension is of the form 'NNN'. NNN signifies the edit number or the version number. The version number is changed only when a new base level is created. Furthermore, if no corrections are made to a file from one base level to the next, the version number is not changed. The availability if File Control Services and File Control Primitives greatly simplify version number maintenance. Program modules adhere to a strict format. Reading and understanding the code is easier because of this format. The following sections are in each module:

For the code section:

1. A .TITLE statement that specifies the name of the module. If a module contains more than one routine, you may use subtitles.

2. A .IDENT statement that specifies the version number. The PDP-11 version number standard appears in section B.10.

3. A .PSECT statement that defines the program section in which the module resides.

4. A copyright statement and the disclaimer.

5. The version number of the file.

   The PDP-11 version number standard is described in section B.10.

6. The name of the principal author and the date on which the module was first created.

7. The name of each modifying author and the date of the modification. Names and modification dates appear one per line and in cronological order.

8. A brief statement of the function of the module.

   Note: Items 1-8 should appear on the same page.

9. A list of the definitions of all equated local symbols used in the module. These definitions appear one per line and in alphabetical order.

10. All local macro definitions, preferably in alphabetical order by name.

11. All local data. The data should indicate:

    a. Description of each element (type, size, etc.)

    b. Organization (functional, alpha, adjacent, etc.)

    c. Adjacency requirements.

12. A more detailed definition of the function of the module.

13. A list of the inputs expected by the module. This includes the calling sequence if non-standard, condition code settings, and global data settings.

14. A list of the outputs produced as a result of entering this module. These include delivered results, condition code settings, but not side effects. (All these outputs are visible to the caller.)

15. A list of all effects (including side effects) produced as a result of entering this module. Effects include alterations in the state of the system not explicitly expected in the calling sequence, or those not visible to the caller.

16. The module code.

B.1.5.3 **Formatting the Module Preface** - Rules:

1. The first eight items appear on the same page and should not have explicit headings. Item 3 may be omitted if the blank P-section is being used.

2. Headings start at the left margin. The left margin consists of a semi-colon followed by a space. Therefore, the heading starts in column 3. Indent descriptive text one tab position.

3. Items 7-14 have headings that start at the left margin and are preceded and followed by lines that contain only a leading semi-colon. Omit items that do not apply.

An example of a module preface follows:

```
FILE-EXAMPL.S01
  .TITLE   EXAMPLE
  .IDENT   /01/
  .PSECT   KERNEL

;
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;
; VERSION 01
;
; JOHN HANCOCK 1-JAN-75
;
; MODIFIED BY:
;
; QUINCY ADAMS 21-JAN-76
;
; JAMES MONROE 12-JUN-76
;
; Brief statement of the module's function.
;
; EQUATED SYMBOLS
;
  List equated symbols.
;
; LOCAL MACROS
;
  Local macros
;
; LOCAL DATA
;
  Local data
;+
; Module function details
;
; INPUTS:
;
; Description of inputs
;
; OUTPUTS:
;
; Description of outputs
;
; EFFECTS:
;
; Descriptions of effects
;-
  Begin module code
```

B.1.5.4 **Modularity** - No other characteristic has more impact on the ultimate engineering success of a system than does modularity. Modularity for PDP-11 Software Engineering's products consists of the application of the single-function philosophy described in section B.5.1 and the adherence to a set of calling and return conventions.

B.1.5.5 **Inter-Module Calling Conventions** - The following calling conventions must be observed:

Transfer of Control

Macros exist for call and return. The actual transfer is by a JSR PC instruction. For register save routines, a JSR Rn,SAVE instruction is permitted.

The CALL macro is:

```
CALL subroutine-name
```

The RETURN macro is:

```
RETURN
```

Register Conventions

Upon entry, a subroutine minimally saves all registers it intends to alter except result registers. Upon exit it restores these registers. (State preservation is assumed across calls.)

Argument Passing

Any registers may be used to pass arguments, but their use should follow a coherent pattern. For example, if passing three arguments, pass them in R0, R1, and R2 rather than R0, R2, and R5. Saving and restoring occurs in one place.

B.1.5.6 **Exiting** - All subroutine exits occur through a single RETURN macro.

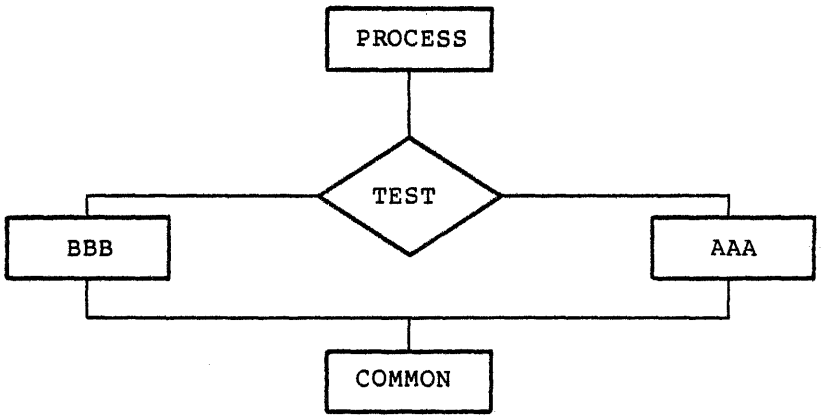
B.1.5.7 **Intra-Module Calling Conventions** - These calling conventions are designer optional, but consistency favors a calling sequence identical to that of the inter-module sequence.

B.1.5.8 **Success or Failure Indication** - The C-bit indicates success or failure where success equals 0 and failure equals 1. You can use the argument registers to return values or additional success or failure data.

B.1.5.9 **Module Checking Routines** - Modules must verify the validity of arguments passed to them. The design of a module's calling sequence should aim at minimizing the validity checks by minimizing invalid combinations. You may add test code to perform additional checks during checkout. All code should aim at discovering an error as close (in terms of instruction executions) to its occurence as possible.

B.1.6 Formatting Standards

B.1.6.1 Program Flow - Programs should be organized on the listing such that they flow down the page, even at the cost of an extra branch or jump. For example:



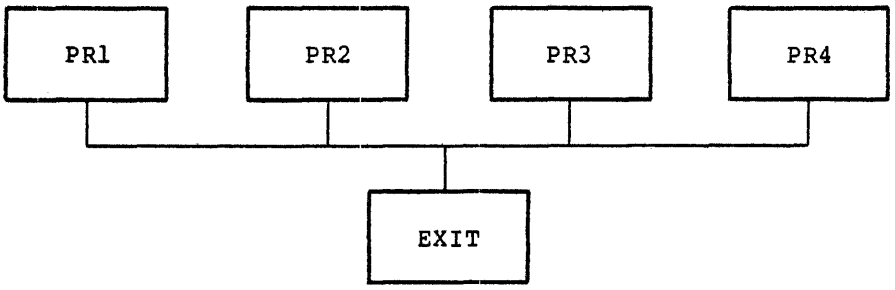
shall appear on the listing as:

```
  TST
  BNE     BBB
AAA:      ....    ....
  ....    ....
  BR      CMN
BBB:      ....    ....
  ....    ....
CMN:      ....    ....
  ....    ....
```

Rather than:

```
  TST
  BNE     BBB
AAA:      ....    ....
  ....    ....
CMN:      ....    ....
  ....    ....
BBB:      ....    ....
  ....    ....
  BR      CMN
```

B.1.6.2 **Common Exits** - A common exit appears as the last code sequence on the listing, illustrated by the following flow chart:



should appear on the listing as:

```
PR1:      ....    ....
  ....    ....
  BR      EXIT
PR2:      ....    ....
  ....    ....
  BR      EXIT
PR3:      ....    ....
  ....    ....
  BR      EXIT
PR4:      ....    ....
  ....    ....
EXIT:     ....    ....
```

and not as:

```
PR1:      ....    ....
  ....    ....
EXIT:     ....    ....
  ....    ....
PR2:      ....    ....
  ....    ....
  BR      EXIT
PR3:      ....    ....
  ....    ....
  BR      EXIT
PR4:      ....    ....
  ....    ....
  BR      EXIT
```

B.1.6.3 **Code with Interrupts Inhibited** - Code that executes instructions with interruptions inhibited, should be flagged by a comment delimiter of three semicolons. For example:

```
..ERTZ:                             ;ENABLE BY RETURNING
                                    ;BY SYSTEM SUBROUTINES
  BIS       PR7,PS                  ;;; INHIBIT INTERRUPTS
  BIT       PR7,+2(SP)              ;;; C
  BEQ      10$                      ;;;  O
  RTT                               ;;;   M
                                    ;;;    M
10$:       ....     ....            ;;;     E
  ....     ....                     ;;;      N
  ....     ....                     ;;;       T
  ....     ....                     ;;;        S
```

B.1.7 **Program Source Files**

Creation of and maintenance of source code is done in base levels. A base level is defined as a point at which changing the program source files is no longer allowed. From this "frozen" point to the next base level, corrections are not made to the base level itself; rather, a file of corrections is accumulated for each file in the base level. Whenever a updated source file is desired, the correction file is applied to the base file.

The accumulation of corrections proceeds until a logical breaking point has occurred (for example, a milestone or significant implementation point is reached). At this time, all accumulated corrections are applied to the previous base level to create a new base level. Correction files are then started for the new base level.

B.1.8 **Forbidden Instruction Usage**

The following instruction usage is not allowed:

1. The use of intructions or index words as literals of the previous instruction. For example, the sequence:

   ```
   MOV      @PC,REGISTER

   BIC      SRC,DST
   ```

   uses the bit clear instruction as a literal. This may seem to be a very good way to save a word but this compounds the problem of program maintenance. To make matters worse, this sequence does not execute correctly if I/D space is enabled on the PDP-11/45. In this case, @PC is a D bank reference.

2. The use of the MOV instruction instead of a JMP instruction to transfer program control to another location. For example:

   ```
   MOV       ALPHA,PC
   ```

   transfers control to location ALPHA. Besides taking longer to execute (2.3 microseconds for the MOV vs. 1.2 for the JMP) the use of MOV instead of JMP makes it nearly impossible to pick up someone else's program and tell where transfers of control take place. A jump trace of a program's execution is

impossible in this case (a move trace is unheard of). As a more general issue, other operations such as ADD and SUB from the PC should be discouraged. Possibly one or two words can be saved by using these operations, but occurences where these operations can be used are rare.

3. The seemingly clever use of all single word instructions where one double-word instruction could be used, would execute faster, and would not consume additional memory. Consider the following instruction sequence:

```
CMP     -(R1),(-R1)

CMP     -(R1),-(R1)
```

The intent of this instruction sequence is to subtract 8 from register R1 (not to set condition codes). This can be accomplished in approximately 1/3 the time by using a SUB instruction (9.4 vs. 3.8 microseconds) at no additional cost in memory space. Also, if R1 is odd this instruction does not give the correct result. The SUB instruction is always faster and always executes correctly.

B.1.9 Recommended Coding Practice

B.1.9.1 Conditional Branches - When using the PDP-11 conditional branch instructions, the correct choice must be made between the signed and the unsigned branches.

Signed	Unsigned
BGE	BHIS (BCC)
BLT	BLO
BGT	BHI
BLE	BLOS (BCS)

A common pitfall is to use a signed branch (for example, BGT) when comparing two memory addresses. This compare works until the two addresses have opposite signs; that is, one of them goes across the 16K (100000(8)) boundary. This type of coding error usually occurs when a program is re-linked at different addresses or the program's size is changed.

B.1.10 PDP-11 Version Number Standard

The PDP-11 Version Number Standard applies to all modules, parameter files, complete programs, and libraries that are written as part of the PDP-11 Software Development effort. It provides unique identification of all released, pre-released, and in-house software.

It is limited because, as currently specified, only six characters of identification are used. Future implementations of the Macro Assembler, Task Builder, and Librarian should provide for at least

nine characters, and possibly twelve. This standard will change as the need arises. The version identifier takes the following form:

Version Identifier = <form> <version> <edit> <patch>

<form> Identifies a particular form of a module or program, where applicable, as in the case of LINK-11. One alphabetic character, if used, and null (for example, a binary 0) if not used.

<version> Identifies the release or generation of a program. The version number is two decimal digits that start at 00 and is incremented at the discretion of the project to reflect a major change.

<edit> Identifies the level to which a particular release or generation of a program or module has been edited. An edit is an alteration to the source form. The edit number consists of two decimal digits that begin at 01. The number is incremented with each edit and remains null if no edit occurs.

<patch> Identifies the level to which a particular release or generation of a program or module has been patched. A patch is an alteration to a binary form. The patch identification consists of one alphabetic character that starts at B. The character is changed toward Z each time a set of patches is released and remains null if no patches are made.

These fields are interrelated. When version is changed, patch and edit must be reset to nulls. When edit is incremented, patch is re-set to null because various bugs have been fixed.

B.1.10.1 **Displaying the Version Identifier** - The visible output of the version identifier should appear as:

Key <letter> <form> <version> - <edit> <patch>

where the following Key letters have been identified:

V released or frozen version
X in-house experimental version
Y field test, pre-release, or in-house release version

and 'V' to company support.

Use the dash that separates version from edit only if edit or patch is not null. When a version identifier is displayed as part of a program identification, the format is:

Program
Name <space><key-letter><form><version>-<edit><patch>

Examples:

```
PIP X03
LINK VB04-C
MACRO Y05-01
```

B.1.10.2 Use of the Version Number in the Program - All sources must contain the version number in an .IDENT directive. For programs (or libraries) that consist of more than one module, each individual module follows this version number standard. The version number of the program or library is not necessarily related to the version numbers of the consituent modules; it is perfectly reasonable, for example, that the first version of a new FORTRAN library, V00, contain an existing SIN routine, say V05-01.

Parameter files are also required to contain the version number in an .IDENT directive. Because the assembler records the last .IDENT seen, parameter files must precede the program.

Entities that consist of a collection of modules or programs (for example, the FORTRAN library) have an identification module in the first position. An identification module exists solely to provide identification and normally consists of something like:

```
;OTS IDENTIFICATION
.TITLE FTNLIB
.IDENT /003010/
.END
```

B.1.11 Co-routines

In some cases, two program routines are highly interactive. They then use a special case of the JSR instruction (JSR PC,@(SP)+). This form of the JSR instruction exchanges the top element of the stack and the contents of the program counter (PC). In this way, two routines may swap program control and resume operation where they stopped, when recalled. Such routines are called co-routines.

This swapping of control is illustrated below with an actual sequence of instructions from RSX-11M Executive code (Version 3.1).

```
CODE                        ACTION                          STACK
$DRECP::
  .                         Address of caller               +-----------+
  .                         of $DRECP       >               | CALLER ADR|
    CALLR $NXTSK                                            +-----------+
(1) (JMP $NXTSK)            (1) PC=Address of $NXTSK

$NXTSK::                                                    STACK
    SAVNR
(1) (JSR R5,$SAVNR)         (1) Push R5 contents onto       +-----------+
                                stack (save R5).            | CALLER ADR|
(2) MOV P.MAIN(R0),R5           Put address of next         +-----------+
                                instruction (2) into R5     |     R5    |
                                (return address).           +-----------+
                                Put address of $SAVNR
                                into PC.
```

```
$SAVNR::
(1) MOV R4, (SP)        (1) Save R4 on stack
(2) MOV R5, (SP)        (2) Save R5 on stack
(3) MOV 4(SP),R5        (3) Restore saved R5 from
(4) CALL @(SP)+             the stack into R5
    (JSR PC,@(SP)+)     (4) Pop "call to" address
(5) MOV (SP)+,R4            (address of step (2) in
(6) MOV (SP)+,R5            $NXTSK) into PC.
(7) RETURN                  Push address of next
    (RTS PC)                instruction (5) onto
                            stack.
```

STACK

CALLER ADR
R5
R4
(5)

```
$NXTSK::
    SAVNR
(1) MOV P.MAIN(R0),R5   (1) Start $NXTSK processing
                            here.
       .                (2) Pop address of (5), in
       .                    $SAVNR, into PC.
(2) RETURN
     (RTS PC)
```

STACK

CALLER ADR
R5
R4

```
$SAVNR::
    .
    .                   (5) Pop saved R4 into R4.
(5) MOV (SP)+,R4        (6) Pop saved R5 into R5.
(6) MOV (SP)+,R5        (7) Return to caller of
(7) RETURN                      $DRECP.
     (RTS PC)
```

STACK

CALLER ADR

APPENDIX C

MACRO EXPANSIONS

C.1 COMMAND STRING INTERPRETER MACRO EXPANSIONS

C.1.1 CSI$1 Macro

This macro calls the command string syntax analyzer.

```
        .MACRO CSI$1 CSBLK,BUFF,LEN
        .GLOBL .CSI1
        .MCALL CSI$,LDR0$
        .IF NDF C.SIZE
        CSI$
        .ENDC
        LDR0$ CSBLK
        .IF NB <BUFF>
        MOV BUFF,C.CMLD+2(R0)
        .ENDC
        .IF NB <LEN>
        MOV LEN,C.CMLD(R0)
        .ENDC
        JSR PC,.CSI1
        .ENDM
```

C.1.2 CSI$2 Macro

This macro calls the command string semantic parser.

```
        .MACRO CSI$2 CSBLK,IO,SWTAB
        .GLOBL .CSI2
        .MCALL CSI$,LDR0$
        .IF NDF C.SIZE
        CSI$
        .ENDC
        LDR0$ CSBLK
        .IF NB <IO>
        .IF IDN <INPUT>,<IO>
        MOVB #CS.INP,(R0)
        .IFF
        .IF IDN <OUTPUT>,<IO>
        MOVB #CS.OUT,(R0)
        .IFF
        .ERROR                  ;Incorrect request to .CSI2
        .ENDC
        .ENDC
        .ENDC
```

```
.IF NB <SWTAB>
MOV SWTAB,C.SWAD(R0)
.ENDC
JSR PC,.CSI2
.ENDM
```

C.1.3 CSI$SW Macro

This macro defines the switch table entry.

```
.MACRO CSI$SW SW,MK,MKW,CLR,NEGS,VALTAB,LNG
.IF B,SW
.ERROR                  ;Missing switch name
.IFF
.EVEN                   ;Force to word alignment
.NCHR SIZ$$,SW          ;Set SIZ$$ to no. of chars in sw
.IF GT,SIZ$$-2          ;If string is longer than 2 chars
.IF B,LNG               ;and not "long" or "exact"
SIZ$$=2                 ;trim it back to 2 characters
.ENDC
.ENDC
CNT$$=0
.IRPC CHR$$$,SW         ;For each character in SW
CHR$$=''CHR$$$
CNT$$=CNT$$+1
.IF GE,<CHR$$-<'A+^O40>>  ;If .GE. lower case A
.IF LE,<CHR$$-<'Z+^O40>>  ; and .LE. lower case Z
CHR$$=CHR$$-^O40          ; convert to upper case alpha
.ENDC
.ENDC
.IF LE,CNT$$-SIZ$$      ;If more characters to store
$.=0
.IF NB,LNG              ;If "long" or "exact"
.IF IDN,<LNG>,<EXACT>   ;If "exact"
.IF GT,CNT$$&1          ; and if first byte of word
.IF   GE,CNT$$+1-SIZ$$  ; and if last word in switch name
$$=^O200                ; then set the exact match flag
.ENDC
.IFF                    ;If 2nd byte of word
.IF LT,CNT$$-SIZ$$      ; and if not the last character
$$=^O200                ; set the "more ASCII words
                        ; coming" bit
.ENDC
.ENDC                   ;End of "if first byte of word"
.IFF                    ;If not "exact"
.IF   IDN,<LNG>,<LONG>  ;Must be "long", otherwise error
.IF EQ,CNT$$&1          ;If 2nd byte of word
.IF LT,CNT$$-SIZ$$      ; and not the last character
$$=^O20                 ; set the "more ASCII words
                        ; coming" bit
.ENDC
.ENDC
.IFF                    ;If not "long"
.ERROR                  ;Illegal "long" or "exact"
                        ; specifier
.ENDC                   ;End of if "long"
.ENDC                   ;End of if "exact"
.ENDC                   ;End of IF NB,LNG
.BYTE CHR$$!$$          ;Generate a character
.ENDC                   ;End of "if more characters"
.ENDM                   ;End of the IRPC loop
.EVEN                   ;Round up to next word boundary
```

```
        .ENDC                   ;End of .IF B,SW
        .IF NB MK
        .WORD MK
        .IFF
        .WORD 0
        .ENDC
$$=0
        .IF NB CLR
        .IF IDN <CLEAR>,<CLR>
$$=1
        .IFF
        .IF IDN <SET>,<CLR>
        .IFF
        .ERROR                  ;Invalid set/clear spec
        .ENDC
        .ENDC
        .ENDC
        .WORD MKW+$$
$$=0
        .IF NB NEGS
        .IF IDN <NEG>,<NEGS>
$$=1
        .IFF
        .ERROR                  ;Invalid negate spec
        .ENDC
        .ENDC
        .WORD VALTAB+$$
        .ENDM
```

C.1.4 CSI$ND Macro

This macro defines the end of the switch value table end.

```
        .MACRO CSI$ND
        .WORD 0
        .ENDM
```

C.1.5 CSI$SV Macro

This macro defines the switch value table entry.

```
        .MACRO CSI$SV TYPE,ADDR,LEN,VALTAB
        .IF NB VALTAB
VALTAB:
        .ENDC
        .IF NB TYPE
        .IF IDN <ASCII>,<TYPE>
        .BYTE 1
        .IFF
        .IF IDN <NUMERIC>,<TYPE>
        .BYTE 2
        .IFF
        .IF IDN <OCTAL>,<TYPE>
        .BYTE 2
        .IFF
        .IF IDN <DECIMAL>,<TYPE>
        .BYTE 3
        .IFF
        .ERROR                  ;Invalid conversion type
        .ENDC
```

```
        .ENDC
        .ENDC
        .ENDC
        .IFF
        .BYTE 1                 ;ASCII conversion assumed
        .ENDC
        .IF NB LEN
        .BYTE LEN
        .IFF
        .ERROR                  ;Length missing
        .BYTE 0
        .ENDC
        .IF NB ADDR
        .WORD ADDR
        .IFF
        .ERROR                  ;Value address missing
        .WORD 0
        .ENDC
        .ENDM
```

C.1.6 LDR0$ Macro

This macro conditionally loads R0.

```
        .MACRO LDR0$ ARG
        .IIF B,ARG,.MEXIT
        .NTYPE PAR$$$,ARG
        .IIF EQ,PAR$$$,.MEXIT
        MOV ARG,R0
        .ENDM
```

C.1.7 CSI$ Macro

This macro defines command string interpreter symbols.

```
        .MACRO CSI$ GBL
        .IF IDN <GBL>,<DEF$G>
        .GLOBL C.TYPR,C.STAT,C.CMLD,C.DEVD,C.DIRD,C.FILD,C.SWAD
        .GLOBL C.MKW1,C.MKW2
        .GLOBL C.SIZE,C.DSDS,CS.INP,CS.OUT
        .GLOBL CS.NMF,CS.DIF,CS.DVF,CS.WLD,CS.MOR,CS.EQU
        .ENDC

C.TYPR=0                        ;Request type (for CSI2)
C.STAT=1                        ;Status (from CSI2)
C.CMLD=2                        ;Length of command string buffer
                                ;Address of command string buffer
C.DEVD=6                        ;Length of device name string
                                ;Address of most recent device
                                ; name string
C.DIRD=^O<12>                   ;Length of most recent DIR info
                                ;Address of DIR info
C.FILD=^O<16>                   ;Length appropriate to C.FILD+2
                                ;CSI1 - address of string seg
                                ; where error occurred
                                ;CSI2 - address of file name for
                                ; current request
C.SWAD=^O<22>                   ;Address of current switch table
C.MKW1=^O<24>                   ;OR of masks for all switches
                                ; found this call
```

```
C.MKW2=^O<26>                   ;On/off settings of masks for
                                ; switches found
C.SIZE=^O<54>                   ;Size of CSI control block (in
                                ; bytes)
C.DSDS=C.DEVD                   ;Displacement to 6 word block for
                                ; FCS
;C.TYPR VALUES
CS.INP=1                        ;Request input string
CS.OUT=2                        ;Request output string
;C.STAT VALUES
CS.NMF=1                        ;1 = File name specified this seg
                                ; of string
CS.DIF=2                        ;1 = Dir info specified this seg
                                ; of string
CS.DVF=4                        ;1 = Device name specified this
                                ; seg of string
CS.WLD=^O<10>                   ;File name has wild card switch
CS.MOR=^O<20>                   ;More string segs follow
CS.EQU=^O<40>                   ;Equal sign seen by CSIl
```

C.2 DIRECTIVE MACRO EXPANSIONS

```
        .MACRO CALL ADR
        JSR PC,ADR
        .ENDM CALL
        .MACRO RETURN
        RTS PC
        .ENDM RETURN

        .MACRO CALLR ADR
        JMP ADR
        .ENDM CALLR
```

C.2.1 ABRT$C Macro

ABRT$C generates a DPB for the ABORT TASK directive in a separate PSECT followed by an EMT 377 in the user specified PSECT.

Macro call: ABRT$C TSK,PSCT,ERR

Description: ABRT$C generates a DPB for the ABORT TASK directive in the separate $DPB$$ program section and generates an EMT 377 in the program section specified by PSCT. TSK, the task name, is the only argument required for the DPB definition. The optional argument, ERR, must be a valid assembler destination operand specifying an error routine address. Because this routine invokes ABRT$, the same factors govern the expansion of code and symbolic offsets.

```
        .MACRO ABRT$C TSK,PSCT,ERR
        .MCALL ABRT$,DIR$
        .IF NDF $$$GLB
        .PSECT $DPB$$
$$$=.
        .IFTF
        ABRT$ TSK
        .IFT
        .PSECT PSCT
        DIR$ #$$$,ERR
        .ENDC
        .ENDM ABRT$C
```

C.2.2 ABRT$S Macro

ABRT$S pushes a DPB for the ABORT TASK directive on the stack and generates an EMT 377.

Macro call: ABRT$S NAMADR,ERR

Description: ABRT$S pushes a DPB for the ABORT TASK directive on the stack. The argument, NAMADR, must be a valid assembler operand that yields the address of a double-word with the task name in RADIX-50. ABRT$S then generates an EMT 377 and considers the optional argument, ERR, the error routine address.

```
.MACRO ABRT$S NADR,ERR
.MCALL RFA$,DIR$
RFA$ NADR
MOV (PC)+,-(SP)
.BYTE 83.,3
DIR$ ,ERR
.ENDM ABRT$S
```

C.2.3 ABRT$ Macro

The ABRT$ macro generates a DPB for the ABORT TASK directive.

Macro call: ABRT$ TSK

Description: This macro creates a DPB for the ABORT TASK directive. The argument, TSK, is the name of the task to be aborted.

This macro defines the following symbolic offset:

A.BTTN-(length is 4 bytes) Task name.

The ABRT$ macro generates the A.BTTN symbolic offset only when the $$$GLB is defined. The symbol, A.BTTN, is a global symbol in this case.

```
.MACRO ABRT$ TSK
.MCALL R50$,OFF$
.IF NDF $$$GLB
.BYTE 83.,3
R50$ TSK
.ENDC
.IF NDF A.BTTN
.NLIST
OFF$
OFF$ A.BTTN,4
.LIST
.ENDC
.ENDM ABRT$
```

C.2.4 ALTP$C Macro

The ALTP$C macro generates a DPB for the ALTER TASK PRIORITY directive in a separate PSECT followed by an EMT 377 in the user specified PSECT.

Macro call: ALTP$C TTASK,NPRIO,PSCT,ERR

Description: This macro generates a DPB for the ALTER TASK PRIORITY directive in the programsection named $DPB$$. The DPB parameters are described in the ALTP$ macro. Then the macro generates an EMT 377 in the program section named in PSCT. The DIR$ macro describes the ERR error service address. The ALTP$ macro controls symbolic offset generation.

```
.MACRO ALTP$C TTASK,NPRIO,PSCT,ERR
.MCALL ALTP$,DIR$
.IF NDF $$$GLB
.PSECT $DPB$$
.IFTF
ALTP$ TTASK,NPRIO
.IFT
.PSECT PSCT
DIR$ #$$$,ERR
.ENDC
.ENDM ALTP$C
```

C.2.5 ALTP$S Macro

The ALTP$S macro generates the code to push a DPB for the ALTER TASK PRIORITY directive on the stack followed by EMT 377.

Macro call: ALTP$S NAMADR,NPRIO,ERR

Description: This macro generates the code to push a DPB for ALTER TASK PRIORITY on the stack. The argument, TNAMADR, must be a valid assembler source operand that yields the address of a double-word containing the RADIX-50 name specified in the ALTP$ macro. The macro then generates an EMT 377. The DIR$ macro describes the ERR error service address.

```
.MACRO ALTP$S NAME,PRI,ERR
.MCALL MOV$,RFA$,DIR$
MOV$ PRI
RFA$ NAME
MOV (PC)+,-(SP)
.BYTE 9.,4
DIR$ ,ERR
.ENDM ALTP$S
```

C.2.6 ALTP$ Macro

The ALTP$ macro generates a DPB for the ALTER TASK PRIORITY directive.

Macro call: ALTP$ TTASK,NPRIO

Description: This macro generates a DPB for the ALTER TASK PRIORITY directive. The arguments are assumed to have the following meanings:

```
TTASK=Name of target task for new priority
NPRIO=New priority for task
```

The following symbols are locally defined with their assigned values equal to the byte offset from the start of the DPB to the respective DPB elements:

```
A.LTTN-(length 4 bytes) target task name,
T.LTPR-(length 2 bytes) new priority
```

If the macro is invoked with the $$$GLB symbol defined, the ALTP$ macro does not generate the DPB and ALTP$ defines the offsets as global symbols.

```
        .MACRO ALTP$ NAME,PRI
        .MCALL R50$,OFF$
        .IF NDF $$$GLB
        .BYTE 9.,4
        R50$ NAME
        .WORD PRI
        .ENDC
        .IF NDF A.LTTN
        .NLIST
        OFF$
        OFF$ A.LTTN,4
        OFF$ A.LTPR,2
        .LIST
        .ENDC
        .ENDM ALTP$
```

C.2.7 ALUN$C Macro

The ALUN$C macro generates a DPB for the ASSIGN LUN directive in a separate PSECT followed by an EMT 377 in the user specified PSECT.

Macro Call: ALUN$C LUN,DEVNAM,DEVNUM,PSCT,ERR

Description: This macro generates a DPB for the ASSIGN LUN directive in the program section named $DPB$$. The arguments through DEVNUM are the DPB parameters as described for the ALUN$ macro. The macro then generates an EMT 377 in the program section as specified by PSCT. The argument, ERR is as described for the DIR$ macro. For an explanation of symbolic offsets, see the ALUN$ macro.

```
        .MACRO ALUN$C LUN,DA,DU,CS,ERR
        .MCALL ALUN$,DIR$
        .IF NDF $$$GLB
        .PSECT $DPB$$
$$$=.
        .IFTF
        ALUN$ LUN,DA,DU
        .IFT
        .PSECT CS
        DIR$ #$$$,ERR
        .ENDC
        .ENDM ALUN$C
```

C.2.8 ALUN$S Macro

The ALUN$S macro generates the code to push a DPB for the ASSIGN LUN directive on the stack followed by an EMT 377.

Macro call: ALUN$S LUN,DEVNAM,DEVNUM,ERR

Description: This macro generates the code to push a DPB for the ASSIGN LUN directive on the stack. The arguments through DEVNUM must be valid assembler source operands, and they must specify the DPB parameters listed in the ALUN$ macro. The DIR$ macro describes the ERR argument.

```
        .MACRO ALUN$S LUN,DA,DU,ERR
        .MCALL MOV$,DIR$
        MOV$ DU
        MOV$ DA
        MOV$ LUN
        MOV (PC)+,-(SP)
        .BYTE 7,4
        DIR$ ,ERR
        .ENDM ALUN$S
```

C.2.9 ALUN$ Macro

The ALUN$ macro generates a DPB for the ASSIGN LUN directive.

Macro call: ALUN$ LUN,DEVNAM,DEVNUM

Description: This macro creates a DPB for the ASSIGN LUN directive. The arguments are assumed to have the following meanings:

LUN=Logical unit number,
DEVNAM=Physical device name (two characters),
DEVNUM=Physical device unit number.

The following symbols are locally defined with their assigned values equal to the byte offset from the start of the DPB to the respective DPB elements:

A.LULU-(length 2 bytes) Logical unit number,
A.LUNA-(2) Physical device name,
A.LUNU-(2) Physical device unit number.

If the macro is invoked with the symbol, $$$GLB, defined, ALUN$ does not generate the DPB and ALUN$ defines the offsets as global symbols.

```
        .MACRO ALUN$ LUN,DA,DU
        .MCALL OFF$
        .IF NDF $$$GLB
        .BYTE 7,4
        .WORD LUN
        .IF B <DA>
        .WORD 0
        .IFF
        .NCHR $$$T1,<DA>
$$$T2=.
        .ASCII /DA/
.=$$$T2+2
        .ENDC
        .WORD DU
        .ENDC
        .IF NDF A.LULU
        .NLIST
        .IRP X,<,<A.LULU,2>,<A.LUNA,2>,<A.LUNU,2>>
        OFF$ X
        .ENDM
        .LIST
        .ENDC
        .ENDM ALUN$
```

C.2.10 ASTX$C Macro

The ASTX$C macro generates a DPB for the AST SERVICE EXIT directive in a separate PSECT followed by an EMT 377 in the user specified program PSECT.

Macro call: ASTX$C PSCT,ERR

Description: This macro generates a DPB for the AST SERVICE EXIT directive in the program section named $DPB$$. The argument, PSCT, is the program section in which to generate an EMT 377. The DIR$ macro describes the ERR argument.

```
        .MACRO ASTX$C PSCT,ERR
        .MCALL ASTX$,DIR$
        .IF NDF $$$GLB
        .PSECT $DPB$$
$$$=.
        .IFTF
        ASTX$
        .IFT
        .PSECT PSCT
        DIR$ #$$$,ERR
        .ENDC
        .ENDM ASTX$C
```

C.2.11 ASTX$S Macro

The ASTX$S macro generates the code to push a DPB for the AST SERVICE EXIT directive on the stack followed by an EMT 377.

Macro call: ASTX$S ERR

Description: This macro generates the code to push a DPB for the AST SERVICE EXIT directive on the stack. Then a MONITOR TRAP is generated. The error routine address argument, ERR, results in an an unconditional call following the EMT because control should never be returned on the AST exit.

```
          ACRO ASTX$S ERR
        .MCALL DIR$
        MOV (PC)+,-(SP)
        .BYTE 115.,1
        DIR$
        .IIF NB <ERR>, JSR PC,ERR
        .ENDM ASTX$S
```

C.2.12 ASTX$ Macro

The ASTX$ macro generates a DPB for the AST SERVICE EXIT directive.

Macro Call: ASTX$

Description: This macro creates a DPB for the AST SERVICE EXIT directive. It takes no arguments.

Note: If the symbol, $$$GLB, is defined, this macro does not generate any code.

```
.MACRO ASTX$
       .IF NDF $$$GLB
       .BYTE 115.,1
       .ENDC
       .ENDM ASTX$
```

C.2.13 CINT$C Macro

The CINT$C macro generates a DPB in a separate PSECT for the CONNECT TO INTERRUPT VECTOR directive followed by an EMT 377 in the user specified PSECT.

Macro call: CINT$C VEC,BASE,ISR,DSI,PSW,AST,PSCT,ERR

Description: CINT$C generates a DPB in the program section named $DPB$$ for the CONNECT TO INTERRUPT VECTOR directive. CINT$ describes the the DPB parameters. CINT$C then generates an EMT 377 in the program section named in PSCT. The DIR$ macro describes the ERR error service address.

```
       .MACRO CINT$C VEC,BASE,ISR,DSI,PSW,AST,PSCT,ERR
       .MCALL CINT$,DIR$
       .IF NDF $$$GLB
       .PSECT $DPB$$
$$$=.
       .IFTF
       CINT$ VEC,BASE,ISR,DSI,PSW,AST
       .IFT
       .PSECT PSCT
       DIR$ #$$$,ERR
       .ENDC
       .ENDM CINT$C
```

C.2.14 CINT$S Macro

The CINT$S macro generates the code to push a DPB on the stack for the CONNECT TO INTERRUPT VECTOR directive followed by an EMT 377.

Macro call: CINT$S VEC,BASE,ISR,DSI,PSW,AST,ERR

Description: CINT$S generates the code to push a DPB for the CONNECT TO INTERRUPT VECTOR directive on the stack. The DPB arguments must be valid assembler source operands and then must specify the information described in the CINT$ macro. The macro, RVP$, pushes the arguments on the stack in reverse order. CINT$S also generates an EMT 377 and uses the ERR error service address as described in the DIR$ macro.

```
.MACRO CINT$S VEC,BASE,ISR,DSI,PSW,AST,ERR
.MCALL RVP$,DIR$
RVP$ VEC,BASE,ISR,DSI,PSW,AST
MOV (PC)+,-(SP)
.BYTE 129.,7
DIR$ ,ERR
.ENDM CINT$S
```

C.2.15 CINT$ Macro

CINT$ generates a DPB for the CONNECT TO INTERRUPT VECTOR directive.

Macro call: CINT$ VEC,BASE,ISR,DSI,PSW,AST

Description: CINT$ generates a DPB for the CONNECT TO INTERRUPT VECTOR directive. The arguments are assumed to have the following meanings:

VEC = Must be in the range 60(8) through the highest vector specified during SYSGEN, and must be a multiple of 4.

BASE = Virtual base address for kernel APR 5 mapping of the ISR, and enable/disable interrupt routines -- This address is automatically truncated to a 32(10)-word boundary. The "base" argument is ignored in an unmapped system.

ISR = Virtual address of the ISR, or 0 to disconnect from the interrupt vector.

DSI = Virtual address of the enable/disable interrupt routine. PSW = Initial priority at which the ISR is to execute -- This is normally equal to the hard-wired interrupt priority, and is expressed in the form n*40, where n is a number in the range 0-7. This form puts the value in bits 5-7 of pri. It is recommended that the programmer make use of the symbols PR4, PR5, PR6, and PR7 for this purpose. These are implemented via the macro HWDDF$ found in [1,1]EXEMC.MLB. AST = Virtual address of an AST routine to be entered after the fork level routine queues an AST.

The following symbols are locally defined with their assigned values equal to the byte offset from the start of the DPB to the respective DPB elements:

C.INVE -- Vector address (2)
C.INBA -- Base address (2)
C.INIS -- ISR address (2)
C.INDI -- Enable/disable interrupt routine address (2)
C.INPS -- Priority (2)
C.INAS -- AST address (2)

If the macro is invoked with the $$$GLB symbol defined, the CINT$ macro does not generate the DPB and CINT$ defines the offsets as global symbols.

```
.MACRO CINT$ VEC,BASE,ISR,DSI,PSW,AST
.MCALL OFF$
.IF NDF $$$GLB
.BYTE 129.,7
.WORD VEC
.WORD BASE
.WORD ISR
.WORD DSI
.WORD PSW
.WORD AST
.ENDC
.IF NDF C.INVE
OFF$
OFF$ C.INVE,2
OFF$ C.INBA,2
OFF$ C.INIS,2
```

```
OFF$ C.INDI,2
OFF$ C.INPS,2
OFF$ C.INAS,2
.ENDC
.ENDM CINT$
```

C.2.16 CLEF$C Macro

The CLEF$C macro generates a DPB for the CLEAR EVENT FLAG directive in a separate PSECT followed by an EMT 377 in the user specified program PSECT.

Macro call: CLEF$C EFN,PSCT,ERR

Description: This macro generates a DPB for the CLEAR EVENT FLAG directive in the $DPB$$ program section. The CLEF$ macro describes the DPB parameters. This macro then generates an EMT 377 in the program section named in PSCT. The DIR$ macro describes the ERR error service address. The CLEF$ macro controls symbolic address generation.

```
        .MACRO CLEF$C EFN,CS,ERR
        .MCALL CLEF$,DIR$
        .IF NDF $$$GLB
        .PSECT $DPB$$
$$$=.
        .IFTF
        CLEF$ EFN
        .IFT
        .PSECT CS
        DIR$ #$$$,ERR
        .ENDC
        .ENDM CLEF$C
```

C.2.17 CLEF$S Macro

The CLEF$S macro generates the code to push a DPB for the CLEAR EVENT FLAG directive on the stack followe by an EMT 377.

Macro call: CLEF$S EFN,ERR

Description: This macro generates the code to push a DPB for the CLEAR EVENT FLAG directive on the stack. The DPB arguments must be valid assembler source operands, and they must specify the information described in the CLEF$ macro. This macro also generates a monitor trap, using the error service address, ERR, as described in the DIR$ macro.

```
        .MACRO CLEF$S EFN,ERR
        .MCALL MOV$,DIR$
        MOV$ EFN
        MOV (PC)+,-(SP)
        .BYTE 31.,2
        DIR$ ,ERR
        .ENDM CLEF$S
```

C.2.18 CLEF$ Macro

The CLEF$ macro generates a DPB for the CLEAR EVENT FLAG directive.

Macro call: CLEF$ EFN

Description: This macro generates a DPB for the CLEAR EVENT FLAG directive. The argument is assumed to have the following meaning:

EFN=EVENT FLAG NUMBER.

The following symbol is locally defined with its assigned value equal to the byte offset from the start of the DPB to the DPB element:

C.LEEF-(length 2 bytes) Event flag number.

If the macro is invoked with the symbol, $$$GLB, defined, CLEF$ does not generate the DPB and CLEF$ defines the offset as a global symbol.

```
        .MACRO CLEF$ EFN
        .MCALL OFF$
        .IF NDF $$$GLB
        .BYTE 31.,2
        .WORD EFN
        .ENDC
        .IF NDF C.LEEF
        .NLIST
        OFF$
        OFF$ C.LEEF,2
        .LIST
        .ENDC
        .ENDM CLEF$
```

C.2.19 CMKT$C Macro

The CMKT$C macro generates a DPB for the CANCEL MARK-TIME REQUESTS directive in a separate PSECT followed by an EMT 377 in the user specified PSECT.

Macro Call: CMKT$C EFN,AST,PSCT,ERR

Description: This macro generates a DPB for the CANCEL MARK-TIME REQUESTS directive in the $DPB$$ program section. The CMKT$S macro describes the DPB parameters. Then the macro generates an EMT 377 in the program section named in the PSCT argument. The DIR$ macro describes the ERR error service address.

```
        .MACRO CMKT$C EFN,AST,PSCT,ERR
        .MCALL CMKT$,DIR$
        .IF NDF $$$GLB
        .PSECT $DPB$$
$$$=.
        .IFTF
        CMKT$ EFN,AST
        .IFT
        .PSECT PSCT
        DIR$ #$$$,ERR
        .ENDC
        .ENDM CMKT$C
```

C.2.20 CMKT$S Macro

The CMKT$S macro generates the code to push a DPB for the CANCEL MARK-TIME REQUESTS directive on the stack followed by an EMT 377.

Macro call: CMKT$S EFN,AST,ERR

Description: This macro generates the code to push a DPB for the CANCEL MARK-TIME REQUESTS directive on the stack. The DPB arguments must be valid assembler source operands, and they must specify the information described in the CMKT$ macro. The macro also generates an EMT 377. The DIR$ macro describes the ERR error service address.

Note: The EFN and AST arguments are required to maintain compatibility with RSX-11D. Despite the fact that they must be specified, the CMKT$S macro ignores them.

```
.MACRO CMKT$S EFN,AST,ERR
.MCALL DIR$
MOV (PC)+,-(SP)
.BYTE 27.,1
DIR$ ,ERR
.ENDM CMKT$S
```

C.2.21 CMKT$ Macro

The CMKT$ macro generates a DPB for the CANCEL MARK-TIME REQUESTS directive.

Macro call: CMKT$ EFN,AST

Description: This macro generates a DPB for the CANCEL MARK-TIME REQUESTS directive.

Note: The EFN and AST arguments are required to maintain compatibility with RSX-11D. Despite the fact that they must be specified, the CMKT$ macro ignores them. If the $$$GLB symbol is defined, this macro does not generate any code.

```
.MACRO CMKT$ EFN,AST
.IF NDF $$$GLB
.BYTE 27.,1
.ENDC
.ENDM CMKT$
```

C.2.22 CSRQ$C Macro

The CSRQ$C macro generates a DPB for the CANCEL SCHEDULED REQUESTS directive in a separate PSECT followed by an EMT 377 in the user specified PSECT.

Macro call: CSRQ$C TTASK,RTASK,PSCT,ERR

Description: This macro generates a DPB for the CANCEL SCHEDULED REQUESTS directive in the $DPB$$ program section. The DPB parameters are described in the CSRQ$ macro. Then the macro generates an EMT 377 in the original program section named in PSCT. The DIR$ macro describes the ERR error service address. The CSRQ$ macro controls symbolic address generation.

Note: Read the discussion notice concerning ignored arguments in the CSRQ$ macro below.

```
        .MACRO CSRQ$C TT,RT,CS,ERR
        .MCALL CSRQ$,DIR$
        .IF NDF $$$GLB
        .PSECT $DPB$$
$$$=.
        .IFTF
        CSRQ$ TT,RT
        .IFT
        .PSECT CS
        DIR$ #$$$,ERR
        .ENDC
        .ENDM CSRQ$C
```

C.2.23 CSRQ$S Macro

The CSRQ$S macro generates the code to push a DPB for the CANCEL SCHEDULED REQUESTS directive on the stack followed by an EMT 377.

Macro call: CSRQ$S TNAMADR,RNAMADR,ERR

Description: This macro generates the code to push a DPB for CANCEL SCHEDULED REQUESTS on the stack. The TNAMADR and RNAMADR arguments must be valid assembler source operands that yield the addresses of double-words containing the RADIX-50 names specified in the CSRQ$ macro. The macro then generates an EMT 377. The DIR$ macro describes the ERR error service address.

Note: Read the discussion notice concerning ignored arguments in the CSRQ$ macro below.

```
        .MACRO CSRQ$S TN,RN,ERR
        .MCALL RFA$,DIR$
        RFA$ TN
        MOV (PC)+,-(SP)
        .BYTE 25.,3
        DIR$ ,ERR
        .ENDM CSRQ$S
```

C.2.24 CSRQ$ Macro

The CSRQ$ macro generates a DPB for the CANCEL SCHEDULED REQUESTS directive.

Macro call: CSRQ$ TTASK,RTASK

Description: This macro generates a DPB for the CANCEL SCHEDULED REQUESTS directive. The arguments are assumed to have the following meanings:

TTASK=Scheduled (target) task name,
RTASK=Scheduler (requester) task name.

The following symbols are locally defined with their assigned values equal to the byte offset from the start of the DPB to the respective DPB elements:

C.SRTN-(length 4 bytes) target task name,
C.SRRN-(4) requester task name.

If the macro is invoked with the $$$GLB symbol defined, CSRQ$ does not generate the DPB and it globally defines the symbolic offsets.

Note: The RTASK argument is required to maintain compatibility with RSX-11D. Despite the fact that it must be specified, the CSRQ$ macro ignores it.

```
        .MACRO CSRQ$ TT,RT
        .MCALL R50$,OFF$
        .IF NDF $$$GLB
        .BYTE 25.,3
        R50$ TT
        .ENDC
        .IF NDF C.SRTN
        .NLIST
        OFF$
        OFF$ C.SRTN,4
        OFF$ C.SRRN,4
        .LIST
        .ENDC
        .ENDM CSRQ$
```

C.2.25 DECL$C Macro

The DECL$C macro generates a DPB for the DECLARE SIGNIFICANT EVENT directive in a separate PSECT followed by an EMT 377 in the user specified program section.

Macro call: DECL$C EFN,PSCT,ERR

Description: This macro generates a DPB for the DECLARE SIGNIFICANT EVENT directive in the $DPB$$ program section. This macro also generates an EMT 377 in the user specified program section, PSCT, with the ERR error service address as described in the DIR$ macro.

Note: The EFN argument is required to maintain compatibility with RSX-11D. Despite the fact that it must be specified, the DECL$C macro ignores it.

```
        .MACRO DECL$C EFN,PSCT,ERR
        .MCALL DECL$,DIR$
        .IF NDF $$$GLB
        .PSECT $DPB$$
$$$=.
        .IFTF
        DECL$ EFN
        .IFT
        .PSECT PSCT
        DIR$ #$$$,ERR
        .ENDC
        .ENDM DECL$C
```

C.2.26 DECL$S Macro

The DECL$S macro generates the code to push a DPB for the DECLARE SIGNIFICANT EVENT directive on the stack followed by an EMT 377.

Macro call: DECL$S EFN,ERR

Description: This macro generates the code to push a DPB for the DECLARE SIGNIFICANT EVENT directive on the stack. The DPB arguments must be valid assembler source operands, and they must specify the information described in the DECL$ macro. This macro also generates an EMT 377, using the ERR error service address as described in the DIR$ macro.

Note: The EFN argument is required to maintain compatibility with RSX-11D. Despite the fact that it must be specified, the DECL$ macro ignores it.

```
.MACRO DECL$S EFN,ERR
.MCALL DIR$
MOV (PC)+,-(SP)
.BYTE 35.,1
DIR$ ,ERR
.ENDM DECL$S
```

C.2.27 DECL$ Macro

The DECL$ macro generates a DPB for the DECLARE SIGNIFICANT EVENT directive.

Macro call: DECL$ EFN

Description: This macro generates a DPB for the DECLARE SIGNIFICANT EVENT directive. DECL$ ignores the EFN argument but EFN must be present to maintain compatibility with RSX-11D.

```
.MACRO DECL$ EFN
.IF NDF $$$GLB
.BYTE 35.,1
.ENDC
.ENDM DECL$
```

C.2.28 DIR$ Macro

DIR$ generates an RSX-11M directive call (EMT 377) with a pre-defined DPB.

Macro call: DIR$ ADR,ERR

Description: The argument, ADR, must be a valid assembler source operand. It pushes the DPB address on the stack. DIR$ then generates an EMT 377 to trap to the Executive. The argument, ERR, is optional. If ERR is defined, it must be a valid assembler destination operand to permit the execution of a JUMP TO SUBROUTINE instruction to an error handler if the directive CALL fails.

```
.MACRO DIR$ ADR,ERR
.IF NB <ADR>
MOV ADR,-(SP)
.ENDC
EMT ^O<377>
.IIF NB <ERR>, .MCALL ERR$
.IIF NB <ERR>, ERR$ ERR
.ENDM DIR$
```

C.2.29 DSAR$C Macro

The DSAR$C macro generates the DPB for the DISABLE AST RECOGNITION directive in a separate program section followed by an EMT 377 in the user specified PSECT.

Macro call: DSAR$C PSCT,ERR

Description: This macro generates a DPB for the DISABLE AST RECOGNITION directive in the PSECT $DPB$$ followed by an EMT 377 in the program section specified in PSCT. The DIR$ macro describes the ERR error service address.

```
        .MACRO DSAR$C PSCT,ERR
        .MCALL DSAR$,DIR$
        .IF NDF $$$GLB
        .PSECT $DPB$$
$$$=.
        .IFTF
        DSAR$
        .IFT
        .PSECT PSCT
        DIR$ #$$$,ERR
        .ENDC
        .ENDM DSAR$C
```

C.2.30 DSAR$S Macro

The DSAR$S macro generates the code to push a DPB for the DISABLE AST RECOGNITION directive on the stack followed by an EMT 377.

Macro call: DSAR$S ERR

Description: This macro generates the code to push a one-word DPB for the DISABLE AST RECOGNITION directive on the stack. Then the macro generates an EMT 377, using the ERR error service address, described in the DIR$ macro.

```
        .MACRO DSAR$S ERR
        .MCALL DIR$
        MOV (PC)+,-(SP)
        .BYTE 99.,1
        DIR$ ,ERR
        .ENDM DSAR$S
```

C.2.31 DSAR$ Macro

The DSAR$ macro generates a DPB for the DISABLE AST RECOGNITION directive.

Macro call: DSAR$

Description: This macro generates a DPB for the DISABLE AST RECOGNITION directive.

```
        .MACRO DSAR$
        .IF NDF $$$GLB
        .BYTE 99.,1
        .ENDC
        .ENDM DSAR$
```

C.2.32 DSCP$C Macro

The DSCP$C macro generates a DPB for the DISABLE CHECKPOINTING directive in a separate PSECT followed by an EMT 377 in the user specified PSECT.

Macro call: DSCP$C PSCT,ERR

Description: This macro generates a DPB for the DISABLE CHECKPOINTING directive in the $DPB$$ program section and an EMT 377 in the user specified PSCT program section. The DIR$ macro describes the ERR error service address.

```
        .MACRO DSCP$C PSCT,ERR
        .MCALL DSCP$,DIR$
        .IF NDF $$$GLB
        .PSECT $DPB$$
$$$=.
        .IFTF
        DSCP$
        .IFT
        .PSECT PSCT
        DIR$ #$$$,ERR
        .ENDC
        .ENDM DSCP$C
```

C.2.33 DSCP$S Macro

The DSCP$S macro generates the code to push a DPB for the DISABLE CHECKPOINTING directive on the stack followed by an EMT 377.

Macro call: DSCP$S ERR

Description: This macro generates the code to push a one-word DPB for the DISABLE CHECKPOINTING directive on the stack. Then an EMT 377 is generated, using the ERR error service address, as described in the DIR$ macro.

```
        .MACRO DSCP$S ERR
        .MCALL DIR$
        MOV (PC)+,-(SP)
        .BYTE 95.,1
        DIR$ ,ERR
        .ENDM DSCP$S
```

C.2.34 DSCP$ Macro

The DSCP$ macro generates a DPB for the DISABLE CHECKPOINTING directive.

Macro call: DSCP$

Description: This macro generates a DPB for the DISABLE CHECKPOINTING directive. There are no arguments.

```
        .MACRO DSCP$
        .IF NDF $$$GLB
        .BYTE 95.,1
        .ENDC
        .ENDM DSCP$
```

C.2.35 ENAR$C Macro

The ENAR$C macro generates a DPB for the ENABLE AST RECOGNITION directive in a separate PSECT, followed by an EMT 377 in the user specified PSECT.

Macro call: ENAR$C PSCT,ERR

Description: This macro generates a DPB for the ENABLE AST RECOGNITION directive in the $DPB$$ program section followed by an EMT 377 in the program section named in PSCT. The DIR$ macro describes the ERR error service address.

```
        .MACRO ENAR$C PSCT,ERR
        .MCALL ENAR$,DIR$
        .IF NDF $$$GLB
        .PSECT $DPB$$
$$$=.
        .IFTF
        ENAR$
        .IFT
        .PSECT PSCT
        DIR$ #$$$,ERR
        .ENDC
        .ENDM ENAR$C
```

C.2.36 ENAR$S Macro

The ENAR$S macro generates the code to push a DPB for the ENABLE AST RECOGNITION directive on the stack followed by an EMT 377.

Macro call: ENAR$S ERR

Description: This macro generates the code to push a one-word DPB for the ENABLE AST RECOGNITION directive on the stack. Then an EMT 377 is generated using the ERR error service address as described in the DIR$ macro.

```
        .MACRO ENAR$S ERR
        .MCALL DIR$
        MOV (PC)+,-(SP)
        .BYTE 101.,1
        DIR$ ,ERR
        .ENDM ENAR$S
```

C.2.37 ENAR$ Macro

The ENAR$ macro generates a DPB for the ENABLE AST RECOGNITION directive.

Macro call: ENAR$

Description: This macro generates a DPB for the ENABLE AST RECOGNITION directive. There are no parameters.

```
         MACRO ENAR$
        .IF NDF $$$GLB
        .BYTE 101.,1
        .ENDC
        .ENDM ENAR$
```

C.2.38 ENCP$C Macro

The ENCP$C macro generates a DPB for the ENABLE CHECKPOINTING directive in a separate PSECT followed by an EMT 377 in the user specified program PSECT.

Macro call: ENCP$C PSCT,ERR

Description: This macro generates a DPB for the ENABLE CHECKPOINTING directive in the $DPB$$ program section. Then the macro generates an EMT 377 in the program section named in PSCT. The DIR$ macro describes the ERR error service address.

```
        .MACRO ENCP$C PSCT,ERR
        .MCALL ENCP$,DIR$
        .IF NDF $$$GLB
        .PSECT $DPB$$
$$$=.
        .IFTF
        ENCP$
        .IFT
        .PSECT PSCT
        DIR$ #$$$,ERR
        .ENDC
        .ENDM ENCP$C
```

C.2.39 ENCP$S Macro

The ENCP$S macro generates the code to push a DPB for the ENABLE CHECKPOINTING directive on the stack followed by an EMT 377.

Macro call: ENCP$S ERR

Description: This macro generates the code to push a one-word DPB for the ENABLE CHECKPOINTING directive on the stack. Then an EMT 377 is generated using the ERR error service address as described in the DIR$ macro.

```
        .MACRO ENCP$S ERR
        .MCALL DIR$
        MOV (PC)+,-(SP)
        .BYTE 97.,1
        DIR$ ,ERR
        .ENDM ENCP$S
```

C.2.40 ENCP$ Macro

The ENCP$ macro generates a DPB for the ENABLE CHECKPOINTING directive.

Macro call: ENCP$

Description: This macro generates a DPB for the ENABLE CHECKPOINTING directive. There are no parameters

```
        .MACRO ENCP$
        .IF NDF $$$GLB
        .BYTE 97.,1
        .ENDC
        .ENDM ENCP$
```

C.2.41 ERR$ Macro

ERR$ is an internal macro that generates a test for directive failure accompanied by a JSR instruction to an error handler.

Macro call: ERR$ ERR

Description: A set C-bit indicates directive failure. If the ERR argument is defined, ERR$ generates code to test the C-bit and skip if not set followed by a JSR to an error handler specified by ERR.

```
.MACRO ERR$ ERR
.IF NB <ERR>
.NLIST
.NTYPE $$$T1,ERR
.LIST
.IIF EQ ^O<$$$T1-27>, BCC .+6
.IIF EQ ^O<$$$T1-37>, BCC .+6
.IF GE ^O<$$$T1-60>
BCC .+6
.IFF
.IF NE ^O<$$$T1-27>
.IIF NE ^O<$$$T1-37>, BCC .+4
.ENDC
.ENDC
CALL ERR
.ENDC
.ENDM ERR$
```

C.2.42 EXIF$C Macro

THE EXIF$C macro generates a DPB for the EXIT IF directive in a separate PSECT followed by an EMT 377 in the user specified program PSECT.

Macro call: EXIF$C EFN,PSCT,ERR

Description: This macro generates a DPB for the EXIT IF directive in the $DPB$$ program section. The DPB parameters are described in the EXIF$ macro. This macro then generates an EMT 377 in the program section named in PSCT. The DIR$ macro describes the ERR error service address. The EXIF$ macro controls symbolic address generation.

```
        .MACRO EXIF$C EFN,CS,ERR
        .MCALL EXIF$,DIR$
        .IF NDF $$$GLB
        .PSECT $DPB$$
$$$=.
        .IFTF
        EXIF$ EFN
        .IFT
        .PSECT CS
        DIR$ #$$$,ERR
        .ENDC
        .ENDM EXIF$C
```

C.2.43 EXIF$S Macro

The EXIF$S macro generates the code to push a DPB for the EXIT IF directive on the stack followed by an EMT 377.

Macro call: EXIF$S EFN,ERR

Description: This macro generates the code to push a DPB for the EXIT IF directive on the stack. The DPB arguments must be valid assembler source operands, and they must specify the information described in the EXIF$ macro. This macro also generates an EMT 377 using the ERR error service address as described in the DIR$ macro.

```
.MACRO EXIF$S EFN,ERR
.MCALL MOV$,DIR$
MOV$ EFN
MOV (PC)+,-(SP)
.BYTE 53.,2
DIR$ ,ERR
.ENDM EXIF$S
```

C.2.44 EXIF$ Macro

The EXIF$ macro generates a DPB for the EXIT IF directive.

Macro call: EXIF$ EFN

Description: This macro generates a DPB for the EXIT IF directive. The argument is assumed to have the following meaning:

EFN=Event flag number.

The following symbol is locally defined with its assigned values equal to the byte offset from the start of the DPB to the DPB element:

E.XFEF-(length 2 bytes) Event flag number.

If the macro is invoked with the symbol $$$GLB defined, EXIF$ does not generate the DPB and it globally defines the symbolic offset.

```
.MACRO EXIF$ EFN
.MCALL OFF$
.IF NDF $$$GLB
.BYTE 53.,2
.WORD EFN
.ENDC
.IF NDF E.XFEF
.NLIST
OFF$
OFF$ E.XFEF,2
.LIST
.ENDC
.ENDM EXIF$
```

C.2.45 EXIT$C Macro

The EXIT$C macro generates a DPB for the TASK EXIT directive in a separate PSECT followed by an EMT 377 in the user specified PSECT.

Macro call: EXIT$C PSCT,ERR

Description: This macro generates a DPB in the program SECTION $DPB$$ followed by an EMT 377 in the PSCT program section. The DIR$ macro describes the ERR error service address.

```
        .MACRO EXIT$C PSCT,ERR
        .MCALL EXIT$,DIR$
        .IF NDF $$$GLB
        .PSECT $DPB$$
$$$=.
        .IFTF
        EXIT$
        .IFT
        .PSECT PSCT
        DIR$ #$$$,ERR
        .ENDC
        .ENDM EXIT$C
```

C.2.46 EXIT$S Macro

The EXIT$S macro generates the code to push a DPB for the TASK EXIT directive on the stack followed by an EMT 377.

Macro call: EXIT$S ERR

Description: This macro generates the code to push a one-word DPB for the TASK EXIT directive on the stack. Then, EXIT$S generates an EMT 377 using the ERR error service address, as described in the EXIT$ macro.

```
        .MACRO EXIT$S ERR
        .MCALL DIR$
        MOV (PC)+,-(SP)
        .BYTE 51.,1
        DIR$
        .IIF NB <ERR>, CALL ERR
        .ENDM EXIT$S
```

C.2.47 EXIT$ Macro

The EXIT$ macro generates a DPB for the TASK EXIT directive.

Macro call: EXIT$

Description: This macro generates a DPB for the TASK EXIT directive. There are no parameters.

```
        .MACRO EXIT$
        .IF NDF $$$GLB
        .BYTE 51.,1
        .ENDC
        .ENDM EXIT$
```

C.2.48 EXTK$C Macro

The EXTK$C macro generates a DPB for the EXTEND TASK directive in a separate PSECT followed by an EMT 377 in the user specified PSECT.

Macro call: EXTK$C INC,PSCT,ERR

Description: This macro generates a DPB for the EXTEND TASK directive in the $DPB$$ program section. The DPB parameters are described in the EXTK$ macro. This macro then generates an EMT 377 in the program section named in PSCT. The DIR$ macro describes the ERR error service address. The EXTK$ macro controls the generation of symbolic offsets.

```
  .MACRO EXTK$C INC,CS,ERR
  .MCALL EXTK$,DIR$
  .IF NDF $$$GLB
  .PSECT $DPB$$
$$$=.
  .IFTF
  EXTK$ INC
  .IFT
  .PSECT CS
  DIR$ #$$$,ERR
  .ENDC
  .ENDM EXTK$C
```

C.2.49 EXTK$S Macro

EXTK$S pushes a DPB for the EXTEND TASK directive on the stack and generates an EMT 377.

Macro call: EXTK$S INC,ERR

Description: EXTK$S pushes a DPB for the EXTEND TASK directive on the stack. The DPB arguments must be valid assembler operands and they must specify the information that the EXTK$ macro describes. EXTK$S also generates an EMT 377 using the ERR error service address that the DIR$ macro describes.

```
  .MACRO EXTK$S INC,ERR
  .MCALL MOV$,DIR$
  CLR -(SP)
  MOV$ INC
  MOV (PC)+,-(SP)
  .BYTE 89.,3
  DIR$ ,ERR
  .ENDM EXTK$S
```

C.2.50 EXTK$ Macro

The EXTK$ macro generates a DPB for the EXTEND TASK directive.

Macro call: EXTK$ INC

Description: EXTK$ generates a DPB for the EXTEND TASK directive. The argument must have the following meaning:

INC=Task size increment in 32 word blocks.

The following symbol is locally defined with its assigned value equal to the byte offset from the start of the DPB to the DPB element:

E.XTIN-(length 2 bytes) Task size increment.

If EXTK$ is invoked with the $$$GLB symbol defined, EXTK$ does not generate the DPB and it globally defines symbolic offsets.

```
  .MACRO EXTK$ INC
  .MCALL OFF$
  .IF NDF $$$GLB
  .BYTE 89.,3
  .WORD INC
  .WORD 0
  .ENDC
  .IF NDF E.XTIN
  .NLIST
  OFF$
  OFF$ E.XTIN,2
  .LIST
  .ENDC
  .ENDM EXTK$
```

C.2.51 GLUN$C Macro

GLUN$C generates a DPB for the GET LUN INFORMATION directive in a separate PSECT followed by an EMT 377 in the user specified program PSECT.

Macro call: GLUN$C LUN,BUFADR,PSCT,ERR

Description: GLUN$C generates a DPB for the GET LUN INFORMATION directive in the $DPB$$ program section and generates an EMT 377 in the program section named in PSCT. GLUN$ describes the DPB parameters and controls symbolic address generation. The DIR$ macro describes the ERR error service address.

```
  .MACRO  GLUN$C LUN,BUFA,CS,ERR
  .MCALL GLUN$,DIR$
  .IF NDF $$$GLB
  .PSECT $DPB$$
$$$=.
  .IFTF
  GLUN$ LUN,BUFA
  .IFT
  .PSECT CS
  DIR$ #$$$,ERR
  .ENDC
  .ENDM GLUN$C
```

C.2.52 GLUN$S Macro

GLUN$S generates the code to push a DPB for the GET LUN INFORMATION directive on the stack and generates an EMT 377.

Macro call: GLUN$S LUN,BUFADR,ERR

Description: GLUN$S generates the code to push a DPB for the GET LUN INFORMATION directive on the stack and generates an EMT 377 by using the ERR error service address as described in the DIR$ macro. GLUN$S also generates symbolic offsets relative to the information buffer as described in the GLUN$ macro. DPB arguments must be valid assembler source operands and must specify the information described in the GLUN$ macro.

```
  .MACRO GLUN$S LUN,BUFA,ERR
  .MCALL MOV$,DIR$,OFF$
  MOV$ BUFA
  MOV$ LUN
  MOV (PC)+,-(SP)
  .BYTE 5,3
  DIR$ ,ERR
  .IF NDF G.LUNA
  .NLIST
$$$OST=0
  .IRP X,<<G.LUNA,2>,<G.LUNU,1>,<G.LUFB,1>,<G.LUCW,8.>>
  OFF$ X
  .ENDM
  .LIST
  .ENDC
  .ENDM GLUN$S
```

C.2.53 GLUN$ Macro

The GLUN$ macro generates a DPB for the GET LUN INFORMATION directive.

Macro call: GLUN$ LUN,BUFADR

Description: This macro generates a DPB for the GET LUN INFORMATION directive. The arguments are assumed to have the following meaning:

LUN=Logical unit number,
BUFADR=Address of six-word buffer.

The following symbols are locally defined with their assigned values equal to the byte offset from the start of the DPB to the respective DPB elements:

G.LULU-(length 2 bytes) Logical unit number,
G.LUBA-(2) Buffer address,
G.LUBL-(2) Buffer length.

The following symbols are assigned relative to the start of the LUN information buffer:

G.LUNA-(2) Device name,
G.LUNU-(1) Device unit number,
G.LUFB-(1) Flags byte,
G.LUCW-(8) Four device characteristic words.

If the macro is invoked with the $$GLB symbol defined, GLUN$ does not generate the DPB and it globally defines the symbolic offsets.

```
  .MACRO GLUN$ LUN,BUFA
  .MCALL OFF$
  .IF NDF $$$GLB
  .BYTE 5,3
  .WORD LUN
  .WORD BUFA
  .ENDC
  .IF NDF G.LULU
  .NLIST
  .IRP X,<,<G.LULU,2>,<G.LUBA,2>,<G.LUBL,2>>
  OFF$ X
  .ENDM
  .IF NDF G.LUNA
$$$OST=0
```

```
   .IRP X,<<G.LUNA,2>,<G.LUNU,1>,<G.LUFB,1>,<G.LUCW,8.>>
   OFF$ X
   .ENDM
   .ENDC
   .LIST
   .ENDC
   .ENDM GLUN$
```

C.2.54 GMCR$C Macro

GMCR$C generates a DPB for the GET MCR COMMAND LINE directive in a separate PSECT followed by an EMT 377 in the user specified PSECT.

Macro call: GMCR$C PSCT,ERR

Description: GMCR$C generates a DPB for the GET MCR COMMAND LINE directive in the $DPB$$ program section and generates an EMT 377 in the program section named in PSCT. GMCR$ describes the DPB parameters and controls symbolic address generation. DIR$ describes the ERR error service address.

```
  .MACRO GMCR$C CS,ERR
  .MCALL GMCR$,DIR$
  .IF NDF $$$GLB
  .PSECT $DPB$$
$$$=.
  .IFTF
  GMCR$
  .IFT
  .PSECT CS
  DIR$ #$$$,ERR
  .ENDC
  .ENDM GMCR$C
```

C.2.55 GMCR$ Macro

The GMCR$ macro generates a DPB for the GET MCR COMMAND LINE directive.

Macro call: GMCR$

Description: This macro generates a DPB for the GET MCR COMMAND LINE directive. GMCR$ locally defines the following symbol with its assigned value equal to the byte offset from the start of the DPB to the DPB element:

G.MCRB-(length 80 bytes) MCR line buffer

If the macro is invoked with the $$$GLB symbol defined, GMCR$ does not generate the DPB and it globally defines the symbolic offset.

```
  .MACRO GMCR$
  .MCALL OFF$
  .IF NDF $$$GLB
  .BYTE 127.,41.
  .BLKW 40.
  .ENDC
  .IF NDF G.MCRB
  .NLIST
  OFF$
```

```
  OFF$ G.MCRB,80.
  .LIST
  .ENDC
 .ENDM GMCR$
```

C.2.56 GPRT$C Macro

GPRT$C generates a DPB for the GET PARTITION PARAMETERS directive in a separate PSECT followed by an EMT 377 in the user specified PSECT.

Macro call: GPRT$C PRTNAM,BUFADR,PSCT,ERR

Description: GPRT$C generates a DPB for the GET PARTITION PARAMETERS directive in the $DPB$$ program section and generates an EMT 377 in the program section named in PSECT. GPRT$ describes the DPB parameters and controls symbolic offset generation. DIR$ describes the ERR error service address.

```
  .MACRO GPRT$C PRT,BUF,CS,ERR
  .MCALL GPRT$,DIR$
  .IF NDF $$$GLB
  .PSECT $DPB$$
$$$=.
  .IFTF
  GPRT$ PRT,BUF
  .IFT
  .PSECT CS
  DIR$ #$$$,ERR
  .ENDC
  .ENDM GPRT$C
```

C.2.57 GPRT$S Macro

GPRT$S generates the code to push a DPB for the GET PARTITION PARAMETERS directive on the stack and generates an EMT 377.

Macro call: GPRT$S PRTNAMADR,BUFADR,ERR

Description: GPRT$S generates the code to push a DPB for the GET PARTITION PARAMETERS directive on the stack and generates an EMT 377 using the ERR error service address described in the DIR$ macro. The DPB arguments must be valid assembler source operands and they must specify the information described in the GPRT$ macro. GPRT$S also generates symbolic offsets relative to the start of the partition parameters buffer described in the GPRT$ macro.

```
  .MACRO GPRT$S PRT,BUF,ERR
  .MCALL MOV$,RFA$,DIR$,OFF$
  MOV$ BUF
  RFA$ PRT
  MOV (PC)+,-(SP)
  .BYTE 65.,4
  DIR$ ,ERR
  .IF NDF G.PRPB
  .NLIST
$$$OST=0
  .IRP X,<<G.PRPB,2>,<G.PRPS,2>,<G.PRFW,2>>
  OFF$ X
  .ENDM
  .LIST
```

```
  .ENDC
  .ENDM GPRT$S
```

C.2.58 GPRT$ Macro

The GPRT$ macro generates a DPB for the GET PARTITION PARAMETERS directive.

Macro call: GPRT$ PRTNAM,BUF

Description: This macro generates a DPB for the GET PARTITION PARAMETERS directive. The arguments are assumed to have the following meanings:

PRTNAM=Partition name,
BUFADR=Address of three word buffer.

The following symbols are locally defined with their assigned values equal to the byte offset from the start of the DPB to the respective DPB elements:

G.PRPN-(length 4 bytes) Partition name,
G.PRBA-(2) Buffer address.

The following offsets are assigned relative to the start of the partition parameters buffer:

G.PRPB-(2) 1/64 Partition base address,
G.PRPS-(2) 1/64 Partition size,
G.PRFW-(2) Partition flags word.

If GPRT$ is invoked with the $$$GLB symbol defined, GPRT$ does not generate the DPB and it globally defines the symbolic offsets.

```
  .MACRO GPRT$ PRT,BUF
  .MCALL OFF$,R50$
  .IF NDF $$$GLB
  .BYTE 65.,4
  R50$ PRT
  .WORD BUF
  .ENDC
  .IF NDF G.PRPN
  .NLIST
  OFF$
  OFF$ G.PRPN,4
  OFF$ G.PRBA,2
  .IF NDF G.PRPB
$$$OST=0
  .IRP X,<<G.PRPB,2>,<G.PRPS,2>,<G.PRFW,2>>
  OFF$ X
  .ENDM
  .ENDC
  .LIST
  .ENDC
  .ENDM GPRT$
```

C.2.59 GSSW$C Macro

The GSSW$C macro generates a DPB for the GET SENSE SWITCHES directive in a separate PSECT followed by an EMT 377 in the user specified PSECT.

Macro call: GSSW$C PSCT,ERR

Description: This macro generates a DPB for the GET SENSE SWITCHES directive in the $DPB$$ program section followed by an EMT 377 in the user specified program section PSCT. The DIR$ macro describes the ERR error service address.

```
  .MACRO GSSW$C PSCT,ERR
  .MCALL GSSW$,DIR$
  .IF NDF $$$GLB
  .PSECT $DPB$$
$$$=.
  .IFTF
  GSSW$
  .IFT
  .PSECT PSCT
  DIR$ #$$$,ERR
  .ENDC
  .ENDM GSSW$C
```

C.2.60 GSSW$S Macro

The GSSW$S macro generates the code to push a DPB for the GET SENSE SWITCHES directive on the stack followed by an EMT 377.

Macro call: GSSW$S ERR

Description: This macro generates the code to push a one-word DPB for the GET SENSE SWTICHES directive on the stack. Then it generates an EMT 377 using the error service address as described in the DIR$ macro.

```
  .MACRO GSSW$S ERR
  .MCALL DIR$
  MOV (PC)+,-(SP)
  .BYTE 125.,1
  DIR$ ,ERR
  .ENDM GSSW$S
```

C.2.61 GSSW$ Macro

The GSSW$ macro generates a DPB for the GET SENSE SWITCHES directive.

Macro call: GSSW$

Description: This macro generates a DPB for the GET SENSE SWITCHES directive. There are no arguments.

```
  .MACRO GSSW$
  .IF NDF $$$GLB
  .BYTE 125.,1
  .ENDC
  .ENDM GSSW$
```

C.2.62 GTIM$C Macro

The GTIM$C macro generates a DPB for the GET TIME PARAMETERS directive in a separate PSECT followed by an EMT 377 in the user specified PSECT.

Macro call: GTIM$C BUFADR,PSCT,ERR

Description: This macro generates a DPB for the GET TIME PARAMETERS directive in the $DPB$$ program section. The GTIM$ macro describes the DPB parameters. This macro then generates an EMT 377 in the program section named in PSCT. The DIR$ macro describes the ERR error service address. The GTIM$ macro controls symbolic address generation.

```
  .MACRO GTIM$C BUFA,CS ERR
  .MCALL GTIM$,DIR$
  .IF NDF $$$GLB
  .PSECT $DPB$$
$$$=.
  .IFTF
  GTIM$ BUFA
  .IFT
  .PSECT CS
  DIR$ #$$$,ERR
  .ENDC
  .ENDM GTIM$C
```

C.2.63 GTIM$S Macro

The GTIM$S macro generates the code to push a DPB for the GET TIME PARAMETERS directive on the stack followed by an EMT 377.

Macro call: GTIM$S BUFADR,ERR

Description: This macro generates the code to push a DPB for the GET TIME PARAMETERS directive on the stack. The DPB arguments must be valid assembler source operands, and they must specify the information described in the GTIM$ macro. This macro also generates an EMT 377 using the ERR error service address, as described in the DIR$ macro. This macro also generates symbolic offsets relative to the time parameters buffer as described in the GTIM$ macro.

```
  .MACRO GTIM$S BUFA,ERR
  .MCALL MOV$,DIR$,OFF$
  MOV$ BUFA
  MOV (PC)+,-(SP)
  .BYTE 61.,2
  DIR$ ,ERR
  .IF NDF G.TIYR
  .NLIST
$$$OST=0
  .IRP X,<<G.TIYR,2>,<G.TIMO,2>,<G.TIDA,2>,<G.TIHR,2>>
  OFF$ X
  .ENDM
  .IRP X,<<G.TIMI,2>,<G.TISC,2>,<G.TICT,2>,<G.TICP,2>>
  OFF$ X
  .ENDM
  .LIST
  .ENDC
  .ENDM GTIM$S
```

C.2.64 GTIM$ Macro

The GTIM$ macro generates a DPB for the GET TIME PARAMETERS directive.

Macro call: GTIM$ BUFADR

Description: This macro generates a DPB for the GET TIME PARAMETERS directive. The argument is assumed to have the following meaning:

BUFADR=Address of eight word buffer.

The following symbol is locally defined with its assigned value equal to the byte offset from the start of the DPB to the element:

G.TIBA-(length 2 bytes) Buffer address.

The following offsets are assigned relative to the start of the time parameters buffer:

G.TIYR-(2) Year,
G.TIMO-(2) Month,
G.TIDA-(2) Day,
G.TIHR-(2) Hour,
G.TIMI-(2) Minute,
G.TISC-(2) Second,
G.TICT-(2) Clock tick,
G.TICP-(2) Clock ticks per second.

If GTIM$ is invoked with the $$$GLB symbol defined, GTIM$ does not generate the DPB and it globally defines the symbolic offsets.

```
  .MACRO GTIM$ BUFA
  .MCALL OFF$
  .IF NDF $$$GLB
  .BYTE 61.,2
  .WORD BUFA
  .ENDC
  .IF NDF G.TIBA
  .NLIST
  OFF$
  OFF$ G.TIBA,2
  .IF NDF G.TIYR
$$$OST=0
  .IRP X,<<G.TIYR,2>,<G.TIMO,2>,<G.TIDA,2>,<G.TIHR,2>>
  OFF$ X
  .ENDM
  .IRP X,<<G.TIMI,2>,<G.TISC,2>,<G.TICT,2>,<G.TICP,2>>
  OFF$ X
  .ENDM
  .ENDC
  .LIST
  .ENDC
  .ENDM GTIM$
```

C.2.65 GTSK$C Macro

The GTSK$C macro generates a DPB for the GET TASK PARAMETERS directive in a separate PSECT followed by an EMT 377 in the user specified PSECT.

Macro call: GTSK$C BUFADR,PSCT,ERR

Description: This macro generates a DPB for the GET TASK PARAMETERS directive in the $DPB$$ program section. The GTSK$S macro describes the DPB parameters. This macro then generates an EMT 377 in the original program control section named in PSCT. The DIR$ macro describes the ERR error service address. The GTSK$ macro controls symbolic offset generation.

```
  .MACRO GTSK$C BUFA,CS,ERR
  .MCALL GTSK$,DIR$
  .IF NDF $$$GLB
  .PSECT $DPB$$
$$$=.
  .IFT
  GTSK$ BUFA
  .IFT
  .PSECT CS
  DIR$ #$$$,ERR
  .ENDC
  .ENDM GTSK$C
```

C.2.66 GTSK$S Macro

The GTSK$S macro generates the code to push a DPB for the GET TASK PARAMETERS directive on the stack followed by an EMT 377.

Macro call: GTSK$S BUFADR,ERR

Description: GTSK$S generates the code to push a DPB for the GET TASK PARAMETERS directive on the stack. The DPB arguments must be valid assembler source operands and they must specify the information described in the GTSK$ macro. GTSK$S generates an EMT 377 using the ERR error service address, as described in the DIR$ macro. GTSK$S also generates symbolic offsets relative to the task parameters buffer as described in the GTSK$ macro.

```
        .MACRO GTSK$S BUFA,ERR
        .MCALL MOV$,DIR$,OFF$
        MOV$ BUFA
        MOV (PC)+,-(SP)
        .BYTE 63.,2
        DIR$ ,ERR
        .IF NDF G.TSTN
        .NLIST
$$$OST=0
        .IRP X,<<G.TSTN,4>,<G.TSPN,4>,<G.TSRN,4>,<G.TSPR,2>,<G.TSPC,1>>
        OFF$ X
        .ENDM
        .IRP X,<<G.TSGC,1>,<G.TSNL,2>,<G.TSMT,2>,<G.TSFW,2>,<G.TSVA,2>>
        VL,2
        OFF$ G.TSTS,2
        OFF$ G.TSSY,2
        OFF$ G.TSDU,2
$$$0ST=0
        .IRP X,<<RX$11D,1>,<RX$11M,1>,<RX$11S,1>,<RX$IAS,1>>
        OFF$ X
        .ENDM
        .LIST
        .ENDC
        .ENDM GTSK$S
```

C.2.67 GTSK$ Macro

The GTSK$ macro generates a DPB for the GET TASK PARAMETERS directive.

Macro call: GTSK$ BUFADR

Description: GTSK$ generates a DPB for the GET TASK PARAMETERS directive. The argument is assumed to have the following meaning:

BUFADR=Address of a 16 word buffer.

The following symbol is locally defined with its assigned value equal to the byte offset from the start of the DPB to the DPB element:

G.TSBA-(length 2 bytes) Buffer address.

The following offsets are assigned relative to the start of the task parameters buffer:

```
G.TSTN-(4) Task name
G.TSPN-(4) Partition name
G.TSRN-(4) Name of task's requester
G.TSPR-(2) Priority
G.TSGC-(1) UIC group code
G.TSPC-(1) UIC programmer code
G.TSNL-(2) Number of logical units
G.TSMT-(2) Machine type
G.TSFW-(2) Std flags word
G.TSVA-(2) Address of task SST vector table
G.TSVL-(2) Length (number of words) of task SST vector table
G.TSTS-(2) Size (in bytes) of task address space
G.TSSY-(2) System in which task is running:
   RX$11D - System is RSX-11D
   RX$11M - System is RSX-11M
   RX$11S - System is RSX-11S
   RX$IAS - System is IAS
G.TSDU-(2) Task's (default) protection UIC
```

If GTSK$ is invoked with the $$$GLB symbol defined, GTSK$ does not generate the DPB and it globally defines the symbolic offsets.

```
        .MACRO GTSK$ BUFA
        .MCALL OFF$
        .IF NDF $$$GLB
        .BYTE 63.,2
        .WORD BUFA
        .ENDC
        .IF NDF G.TSBA
        .NLIST
        OFF$
        OFF$ G.TSBA,2
        .IF NDF G.TSTN
$$$OST=0
        .IRP X,<<G.TSTN,4>,<G.TSPN,4>,<G.TSRN,4>,<G.TSPR,2>,<G.TSPC,1>>
        OFF$ X
        .ENDM
        .IRP X,<<G.TSGC,1>,<G.TSNL,2>,<G.TSMT,2>,<G.TSFW,2>,<G.TSVA,2>>
        OFF$ X
        .ENDM
        OFF$ G.TSVL,2
        OFF$ G.TSTS,2
        OFF$ G.TSSY,2
        OFF$ G.TSDU,2
$$$OST=0
```

```
.IRP X,<<RX$11D,1>,<RX$11M,1>,<RX$11S,1>,<RX$IAS,1>>
OFF$ X
.ENDM
.ENDC
.LIST
.ENDC
.ENDM GTSK$
```

C.2.68 IHAR$C Macro

The IHAR$C macro generates a DPB for the INHIBIT DISABLE AST RECOGNITION directive in a separate PSECT followed by an EMT 377 in the user specified PSECT.

Macro call: IHAR$C PSCT,ERR

Description: This macro generates a DPB for the INHIBIT DISABLE AST RECOGNITION directive in the $DPB$$ program section followed by an EMT 377 in the user specified program section named PSCT. The DIR$ macro describes the ERR error service address.

Note: This macro is the same as the DSAR$C macro, and is included only for compatibility with RSX-11D.

```
.MACRO IHAR$C PSCT,ERR
.MCALL DSAR$C
DSAR$C PSCT,ERR
.ENDM IHAR$C
```

C.2.69 IHAR$S Macro

The IHAR$S macro generates the code to push a DPB for the INHIBIT AST RECOGNITION directive on the stack and an EMT 377.

Macro call: IHAR$S ERR

Description: This macro generates the code to push a one-word DPB for the DISABLE AST RECOGNITION directive on the stack. Then the macro generates an EMT 377 using the ERR error service address described in the DIR$ macro.

Note: This macro is included only for compatibility with RSX-11D.

```
.MACRO IHAR$S ERR
.MCALL DSAR$S
DSAR$S ERR
.ENDM IHAR$S
```

C.2.70 IHAR$ Macro

The IHAR$ macro generates a DPB for the INHIBIT DISABLE AST RECOGNITION directive.

Macro call: IHAR$

Description: This macro generates a DPB for the INHIBIT DISABLE AST RECOGNITION directive. There are no parameters.

Note: This macro is included only for compatiblity with RSX-11D.

```
.MACRO IHAR$
.MCALL DSAR$
DSAR$
.ENDM IHAR$
```

C.2.71 MOV$ Macro

This is an internal macro that pushes an argument on the stack.

Macro call: MOV$ <ARG>

Description: MOV$ pushes an argument on the stack. MOV$ examines the argument first to determine which code is valid to perform the push. If the argument is left blank, MOV$ uses a CLR instruction. Otherwise, MOV$ generates a "MOV ARG,-(SP)" instruction.

```
.MACRO MOV$ ARG
.IF NB <ARG>
.IF DIF <ARG>,<#0>
MOV ARG,-(SP)
.MEXIT
.ENDC
.ENDC
CLR -(SP)
.ENDM MOV$
```

C.2.72 MRKT$C Macro

The MRKT$C macro generates a DPB for the MARK TIME directive in a separate PSECT followed by an EMT 377 in the user specified PSECT.

Macro call: MRKT$C EFN,TIMMAG,TIMUNIT,AST,PSCT,ERR

Description: This macro generates a DPB for the MARK TIME directive in the $DPB$$ program section. The MRKT$ macro describes the DPB parameters. This macro then generates an EMT 377 in the program section named in PSCT. The DIR$ macro describes the ERR error service address. The MRKT$ macro controls the generation of symbolic offsets.

```
.MACRO MRKT$C EF,TM,TU,AST,CS,ERR
.MCALL MRKT$,DIR$
.IF NDF $$$GLB
.PSECT $DPB$$
$$$=.
.IFTF
MRKT$ EF,TM,TU,AST
.IFT
.PSECT CS
DIR$ #$$$,ERR
.ENDC
.ENDM MRKT$C
```

C.2.73 MRKT$S Macro

The MRKT$S macro generates the code to push a DPB for the MARK TIME directive on the stack followed by an EMT 377.

Macro call: MRKT$S EFN,TIMMAG,TIMUNIT,AST,ERR

Description: This macro generates the code to push a DPB for the MARK TIME directive on the stack. The DPB arguments must be valid assembler source operands and they must specify the information described in the MRKT$ macro. This macro also generates an EMT 377 using the ERR error service address as described in the DIR$ macro.

```
.MACRO MRKT$S EF,TM,TU,AST,ERR
.MCALL RVP$,DIR$
RVP$ EF,TM,TU,AST
MOV (PC)+,-(SP)
.BYTE 23.,5
DIR$ ,ERR
.ENDM MRKT$S
```

C.2.74 MRKT$ Macro

The MRKT$ macro generates a DPB for the MARK TIME DIRECTIVE.

Macro call: MRKT$ EFN,TIMMAG,TIMUNIT,AST

Description: This macro generates a DPB for the MARK TIME directive. The arguments are assumed to have the following meanings:

EFN=Event flag number,
TIMMAG=Time interval magnitude,
TIMUNIT=Time interval unit,
AST=AST entry address.

The following symbols are locally defined with their assigned values equal to the byte offset from the start of the DPB to the respective DPB elements:

M.KTEF-(length 2 bytes) Event flag,
M.KTMG-(2) Time magnitude,
M.KTUN-(2) Time unit,
M.KTAE-(2) AST entry address.

If MRKT$ is invoked with the $$$GLB symbol defined, MRKT$ does not generate the DPB and globally defines the symbolic offsets.

```
.MACRO MRKT$ EFN,TM,TU,AST
.MCALL OFF$
.IF NDF $$$GLB
.BYTE 23.,5
.WORD EFN
.WORD TM
.WORD TU
.WORD AST
.ENDC
.IF NDF M.KTEF
.NLIST
.IRP X,<,<M.KTEF,2>,<M.KTMG,2>,<M.KTUN,2>,<M.KTAE,2>>
OFF$ X
.ENDM
.LIST
```

```
  .ENDC
  .ENDM MRKT$
```

C.2.75 MVB$ Macro

MVB$ is an internal macro that pushes two bytes on the stack.

Macro call: MVB$ LOWB,HIGHB

Description: MVB$ examines the two arguments and based on that examination generates the code to push the bytes on the stack.

```
  .MACRO MVB$ LOW,HIGH
  .IF B <LOW>
  .IF B <HIGH>
  CLR -(SP)
  .IFF
  CLRB -(SP)
  MOVB HIGH,1(SP)
  .ENDC
  .IFF
  .IF B <HIGH>
  CLR -(SP)
  MOVB LOW,(SP)
  .IFF
  MOVB LOW,-(SP)
  MOVB HIGH,1(SP)
  .ENDC
  .ENDC
  .ENDM MVB$
```

C.2.76 OFF$ Macro

OFF$ is an internal macro that generates symbolic offsets.

Macro call: OFF$ SYMB,LEN

Description: OFF$ creates tables of symbolic offsets for the elements within DPBs. The first argument, SYMB, is the name of the symbol. The second argument, LEN, is the length of the symbol in bytes. OFF$ adds LEN to the offset counter after OFF$ makes the symbolic assignment. If the $$$GLB symbol is defined, OFF$ makes the symbolic assignments global. Otherwise, OFF$ makes all assignments local.

If both SYMB and LEN are blank, OFF$ initializes the offset counter to two (2).

```
  .MACRO OFF$ SYMB,LEN
  .IF B <'SYMB'LEN>
$$$OST=2
  .MEXIT
  .ENDC
  .IF NB <SYMB>
  .IF NDF $$$GLB
SYMB=$$$OST
  .IFF
SYMB==$$$OST
  .ENDC
  .ENDC
```

C.2.77 QDPB$S Macro

The QDPB$S macro generates the code to push a QUEUE I/O or QUEUE I/O AND WAIT DPB on the stack and it generates an EMT 377.

Macro call: QDPB$S DIC,FNC,LUN,EFN,PRI,IOST,AST,PRMLST,ERR

Description: This macro generates the code to push the proper QUEUE I/O DPB on the stack. It is meant to be called only by QIO$S, or QIOW$S to generate the required code to build a DPB and issue the EMT 377.

```
  .MACRO QDPB$S DIC,FNC,LUN,EFN,PRI,IOST,AST,PRMLST,ERR
  .MCALL RVP$,MVB$,DIR$
  .NLIST
$$$ARG=0
  .IRP X,<PRMLST>
$$$ARG=$$$ARG+1
  .ENDM
  .LIST
  .IF GT 6-$$$ARG
  .REPT <6-$$$ARG>
  CLR -(SP)
  .ENDR
  .ENDC
  .IIF NB <PRMLST>, RVP$ PRMLST
  RVP$ IOST,AST
  MVB$ EFN,
  RVP$ FNC,LUN
  MOV (PC)+,-(SP)
  .BYTE DIC,12.
  DIR$ ,ERR
  .ENDM QDPB$S
```

C.2.78 QDPB$ Macro

The QDPB$ macro generates the QUEUE I/O or QUEUE I/O AND WAIT DPB.

Macro call: QDPB$ DIC,FNC,LUN,EFN,PRI,IOST,AST,PRMLST

Description: This macro generates the required DPB for the specified QUEUE I/O directive. It is only meant to be called by the QIO$, QIO$C, QIOW$, OR QIOW$C macros to generate the required DPB.

```
  .MACRO QDPB$ DIC,FNC,LUN,EFN,PRI,IOST,AST,PRMLST
  .MCALL OFF$
  .IF NDF $$$GLB
  .BYTE DIC,12.
  .WORD FNC
  .WORD LUN
  .BYTE EFN,0
  .WORD IOST
  .WORD AST
  .NLIST
$$$ARG=0
  .LIST
  .IRP X,<PRMLST>
  .WORD X
  .NLIST
$$$ARG=$$$ARG+1
  .LIST
  .ENDM
```

```
  .IF GT 6-$$$ARG
  .REPT <6-$$$ARG>
  .WORD 0
  .ENDR
  .ENDC
  .ENDC
  .IF NDF Q.IOFN
  .NLIST
  .IRP X,<,<Q.IOFN,2>,<Q.IOLU,2>,<Q.IOEF,1>,<Q.IOPR,1>>
  OFF$ X
  .ENDM
  .IRP X,<<Q.IOSB,2>,<Q.IOAE,2>,<Q.IOPL>>
  OFF$ X
  .ENDM
  .LIST
  .ENDC
  .ENDM QDPB$
```

C.2.79 QIO$C Macro

The QIO$C macro generates a QUEUE I/O DPB in a separate PSECT followed by an EMT 377 in the user specified PSECT.

Macro call: QIO$C FNC,LUN,EFN,PRI,IOST,AST,PRMLST,PSECT,ERR

Description: This macro generates the required QUEUE I/O DPB in the $DPB$$ program section. All of the arguments through PRMLST are as described for the QIO$ macro. The PSECT argument should be the name of the original program program section into which the standard monitor trap code is generated. The optional argument, ERR, is the error routine address. This macro invokes QIO$ and, therefore, follows the same expansion guidelines.

Note: Read the note in the QIO$ macro description concerning ignored arguments in the QIO$ macro below.

```
  .MACRO QIO$C FNC,LUN,EFN,PRI,IOST,AST,PRMLST,PSCT,ERR
  .MCALL QDPB$,DIR$
  .IF NDF $$$GLB
  .PSECT $DPB$$
$$$=.
  .IFTF
  QDPB$ 1,FNC,LUN,EFN,PRI,IOST,AST,<PRMLST>
  .IFT
  .PSECT PSCT
  DIR$ #$$$,ERR
  .ENDC
  .ENDM QIO$C
```

C.2.80 QIO$S Macro

The QIO$S macro generates the code to push a QUEUE I/O DPB on the stack and generate an EMT 377.

Macro call: QIO$S FNC,LUN,EFN,PRI,IOST,AST,PRMLST,ERR

Description: This macro generates the code to push the required queue I/O DPB on the stack. The arguments through PRMLST represent the information as described in the macro QIO$. However, the arguments must all be valid assembler source operands.

Note: Read the note in the QIO$ macro description concerning ignored arguments in the QIO$ macro below.

```
.MACRO QIO$S FNC,LUN,EFN,PRI,IOST,AST,PRMLST,ERR
.MCALL QDPB$S
QDPB$S 1,FNC,LUN,EFN,PRI,IOST,AST,<PRMLST>,ERR
.ENDM QIO$S
```

C.2.81 QIO$ Macro

The QIO$ macro generates the QUEUE I/O DPB.

Macro call: QIO$ FNC,LUN,EFN,PRI,IOST,AST,PRMLST

Description: This macro generates the required DPB specified for the QUEUE I/O directive. The arguments are treated as follows:

FNC-I/O Function code,
LUN-Logical unit number,
EFN-Event flag number,
PRI-Priority,
IOST-Address of I/O status block,
AST-Address of I/O done AST entry point
PRMLST-Parameter list of the form <P1,...,P6>

All of the arguments must be valid expressions to be used in assembler data storage directives. The first call of this macro defines the following symbols and assigns, as a value, their byte offset from the beginning of the DPB:

Q.IOFN-(length 2 bytes) I/O function,
Q.IOLU-(2) Logical unit number,
Q.IOEF-(1) Event flag number,
Q.IOPR-(1) Priority,
Q.IOSB-(2) Address of I/O status block,
Q.IOAE-(2) Address of I/O done AST entry point,
Q.IOPL-(0) Parameter list (up to 6 words).

If the $$$GLB symbol is defined, QIO$ does not generate the DPB and it globally defines the symbolic offsets.

Note: The argument PRI is required to maintain compatibility with RSX-11D. Desite the fact that it must be specified, the QIO$ macro ignores it.

```
.MACRO QIO$ FNC,LUN,EFN,PRI,IOST,AST,PRMLST
.MCALL QDPB$
QDPB$ 1,FNC,LUN,EFN,PRI,IOST,AST,<PRMLST>
.ENDM QIO$
```

C.2.82 QIOW$C Macro

The QIOW$C macro generates a QUEUE I/O AND WAIT DPB in a separate PSECT followed by an EMT 377 in the user specified PSECT.

Macro call: QIOW$C FNC,LUN,EFN,PRI,IOST,AST,PRMLST,PSECT,ERR

Description: This macro generates the required QUEUE I/O AND WAIT DPB in the program section named $DPB$$. All of the arguments through

PRMLST are as described for the QIOW$ macro. The argument PSECT should be the name of the original program program section into which the standard monitor trap code is generated. The optional argument, ERR, is the error routine address.

Note: Read the note concerning ignored arguments in the QIOW$ macro below.

```
  .MACRO QIOW$C FNC,LUN,EFN,PRI,IOST,AST,PRMLST,PSCT,ERR
  .MCALL QDPB$,DIR$
  .IF NDF $$$GLB
  .PSECT $DPB$$
$$$=.
  .IFTF
  QDPB$ 3,FNC,LUN,EFN,PRI,IOST,AST,<PRMLST>
  .IFT
  .PSECT PSCT
  DIR$ #$$$,ERR
  .ENDC
  .ENDM QIOW$C
```

C.2.83 QIOW$S Macro

The QIOW$S macro generates the code to push a queue I/O and wait DPB on the stack and generate an EMT 377.

Macro call: QIOW$S FNC,LUN,EFN,PRI,IOST,AST,PRMLST,ERR QIOW$S Macro

Description: This macro generates the code to push the required QUEUE I/O AND WAIT DPB on the stack. The arguments through PRMLST represent the information as described in the QIOW$ macro. However, the arguments must all be valid assembler source operands.

Note: Read the note concerning ignored arguments in the QIOW$ macro below.

```
  .MACRO QIOW$S FNC,LUN,EFN,PRI,IOST,AST,PRMLST,ERR
  .MCALL QDPB$S
  QDPB$S 3,FNC,LUN,EFN,PRI,IOST,AST,<PRMLST>,ERR
  .ENDM QIOW$S
```

C.2.84 QIOW$ Macro

The QIOW$ macro generates the QUEUE I/O AND WAIT DPB.

Macro call: QIOW$ FNC,LUN,EFN,PRI,IOST,AST,PRMLST

Description: This macro generates the required DPB specified for the QUEUE I/O AND WAIT directive. The arguments are treated as follows:

FNC-I/O function code,
LUN-Logical unit number,
EFN-Event flag number,
PRI-Priority,
IOST-Address of I/O status block,
AST-Address of I/O done AST entry point
PRMLST-Parameter list of the form <P1,...,P6> .

All of the arguments must be valid expressions to be used in assembler data storage directives. The first call of this macro defines the

following symbols and assigns, as values, their byte offset from the beginning of the DPB:

```
Q.IOFN-(Length 2 bytes) I/O function,
Q.IOLU-(2) Logical unit number,
Q.IOEF-(1) Event flag number,
Q.IOPR-(1) Priority,
Q.IOSB-(2) Address of I/O status block,
Q.IOAE-(2) Address of I/O done AST entry point,
Q.IOPL-(0) Parameter list (up to 6 words).
```

If the $$$GLB symbol is defined, QIOW$ does not generate the DPB and it globally defines the symbolic offsets.

Note: This macro requires the PRI argument to maintain compatibility with RSX-11D. Despite the fact that it must be specified, QIOW$ ignores it.

```
  .MACRO QIOW$ FNC,LUN,EFN,PRI,IOST,AST,PRMLST
  .MCALL QDPB$
  QDPB$ 3,FNC,LUN,EFN,PRI,IOST,AST,<PRMLST>
  .ENDM QIOW$
```

C.2.85 R50$ Macro

This internal macro generates a two-word RADIX-50 name.

Macro call: R50$ NAME

Description: This macro converts the NAME argument into RADIX-50 using the .RAD50 assembler directive. Furthermore, R50$ ensures that the data generated is at least two words long.

```
  .MACRO R50$ NAME
  .NLIST
  .NCHR $$$T1,NAME
  .LIST
  .IF EQ $$$T1
  .WORD 0,0
  .IFF
  .IF GT $$$T1-6
$$$T4=.+4
  .IFTF
  .RAD50 /NAME/
  .IFT
.=$$$T4
  .ENDC
  .IIF LT $$$T1-4, .WORD 0
  .ENDC
  .ENDM R50$
```

C.2.86 RCVD$C Macro

RCVD$C generates a DPB for the RECEIVE DATA directive in a separate PSECT followed by an EMT 377 in the user specified PSECT.

Macro call: RCVD$C TASK,BUFADR,PSCT,ERR

Description: RCVD$C generates a DPB for the RECEIVE DATA directive in the $DPB$$ program section. RCVD$ describes the DPB parameters.

RCVD$C then generates an EMT 377 in the program section named in PSCT. DIR$ describes the ERR error service address. RCVD$ controls the generation of symbolic offsets.

```
  .MACRO RCVD$C TN,BA,CS,ERR
  .MCALL RCVD$,DIR$
  .IF NDF $$$GLB
  .PSECT $DPB$$
$$$=.
  .IFTF
  RCVD$ TN,BA
  .IFT
  .PSECT CS
  DIR$ #$$$,ERR
  .ENDC
  .ENDM RCVD$C
```

C.2.87 RCVD$S Macro

The RCVD$S macro generates the code to push a DPB for the RECEIVE DATA directive on the stack followed by an EMT 377.

Macro call: RCVD$S TSKNAMADR,BUFADR,ERR

Description: This macro generates the code to push a DPB for the RECEIVE DATA directive on the stack. The DPB arguments must be valid assembler source operands, and they must specify the information described in the RCVD$ macro. This macro also generates an EMT 377 using the ERR error service address as described in the DIR$ macro.

```
  .MACRO RCVD$S TN,BA,ERR
  .MCALL MOV$,DIR$, RFA$
  MOV$ BA
  RFA$ TN
  MOV (PC)+,-(SP)
  .BYTE 75.,4
  DIR$ ,ERR
  .ENDM RCVD$S
```

C.2.88 RCVD$ Macro

The RCVD$ macro generates a DPB for the RECEIVE DATA directive.

Macro call: RCVD$ TASK,BUFADR

Description: This macro generates a DPB for the RECEIVE DATA directive. The arguments are assumed to have the following meanings:

TASK=Sender task name,
BUFADR=Address of fifteen word buffer.

The following symbols are locally defined with their assigned values equal to the byte offset from the start of the DPB to the respective DPB elements:

R.VDTN-(length 4 bytes) Task name,
R.VDBA-(2) Buffer address.

If RCVD$ is invoked with the $$$GLB symbol defined, RCVD$ does not generate the DPB and it globally defines the symbolic offsets.

```
.MACRO RCVD$ TN,BA
.MCALL OFF$, R50$
.IF NDF $$$GLB
.BYTE 75.,4
R50$ TN
.WORD BA
.ENDC
.IF NDF R.VDTN
.NLIST
.IRP X,<,<R.VDTN,4>,<R.VDBA,2>>
OFF$ X
.ENDM
.LIST
.ENDC
.ENDM RCVD$
```

C.2.89 RCVX$C Macro

The RCVX$C macro generates a DPB for the RECEIVE DATA OR EXIT directive in a separate PSECT followed by an EMT 377 in the user specified PSECT.

Macro call: RCVX$C TASK,BUFADR,PSCT,ERR

Description: This macro generates a DPB for the RECEIVE DATA OR EXIT DIRECTIVE in the program section named $DPB$$. The RCVX$ macro describes the DPB parameters. This macro then generates an EMT 377 in the program section named in PSCT. The ERR error service address is described in the DIR$ macro. The RCVX$ macro controls the generation of symbolic offsets.

```
.MACRO RCVX$C TN,BA,CS,ERR
.MCALL RCVX$,DIR$
.IF NDF $$$GLB
.PSECT $DPB$$
$$$=.
.IFTF
RCVX$ TN,BA
.IFT
.PSECT CS
DIR$ #$$$,ERR
.ENDC
.ENDM RCVX$C
```

C.2.90 RCVX$S Macro

The RCVX$S macro generates the code to push a DPB for the RECEIVE DATA OR EXIT directive on the stack followed by an EMT 377.

Macro call: RCVX$S TSKNAMADR,BUFADR,ERR

Description: This macro generates the code to push a DPB for the RECEIVE DATA OR EXIT directive on the stack. The DPB arguments must be valid assembler source operands, and they must specify the information described in the RCVX$ macro. This macro also generates an EMT 377 using the ERR error service address as defined in the DIR$ macro.

```
.MACRO RCVX$S TN,BA,ERR
.MCALL MOV$,DIR$, RFA$
```

```
MOV$ BA
RFA$ TN
MOV (PC)+,-(SP)
.BYTE 77.,4
DIR$ ,ERR
.ENDM RCVX$S
```

C.2.91 RCVX$ Macro

The RCVX$ macro generates a DPB for the RECEIVE DATA OR EXIT directive.

Macro call: RCVX$ TASK,BUFADR

Description: This macro generates a DPB for the RECEIVE DATA OR EXIT directive. The arguments are assumed to have the following meanings:

TASK=Sender task name,
BUFADR=Address of fifteen word buffer.

The following symbols are locally defined with their assigned values equal to the byte offset from the start of the DPB to the respective DPB elements:

R.VXTN-(length 4 bytes) Task name,
R.VXBA-(2) Buffer address.

If RCVX$ is invoked with the $$$GLB symbol defined, RCVX$ does not generate the DPB and it globally defines the symbolic offsets.

```
.MACRO RCVX$ TN,BA
.MCALL OFF$, R50$
.IF NDF $$$GLB
.BYTE 77.,4
R50$ TN
.WORD BA
.ENDC
.IF NDF R.VXTN
.NLIST
.IRP X,<,<R.VXTN,4>,<R.VXBA,2>>
OFF$ X
.ENDM
.LIST
.ENDC
.ENDM RCVX$
```

C.2.92 RDAF$C Macro

The RDAF$C macro generates a DPB for the READ ALL FLAGS directive in a separate PSECT followed by an EMT 377 in the user specified PSECT.

Macro call: RDAF$C BUFADR,PSCT,ERR

Description: This macro generates a DPB for the READ ALL FLAGS directive in the program section named $DPB$$. The DPB parameters are described in the RDAF$ macro. This macro then generates an EMT 377 in the program section named in PSCT. The DIR$ macro describes the ERR error service address. The RDAF$ macro controls symbolic address generation.

```
  .MACRO RDAF$C BA,CS,ERR
  .MCALL RDAF$,DIR$
  .IF NDF $$$GLB
  .PSECT $DPB$$
$$$=.
  .IFTF
  RDAF$ BA
  .IFT
  .PSECT CS
  DIR$ #$$$,ERR
  .ENDC
  .ENDM RDAF$C
```

C.2.93 RDAF$S Macro

The RDAF$S macro generates the code to push a DPB for the READ ALL FLAGS directive on the stack followed by an EMT 377.

Macro call: RDAF$S BUFADR,ERR

Description: This macro generates the code to push a DPB for the READ ALL FLAGS directive on the stack. The DPB arguments must be valid assembler source operands and must specify the information described in the RDAF$ macro. RDAF$S also generates an EMT 377, using the ERR error service address, as described in the DIR$ macro.

```
  .MACRO RDAF$S BA,ERR
  .MCALL MOV$,DIR$
  MOV$ BA
  MOV (PC)+,-(SP)
  .BYTE 39.,2
  DIR$ ,ERR
  .ENDM RDAF$S
```

C.2.94 RDAF$ Macro

The RDAF$ macro generates a DPB for the READ ALL FLAGS directive.

Macro call: RDAF$ BUFADR

Description: This macro generates a DPB for the READ ALL FLAGS directive. The argument is assumed to have the following meaning:

BUFADR=Address of four word buffer.

The following symbol is locally defined with its assigned value equal to the byte offset from the start of the DPB to the DPB element:

R.DABA-(length 2 bytes) Buffer address.

If the macro is invoked with the $$$GLB symbol defined, RDAF$ does not generate the DPB and it globally defines the symbolic offset.

```
  .MACRO RDAF$ BA
  .MCALL OFF$
  .IF NDF $$$GLB
  .BYTE 39.,2
  .WORD BA
  .ENDC
  .IF NDF R.DABA
```

```
  .NLIST
  OFF$
  OFF$ R.DABA,2.
  .LIST
  .ENDC
  .ENDM RDAF$
```

C.2.95 RFA$ Macro

RFA$ is an internal macro that pushes two words on the stack in reverse order from the specified double-word.

Macro call: RFA$ ADR

Description: RFA$ generates the code to push two words on the stack in reverse order from the double word with its address specified by the source operand's ADR.

```
  .MACRO RFA$ ADR
  .IF NB <ADR>
  .NLIST
  .NTYPE $$$T2,ADR
  .LIST
  .IF LT $$$T2-6
  MOV 2(ADR),-(SP)
  MOV (ADR),-(SP)
  .IFF
  MOV ADR,-(SP)
  MOV @(SP),-(SP)
  ADD #2,2(SP)
  MOV @2(SP),2(SP)
  .ENDC
  .IFF
  CLR -(SP)
  CLR -(SP)
  .ENDC
  .ENDM RFA$
```

C.2.96 RQST$C Macro

The RQST$C macro generates a DPB for the REQUEST directive in a separate PSECT followed by an EMT 377 in the user specified PSECT.

Macro call: RQST$C TASK,PART,PRI,UICGC,UICPC,PSCT,ERR

Description: This macro generates a DPB for the REQUEST directive in the $DPB$$ program section. The RQST$ macro describes the DPB parameters. RQST$C then generates an EMT 377 in the program section named in PSCT. The DIR$ macro describes the ERR error service address. The RQST$ macro controls symbolic address generation.

Note: Read the notice concerning ignored arguments in the RQST$ macro below.

```
  .MACRO RQST$C TN,PN,PR,GC,P,CS,ERR
  .MCALL RQST$,DIR$
  .IF NDF $$$GLB
  .PSECT $DPB$$
$$$=.
  .IFTF
```

```
RQST$ TN,PN,PR,GC,P
.IFT
.PSECT CS
DIR$ #$$$,ERR
.ENDC
.ENDM
```

C.2.97 RQST$S Macro

The RQST$S macro generates the code to push a DPB for the REQUEST directive on the stack followed by an EMT 377.

Macro call: RQST$S TSKNAMADR,PRTNAMADR,PRI,UICGC,UICPC,ERR

Description: RQST$S generates the code to push a DPB for the REQUEST directive on the stack. The DPB arguments must be valid assembler source operands and must specify the information described in the RQST$ macro. RQST$S also generates an EMT 377 using the ERR error service address described in DIR$.

Note: Read the notice concerning ignored arguments in the RQST$ macro below.

```
.MACRO RQST$S TN,PN,PR,GC,P,ERR
.MCALL MVB$,RFA$,DIR$
MVB$ P,GC
CLR -(SP)
RFA$
RFA$ TN
MOV (PC)+,-(SP)
.BYTE 11.,7
DIR$ ,ERR
.ENDM RQST$S
```

C.2.98 RQST$ Macro

The RQST$ macro generates a DPB for the REQUEST directive.

Macro call: RQST$ TASK,PART,PRI,UIGC,UICPC

Description: This macro generates a DPB for the REQUEST directive. The arguments are assumed to have the following meanings:

```
TASK=Task name,
PART=Partition name,
PRI=Priority,
UICGC=UIC group code,
UICPC=UIC programmer code.
```

The following symbols are locally defined with their assigned values equal to the byte offset from the start of the DPB to the respective DPB elements:

```
R.QSTN-(length 4 bytes) Task name,
R.QSPN-(4) Partition name,
R.QSPR-(2) Priority,
R.QSGC-(1) UIC Group,
R.QSPC-(1) UIC Programmer.
```

If RQST$ is invoked with the $$$GLB symbol defined, RQST$ does not generate the DPB and it globally defines the symbolic offsets.

Note: RQST$ requires the arguments PART and PRI to maintain compatibility with RSX-11D. Despite the fact that they must be specified, RQST$ ignores them.

```
.MACRO RQST$ TN,PN,PR,GC,P
.MCALL R50$,OFF$
.IF NDF $$$GLB
.BYTE 11.,7
R50$ TN
.WORD 0,0
.WORD 0
.BYTE P,GC
.ENDC
.IF NDF R.QSTN
.NLIST
.IRP X,<,<R.QSTN,4>,<R.QSPN,4>,<R.QSPR,2>,<R.QSPC,1>,<R.QSGC,1>>
OFF$ X
.ENDM
.LIST
.ENDC
.ENDM RQST$
```

C.2.99 RSUM$C Macro

The RSUM$C macro generates a DPB for the RESUME directive in a separate PSECT followed by an EMT 377 in the user specified PSECT.

Macro call: RSUM$C TASK,PSCT,ERR

Description: This macro generates a DPB for the RESUME directive in the $DPB$$ program section. The RSUM$ macro describes the DPB parameters. This macro then generates an EMT 377 in the program section named in PSCT. The ERR error service address is described in the DIR$ macro. The RSUM$ macro controls generation of symbolic offsets.

```
  .MACRO RSUM$C TN,CS,ERR
  .MCALL RSUM$,DIR$
  .IF NDF $$$GLB
  .PSECT $DPB$$
$$$=.
  .IFTF
  RSUM$ TN
  .IFT
  .PSECT CS
  DIR$ #$$$,ERR
  .ENDC
  .ENDM RSUM$C
```

C.2.100 RSUM$S Macro

The RSUM$S macro generates the code to push a DPB for the RESUME directive on the stack and the code for an EMT 377.

Macro call: RSUM$S TSKNAMADR,ERR

Description: This macro generates the code to push a DPB for the RESUME directive on the stack. The DPB arguments must be valid assembler source operands, and they must specify the information described in the RSUM$ macro. This macro also generates an EMT 377 using the ERR error service address as described in the DIR$ macro.

```
.MACRO RSUM$S TN,ERR
.MCALL RFA$,DIR$
RFA$ TN
MOV (PC)+,-(SP)
.BYTE 47.,3
DIR$ ,ERR
.ENDM RSUM$S
```

C.2.101 RSUM$ Macro

The RSUM$ macro generates a DPB for the RESUME directive.

Macro call: RSUM$ TASK

Description: This macro generates a DPB for the RESUME directive. The argument is assumed to have the following meaning:

TASK=Task name.

The following symbol is locally defined with its assigned value equal to the byte offset from the start of the DPB to the DPB element:

R.SUTN-(length 4 bytes) Task name.

If RSUM$ is invoked with the $$$GLB symbol defined, RSUM$ does not generate the DPB and it globally defines the symbolic offset.

```
.MACRO RSUM$ TN
.MCALL R50$,OFF$
.IF NDF $$$GLB
.BYTE 47.,3
R50$ TN
.ENDC
.IF NDF R.SUTN
.NLIST
OFF$
OFF$ R.SUTN,4
.LIST
.ENDC
.ENDM RSUM$
```

C.2.102 RUN$C Macro

RUN$C generates a DPB for the RUN directive in a separate PSECT followed by an EMT 377 in the user specified PSECT.

Macro call: RUN$C TSK,PRT,PRI,UGC,UPC,SMG,SNT,RMG,RNT,PSCT,ERR

Description: RUN$C generates a DPB for the RUN directive in the $DPB$$ program section. RUN$ describes the DPB parameters. RUN$C then generates an EMT 377 in the program section named in PSCT. DIR$ describes the ERR error service address. The RUN$ macro controls symbolic address generation.

Note: Read the discussion notice concerning ignored arguments in the RUN$ macro below.

```
  .MACRO RUN$C TN,PN,PR,UG,UP,SM,SU,RM,RU,CS,ERR
  .MCALL RUN$,DIR$
  .IF NDF $$$GLB
  .PSECT $DPB$$
$$$=.
  .IFTF
  RUN$ TN,PN,PR,UG,UP,SM,SU,RM,RU
  .IFT
  .PSECT CS
  DIR$ #$$$,ERR
  .ENDC
  .ENDM RUN$C
```

C.2.103 RUN$S Macro

RUN$S generates the code to push a DPB for the RUN directive on the stack and generates an EMT 377.

Macro call: RUN$S TNAMADR,PNAMADR,PRI,UGC,UPC,SMG,SNT,RMG,RNT,ERR

Description: RUN$S generates the code to push a DPB for the RUN directive on the stack and generates an EMT 377 using the ERR error service address described in DIR$. DPB arguments must be valid assembler source operands and must specify the information described in the RUN$ macro.

Note: Read the discussion notice concerning ignored arguments in the RUN$ macro below.

```
  .MACRO RUN$S TN,PN,PR,UG,UP,SM,SU,RM,RU,ERR
  .MCALL RVP$,MVB$,RFA$,DIR$
  RVP$ SM,SU,RM,RU
  MVB$ UP,UG
  CLR -(SP)
  RFA$
  RFA$ TN
  MOV (PC)+,-(SP)
  .BYTE 17.,11.
  DIR$ ,ERR
  .ENDM RUN$S
```

C.2.104 RUN$ Macro

The RUN$ macro generates a DPB for the RUN directive.

Macro call: RUN$ TSK,PRT,PRI,UGC,UPC,SMG,SNT,RMG,RNT

Description: The arguments must have the following meanings:

```
     TSK=Task name,
     PRT=Partition name,
     PRI=Priority,
     UGC=UIC group code,
     UPC=UIC programmer code,
     SMG=Schedule delta magnitude,
     SNT=Schedule delta unit,
     RMG=Re-schedule interval magnitude,
     RNT=Re-schedule interval unit.
```

The following symbols are locally defined with their assigned values equal to the byte offset from the start of the DPB to the respective DPB elements:

R.UNTN-(length 4 bytes) Task name,
R.UNPN-(4) Partition name,
R.UNPR-(2) Priority,
R.UNGC-(1) UIC group,
R.UNPC-(1) UIC programmer,
R.UNSM-(2) Schedule magnitude,
R.UNSU-(2) Schedule unit,
R.UNRM-(2) Re-schedule magnitude,
R.UNRU-(2) Re-schedule unit.

If RUN$ is invoked with the $$$GLB symbol defined, RUN$ does not generate the DPB and RUN$ globally defines the symbolic offsets.

Note: RUN$ requires the PRT and PRI arguments to maintain compatibility with RSX-11D. Despite the fact that they must be specified, RUN$ ignores them.

```
      .MACRO RUN$ TN,PN,PR,GC,P,SM,SU,RM,RU
      .MCALL R50$,OFF$
      .IF NDF $$$GLB
      .BYTE 17.,11.
      R50$ TN
      .WORD 0,0
      .WORD 0
      .BYTE P,GC
      .WORD SM
      .WORD SU
      .WORD RM
      .WORD RU
      .ENDC
      .IF NDF R.UNTN
      .NLIST
      .IRP X,<,<R.UNTN,4>,<R.UNPN,4>,<R.UNPR,2>,<R.UNPC,1>,<R.UNGC,1>>
      OFF$ X
      .ENDM
      .IRP X,<<R.UNSM,2>,<R.UNSU,2>,<R.UNRM,2>,<R.UNRU,2>>
      OFF$ X
      .ENDM
  .LIST
  .ENDC
  .ENDM RUN$
```

C.2.105 RVP$ Macro

RVP$ is an internal macro that places the parameters passed as an argument list into the stack in reverse order.

Macro call: RVP$ A1,A2,...,A10

Description: RVP$ pushes the elements of the argument list on the stack in reverse order. RVP$ assumes all elements to be full-word. The list is limited to a maximum of ten elements.

```
  .MACRO RVP$ P0,P1,P2,P3,P4,P5,P6,P7,P8,P9
  .MCALL MOV$
  .NLIST
  .NARG $$$ARG
  .LIST
```

```
  .IIF GT $$$ARG-9., MOV$ <P9>
  .IIF GT $$$ARG-8., MOV$ <P8>
  .IIF GT $$$ARG-7, MOV$ <P7>
  .IIF GT $$$ARG-6, MOV$ <P6>
  .IIF GT $$$ARG-5, MOV$ <P5>
  .IIF GT $$$ARG-4, MOV$ <P4>
  .IIF GT $$$ARG-3, MOV$ <P3>
  .IIF GT $$$ARG-2, MOV$ <P2>
  .IIF GT $$$ARG-1, MOV$ <P1>
  .IIF GT $$$ARG, MOV$ <P0>
  .ENDM RVP$
```

C.2.106 SDAT$C Macro

The SDAT$C macro generates a DPB for the SEND DATA directive in a separate PSECT followed by an EMT 377 in the user specified PSECT.

Macro call: SDAT$C TASK,BUFADR,EFN,PSCT,ERR

Description: SDAT$C generates a DPB for the SEND DATA directive in the $DPB$$ program section and generates an EMT 377 in the program section named in PSCT. SDAT$ describes the DPB parameters and controls symbolic address generation. DIR$ describes the ERR error service address.

```
  .MACRO SDAT$C TN,BA,EFN,CS,ERR
  .MCALL SDAT$,DIR$
  .IF NDF $$$GLB
  .PSECT $DPB$$
$$$=.
  .IFTF
  SDAT$ TN,BA,EFN
  .IFT
  .PSECT CS
  DIR$ #$$$,ERR
  .ENDC
  .ENDM SDAT$C
```

C.2.107 SDAT$S Macro

SDAT$S generates the code to push a DPB for the SEND DATA directive on the stack and generates an EMT 377.

Macro call: SDAT$S TSKNAMADR,BUFADR,EFN,ERR

Description: SDAT$S generates the code to push a DPB for the SEND DATA directive on the stack and generates an EMT 377 using the ERR error service address described in DIR$. The DPB arguments must be valid assembler source operands and they must specify the information described in the SDAT$ macro.

```
  .MACRO SDAT$S TN,BA,EFN,ERR
  .MCALL MOV$,RFA$,DIR$
  MOV$ EFN
  MOV$ BA
  RFA$ TN
  MOV (PC)+,-(SP)
  .BYTE 71.,5
  DIR$ ,ERR
  .ENDM SDAT$S
```

C.2.108 SDAT$ Macro

The SDAT$ macro generates a DPB for the SEND DATA directive.

Macro call: SDAT$ TASK,BUFADR,EFN

Description: This macro generates a DPB for the SEND DATA directive. The arguments are assumed to have the following meanings:

TASK=Receiver task name,
BUFADR=Address of thirteen word data buffer,
EFN=Event flag number.

The following symbols are locally defined with their assigned values equal to the byte offset from the start of the DPB to the respective DPB elements:

S.DATN-(length 4 bytes) Task name,
S.DABA-(2) Buffer address,
S.DAEF-(2) Event flag number.

If SDAT$ is invoked with the $$$GLB symbol defined, SDAT$ does not generate the DPB and it globally defines the symbolic offsets.

```
.MACRO SDAT$ TN,BA,EFN
.MCALL R50$,OFF$
.IF NDF $$$GLB
.BYTE 71.,5
R50$ TN
.WORD BA
.WORD EFN
.ENDC
.IF NDF S.DATN
.NLIST
.IRP X,<,<S.DATN,4>,<S.DABA,2>,<S.DAEF,2>>
OFF$ X
.ENDM
.LIST
.ENDC
.ENDM SDAT$
```

C.2.109 SETF$C Macro

The SETF$C macro generates a DPB for the SET EVENT FLAG directive in a separate PSECT followed by an EMT 377 in the user specified PSECT.

Macro call: SETF$C EFN,PSCT,ERR

Description: This macro generates a DPB for the SET EVENT FLAG directive in the program section named $DPB$$. The SETF$ macro describes the DPB parameters. The SETF$C macro then generates an EMT 377 in the program section named in PSCT. The DIR$ macro describes the ERR error service address. The SETF$ macro controls symbolic offset generation.

```
.MACRO SETF$C EFN,CS,ERR
.MCALL SETF$,DIR$
.IF NDF $$$GLB
.PSECT $DPB$$
$$$=.
.IFTF
SETF$ EFN
```

```
.IFT
.PSECT CS
DIR$ #$$$,ERR
.ENDC
.ENDM SETF$C
```

C.2.110 SETF$S Macro

SETF$S pushes a DPB for the SET EVENT FLAG directive on the stack and generates an EMT 377.

Macro call: SETF$S EFN,ERR

Description: SET$F pushes a DPB for the SET EVENT FLAG directive on the stack. DPB arguments must be valid assembler operands and specify the information described in the SETF$ macro. SET$F also generates an EMT 377 using the ERR error service address that DIR$ describes.

```
.MACRO SETF$S EFN,ERR
.MCALL MOV$,DIR$
MOV$ EFN
MOV (PC)+,-(SP)
.BYTE 33.,2
DIR$ ,ERR
.ENDM SETF$S
```

C.2.111 SETF$ Macro

The SETF$ macro generates a DPB for the SET EVENT FLAG directive.

Macro call: SETF$ EFN

Description: This macro generates a DPB for the SET EVENT FLAG directive. The argument is assumed to have the following meaning:

EFN=Event flag number.

The following symbol is locally defined with its assigned value equal to the byte offset from the start of the DPB to the DPB element:

S.ETEF-(length 2 bytes) Event flag.

If SETF$ is invoked with the $$$GLB symbol defined, SETF$ does not generate the DPB and it globally defines the symbolic offset.

```
.MACRO SETF$ EFN
.MCALL OFF$
.IF NDF $$$GLB
.BYTE 33.,2
.WORD EFN
.ENDC
.IF NDF S.ETEF
.NLIST
OFF$
OFF$ S.ETEF,2
.LIST
.ENDC
.ENDM SETF$
```

C.2.112 SFPA$C Macro

The SFPA$C macro generates a DPB for the SPECIFY FLOATING POINT EXCEPTION AST directive in a separate PSECT followed by an EMT 377 in the user specified PSECT.

Macro call: SFPA$C AST,PSCT,ERR

Description: SFPA$C generates a DPB for the SPECIFY FLOATING POINT EXCEPTION AST directive in the $DPB$$ program section. SFPA$ describes the DPB parameters. SFPA$C then generates an EMT 377 in the program section named in PSCT. DIR$ describes the ERR error service address. The SFPA$ macro controls symbolic offset generation.

```
  .MACRO SFPA$C AST,CS,ERR
  .MCALL SFPA$,DIR$
  .IF NDF $$$GLB
  .PSECT $DPB$$
$$$=.
  .IFTF
  SFPA$ AST
  .IFT
  .PSECT CS
  DIR$ #$$$,ERR
  .ENDC
  .ENDM SFPA$C
```

C.2.113 SFPA$S Macro

SFPA$S generates the code to push a DPB for the SPECIFY FLOATING POINT EXCEPTION AST directive on the stack and generates an EMT 377.

Macro call: SFPA$S AST,ERR

Description: This macro generates the code to push a DPB for the SPECIFY FLOATING POINT EXCEPTION AST directive on the stack. The DPB arguments must be valid assembler source operands, and they must specify the information described in the SFPA$ macro. The SFPA$S macro also generates an EMT 377 using the ERR error service address as described in the DIR$ macro.

```
  .MACRO SFPA$S AST,ERR
  .MCALL MOV$,DIR$
  MOV$ AST
  MOV (PC)+,-(SP)
  .BYTE 111.,2
  DIR$ ,ERR
  .ENDM SFPA$S
```

C.2.114 SFPA$ Macro

SFPA$ generates a DPB for the SPECIFY FLOATING POINT EXCEPTION AST directive.

Macro call: SFPA$ AST

Description: The argument must have the following meaning:

AST=AST Service entry address.

The following symbol is locally defined with its assigned values equal to the byte offset from the start of the DPB to the DPB element:

S.FPAE-(length 2 bytes) AST Entry address.

If SFPA$ is invoked with the $$$GLB symbol defined, SFPA$ does not generate the DPB and it globally defines the symbolic offsets.

```
.MACRO SFPA$ AST
.MCALL OFF$
.IF NDF $$$GLB
.BYTE 111.,2
.WORD AST
.ENDC
.IF NDF S.FPAE
.NLIST
OFF$
OFF$ S.FPAE,2
.LIST
.ENDC
.ENDM SFPA$
```

C.2.115 SPND$C Macro

SPND$C generates a DPB for the SUSPEND directive in a separate PSECT followed by an EMT 377 in the user specified PSECT.

Macro call: SPND$C PSCT,ERR

Description: SPND$C generates a DPB for the SUSPEND directive in the $DPB$$ program section followed by an EMT 377 in the original program section named PSCT. DIR$ describes the ERR error service address.

```
        .MACRO SPND$C PSCT,ERR
        .MCALL SPND$,DIR$
        .IF NDF $$$GLB
        .PSECT $DPB$$
$$$=.
        .IFTF
        SPND$
        .IFT
        .PSECT PSCT
        DIR$ #$$$,ERR
        .ENDC
        .ENDM SPND$C
```

C.2.116 SPND$S Macro

The SPND$S macro generates the code to push a DPB for the SUSPEND directive on the stack and generates an EMT 377.

Macro call: SPND$S ERR

Description: This macro generates the code to push a one-word DPB for the SUSPEND directive on the stack. Then it generates an EMT 377 using the error service address as described in the DIR$ macro.

```
.MACRO SPND$S ERR
.MCALL DIR$
MOV (PC)+,-(SP)
```

```
  .BYTE 45.,1
  DIR$ ,ERR
  .ENDM SPND$S
```

C.2.117 SPND$ Macro

The SPND$ macro generates a DPB for the SUSPEND directive.

Macro call: SPND$

Description: This macro generates a DPB for the SUSPEND directive. There are no arguments.

```
  .MACRO SPND$
  .IF NDF $$$GLB
  .BYTE 45.,1
  .ENDC
  .ENDM SPND$
```

C.2.118 SPRA$C Macro

The SPAR$C macro generates a DPB for the SPECIFY POWER RECOVERY AST directive in a separate PSECT followed by an EMT 377 in the user specified PSECT.

Macro call: SPRA$C AST,PSCT,ERR

Description: This macro generates a DPB for the SPECIFY POWER RECOVERY AST directive in the $DPB$$ program section. The SPRA$ macro describes the DPB parameters. The SPRA$C macro then generates an EMT 377 in the program section named in PSCT. The DIR$ macro describes the ERR error service address. The SPRA$ macro controls the generation of symbolic offsets.

```
  .MACRO SPRA$C AST,CS,ERR
  .MCALL SPRA$,DIR$
  .IF NDF $$$GLB
  .PSECT $DPB$$
$$$=.
  .IFTF
  SPRA$ AST
  .IFT
  .PSECT CS
  DIR$ #$$$,ERR
  .ENDC
  .ENDM SPRA$C
```

C.2.119 SPRA$S Macro

The SPRA$S macro generates the code to push a DPB for the SPECIFY POWER RECOVERY AST directive on the stack and generates an EMT 377.

Macro call: SPRA$S AST,ERR

Description: This macro generates the code to push a DPB for the SPECIFY POWER RECOVERY AST directive on the stack. The DPB arguments must be valid assembler source operands, and they must specify the information described in the SPRA$ macro. The SPRA$S macro also

generates an EMT 377 using the ERR error service address as described in the DIR$ macro.

```
.MACRO SPRA$S AST,ERR
.MCALL MOV$,DIR$
MOV$ AST
MOV (PC)+,-(SP)
.BYTE 109.,2
DIR$ ,ERR
.ENDM SPRA$S
```

C.2.120 SPRA$ Macro

The SPRA$ macro generates a DPB for the SPECIFY POWER RECOVERY AST directive.

Macro call: SPRA$ AST

Description: This macro generates a DPB for the SPECIFY POWER RECOVERY AST directive. The argument is assumed to have the following meaning:

AST=AST Service entry address.

The following symbol is locally defined with is assigned a value equal to the byte offset from the start of the DPB to the DPB element:

S.PRAE-(length 2 bytes) AST entry address.

If SPRA$ is invoked with the $$$GLB symbol defined, SPRA$ does not generate the DPB and it globally defines the symbolic offset.

```
.MACRO SPRA$ AST
.MCALL OFF$
.IF NDF $$$GLB
.BYTE 109.,2
.WORD AST
.ENDC
.IF NDF S.PRAE
.NLIST
OFF$
OFF$ S.PRAE,2
.LIST
.ENDC
.ENDM SPRA$
```

C.2.121 SRDA$C Macro

The SRDA$C macro generates a DPB for the SPECIFY RECEIVE DATA AST directive in a separate PSECT followed by an EMT 377 in the user specified PSECT.

Macro call: SRDA$C AST,PSCT,ERR

Description: This macro generates a DPB for the SPECIFY RECEIVE DATA AST directive in the $DPB$$ program section. The SRDA$ macro describes the DPB parameters. This macro then generates an EMT 377 in the program section named in PSCT. The DIR$ macro describes the ERR error service address. The SRDA$ macro controls symbolic offset generation.

```
  .MACRO SRDA$C AST,CS,ERR
  .MCALL SRDA$,DIR$
  .IF NDF $$$GLB
  .PSECT $DPB$$
$$$=.
  .IFTF
  SRDA$ AST
  .IFT
  .PSECT CS
  DIR$ #$$$,ERR
  .ENDC
  .ENDM SRDA$C
```

C.2.122 SRDA$S Macro

SRDA$S macro pushes a DPB for the SPECIFY RECEIVE DATA AST directive on the stack and generates an EMT 377.

Macro call: SRDA$S AST,ERR

Description: This macro generates the code to push a DPB for the SPECIFY RECEIVE DATA AST directive on the stack. The DPB arguments must be valid assembler source operands, and they must specify the information described in the SRDA$ macro. The SRDA$S macro also generates an EMT 377 using the ERR error service address as described in the DIR$ macro.

```
  .MACRO SRDA$S AST,ERR
  .MCALL MOV$,DIR$
  MOV$ AST
  MOV (PC)+,-(SP)
  .BYTE 107.,2
  DIR$ ,ERR
  .ENDM SRDA$S
```

C.2.123 SRDA$ Macro

SRDA$ generates a DPB for the SPECIFY RECEIVE DATA AST directive.

Macro call: SRDA$ AST

Description: This macro generates a DPB for the SPECIFY RECEIVE DATA AST directive. The argument is assumed to have the following meaning:

AST=AST service entry address.

The following symbol is locally defined with its assigned value equal to the byte offset from the start of the DPB to the DPB element:

S.RDAE-(length 2 bytes) AST entry address.

If SRDA$ is invoked with the $$$GLB symbol defined, SRDA$ does not generate the DPB and it globally defines the symbolic offset.

```
  .MACRO SRDA$ AST
  .MCALL OFF$
  .IF NDF $$$GLB
  .BYTE 107.,2
  .WORD AST
  .ENDC
```

```
  .IF NDF S.RDAE
  .NLIST
  OFF$
  OFF$ S.RDAE,2
  .LIST
  .ENDC
  .ENDM SRDA$
```

C.2.124 SVDB$C Macro

SVDB$C generates a DPB for the SPECIFY SST VECTOR TABLE FOR DEBUGGING AID directive in a separate PSECT followed by an EMT 377 in the user specified PSECT.

Macro call: SVDB$C ADR,LEN,PSCT,ERR

Description: SVDB$C generates a DPB for the SPECIFY SST VECTOR TABLE FOR DEBUGGING AID directive in the $DPB$$ program section and generates an EMT 377 in the program section named in PSCT. SVDB$ describes the DPB parameters and controls symbolic address generation. DIR$ describes the ERR error service address.

```
  .MACRO SVDB$C AD,LN,CS,ERR
  .MCALL SVDB$,DIR$
  .IF NDF $$$GLB
  .PSECT $DPB$$
$$$=.
  .IFTF
  SVDB$ AD,LN
  .IFT
  .PSECT CS
  DIR$ #$$$,ERR
  .ENDC
  .ENDM SVDB$C
```

C.2.125 SVDB$S Macro

The SVDB$S macro generates the code to push a DPB for the SPECIFY SST VECTOR TABLE FOR DEBUGGING AID directive on the stack and generates an EMT 377.

Macro call: SVDB$S ADR,LEN,ERR

Description: SRDA$S macro pushes a DPB for the SPECIFY SST VECTOR TABLE FOR DEBUGGING AID directive on the stack. DPB arguments must be valid assembler operands and must specify the information described by SVDB$. SVDB$S also generates an EMT 377 using the ERR error service address described by DIR$.

```
  .MACRO SVDB$S AD,LN,ERR
  .MCALL MOV$,DIR$
  MOV$ LN
  MOV$ AD
  MOV (PC)+,-(SP)
  .BYTE 103.,3
  DIR$ ,ERR
  .ENDM SVDB$S
```

C.2.126 SVDB$ Macro

The SVDB$ macro generates a DPB for the SPECIFY SST VECTOR TABLE FOR DEBUGGING AID directive.

Macro call: SVDB$ ADR,LEN

Description: This macro generates a DPB for the SPECIFY SST VECTOR TABLE FOR DEBUGGING AID directive. The arguments are assumed to have the following meanings:

ADR=Address of SST vector table,
LEN=Length of (number of entries in) table.

The following symbols are locally defined with their assigned values equal to the byte offset from the start of the DPB to the respective DPB elements:

S.VDTA-(length 2 bytes) Table address,
S.VDTL-(2) Table length.

If SVDB$ is invoked with the $$$GLB symbol defined, SVDB$ does not generate the DPB and it globally defines the symbolic offsets.

```
.MACRO SVDB$ A,L
.MCALL OFF$
.IF NDF $$$GLB
.BYTE 103.,3
.WORD A
.WORD L
.ENDC
.IF NDF S.VDTA
.NLIST
.IRP X,<,<S.VDTA,2>,<S.VDTL,2>>
OFF$ X
.ENDM
.LIST
.ENDC
.ENDM SVDB$
```

C.2.127 SVTK$C Macro

SVTK$C generates a DPB for the SPECIFY SST VECTOR TABLE FOR TASK directive in a separate PSECT followed by an EMT 377 in the user specified PSECT.

Macro call: SVTK$C ADR,LEN,PSCT,ERR

Description: SVTK$C generates a DPB for the SPECIFY SST VECTOR TABLE FOR TASK directive in the $DPB$$ program section and generates an EMT 377 in the program section named in PSCT. DIR$ describes the ERR error service address. The SVTK$ macro controls symbolic address generation and describes DPB parameters.

```
.MACRO SVTK$C ADR,LEN,CS,ERR
.MCALL SVTK$,DIR$
.IF NDF $$$GLB
.PSECT $DPB$$
$$$=.
.IFTF
SVTK$ ADR,LEN
.IFT
```

```
.PSECT CS
DIR$ #$$$,ERR
.ENDC
.ENDM SVTK$C
```

C.2.128 SVTK$S Macro

The SVTK$S macro generates the code to push a DPB for the SPECIFY SST VECTOR TABLE FOR TASK directive on the stack and generates an EMT 377.

Macro call: SVTK$S ADR,LEN,ERR

Description: This macro generates the code to push a DPB for the SPECIFY SST VECTOR TABLE FOR TASK directive on the stack. The DPB arguments must be valid assembler source operands, and they must specify the information described in the SVTK$ macro. This macro also generates an EMT 377 using the ERR error service address as described in the DIR$ macro.

```
.MACRO SVTK$S ADR,LEN,ERR
.MCALL MOV$,DIR$
MOV$ LEN
MOV$ ADR
MOV (PC)+,-(SP)
.BYTE 105.,3
DIR$ ,ERR
.ENDM SVTK$S
```

C.2.129 SVTK$ Macro

The SVTK$ macro generates a DPB for the SPECIFY SST VECTOR TABLE FOR TASK directive.

Macro call: SVTK$ ADR,LEN

Description: This macro generates a DPB for the SPECIFY SST VECTOR TABLE FOR TASK directive. The arguments are assumed to have the following meanings:

ADR=Address of SST vector table,
LEN=Length of (number of entries in) table.

The following symbols are locally defined with their assigned values equal to the byte offset from the start of the DPB to the respective DPB elements:

S.VTTA-(length 2 bytes) Table address,
S.VTTL-(2) Table length.

If SVTK$ is invoked with the $$$GLB symbol defined, SVTK$ does not generate the DPB and it globally defines the symbolic offsets.

```
.MACRO SVTK$ TA,TL
.MCALL OFF$
.IF NDF $$$GLB
.BYTE 105.,3
.WORD TA
.WORD TL
.ENDC
.IF NDF S.VTTA
```

```
        .NLIST
        .IRP X,<,<S.VTTA,2>,<S.VTTL,2>>
        OFF$ X
        .ENDM
        .LIST
        .ENDC
        .ENDM SVTK$
```

C.2.130 WSIG$C Macro

The WSIG$C macro generates a DPB for the WAIT FOR SIGNIFICANT EVENT directive in a separate PSECT followed by an EMT 377 in the user specified PSECT.

Macro call: WSIG$C PSCT,ERR

Description: This macro generates a DPB for the WAIT FOR SIGNIFICANT EVENT directive in the $DPB$$ program section followed by an EMT 377 in the user specified program section that is named PSCT. The DIR$ macro describes the ERR error service address.

```
        .MACRO WSIG$C PSCT,ERR
        .MCALL WSIG$,DIR$
        .IF NDF $$$GLB
        .PSECT $DPB$$
$$$=.
        .IFTF
        WSIG$
        .IFT
        .PSECT PSCT
        DIR$ #$$$,ERR
        .ENDC
        .ENDM WSIG$C
```

C.2.131 WSIG$S Macro

The WSIG$S macro generates the code to push a DPB for the WAIT FOR SIGNIFICANT event directive on the stack and generates an EMT 377.

Macro call: WSIG$S ERR

Description: This macro generates the code to push a one-word DPB for the WAIT FOR SIGNIFICANT EVENT directive on the stack. Then it generates an EMT 377 using the ERR error service address as described in the DIR$ macro.

```
        .MACRO WSIG$S ERR
        .MCALL DIR$
        MOV (PC)+,-(SP)
        .BYTE 49.,1
        DIR$ ,ERR
        .ENDM WSIG$S
```

C.2.132 WSIG$ Macro

The WSIG$ macro generates a DPB for the WAIT FOR SIGNIFICANT EVENT directive.

Macro call: WSIG$

Description: This macro generates a DPB for the WAIT FOR SIGNIFICANT EVENT directive. There are no arguments.

```
        .MACRO WSIG$
        .IF NDF $$$GLB
        .BYTE 49.,1
        .ENDC
        .ENDM WSIG$
```

C.2.133 WTLO$C Macro

The WTLO$C Macro generates a DPB for the WAIT FOR LOGICAL OR OF EVENT FLAGS directive in a separate PSECT followed by an EMT 377 in the user specified PSECT.

Macro call: WTLO$C SET,MASK,PSCT,ERR

Description: This macro generates a DPB for the WAIT FOR LOGICAL OR OF EVENT FLAGS directive in the $DPB$$ program section. The WTLO$ macro describes the DPB parameters. The WTLO$C macro then generates an EMT 377 in the program section named in PSCT. The DIR$ macro describes the ERR error service address. The WTLO$ macro controls symbolic offset generation.

Note: Read the discussion notice concerning ignored arguments in the WTLO$ macro below.

```
        .MACRO WTLO$C SET,MASK,CS,ERR
        .MCALL WTLO$,DIR$
        .IF NDF $$$GLB
        .PSECT $DPB$$
$$$=.
        .IFTF
        WTLO$ SET,<MASK>
        .IFT
        .PSECT CS
        DIR$ #$$$,ERR
        .ENDC
        .ENDM WTLO$C
```

C.2.134 WTLO$S Macro

The WTLO$S macro generates the code to push a DPB for the WAIT FOR LOGICAL OR OF EVENT FLAGS directive on the stack and generates an EMT 377.

Macro call: WTLO$S SET,MASK,ERR

Description: This macro generates the code to push a DPB for the WAIT FOR LOGICAL OR OF EVENT FLAGS directive on the stack. The arguments are assumed to have the following meanings:

```
     SET=Desired set of event flags (0-4)
     MASK=Assembler source operand that yields the desired
          mask word
```

The macro also generates an EMT 377, using the ERR error service address as described in the DIR$ macro.

Note: Read the discussion notice concerning ignored arguments in the WTLO$ macro below.

```
.MACRO WTLO$S SET,MSK,ERR
.MCALL MOV$,DIR$
.IF EQ SET-4
.ERROR SET              ;Unsupported macro option;
.IFF
MOV$ MSK
.IF NE SET
MOV #SET,-(SP)
.IFF
 LR -(SP)
.ENDC
MOV (PC)+,-(SP)
.BYTE 43.,3
.ENDC
DIR$ ,ERR
.ENDM WTLO$S
```

C.2.135 WTLO$ Macro

The WTLO$ macro generates a DPB for the WAIT FOR LOGICAL OR OF EVENT FLAGS directive.

Macro call: WTLO$ SET,MASK

Description: This macro generates a DPB for the WAIT FOR LOGICAL OR OF EVENT FLAGS directive. The arguments are assumed to have the following meanings:

```
SET=Desired set of event flags (0-4),
MASK=If set is 0, 1, 2, or 3, a 16-bit (16 flag) mask word;
     If set is 4, a list of four mask words (<M1,M2,M3,M4>).
```

WTLO$ does not define any symbolic offsets. WTLO$ does not generate any code if the $$GLB symbol is defined at the time WTLO$ is invoked.

Note: RSX-11M does not support the specification of flags set number 4. If flag set number 4 is specified it causes an error.

```
.MACRO WTLO$ SET,MASK
.IF NDF $$$GLB
.IF EQ SET-4
.ERROR SET            ;Unsupported macro option
.IFF
.BYTE 43.,3
.WORD SET
.WORD MASK
.ENDC
.ENDC
      .ENDM WTLO$
```

C.2.136 WTSE$C Macro

The WTSE$C macro generates a DPB for the WAIT FOR SINGLE EVENT FLAG directive in a separate PSECT followed by an EMT 377 in the user specified PSECT.

Macro call: WTSE$C EFN,PSCT,ERR

Description: This macro generates a DPB for the WAIT FOR SINGLE EVENT FLAG directive in the $DPB$$ section. The WTSE$ macro describes the DPB parameters. The WTSE$C macro then generates an EMT 377 in the program section named in PSCT. The DIR$ macro describes the ERR error service address. The WTSE$ macro controls symbolic address generation.

```
  .MACRO WTSE$C EF,CS,ERR
  .MCALL WTSE$,DIR$
  .IF NDF $$$GLB
  .PSECT $DPB$$
$$$=.
  .IFTF
  WTSE$ EF
  .IFT
  .PSECT CS
  DIR$ #$$$,ERR
  .ENDC
  .ENDM WTSE$C
```

C.2.137 WTSE$S Macro

The WTSE$S macro generates the code to push a DPB for the WAIT FOR SINGLE EVENT FLAG directive on the stack and generates an EMT 377.

Macro call: WTSE$S EFN,ERR

Description: This macro generates the code to push a DPB for the WAIT FOR SINGLE EVENT FLAG directive on the stack. The DPB arguments must be valid assembler source operands, and they must specify the information described in the WTSE$S macro. This macro also generates an EMT 377, using the ERR error service address as described in the DIR$ macro.

```
  .MACRO WTSE$S EF,ERR
  .MCALL MOV$,DIR$
  MOV$ EF
  MOV (PC)+,-(SP)
  .BYTE 41.,2
  DIR$ ,ERR
  .ENDM WTSE$S
```

C.2.138 WTSE$ Macro

WTSE$ generates a DPB for the WAIT FOR SINGLE EVENT FLAG directive.

Macro call: WTSE$ EFN

Description: WTSE$ generates a DPB for the WAIT FOR SINGLE EVENT FLAG directive. The argument must have the following meaning:

EFN=Event flag number.

The following symbol is locally defined with its assigned value equal to the byte offset from the start of the DPB to the DPB element:

W.TSEF-(length 2 bytes) Event flag number.

If WTSE$ is invoked with the $$$GLB symbol defined, WTSE$ does not generate the DPB and it globally defines the symbolic offset.

```
.MACRO WTSE$ EFN
.MCALL OFF$
.IF NDF $$$GLB
.BYTE 41.,2
.WORD EFN
.ENDC
.IF NDF W.TSEF
.NLIST
OFF$
OFF$ W.TSEF,2
.LIST
.ENDC
.ENDM WTSE$
```

C.3 EXECUTIVE MACRO EXPANSIONS

The following coded instructions are expansions of macros that you may find in the Executive source listings of RSX-11M.

C.3.1 CALL Macro

```
.MACRO CALL SUBR ARG
.IF IDN <$INTSV>,<SUBR>
JSR R5,$INTSV
.IF DF L$$SI1
.WORD ARG
.IFF
.WORD ^C<ARG>&PR7
.ENDC
.IFF
.IF IDN <$SAVNR>,<SUBR>
JSR R5,$SAVNR
.IFF
.IF IDN <$SWSTK>,<SUBR>
EMT 376
.WORD ARG
.IFF
JSR PC,SUBR
.ENDC
.ENDC
.ENDC
.ENDM
```

C.3.2 CALLR Macro

CALLR is a call and return from subroutine macro.

```
.MACRO CALLR SUBR
JMP SUBR
.ENDM
```

C.3.3 CRASH Macro

CRASH crashes the system.

```
.MACRO CRASH
IOT
.ENDM
```

C.3.4 DIRSV$ Macro

DIRSV$ is the directive register save and set priority macro.

```
.MACRO DIRSV$
JSR R5,$DIRSV
.ENDM
```

C.3.5 DRSTS Macro

DRSTS causes a trap to set directive status.

```
.MACRO  DRSTS VALUE
TRAP VALUE
.ENDM
```

C.3.6 GTUCB$ Macro

GTUCB$ generates code to load the UCB address into R5. It is called by INTSE$ and INTSV$ only.

```
.MACRO GTUCB$ UCBSV,NCTRLR
.IF NB <UCBSV>
.IF GT NCTRLR-1
MOV UCBSV(R4),R5
.IFF
MOV UCBSV,R5
.ENDC
.IFF
.IF GT NCTRLR-1
MOV CNTBL(R4),R5
.IFF
MOV CNTBL,R5
.ENDC
.ENDC
.ENDM
```

C.3.7 INTLB Macro

Generates an interrupt routine entry point label.

```
.IF DF E$$DVC
.MACRO INTLB NUM,NAM
$'NAM'NUM'T::
        .ENDM
        .ENDC
```

C.3.8 INTSE$ Macro

This is the interrupt save generation macro for error logging devices.

```
   .MACRO INTSE$ DEV,PRI,NCTRLR,PSWSV,UCBSV,?LAB
   .IF DF L$$DRV & LD$'DEV & M$$MGE
$'DEV'INT::
   .IF NDF E$$DVC
   .IF EQ NCTRLR-1
   CLR R4
   .ENDC
   .ENDC
   .IFF
   .IF NDF E$$DVC
$'DEV'INT::INTSV$ DEV,PRI,NCTRLR,PSWSV,UCBSV
   .IF EQ NCTRLR-1
   CLR R4
   .ENDC
   .MEXIT
   .IFF
$$$=0
   .REPT NCTRLR
   INTLB \$$$,DEV
   JSR R5,$INTSE
   SCBLB \$$$,DEV
   .IF DF L$$SI1
   .WORD PRI
   .IFF
   .WORD ^C<PRI>&PR7
   .ENDC
   .IF GT NCTRLR-$$$-1
   BR LAB
   .ENDC
$$$=$$$+1
   .ENDR
LAB:
   .ENDC
   .ENDC
   GTUCB$ UCBSV,NCTRLR
   .ENDM
```

C.3.9 INTSV$ Macro

INTSV$ causes interrupt save generation for non-error logging devices.

```
   .MACRO INTSV$ DEV,PRI,NCTRLR,PSWSV,UCBSV
   .IF NDF L$$DRV ! M$$MGE ! LD$'DEV
   .IF GT NCTRLR-1
   .IF B <PSWSV>
   MFPS TEMP
   .IFF
   MFPS PSWSV
   .ENDC
   .IFTF
   JSR R5,$INTSV
   .IF DF L$$SI1
   .WORD PRI
   .IFF
   .WORD ^C<PRI>&PR7
   .ENDC
   .IFT
   .IF B <PSWSV>
```

```
  MOV TEMP,R4
  .IFF
  MOV PSWSV,R4
  .ENDC
  BIC #177760,R4
  ASL R4
  .ENDC
  .ENDC
  GTUCB$ UCBSV,NCTRLR
  .ENDM
```

C.3.10 MFPS/MTPS Macros

These macros either read or write processor status.

```
  .IF NDF L$$SI1
  .MACRO MFPS DST
  MOVB @#PS,DST
  .ENDM
  .MACRO MTPS SRC
  .IF IDN <#0>,<SRC>
  CLRB @#PS
  .IFF
  MOVB SRC,@#PS
  .ENDC
  .ENDM
  .ENDC
```

C.3.11 RETURN Macro

RETURN generates an RTS PC instruction.

```
  .MACRO RETURN
  RTS PC
  .ENDM
```

C.3.12 SAVNR Macro

SAVNR causes a jump to a subroutine to save nonvolatile registers.

```
  .MACRO SAVNR
  JSR R5,$SAVNR
  .ENDM
```

C.3.13 SCBLB Macro

SCBLB generates a general status control block reference label.

```
  .IF DF E$$DVC
  .MACRO SCBLB NUM,NAM
  .WORD $'NAM'NUM
  .ENDM
  .ENDC
```

C.3.14 SETD Macro

SETD sets the floating-point processor to double precision mode.

```
.MACRO SETD
.WORD 170011
.ENDM
```

C.3.15 SOB Macro

SOB generates a decrement loop.

```
.IF NDF R$$EIS
.MACRO SOB A,B
DEC A
BNE B
.ENDM
.ENDC
```

C.3.16 STD Macro

STD stores a single or double proecision word from the floating-point processor.

```
.MACRO STD A,B
.NTYPE N,A
.NTYPE M,B
.WORD 174000+<N*64.>+M
.ENDM
```

C.3.17 STFPS Macro

STFPS stores the floating-point processor's status.

```
.MACRO STFPS A
.NTYPE N,A
.WORD 170200+N
.ENDM
```

C.3.18 STST Macro

STST stores the floating-point exception code and exception address pointer.

```
.MACRO STST A
.WORD 170337
.WORD FLSTS
.ENDM
.ENDC
.IIF NDF S$$YDF, .LIST
```

C.3.19 SWSTK$ Macro

SWSTK$ calls $SWSTK to switch system states.

```
  .MACRO SWSTK$ ARG
  CALL $SWSTK,ARG
  .ENDM
  .IF DF F$$LPP
```

C.3.20 LDD Macro

LDD loads double precision floating-point word into the accumulator.

```
  .MACRO LDD A,B
  .NTYPE N,A
  .NTYPE M,B
  .WORD 172400+<M*64.>+N
  .ENDM
```

C.3.21 LDFPS Macro

LSFPS loads floating-point status.

```
  .MACRO LDFPS A
  .IF IDN <A>,<@H.FPSA(R2)>
  .WORD 170100+72
  .WORD H.FPSA
  .IFF
  .NTYPE N,A
  .WORD 170100+N
  .ENDC
  .ENDM
```

C.4 FILES-11 HEADER OFFSETS MACRO DEFINITIONS

C.4.1 FHDO1$ Macro

FHDO1$ defines Files-11 offsets.

```
  .MACRO FHDO1$ OFFSET
  .MCALL DEF$I,OFFSET,DEFIN$
  .IF DF,H.FPRO
  .ERROR
  .ENDC

Header Area Offsets

  DEF$I 0
  OFFSET H.IDOF,1          ;IDENT area offset in words
  OFFSET H.MPOF,1          ;Map area offset in words
  OFFSET H.FNUM,2          ;File number
  OFFSET H.FSEQ,2          ;File sequence number
  OFFSET H.FLEV,2          ;Structure level and system number
  OFFSET H.FOWN            ;Owner of file consisting of:
  OFFSET H.PROG,1          ; Programmer number
```

```
  OFFSET H.PROJ,1          ; Project number
  OFFSET H.FPRO,2          ; File protection code

File Protection Bits

  DEFIN$ FP.RDV,1          ;Read access allowed if clear
  DEFIN$ FP.WRV,2          ;Write access allowed if clear
  DEFIN$ FP.EXT,4          ;Extend access allowed if clear
  DEFIN$ FP.DEL,10          ;Delete allowed if clear
  DEFIN$ FP.RAT,1          ;Read attributes allowed if clear
  OFFSET H.FCHA            ;File characteristics code
                                ;  consisting of:
  OFFSET H.UCHA,1          ; User controlled characteristics byte

Bit Definitions for User Controlled Characteristics Byte

  DEFIN$ UC.CON,200        ;File is logically contiguous if set
  DEFIN$ UC.DLK,100        ;Deaccess lock set if bit is set
  OFFSET H.SCHA,1          ;System controlled characteristics
                                ; byte

Bit Definitions for System Controlled Characteristics Byte

  DEFIN$ SC.MDL,200        ;Marked for delete if set
  DEFIN$ SC.BAD,100        ;Bad data block in file if set
  OFFSET H.UFAT,32.        ;User file attributes
  OFFSET S.HDHD            ;Size in bytes of header area

Ident Area Offsets

        DEF$I 0
  OFFSET I.FNAM,6          ;File name in RAD50
  OFFSET I.FTYP,2          ;File type in RAD50
  OFFSET I.FVER,2          ;File version number in binary
  OFFSET I.RVNO,2          ;Revision number
  OFFSET I.RVDT,7          ;Revision date
  OFFSET I.RVTI,6          ;Revision time
  OFFSET I.CRDT,7          ;Creation date
  OFFSET I.CRTI,6          ;Creation time
  OFFSET I.EXDT,7          ;Expiration date
  OFFSET ,1                ;Round up to word boundary
  OFFSET S.IDHD            ;Size in bytes of IDENT area
  DEFIN$ I.DASZ,7          ;Number of bytes in date string
  DEFIN$ I.TISZ,6          ;Number of bytes in time string
```

C.4.2 FHDOF$ Macro

FHDOF$ defines Files-11 header offsets.

```
        FHDOF$                   ;Define offsets locally
  FHDOF$ DEF$L             ;Define offsets locally
  FHDOF$ DEF$G             ;Define offsets globally
  .MACRO FHDOF$ GLOBAL
  .MCALL FHDO1$
  ...GBL=0
  .IF B,GLOBAL
  FHDO1$ DEF$L
  .IFF
  .IF IDN,<GLOBAL>,<DEF$G>
  ...GBL=1
  .ENDC
  FHDO1$ GLOBAL
```

```
  .ENDC
  .IF DIF,<GLOBAL>,<DEF$N>
  .MACRO FHDOF$ ARG1        ;Redefine macro
  .ENDM FHDOF$
  .ENDC
  .ENDM FHDOF$

Map Area Offset

  DEF$I 0
  OFFSET M.ESQN,1           ;Extension sequence number
  OFFSET M.ERVN,1           ;Extension relative volume number
  OFFSET M.EFNU,2           ;Extension file number
  OFFSET M.EFSQ,2           ;Extension file sequence number
  OFFSET M.CTSZ,1           ;Block count field size
  OFFSET M.LBSZ,1           ;Logical block number field size
  OFFSET M.USE,1            ;Words in use in the map
  OFFSET M.MAX,1            ;Max number of words available in map
  OFFSET M.RTRV             ;Start of retrieval pointers
  OFFSET S.MPHD             ;Size in bytes of the map area

Checksum for File Header

  DEFIN$ H.CKSM,510.        ;Sum of words 0-255.
  .IF DIF,<OFFSET>,<DEF$N>
  .MACRO FHDO1$ ARG1
  .ENDM FHDO1$
  .ENDC
        .ENDM FHDO1$
```

C.4.3 HMBOF$ And HMBO1$ Macros

HMBOF$ and HMBO1$ define Files-11 home block offsets.

```
  HMBOF$                    ;Define offsets locally
  HMBOF$ DEF$L              ;Define offsets locally
  HMBOF$ DEF$G              ;Define offsets globally
  .MACRO HMBOF$ GLOBAL
  .MCALL HMBO1$
  ...GBL=0
  .IF B,GLOBAL
  HMBO1$ DEF$L
  .IFF
  .IF IDN,<GLOBAL>,<DEF$G>
  ...GBL=1
  .ENDC
  HMBO1$ GLOBAL
  .ENDC
  .IF DIF,<GLOBAL>,<DEF$N>
  .MACRO HMBOF$ ARG1
  .ENDM HMBOF$
  .ENDC
  .ENDM HMBOF$
  .MACRO HMBO1$ OFFSET
  .MCALL DEF$I,OFFSET,DEFIN$
  DEF$I 0
  OFFSET H.IBSZ,2           ;Index bit map size
  OFFSET H.IBLB,4           ;Index bit map LBN
  OFFSET H.FMAX,2           ;Maximum number of files on volume
  OFFSET H.SBCL,2           ;Storage bit map cluster factor
  OFFSET H.DVTY,2           ;Disk device type
  OFFSET H.VLEV,2           ;Structure  level
```

```
  OFFSET H.VNAM,12.       ;Volume name - ASCII
  OFFSET ,4               ;RESERVED
  OFFSET H.VOWN,2         ;Volume owner's UIC
  OFFSET H.VPRO,2         ;Volume protection code
        OFFSET H.VCHA,2         ;Volume characteristics

New Home Block Information Down to H.FIEX

  OFFSET H.DFPR,2         ;Default file protection
  .IF DF,H.FPRO
  .ERROR                  ;Tried to multiply define H.FPRO
  .ENDC
  .IF DF,R$$11M
  OFFSET H.VFSQ,2         ;Volume file sequence number
                                ;Updated by dismount
  .IFF
  OFFSET ,2               ;Not used
  .ENDC
  OFFSET ,4               ;Not used
  OFFSET H.WISZ,1         ;Window size for all files on volume
  OFFSET H.FIEX,1         ;Default file extend in blocks
  OFFSET H.LRUC,1         ;Number of entries in directory LRU
  OFFSET ,11.             ;Available
  OFFSET H.CHK1,2         ;Checksum of words 0-28.
  OFFSET H.VDAT,14.       ;Creation date
  OFFSET ,398.            ;Reserved for relative volume table
  OFFSET H.INDN,12.       ;System independent volume name
  OFFSET H.INDO,12.       ;System independent owner name
  OFFSET H.INDF,12.       ;System independent format type
  OFFSET ,2               ;Not used
  OFFSET H.CHK2,2         ;Checksum of words 0-255.
  .IF DIF,<OFFSET>,<DEF$N>
  .MACRO HMBO1$ ARG1
  .ENDM HMBO1$
  .ENDC
  .ENDM HMBO1$
  .IIF NDF,S$$YDF,.LIST
```

C.5 FILE CONTROL SERVICES MACRO EXPANSIONS

C.5.1 BDOFF$ Macro

BDOFF$ generates the buffer descriptor offsets. The same type of call occurs as for file descriptor offsets.

```
        .MACRO BDOFF$ OFFSET
        .MCALL OFFSET,DEF$I
        DEF$I 0
        OFFSET ,4
        OFFSET B.VBN,4          ;Virtual block number for this buffer
  OFFSET B.BBFS,2         ;NUMBER OF bytes read or written
        OFFSET B.NXBD,2         ;Pointer to next buffer descriptor
        OFFSET ,1               ;Spare byte
        OFFSET B.BFST,1         ;Buffer status byte
        OFFSET ,2
        OFFSET S.BFHD
        .IIF IDN,<DEF$N>,<OFFSET>,.MEXIT
        .MACRO BDOFF$ ARG
        .ENDM BDOFF$
         ENDM BDOFF$
```

C.5.2 CBYTE$ Macro

CBYTE$ conditionally assembles a .BYTE directive for VAR at the specified offset from the beginning of the FDB.

```
 .MACRO CBYTE$ VAR,OFFSET
 .IF NB,VAR              ;If non null
...PC2=.                 ;Save PC
.=...PC1+OFFSET          ;Set PC to specified offset
.BYTE VAR                ;Assemble the byte
.=...PC2                 ;Restore PC
.ENDC
.ENDM CBYTE$
```

C.5.3 CLOSE$ Macro

CLOSE$ closes a file.

```
 .MACRO CLOSE$ FDB,ERR
 .MCALL LDFDB$,ERR$
 LDFDB$ FDB
 .GLOBL .CLOSE
 JSR PC,.CLOSE
 ERR$ ERR
 .ENDM CLOSE$
```

C.5.4 CMOV$2 Macro

CMOV$2 conditionally moves two words from VAR to the specified offset of R0.

```
 .MACRO CMOV$2 VAR,OFFSET
 .IIF B,VAR,.MEXIT
 MOV VAR,-(SP)            ;Address of 2 words to state
 MOV @(SP),OFFSET(R0)     ;First word to FDB
 ADD #2,(SP)             ;Calculate address of 2nd word
 MOV @(SP)+,OFFSET+2(R0) ;2nd word to FDB
 .ENDM CMOV$2
```

C.5.5 CMOV$B Macro

CMOV$B conditionally generates a MOVE BYTE instruction to move a byte to the specified offset of R0.

```
 .MACRO CMOV$B VAR,OFFSET
 .IF IDN,<#0>,<VAR>
 CLRB OFFSET(R0)
 .MEXIT
 .ENDC
 .IIF NB,VAR, MOVB VAR,OFFSET(R0)
 .ENDM CMOV$B
```

C.5.6 CMOV$W Macro

CMOV$W conditionally moves a word to the specified offset of R0.

```
        .MACRO CMOV$W VAR,OFFSET
        .IF IDN,<#0>,<VAR>
        CLR OFFSET(R0)
        .MEXIT
        .ENDC
        .IIF NB,VAR, MOV VAR,OFFSET(R0)
        .ENDM CMOV$W
```

C.5.7 CWORD$ Macro

CWORD$ conditionally assembles a .WORD directive for VAR at the specified offset for the beginning of the FDB.

```
         MACRO CWORD$ VAR,OFFSET
        .IF NB,VAR              ;If VAR is not null
        ...PC2=.                ;Save the PC
        .=...PC1+OFFSET         ;Set the PC to the specified offset
        .WORD VAR               ;Assemble the word
        .=...PC2                ;Restore the PC
        .ENDC
        .ENDM CWORD$
```

C.5.8 DEF$G Macro

DEF$G defines offsets globally.

```
  .MACRO DEF$G VAR,SIZ    ;Define global offset
  .MCALL DEF$L
  .IIF NB,VAR,.GLOBL VAR
  DEF$L VAR,SIZ
  .ENDM DEF$G
```

C.5.9 DEF$I Macro

```
  .MACRO DEF$I IVAL       ;Initialize definition
  ...TPC=^O<IVAL>  ;Macros program counter
  .ENDM DEF$I
```

C.5.10 DEF$L Macro

```
  .MACRO DEF$L SYM,SIZ
  .IF NB,SYM
  SYM=^O<...TPC>
  .ENDC
  .IF NB,SIZ
  ...TPC=^O<...TPC+SIZ>
  .ENDC
  .ENDM DEF$L
```

C.5.11 DEF$N Macro

DEF$N updates ...TPC but does not define the symbol.

```
.MACRO DEF$N VAR,SIZ    ;Define no offset-calculate the size
.MCALL DEF$L
DEF$L ,SIZ
.ENDM DEF$N
```

C.5.12 DEFIN$ Macro

DEFIN$ equates the symbol with its specified value and defines it globally if ...GBL = 1. Otherwise, it locally defines the symbol.

```
        .MACRO DEFIN$ SYM,VAL
        .IIF EQ,...GBL-1,.GLOBL SYM
        SYM=^O<VAL>
        .ENDM DEFIN$
```

C.5.13 DELET$ Macro

DELET$ deletes a file.

```
        .MACRO DELET$ FDB,ERR
        .MCALL LDFDB$,ERR$
        LDFDB$ FDB
        .GLOBL .DELET
        JSR PC,.DELET
        ERR$ ERR
        .ENDM DELET$
```

C.5.14 FCSBT$ Macro

FCSBT$ defines FCS bits and values locally or globally. Call with DEF$G for global definitions; conventionally called with DEF$L for local, but anything not equal to DEF$G will do

```
        .MACRO          FCSBT$ GLOBL
        .MCALL DEFIN$
        ...GBL=0
        .IIF IDN,<GLOBL>,<DEF$G>,...GBL=1
```

F.RATT bits - Record Attribute Byte

```
        DEFIN$ FD.FTN,1             ;FORTRAN carriage control bit
        DEFIN$ FD.CR,2              ;Insert carriage returns between
                                    ;records
        DEFIN$ FD.PRN,4             ;R.SEQ/VFC print file
        DEFIN$ FD.BLK,10            ;1 if records cannot cross block
                                    ;boundaries
```

F.RACC bits - Record Access Byte

```
        DEFIN$ FD.RWM,1             ;On if read/write, off if GET/PUT
        DEFIN$ FD.RAN,2             ;On if random, off if sequential
        DEFIN$ FD.PLC,4             ;On if partial locate, off if
                                    ;sequential
        DEFIN$ FD.INS,10            ;On if put sequential insert
                                    ;mode; off if truncate mode
```

```
F.RCTL bits - Record Control Byte - Device Characteristics

        DEFIN$ FD.REC,1             ;On if record oriented device,
                                    ;off if block oriented
        DEFIN$ .D.CCL,2             ;On if carriage control output
         device;
                                    ;off if not
        DEFIN$ FD.TTY,4             ;On if this device is a TTY
        DEFIN$ FD.DIR,10            ;On if directory device, off if
                                    ;not
        DEFIN$ FD.SDI,20            ;On if single directory device
        DEFIN$ FD.SQD,40            ;On if sequential device
        DEFIN$ FD.ISP,2000          ;Input spooling
        DEFIN$ FD.OSP,4000          ;Output spooling
        DEFIN$ FD.PSE,10000
        DEFIN$ FD.COM,20000
        DEFIN$ FD.F11,40000
        DEFIN$ FD.MNT,100000

N.STAT Bits - File Name Block Status Word - Set by parse

        DEFIN$ NB.VER,1             ;Set if file version was explicit
        DEFIN$ NB.TYP,2             ;Set if file type was explicit
        DEFIN$ NB.NAM,4             ;Set if file name was explicit
        DEFIN$ NB.SVR,10            ;Set if * in version field
        DEFIN$ NB.STP,20            ;Set if * in type field
        DEFIN$ NB.SNM,40            ;Set if * in name field
        DEFIN$ NB.DIR,100           ;Set if explicit directory
                                    ;specified
        DEFIN$ NB.DEV,200           ;Set if device name was explicit
        DEFIN$ NB.SD1,400           ;Set if * in project number of
         PPN
        DEFIN$ NB.SD2,1000          ;Set if * in programmer number of
         PPN


***** NOTE: MORE BITS IN N.STAT ARE LOCALLY USED BY FCS

Check Definition Section in FCS
F.RTYP Values - Record Type Byte
Note: These are values, not bits

        DEFIN$ R.FIX,1              ;Fixed length records
        DEFIN$ R.VAR,2              ;Variable length records
        DEFIN$ R.SEQ,3              ;Sequenced records

F.FACC Bits - File Access Byte

        DEFIN$ FA.RD,1              ;Set if read only
        DEFIN$ FA.WRT,2             ;Set if accessed for write
        DEFIN$ FA.EXT,4             ;Set if access for extend
        DEFIN$ FA.CRE,10            ;Set if creating new file
        DEFIN$ FA.TMP,20            ;Set if creating temp file
        DEFIN$ FA.SHR,40            ;Set if shared access

The following two names apply to the same control bit in F.FACC:

        FA.APD is only used if the file is an existing file
        FA.CRE=0);
        FA.NSP is only used if the file is being created
        (FA.CRE=1)
```

```
        DEFIN$ FA.APD,100               ;Set if appending (POSIT to EOF)
        DEFIN$ FA.NSP,100               ;Set if inhibiting supersede on
                                        ;file creation
        DEFIN$ FO.RD,FA.RD              ;Open for read
        DEFIN$ FO.WRT,FA.WRT!FA.EXT!FA.CRE ;Open for write (create)
        DEFIN$ FO.APD,FA.WRT!FA.EXT!FA.APD ;Open for append
        DEFIN$ FO.MFY,FA.WRT            ;Open for modify
         FO.UPD,FA.WRT!FA.EXT ;Open for update
```

Bits in F.ACTL in the FDB - Several of these bits also have local definitions in FCSPRE.MAC; however, all definitions are mutually exclusive.

```
        DEFIN$ FA.ENB,100000            ;Enable use of F.ACTL word
        DEFIN$ FA.WCK,20000             ;Enable write check
        DEFIN$ FA.SEQ,40000             ;Enable sequential processing only
        DEFIN$ FA.DLK,1000              ;Enable no lock on abnormal close
        DEFIN$ FA.RWD,4000              ;Enable rewind control for magtape
        DEFIN$ FA.POS,10000             ;File creation position control for
                                        ;magtape
        DEFIN$ FA.EXC,2000              ;Exclusive use bit
```

F.CHR Bits - ACP Global Volume Characteristics

```
        DEFIN$ CH.AND,1                 ;ANSI 'D' format
```

F.MBFG Bits - Multiple Buffering Flag Word -

```
        DEFIN$ FD.RAH,1                 ;Read ahead if set - this or write
                                        ;behind
        DEFIN$ FD.WBH,2                 ;Write behind if set - not both
```

Note: More bits in F.MBFG used in FCS locally

.CTRL Function Codes

```
        DEFIN$ FF.RWD,1                 ;Rewind
        DEFIN$ FF.POE,2                 ;Position to end of volume (set)
        DEFIN$ FF.NV,3                  ;Next volume
        DEFIN$ FF.SPC,4                 ;Space
        DEFIN$ FF.CHR,5                 ;Get APC characteristics
        DEFIN$ FF.RWF,6                 ;ERS rewind file
        .MACRO FCSBT$ ARG
        .ENDM FCSBT$
        .ENDM FCSBT$
```

C.5.15 FCSMC$ Macro

FCSMC$ executes an MCALL for all the FCS macros.

```
        .MACRO FCSMC$
        .MCALL OPEN$R,OPEN$W,OPEN$M,OPEN$U,OPEN$A,CLOSE$
        .MCALL OPNS$R,OPNS$W,OPNS$M,OPNS$U,OPNS$A
        .MCALL READ$,WRITE$,WAIT$,GET$,PUT$,DELET$,FINIT$
        .MCALL FSRSZ$,FDBDF$,FDAT$A,FDRC$A,FDOP$A,FDBF$A,FDBK$A
        .MCALL FDAT$R,FDRC$R,FDOP$R,FDBF$R,FDBK$R,NMBLK$
        .MACRO FCSMC$
        .ENDM FCSMC$
        .ENDM FCSMC$
```

C.5.16 FDAT$A Macro

FDAT$A initializes the file attribute section of the FDB at assembly time.

```
        .MACRO FDAT$A RTYP,RATT,RSIZ,CNTG,ALOC
        .MCALL FDOFF$,CBYTE$,CWORD$
        FDOFF$ DEF$L
        CBYTE$ <RTYP>,F.RTYP
        CBYTE$ <RATT>,F.RATT
        CWORD$ <RSIZ>,F.RSIZ
        CWORD$ <CNTG>,F.CNTG
        CWORD$ <ALOC>,F.ALOC
        .ENDM FDAT$A
```

C.5.17 FDAT$R Macro

FDAT$R initializes the file attribute section of the FDB at run time.

```
        .MACRO FDAT$R FDB,RTYP,RATT,RSIZ,CNTG,ALOC
        .MCALL LDFDB$,CMOV$W,CMOV$B
        LDFDB$ FDB                      ;Load FDB address
        CMOV$B RTYP,F.RTYP
        CMOV$B RATT,F.RATT
        CMOV$W RSIZ,F.RSIZ
        CMOV$W CNTG,F.CNTG
        CMOV$W ALOC,F.ALOC
        .ENDM FDAT$R
```

C.5.18 FDBDF$ Macro

FDBDF$ allocates space at assembly time for the FDB.

```
        .MACRO FDBDF$
        .MCALL FDBSZ$
        FDBSZ$
        ...PC1=.
        .BLKB S.FDB
        .ENDM FDBDF$
```

C.5.19 FDBF$A Macro

FDBF$A intializes the buffer descriptor section of the FDB at assembly time.

```
        .MACRO FDBF$A EFN,OVBS,MBCT,MBFG
        .MCALL FDOFF$,CBYTE$,CWORD$
        FDOFF$ DEF$L
        CBYTE$ <EFN>,F.EFN
        CWORD$ <OVBS>,F.OVBS
        CBYTE$ <MBCT>,F.MBCT
        CBYTE$ <MBFG>,F.MBFG
        .ENDM FDBF$A
```

C.5.20 FDBF$R Macro

FDBF$R initializes the block buffer section of the FDB at run time.

```
        .MACRO FDBF$R FDB,EFN,OVBS,MBCT,MBFG
         MCALL LDFDB$,CMOV$W,CMOV$B
        LDFDB$ FDB
        CMOV$B EFN,F.EFN              ;Event flag to use
        CMOV$W OVBS,F.OVBS            ;Size of block buffer
        CMOV$B MBCT,F.MBCT            ;No. of buffers
        CMOV$B MBFG,F.MBFG            ;Read ahead or write behind
        .ENDM FDBF$R
```

C.5.21 FDBK$A Macro

FDBK$A initializes the block access section of the FDB at assembly time.

```
        .MACRO FDBK$A BKAD,BKSZ,BKVB,BKEF,BKST,BKDN
        .MCALL FDOFF$,CBYTE$,CWORD$
        FDOFF$ DEF$L
        CWORD$ <BKAD>,F.BKDS+2
        CWORD$ <BKSZ>,F.BKDS
        CWORD$ <BKVB>,F.BKVB+2        ;Store low order only
        CBYTE$ <BKEF>,F.BKEF
        CWORD$ <BKST>,F.BKST
        CWORD$ <BKDN>,F.BKDN
        .ENDM FDBK$A
```

C.5.22 FDBK$R Macro

FDBK$R initializes the block access section of the FDB at run time.

```
        .MACRO FDBK$R FDB,BKAD,BKSZ,BKVB,BKEF,BKST,BKDN
        .MCALL LDFDB$,CMOV$B,CMOV$W,CMOV$2
        LDFDB$ FDB
        CMOV$W BKAD,F.BKDS+2          ;Block address-memory buffer
        CMOV$W BKSZ,F.BKDS            ;Size of transfer in bytes
        CMOV$2 BKVB,F.BKVB            ;Address of 2 word virtual
                                      ;Block number, move both words
        CMOV$B BKEF,F.BKEF            ;Event flag
        CMOV$W BKST,F.BKST            ;ADR OF I/O STATUS BLOCK
        CMOV$W BKDN,F.BKDN            ;Address of I/O done AST
        .ENDM FDBK$R
```

C.5.23 FDBSZ$ Macro

FDBSZ$ defines the size of the FDB as a local symbol (S.FDB).

```
        .MACRO FDBSZ$             ;Define S.FDB as size of FDB
        .IIF DF,S.FDB,.MEXIT
        .MCALL FDOFF$,DEF$L
        FDOFF$ DEF$N              ;Invoke offset definitions but do
                                  ; not actually define the offset
                                  ; names
        DEF$L S.FDB               ;Now define S.FDB
        .ENDM FDBSZ$
```

C.5.24 FDOP$A Macro

FDOP$A initializes the file open section of the FDB at assembly time.

```
.MACRO FDOP$A LUN,FNPT,DFNB,FACC,FACTRL
.MCALL FDOFF$,CBYTE$,CWORD$
FDOFF$ DEF$L
CBYTE$ <LUN>,F.LUN
CWORD$ <FNPT>,F.DSPT
CWORD$ <DFNB>,F.DFNB
CBYTE$ <FACC>,F.FACC
CWORD$ <FACTRL>,F.ACTL
.ENDM FDOP$A
```

C.5.25 FDOP$R Macro

FDOP$R initializes the file open section of the FDB at run time.

```
.MACRO FDOP$R FDB,LUN,FNPT,DFNB,FACC,FACTRL
.MCALL LDFDB$,CMOV$W,CMOV$B
LDFDB$ FDB
CMOV$B LUN,F.LUN
CMOV$W FNPT,F.DSPT
CMOV$W DFNB,F.DFNB
CMOV$B FACC,F.FACC
CMOV$W FACTRL,F.ACTL
.ENDM FDOP$R
```

C.5.26 FDRC$A Macro

FDRC$A initializes the record access section of the FDB at assembly time.

```
.MACRO FDRC$A RACC,URBA,URBS
.MCALL FDOFF$,CBYTE$,CWORD$
FDOFF$ DEF$L
CBYTE$ <RACC>,F.RACC
CWORD$ <URBA>,F.URBD+2
CWORD$ <URBS>,F.URBD
.ENDM FDRC$A
```

C.5.27 FDRC$R Macro

FDRC$R initializes the record access section of the FDB at run time.

```
.MACRO FDRC$R FDB,RACC,URBA,URBS
.MCALL LDFDB$,CMOV$W,CMOV$B
LDFDB$ FDB
CMOV$B RACC,F.RACC
C..V$W URBA,F.URBD+2
CMOV$W URBS,F.URBD
.ENDM FDRC$R
```

C.5.28 FDOF$L Macro

FDOF$L calls FDOFF$ to locally define offsets. This action occurs only once.

```
        .MACRO FDOF$L
        .MCALL FDOFF$
        FDOFF$ DEF$L
        .ENDM FDOF$L
```

C.5.29 FDOFF$ Macro

FDOFF$ is the File Descriptor Block definition macro. It is called with one of the following macro names: DEFL, DEFG, or DEF$N. DEF$L defines local offsets, DEF$G defines total offsets, and DEF$N defines the size of the FDB.

```
        .MACRO FDOFF$ OFFSET
        .MCALL OFFSET,DEF$I,NBOFF$
        NBOFF$ OFFSET
        DEF$I 0                 ;Initialize the definition macro

File Attribute Section

        OFFSET F.RTYP,1         ;Record type
        OFFSET F.RATT,1         ;Record attributes
        OFFSET F.RSIZ,2         ;Record size
        OFFSET F.HIBK,4         ;Highest virtual block no. allocated
        OFFSET F.EFBK,4         ;End of file block number
        OFFSET F.FFBY,2         ;First free byte in last block
        OFFSET S.FATT           ;Size of file attribute section

Record Access Section

        OFFSET F.RACC,1         ,Record access
        OFFSET F.RCTL,1         ;Record control
        OFFSET F.BKDS           ;Block I/O - buffer descriptor
        OFFSET F.URBD,4         ;User's record buffer descriptor
        OFFSET F.BKST           ;Block I/O - I/O status block address
        OFFSET F.NRBD,2         ;Next record buffer descriptor
        OFFSET F.BKDN           ;Block I/O - I/O done AST address
        OFFSET ,2               ;2nd word of NRBD
        OFFSET F.OVBS           ;Override block buffer size
        OFFSET F.NREC,2         ;Next record address in block buffer
        OFFSET F.EOBB,2         ;End of block buffer
        OFFSET F.CNTG           ;Size in blocks of contiguous file
        OFFSET F.RCNM,2         ;Record number for random records
        OFFSET F.STBK           ;Address to read in statistics block
        OFFSET ,2               ;2nd word of RCNM
        OFFSET F.ALOC,2         ;Allocate this much space when need
                                ;To extend, + = contig, - = not
File Open Section

        OFFSET F.LUN,1          ;Logical unit number
        OFFSET F.FACC,1         ;File access
        OFFSET F.DSPT,2         ;File descriptor pointer
        OFFSET F.DFNB,2         ;Default file name block address
```

```
Block Buffer Section

        OFFSET F.BKEF           ;Block I/O - event flag number
        OFFSET F.EFN,1          ;Event flag used in QIO
        OFFSET F.BKP1,1         ;Bookkeeping bits
        OFFSET F.ERR,2          ;1st byte error return code
                                ;2nd byte for QIO error indicator
        OFFSET F.MBCT,1         ;Number of buffers to use (desired)
        OFFSET F.MBC1,1         ;Number of buffers in use
        OFFSET F.MBFG,1         ;Multiple buffering control flags
        OFFSET F.BGBC,1         ;Big buffer block count (size in
                                ; blocks)
        OFFSET F.VBSZ,2         ;Virtual block size in bytes
        OFFSET F.BBFS,2         ;Block buffer size
        OFFSET F.BKVB           ;Block I/O - virtual block number
        OFFSET F.VBN,4          ;Virtual block number
        OFFSET F.BDB,2          ;Block buffer descriptor block
        OFFSET F.SPDV,2         ;Spool device indicator
        OFFSET F.SPUN,1         ;Spool unit designator
        OFFSET F.CHR,1          ;ACP volume characteristics summary
                                ; byte
        OFFSET F.ACTL,2         ;Access control word
        OFFSET F.SEQN,2         ;Sequence number for sequenced files

File Name Block Section

        OFFSET F.FNB,S.FNB      ;Beginning of file name block
        .IIF IDN,<OFFSET>,<DEF$N>,.MEXIT
        .IF IDN,<OFFSET>,<DEF$G>
        .GLOBL F.FNAM,F.FTYP,F.FVER,F.DVNM,F.UNIT
        .ENDC
        F.FNAM=N.FNAM+F.FNB
        F.FTYP=N.FTYP+F.FNB
        F.FVER=N.FVER+F.FNB
        F.DVNM=N.DVNM+F.FNB
        F.UNIT=N.UNIT+F.FNB
        OFFSET S.FDB            ;Size of FDB
        .MACRO FDOFF$ ARG
        .ENDM FDOFF$
        .ENDM FDOFF$
```

C.5.30 FDSOF$ Macro

FDSOF$ defines offsets relative to the file descriptor pointer, F.DSPT.

```
  .MACRO FDSOF$ OFFSET
  .MCALL OFFSET,DEF$I,DEF$L
  DEF$I 0
  OFFSET N.DEVD,4  ;Device string descriptor
  OFFSET N.DIRD,4  ;Directory string descriptor
  OFFSET N.FNMD,4  ;File name string descriptor
  OFFSET S.FIDS
  .IF IDN,<DEF$N>,<OFFSET>
  DEF$L S.FIDS
  .MEXIT
  .ENDC
  .MACRO FDSOF$ ARG
  .ENDM FDSOF$
  .ENDM FDSOF$
```

C.5.31 FINIT$ and FSRSZ$ Macros

FINIT$ and FSRSZ$ initialize the file control services.

```
        .MACRO FINIT$
        .GLOBL .FINIT
        JSR PC,.FINIT
        .ENDM FINIT$
        .MACRO FSRSZ$ NFILES,BFSPAC,PSECT
        .MCALL BDOFF$,DEF$L
        .IF NDF,S.BFHD
        BDOFF$ DEF$N
        DEF$L S.BFHD
        .ENDC
        .GLOBL .FSRCB
        .PSECT $$FSR1,GBL,OVR,D
        .IF NB,<BFSPAC>
        .BLKB NFILES*S.BFHD+<BFSPAC>
        .IFF
        .BLKB NFILES*<S.BFHD+512.>
        .ENDC
        .PSECT PSECT
        .ENDM FSRSZ$
```

C.5.32 FSROF$ Macro

FSROF$ generates the file storage region offsets.

```
        .MACRO FSROF$ OFFSET
        .MCALL OFFSET,DEF$I,DEF$L

Define the Offsets for $$FSR2

        DEF$I 0
        OFFSET ,4                       ;List head for allocation
        OFFSET A.BFSR,2                 ;First address in FSR1
        OFFSET A.EFSR,2                 ;Last address in FSR1

        ***** DO NOT SEPARATE THE FOLLOWING 2 DEFINITIONS
        OFFSET A.OWUI,2;UIC of owner (from task header)
        OFFSET A.FIPR,2                 ;Default file protection word
        ***** DO NOT SEPARATE THE PRECEEDING 2 DEFINITIONS

        ***** DO NOT SEPARATE THE FOLLOWING 3 DEFINTIONS
        OFFSET A.DPB,24.                ;QI/O DPB and scratch area
        OFFSET A.IOST,4                 ;Scratch I/O status block
        OFFSET A.DFDR,24.               ;Default directory information
        ***** DO NOT SEPARATE THE PRECEEDING 3 DEFINITIONS

        OFFSET A.DFBC,2                  ;Default buffer count (multiple
                                         ;buffering)
        OFFSET A.DFUI,2                  ;Default UIC (task UIC)
        OFFSET S.FSR2                    ;Size of file storage region 2
        DEF$L S.FSR2

Define Offsets Relative to Beginning of the Default Directory Info

DEF$I 0
OFFSET ,14.
OFFSET D.DFID,6                          ;Default directory ID
OFFSET D.DFDV,2                          ;Device name for default
                                         ;directory ID
```

```
OFFSET D.DFUN,2                         ;Unit number for default
                                        ;directory ID
.IIF IDN,<DEF$N>,<OFFSET>,.MEXIT
.MACRO FSROF$ ARG
.ENDM FSROF$
.ENDM FSROF$
```

C.5.33 GET$ Macro

GET$ gets a record from a file.

```
        .MACRO GET$ FDB,INADR,MAXCNT,ERR
        .MCALL LDFDB$,CMOV$W,ERR$
        LDFDB$ FDB
        CMOV$W INADR,F.URBD+2   ;User record buffer address
        CMOV$W MAXCNT,F.URBD    ;User record buffer size
        .GLOBL .GET
        JSR PC,.GET
        ERR$ ERR
        .ENDM GET$
```

C.5.34 GET$R Macro

GET$R gets a record in random mode.

```
        .MACRO GET$R FDB,INADR,MAXCNT,LRCNM,HRCNM,ERR
        .MCALL LDFDB$,CMOV$W,ERR$
        LDFDB$ FDB
        CMOV$W INADR,F.URBD+2   ;User record buffer address
        CMOV$W MAXCNT,F.URBD    ;User record buffer size
        CMOV$W LRCNM,F.RCNM+2   ;Low order record number
        CMOV$W HRCNM,F.RCNM     ;High order record number
        .GLOBL .GET
        JSR PC,.GET
        ERR$ ERR
        .ENDM GET$R
```

C.5.35 GET$S Macro

GET$S gets a record in strictly sequential mode.

```
        .MACRO GET$S FDB,INADR,MAXCNT,ERR
        .MCALL LDFDB$,CMOV$W,ERR$
        LDFDB$ FDB
        CMOV$W INADR,F.URBD+2   ;User record buffer address
        CMOV$W MAXCNT,F.URBD    ;User record buffer size
        .GLOBL .GETSQ
        JSR PC,.GETSQ
        ERR$ ERR
        .ENDM GET$S
```

C.5.36 NBOF$L Macro

NBOF$L calls NBOFF$ to define offsets as local symbols. This action occurs only once.

```
.MACRO NBOF$L
.MCALL NBOFF$
NBOFF$ DEF$L
.ENDM NBOF$L
```

If the FDB parameter is null or R0, LDFDB$ does not move FDB to R0. Otherwise, it does move the FDB to R0.

```
.MACRO LDFDB$ FDB
.IIF B,FDB,.MEXIT       ;If null then exit
.NTYPE PAR$$$,FDB
.IIF EQ,PAR$$$,.MEXIT   ;If R0 then exit
MOV FDB,R0              ;Else generate the move
.ENDM LDFDB$
```

C.5.37 NBOFF$ Macro

NBOFF$ generates the file name block offsets.

```
.MACRO NBOFF$ OFFSET
.MCALL OFFSET,DEF$I,DEF$L
DEF$I 0
OFFSET S.FNAM           ;Define as global if parameter
OFFSET S.FTYP           ;Is DEF$G
OFFSET S.FNTY
OFFSET S.FNBW
S.FNAM=6                ;Size of filename in bytes
S.FTYP=2                ;Size of file type in bytes
S.FNTY=<S.FNAM+S.FTYP>/2  ;Size of filename + type in words
OFFSET N.FID,6          ;File ID
OFFSET N.FNAM,S.FNAM    ;Filename
OFFSET N.FTYP,S.FTYP    ;Type
OFFSET N.FVER,2         ;Version
OFFSET S.NFEN           ;Size of name file entry in bytes
DEF$L S.NFEN            ;Force at least a local definition
OFFSET N.STAT,2         ;Status
OFFSET N.NEXT,2         ;Temp cell for find next
OFFSET N.DID,6          ;Directory ID
OFFSET N.DVNM,2         ;Device name in ASCII
OFFSET N.UNIT,2         ;Unit number
OFFSET S.FNB            ;Size of FNB in bytes
DEF$L S.FNB             ;Force local definition at least
S.FNBW=S.FNB/2          ;Size of FNB in words
.IIF IDN,<DEF$N>,<OFFSET>,.MEXIT ;Don't redefine the macro
.MACRO NBOFF$ ARG
.ENDM NBOFF$
.ENDM NBOFF$
```

C.5.38 NMBLK$ Macro

NMBLK$ defines the file name block at assembly time.

```
.MACRO NMBLK$ FNAME,FTYPE,VERS,DEVNAM,UNIT
.MCALL RAD50$,CWORD$,NBOFF$
NBOFF$ DEF$L            ;Define name block offsets locally
.IIF NDF,...PC1,...PC1=0
...PC3=...PC1           ;Preserve ...PC1
...PC1=.
.=...PC1+N.FNAM
RAD50$ <FNAME>,S.FNAM/2
```

```
        .=...PC1+N.FTYP
        RAD50$ <FTYPE>,S.FTYP/2
        CWORD$ <VERS>,N.FVER
        .IF NB,DEVNAM
        .=...PC1+N.DVNM
        .WORD "DEVNAM
        .ENDC
        C..ORD$ <UNIT>,N.UNIT
        .=...PC1+S.FNB
        ...PC1=...PC3           ;Restore ...PC1
        .ENDM NMBLK$
```

C.5.39 OPEN$ Macro

OPEN$ opens a file.

```
  .MACRO OPEN$ FDB,FACC,LUN,FNPT,DFNB,RACC,URBA,URBS,ERR
  .MCALL FDOP$R,FDRC$R,ERR$,CMOV$B
  FDOP$R FDB,LUN,FNPT,DFNB,FACC
  FDRC$R ,RACC,URBA,URBS
  .GLOBL .OPEN
  JSR PC,.OPEN
  ERR$ ERR
  .ENDM OPEN$
```

C.5.40 OPEN$A Macro

OPEN$A opens a file for appending.

```
  .MACRO OPEN$A FDB,LUN,FNPT,RACC,URBA,URBS,ERR
  .MCALL OPEN$
  OPEN$ FDB,#FO.APD,LUN,FNPT,,RACC,URBA,URBS,ERR
  .ENDM OPEN$A
```

C.5.41 OPEN$M Macro

OPEN$M opens a file for modification.

```
  .MACRO OPEN$M FDB,LUN,FNPT,RACC,URBA,URBS,ERR
  .MCALL OPEN$
  OPEN$ FDB,#FO.MFY,LUN,FNPT,,RACC,URBA,URBS,ERR
  .ENDM OPEN$M
```

C.5.42 OPEN$R Macro

OPEN$R opens a file for reading.

```
  .MACRO OPEN$R, FDB,LUN,FNPT,RACC,URBA,URBS,ERR
  .MCALL OPEN$
  OPEN$ FDB,#FO.RD,LUN,FNPT,,RACC,URBA,URBS,ERR
  .ENDM OPEN$R
```

C.5.43 OPEN$U Macro

OPEN$U opens a file for updating.

```
.MACRO OPEN$U FDB,LUN,FNPT,RACC,URBA,URBS,ERR
.MCALL OPEN$
OPEN$ FDB,#FO.UPD,LUN,FNPT,,RACC,URBA,URBS,ERR
.ENDM OPEN$U
```

C.5.44 OPEN$W Macro

OPEN$W opens a file for writing.

```
.MACRO OPEN$W FDB,LUN,FNPT,RACC,URBA,URBS,ERR
.MCALL OPEN$
OPEN$ FDB,#FO.WRT,LUN,FNPT,,RACC,URBA,URBS,ERR
.ENDM OPEN$W
```

C.5.45 OPNS$A Macro

OPNS$A opens a shared file for appending.

```
.MACRO OPNS$A FDB,LUN,FNPT,RACC,URBA,URBS,ERR
.MCALL OPEN$
OPEN$ FDB,#FA.SHR!FO.APD,LUN,FNPT,,RACC,URBA,URBS,ERR
.ENDM OPNS$A
```

C.5.46 OPNS$M Macro

OPNS$M opens a shared file for modification.

```
.MACRO OPNS$M FDB,LUN,FNPT,RACC,URBA,URBS,ERR
.MCALL OPEN$
OPEN$ FDB,#FA.SHR!FO.MFY,LUN,FNPT,,RACC,URBA,URBS,ERR
.ENDM OPNS$M
```

C.5.47 OPNS$R Macro

OPNS$R opens a shared file for reading.

```
.MACRO OPNS$R FDB,LUN,FNPT,RACC,URBA,URBS,ERR
.MCALL OPEN$
OPEN$ FDB,#FA.SHR!FO.RD,LUN,FNPT,,RACC,URBA,URBS,ERR
.ENDM OPNS$R
```

C.5.48 OPNS$U Macro

OPNS$U opens a shared file for updating.

```
.MACRO OPNS$U FDB,LUN,FNPT,RACC,URBA,URBS,ERR
.MCALL OPEN$
OPEN$ FDB,#FA.SHR!FO.UPD,LUN,FNPT,,RACC,URBA,URBS,ERR
.ENDM OPNS$U
```

C.5.49 OPNS$W Macro

OPNS$W opens a shared file for writing.

```
.MACRO OPNS$W FDB,LUN,FNPT,RACC,URBA,URBS,ERR
.MCALL OPEN$
OPEN$ FDB,#FA.SHR!FO.WRT,LUN,FNPT,,RACC,URBA,URBS,ERR
.ENDM OPNS$W
```

C.5.50 OPNT$D Macro

Create, access, and mark for delete a new file not entered in a directory. It will be deleted when closed (deaccessed) and will be properly deleted if program should terminate abnormally.

```
.MACRO OPNT$D FDB,LUN,FNPT,RACC,URBA,URBS,ERR
.MCALL OPNT$W
OPNT$W FDB,LUN,FNPT,RACC,URBA,URBS
BCS .+6
JSR PC,.MRKDL
ERR$ ERR
.ENDM OPNT$D
```

C.5.51 OPNT$W Macro

OPNT$W creates and accesses a new file and does enter it in a directory. The file may be closed and reopened by file ID. The file should be deleted before the program exits otherwise it remains in the index file with no directory entry.

```
.MACRO OPNT$W FDB,LUN,FNPT,RACC,URBA,URBS,ERR
.MCALL OPEN$
OPEN$ FDB,#FA.TMP!FO.WRT,LUN,FNPT,,RACC,URBA,URBS,ERR
.ENDM OPNT$W
```

C.5.52 OFID$ Macro

OFID$ opens a file by file ID.

```
.MACRO OFID$ FDB,FACC,LUN,FNPT,DFNB,RACC,URBA,URBS,ERR
.MCALL FDOP$R,FDRC$R,ERR$,CMOV$B
FDOP$R FDB,LUN,FNPT,DFNB,FACC
FDRC$R ,RACC,URBA,URBS
.GLOBL .OPFID
JSR PC,.OPFID
ERR$ ERR
.ENDM OFID$
```

C.5.53 OFID$A Macro

OFID$A opens a file by file ID for appending.

```
.MACRO OFID$A FDB,LUN,FNPT,RACC,URBA,URBS,ERR
.MCALL OFID$
OFID$ FDB,#FO.APD,LUN,FNPT,,RACC,URBA,URBS,ERR
.ENDM OFID$A
```

C.5.54 OFID$M Macro

OFID$M opens a file for modification by file ID.

```
.MACRO OFID$M FDB,LUN,FNPT,RACC,URBA,URBS,ERR
.MCALL OFID$
OFID$ FDB,#FO.MFY,LUN,FNPT,,RACC,URBA,URBS,ERR
.ENDM OFID$M
```

C.5.55 OFID$R Macro

OFID$R opens a file for reading by file ID.

```
.MACRO OFID$R FDB,LUN,FNPT,RACC,URBA,URBS,ERR
.MCALL OFID$
OFID$ FDB,#FO.RD,LUN,FNPT,,RACC,URBA,URBS,ERR
.ENDM OFID$R
```

C.5.56 OFID$U Macro

OFID$U opens a file for updating by file ID.

```
.MACRO OFID$U FDB,LUN,FNPT,RACC,URBA,URBS,ERR
.MCALL OFID$
OFID$ FDB,#FO.UPD,LUN,FNPT,,RACC,URBA,URBS,ERR
.ENDM OFID$U
```

C.5.57 OFID$W Macro

OFID$W opens a file for writing by file ID.

```
.MACRO OFID$W FDB,LUN,FNPT,RACC,URBA,URBS,ERR
.MCALL OFID$
OFID$ FDB,#FO.WRT,LUN,FNPT,,RACC,URBA,URBS,ERR
.ENDM OFID$W
```

C.5.58 OFNB$ Macro

OFNB$ opens a file by file name block.

```
.MACRO OFNB$ FDB,FACC,LUN,FNPT,DFNB,RACC,URBA,URBS,ERR
.MCALL FDOP$R,FDRC$R,ERR$,CMOV$B
FDOP$R FDB,LUN,FNPT,DFNB,FACC
FDRC$R ,RACC,URBA,URBS
.GLOBL .OPFNB
JSR PC,.OPFNB
ERR$ ERR
.ENDM OFNB$
```

C.5.59 OFNB$A Macro

OFNB$A opens a file by file name block for appending.

```
        .MACRO OFNB$A FDB,LUN,FNPT,RACC,URBA,URBS,ERR
        .MCALL OFNB$
        OFNB$ FDB,#FO.APD,LUN,FNPT,,RACC,URBA,URBS,ERR
        .ENDM OFNB$A
```

C.5.60 OFNB$M Macro

OFNB$M opens a file by file name block for modification.

```
        .MACRO OFNB$M FDB,LUN,FNPT,RACC,URBA,URBS,ERR
        .MCALL OFNB$
        OFNB$ FDB,#FO.MFY,LUN,FNPT,,RACC,URBA,URBS,ERR
        .ENDM OFNB$M
```

C.5.61 OFNB$R Macro

OFNB$R opens a file by file name block for reading.

```
        .MACRO OFNB$R FDB,LUN,FNPT,RACC,URBA,URBS,ERR
        .MCALL OFNB$
        OFNB$ FDB,#FO.RD,LUN,FNPT,,RACC,URBA,URBS,ERR
        .ENDM OFNB$R
```

C.5.62 OFNB$U Macro

OFNB$U opens a file by file name block for updating.

```
        .MACRO OFNB$U FDB,LUN,FNPT,RACC,URBA,URBS,ERR
        .MCALL OFNB$
        OFNB$ FDB,#FO.UPD,LUN,FNPT,,RACC,URBA,URBS,ERR
        .ENDM OFNB$U
```

C.5.63 OFNB$W Macro

OFNB$W opens a file by file name block for writing.

```
        .MACRO OFNB$W FDB,LUN,FNPT,RACC,URBA,URBS,ERR
        .MCALL OFNB$
        OFNB$ FDB,#FO.WRT,LUN,FNPT,,RACC,URBA,URBS,ERR
        .ENDM OFNB$W
```

C.5.64 PUT$ Macro

PUT$ puts a record in random or sequential mode.

```
        .MACRO PUT$ FDB,OUTADR,OUTCNT,ERR
        .MCALL LDFDB$,CMOV$W,ERR$
        LDFDB$ FDB
        CMOV$W OUTADR,F.NRBD+2  ;Next record buffer address
        CMOV$W OUTCNT,F.NRBD    ;Next record buffer size
```

```
        .GLOBL .PUT
        JSR PC,.PUT
        ERR$ ERR
        .ENDM PUT$
```

C.5.65 PUT$R Macro

PUT$R puts a record in random mode.

```
        .MACRO PUT$R FDB,OUTADR,OUTCNT,LRCNM,HRCNM,ERR
        .MCALL LDFDB$,CMOV$W,ERR$
        LDFDB$ FDB
        CMOV$W OUTADR,F.NRBD+2  ;Next record buffer address
        CMOV$W OUTCNT,F.NRBD    ;Next record buffer size
        CMOV$W LRCNM,F.RCNM+2   ;Low order record number
        CMOV$W HRCNM,F.RCNM     ;High order record number
        .GLOBL .PUT
        JSR PC,.PUT
        ERR$ ERR
        .ENDM PUT$R
```

C.5.66 PUT$S Macro

PUT$S puts a record in strictly sequential mode.

```
        .MACRO PUT$S FDB,OUTADR,OUTCNT,ERR
        .MCALL LDFDB$,CMOV$W,ERR$
        LDFDB$ FDB
        CMOV$W OUTADR,F.NRBD+2  ;Next record buffer address
        CMOV$W OUTCNT,F.NRBD    ;Next record buffer size
        .GLOBL .PUTSQ
        JSR PC,.PUTSQ
        ERR$ ERR
        .ENDM PUT$S
```

C.5.67 RAD50$ Macro

```
  .MACRO RAD50$ STRING,MAXWRD
  ...PC2=.
  .RAD50 /STRING/
  .IF GT,<.-...PC2>-^O<2*MAXWRD>
  .ERROR            ;String   RAD50 - string too long,
                    ; truncated
         .=^O<...PC2+<2*MAXWRD>>
  .MEXIT
  .ENDC
  .REPT ^O<MAXWRD-<<.-...PC2>/2>>
  .WORD 0
  .ENDR
  .ENDM RAD50$
```

C.5.68 READ$ Macro

READ$ reads a virtual block.

```
        .MACRO READ$ FDB,BKAD,BKSZ,BKVB,BKEF,BKST,BKDN,ERR
        .MCALL FDBK$R,ERR$
        FDBK$R FDB,BKAD,BKSZ,BKVB,BKEF,BKST,BKDN
        .GLOBL .READ
        JSR PC,.READ
        ERR$ ERR
        .ENDM READ$
```

C.5.69 TRUNC$ Macro

TRUNC$ truncates a file.

```
        .MACRO TRUNC$ FDB,ERR
        .MCALL LDFDB$,ERR$
        LDFDB$ FDB
        .GLOBL .TRUNC
        JSR PC,.TRUNC
        ERR$ ERR
        .ENDM TRUNC$
```

C.5.70 WAIT$ Macro

WAIT$ waits for I/O completion after a READ$ or WRITE$ macro execution.

```
        .MACRO WAIT$ FDB,EFN,BKST,ERR
        .MCALL LDFDB$,CMOV$W,CMOV$B,ERR$
        LDFDB$ FDB
         CMOV$B EFN,F.EFN
        CMOV$W BKST,F.BKST
        .GLOBL .WAIT
        JSR PC,.WAIT
        ERR$ ERR
        .ENDM WAIT$
```

C.5.71 WRITE$ Macro

WRITE$ writes a virtual block.

```
        .MACRO WRITE$ FDB,BKAD,BKSZ,BKVB,BKEF,BKST,BKDN,ERR
        .MCALL FDBK$R,ERR$
        FDBK$R FDB,BKAD,BKSZ,BKVB,BKEF,BKST,BKDN
        .GLOBL .WRITE
        JSR PC,.WRITE
        ERR$ ERR
        .ENDM WRITE$
```

C.6 NETWORK SYMBOL DEFINITION MACRO

C.6.1 COMDF$ Macro

Commom Symbol Module for M/D Networks Implementation

```
   .MACRO COMDF$ DEF
   .NLIST
   .IF IDN <DEF>,<DEF$G>
   .GLOBL B.OT,B.UN,B.RC,B.RN,B.RP,B.RU,B.NA,B.UA,B.MN,B.MX
   .GLOBL CT.IN,CT.CN,LB.N,LB.E
   .GLOBL NT.IN,NT.NS
   .GLOBL CR.UR,CR.NR,CR.MX
   .GLOBL CR.N0,CR.N1,CR.N2,CR.N3,CR.N4,CR.N5,CR.N6,CR.N9,
          CR.N10,CR.N11
   .GLOBL CR.N7,CR.N8
   .GLOBL CR.DI,CR.DT,CR.DA
   .GLOBL IA.ISM,IA.ABO,IA.DIS,IA.NFW
   .GLOBL CN.IN,CN.OU,CN.UT,CN.NT
   .GLOBL OB.TA,OB.FS,OB.SQ,OB.BO,OB.TC,OB.RD,OB.RA,OB.ND,
          OB.DD,OB.BM
   .GLOBL OB.TH,OB.TB,OB.TI,OB.CR,OB.LP,OB.PR,OB.PP,OB.PL,OB.MT
   .GLOBL OB.DT,OB.CS,OB.CP,OB.FH,OB.MH,OB.FL
   .ENDC
   B.OT = 0                    ;Object type value
   B.UN = 1                    ;Object type unit number
   B.RC = B.OT+2          ;Offset to remote connect #
   B.RP = B.RN+4          ;Offset to remote process name [RAD50]
   B.RU = B.RP+4          ;Offset to remote UIC [.WORD
                           ; GROUP,USER]
   B.NA = B.RU+4          ;Offset to # of user arguements
   B.UA = B.NA+2          ;Offset to first user arguement
   B.MN = B.UA             ;Minimum size of buffer [0 arguements]
   B.MX = B.MN+10        ;Maximum size of buffer [8. arguments]
   NT.IN = 10               ;Send this message at AST level [XMIT]
   NT.NS = 1                ;No status message required [RECV]
   CR.UR = 2                ;Connect reject [remote user
                            ; rejection]
   CR.NR = 3                ;Connect reject [remote NCS rejection]
   CR.MX = 6                ;Maximum reason
   CR.N0 = 0                ;Reject by NCS
   CR.N1 = 1                ;Too many connects to remote node
   CR.N2 = 2                ;Too many connects to remote process
   CR.N3 = 3                ;Process does not exist on this node
   CR.N4 = 4                ;Object type does not exist on this
                            ; node
   CR.N5 = 5                ;Destination address in use
   CR.N6 = 6                ;Node shutting down
   CR.N7 = 7
   CR.N8 = 8.
   CR.N9 = 11               ;Invalid task name
   CR.N10 = 12              ;Invalid qualifier
   CR.N11 = 13              ;Bad destination parameter
   CR.DI = 4                ;Disconnect initiate
   CR.DT = 5                ;Disconnect terminate [CONFIRM]
   CR.DA = 6                ;Disconnect abort
   LB.N=0                   ;Loopback normal
   LB.E=2                   ;Loopback echo mode
   CT.IN = 0                ;Connect initiate
   CT.CN = 1                ;Connect confirm
   IA.ABO = -5               ;Disconnect abort [partner terminated]
```

```
IA.DIS = -7             ;Disconnect requested [partner did
                        ; disc QIO]
IA.NFW = 177673         ;Topology change -- partner no longer
                        ; reachable
IA.ISM = 1              ;Interrupt semaphore from partner
CN.IN = 1               ;If set: inhibit incoming connections
CN.OU = 2               ;If set: inhibit outgoing connections
CN.UT = 4               ;If set: user tap
CN.NT = 10              ;If set: NCL tap
OB.TA = 0               ;Task
OB.FS = 1               ;File system [dap]
OB.SQ = 2               ;Sequential devices [DAP]
OB.BO = 3               ;Boot task
OB.TC = 4               ;Terminal control task
OB.RD = 5               ;Remote directives
OB.RA = 6               ;Resource allocater
OB.ND = 7               ;Network directory service
OB.DD = 10              ;DDCMP link
OB.BM = 11              ;Boot message link
;12-17 RESERVED
OB.TH = 20              ;Terminal handler
OB.TB = 21              ;Terminal : block mode
OB.TI = 22              ;Terminal : interactive
OB.CR = 23              ;Card reader
OB.LP = 24              ;Line printer
OB.PR = 25              ;PAPER TAPE READER
OB.PP = 26              ;Paper tape punch
OB.PL = 27              ;Plotter
OB.MT = 30              ;Magnetic tape
OB.DT = 31              ;DECTAPE
OB.CS = 32              ;Cassette
OB.CP = 33              ;Card punch
OB.FH = 34              ;Fixed head disk
OB.MH = 35              ;Moving head disk
OB.FL = 36              ;Floppy disk
.MACRO COMDF$ A
.ENDM
.LIST
.ENDM
.END
```

C.7 PROGRAM LOGICAL ADDRESS SPACE EXTENSION MACRO EXPANSIONS

C.7.1 ATRG$, ATRG$C, and ATRG$S Macros

These macros generate the code to attach a region.

```
.MACRO ATRG$ RDB
.MCALL OFF$
.IF NDF $$$GLB
.BYTE 57.,2
.WORD RDB
.ENDC
.IF NDF A.TRBA
OFF$
OFF$ A.TRBA,2
.ENDC
.ENDM ATRG$
```

```
  .MACRO ATRG$C RDB,CS,ERR
         .MCALL ATRG$,DIR$
  .IF NDF $$$GLB
  .PSECT $DPB$$
$$$=.
  .IFTF
  ATRG$ RDB
  .IFT
  .PSECT CS
  DIR$ #$$$,ERR
  .ENDC
  .ENDM ATRG$C

  .MACRO ATRG$S RDB,ERR
  .MCALL DIR$,MOV$
  MOV$ RDB
  MOV (PC)+,-(SP)
  .BYTE 57.,2
  DIR$ ,ERR
  .ENDM ATRG$S
```

C.7.2 .BLK., .BLKB., and .BLKW. Macros

These macros define the block offset symbol. The Program Logical Address Space definition macros use these macros.

```
         .MACRO .BLKB. NUM,SYM,GBL
         .IF NB <SYM>
         .IF IDN <DEF$G>,<GBL>
SYM==$$$
         .IFF
SYM=$$$
         .ENDC
         .ENDC
$$$=$$$+NUM
         .ENDM .BLKB.
         .MACRO .BLKW. NUM,SYM,GBL
         .IF NB <SYM>
         .IF IDN <DEF$G>,<GBL>
SYM==$$$
         .IFF
SYM=$$$
         .ENDC
         .ENDC
$$$=$$$+<2*NUM>
         .ENDM .BLKW.


         .MACRO .BLK.
$$$=0
         .ENDM .BLK.
```

C.7.3 CRAW$, CRAW$C, CRAW$S Macro

These macros generate the code to create an address window.

```
  .MACRO CRAW$ WDB
  .MCALL OFF$
  .IF NDF $$$GLB
  .BYTE 117.,2
```

```
   .WORD WDB
   .ENDC
   .IF NDF C.RABA
   OFF$
   OFF$ C.RABA,2
   .ENDC
   .ENDM CRAW$

   .MACRO CRAW$C WDB,CS,ERR
   .MCALL CRAW$,DIR$
   .IF NDF $$$GLB
   .PSECT $DPB$$
$$$=.
   .IFTF
   CRAW$ WDB
   .IFT
   .PSECT CS
   DIR$ #$$$,ERR
   .ENDC
   .ENDM CRAW$C

   .MACRO CRAW$S WDB,ERR
   .MCALL DIR$,MOV$
   MOV$ WDB
   MOV (PC)+,-(SP)
   .BYTE 117.,2
   DIR$ ,ERR
   .ENDM CRAW$S
```

C.7.4 CRRG$, CRRG$C, and CRRG$S Macros

These macros generate the code to create a region.

```
   .MACRO CRRG$ RDB
   .MCALL OFF$
   .IF NDF $$$GLB
   .BYTE 55.,2
   .WORD RDB
   .ENDC
   .IF NDF C.RRBA
   OFF$
   OFF$ C.RRBA,2
   .ENDC
   .ENDM CRRG$

   .MACRO CRRG$C RDB,CS,ERR
   .MCALL CRRG$,DIR$
   .IF NDF $$$GLB
   .PSECT $DPB$$
$$$=.
   .IFTF
   CRRG$ RDB
   .IFT
   .PSECT CS
   DIR$ #$$$,ERR
   .ENDC
   .ENDM CRRG$C

   .MACRO CRRG$S RDB,ERR
   .MCALL DIR$,MOV$
   MOV$ RDB
   MOV (PC)+,-(SP)
```

```
  .BYTE 55.,2
  DIR$ ,ERR
  .ENDM CRRG$S
```

C.7.5 DTRG$, DTRG$C, and DTRG$S Macros

These macros generate the code to detach a region.

```
  .MACRO DTRG$ RDB
  .MCALL OFF$
  .IF NDF $$$GLB
  .BYTE 59.,2
  .WORD RDB
  .ENDC
  .IF NDF D.TRBA
  OFF$
  OFF$ D.TRBA,2
  .ENDC
  .ENDM DTRG$

  .MACRO DTRG$C RDB,CS,ERR
  .MCALL DTRG$,DIR$
  .IF NDF $$$GLB
  .PSECT $DPB$$
$$$=.
  .IFTF
  DTRG$ RDB
  .IFT
  .PSECT CS
  DIR$ #$$$,ERR
  .ENDC
  .ENDM DTRG$C


  .MACRO DTRG$S RDB,ERR
  .MCALL DIR$,MOV$
  MOV$ RDB
  MOV (PC)+,-(SP)
  .BYTE 59.,2
  DIR$ ,ERR
  .ENDM DTRG$S
```

C.7.6 ELAW$, ELAW$C, and ELAW$S Macros

These macros generate the code to eliminate an address window.

```
  .MACRO ELAW$ WDB
  .MCALL OFF$
  .IF NDF $$$GLB
  .BYTE 119.,2
  .WORD WDB
  .ENDC
  .IF NDF E.LABA
  OFF$
  OFF$ E.LABA,2
  .ENDC
  .ENDM ELAW$

  .MACRO ELAW$C WDB,CS,ERR
  .MCALL ELAW$,DIR$
```

```
   .IF NDF $$$GLB
   .PSECT $DPB$$
$$$=.
   .IFTF
   ELAW$ WDB
   .IFT
   .PSECT CS
   DIR$ #$$$,ERR
   .ENDC
   .ENDM ELAW$C

   .MACRO ELAW$S WDB,ERR
   .MCALL DIR$,MOV$
   MOV$ WDB
   MOV (PC)+,-(SP)
   .BYTE 119.,2
   DIR$ ,ERR
   .ENDM ELAW$S
```

C.7.7 GMCX$, GMCX$C, and GMCX$S Macros

The macros generate the code to get the mapping context.

```
   .MACRO GMCX$ WVEC
   .MCALL OFF$
   .IF NDF $$$GLB
   .BYTE 113.,2
   .WORD WVEC
   .ENDC
   .IF NDF G.MCVA
   OFF$
   OFF$ G.MCVA,2
   .ENDC
   .ENDM GMCX$
   .MACRO GMCX$C WVEC,CS,ERR
   .MCALL GMCX$,DIR$
   .IF NDF $$$GLB
   .PSECT $DPB$$
$$$=.
   .IFTF
   GMCX$ WVEC
   .IFT
   .PSECT CS
   DIR$ #$$$,ERR
   .ENDC
   .ENDM GMCX$C
   .MACRO GMCX$S WVEC,ERR
   .MCALL DIR$,MOV$
   MOV$ WVEC
   MOV (PC)+,-(SP)
   .BYTE 113.,2
   DIR$ ,ERR
   .ENDM GMCX$S
```

C.7.8 GREG$, GREG$C, and GREG$S Macros

These macros get region parameters. They are a special case of the get partition parameters macros.

```
  .MACRO GREG$ RID,BUF
  .MCALL OFF$
  .IF NDF $$$GLB
  .BYTE 65.,4
  .WORD 0,RID
  .WORD BUF
  .ENDC
  .IF NDF G.RGID
  .NLIST
  OFF$
  OFF$ ,2
  OFF$ G.RGID,2
  OFF$ G.RGBA,2
  .IF NDF G.RGRB
$$$OST=0
  .IRP X,<<G.RGRB,2>,<G.RGRS,2>,<G.RGFW,2>>
  OFF$ X
  .ENDM
  .ENDC
  .LIST
  .ENDC
  .ENDM GREG$
  .MACRO GREG$C RID,BUF,CS,ERR
  .MCALL GREG$,DIR$
  .IF NDF $$$GLB
  .PSECT $DPB$$
$$$=.
  .IFTF
  GREG$ RID,BUF
  .IFT
  .PSECT CS
  DIR$ #$$$,ERR
  .ENDC
  .ENDM GREG$C
  .MACRO GREG$S RID,BUF,ERR
  .MCALL MOV$,DIR$,OFF$
  MOV$ BUF
  MOV$ RID
  CLR -(SP)
  MOV (PC)+,-(SP)
  .BYTE 65.,4
  DIR$ ,ERR
  .IF NDF G.RGRB
  .NLIST
$$$OST=0
  .IRP X,<<G.RGRB,2>,<G.RGRS,2>,<G.RGFW,2>>
  OFF$ X
  .ENDM
  .LIST
  .ENDC
  .ENDM GREG$S
```

C.7.9 MAP$, MAP$C, MAP$S Macros

These macros generate the code to map an address window.

```
  .MACRO MAP$ WDB
  .MCALL OFF$
  .IF NDF $$$GLB
  .BYTE 121.,2
  .WORD WDB
  .ENDC
```

```
  .IF NDF M.APBA
  OFF$
  OFF$ M.APBA,2
  .ENDC
  .ENDM MAP$

  .MACRO MAP$C WDB,CS,ERR
  .MCALL MAP$,DIR$
  .IF NDF $$$GLB
  .PSECT $DPB$$
$$$=.
  .IFTF
  MAP$ WDB
  .IFT
  .PSECT CS
  DIR$ #$$$,ERR
  .ENDC
  .ENDM MAP$C

  .MACRO MAP$S WDB,ERR
  .MCALL DIR$,MOV$
  MOV$ WDB
  MOV (PC)+,-(SP)
  .BYTE 121.,2
  DIR$ ,ERR
  .ENDM MAP$S
```

C.7.10 RDBBK$ Macro

RDBBK$ generates a region definition block.

```
  .MACRO RDBBK$ SIZ,NAM,PAR,STS,PRO
  .MCALL RDBDF$,R50$
  RDBDF$                    ;Define region definition block
                                  ; symbols
  .WORD 0                   ;Region ID
  .WORD SIZ                 ;Size of region (32w blocks)
  R50$ NAM                  ;Name of region (RAD50)
  R50$ PAR                  ;Region's main partition name (RAD50)
  .WORD STS                 ;Region status word
  .WORD PRO                 ;Region protection word
  .ENDM RDBBK$
```

C.7.11 RREF$, RREF$C, and RREF$S Macros

These macros generate the code to receive by reference.

```
  .MACRO RREF$ WDB
  .MCALL OFF$
  .IF NDF $$$GLB
  .BYTE 81.,2
  .WORD WDB
  .ENDC
  .IF NDF R.REBA
  OFF$
  OFF$ R.REBA,2
  .ENDC
  .ENDM RREF$
```

```
  .MACRO RREF$C WDB,CS,ERR
  .MCALL RREF$,DIR$
  .IF NDF $$$GLB
  .PSECT $DPB$$
$$$=.
  .IFTF
  RREF$ WDB
  .IFT
  .PSECT CS
  DIR$ #$$$,ERR
  .ENDC
  .ENDM RREF$C

  .MACRO RREF$S WDB,ERR
  .MCALL DIR$,MOV$
  MOV$ WDB
  MOV (PC)+,-(SP)
  .BYTE 81.,2
  DIR$ ,ERR
  .ENDM RREF$S
```

C.7.12 SREF$, SREF$C, and SREF$S Macros

These macros generate the code to send by reference.

```
  .MACRO SREF$ TASK,WDB,EFN
  .MCALL R50$,OFF$
  .IF NDF $$$GLB
  .BYTE 69.,5
  R50$ TASK
  .WORD EFN
  .WORD WDB
  .ENDC
  .IF NDF S.RETN
  .IRP X,<,<S.RETN,4>,<S.REEF,2>,<S.REBA,2>>
  OFF$ X
  .ENDM
  .ENDC
  .ENDM SREF$
        .MACRO SREF$C TASK,WDB,EFN,CS,ERR
        .MCALL SREF$,DIR$
        .IF NDF $$$GLB
        .PSECT $DPB$$
$$$=.
        .IFTF
        SREF$ TASK,WDB,EFN
        .IFT
        .PSECT CS
        DIR$ #$$$,ERR
        .ENDC
        .ENDM SREF$C

        .MACRO SREF$S TSKADR,WDB,EFN,ERR
        .MCALL DIR$,MOV$,RFA$
        MOV$ WDB
        MOV$ EFN
        RFA$ TSKADR
        MOV (PC)+,-(SP)
        .BYTE 69.,5
        DIR$ ,ERR
        .ENDM SREF$S
```

C.7.13 SRRA$, SRRA$C, and SRRA$S Macros

These macros generate the code for the SPECIFY RECEIVE BY REFERENCE AST directive.

```
        .MACRO SRRA$ AST
        .MCALL OFF$
        .IF NDF $$$GLB
        .BYTE 21.,2
        .WORD AST
        .ENDC
        .IF NDF S.RRAE
        .NLIST
        OFF$
        OFF$ S.RRAE,2
        .LIST
        .ENDC
        .ENDM SRRA$

        .MACRO SRRA$C AST,CS,ERR
        .MCALL SRRA$,DIR$
        .IF NDF $$$GLB
        .PSECT $DPB$$
$$$=.
        .IFTF
        SRRA$ AST
        .IFT
        .PSECT CS
        DIR$ #$$$,ERR
        .ENDC
        .ENDM SRRA$C
        .MACRO SRRA$S AST,ERR
        .MCALL MOV$,DIR$
        MOV$ AST
        MOV (PC)+,-(SP)
        .BYTE 21.,2
        DIR$ ,ERR
        .ENDM SRRA$S
```

C.7.14 UMAP$, UMAP$C, and UMAP$S Macros

These macros generate the code to unmap an address window.

```
        .MACRO UMAP$ WDB
        .MCALL OFF$
        .IF NDF $$$GLB
        .BYTE 123.,2
        .WORD WDB
        .ENDC
        .IF NDF U.MABA
        OFF$
        OFF$ U.MABA,2
        .ENDC
        .ENDM UMAP$

        .MACRO UMAP$C WDB,CS,ERR
        .MCALL UMAP$,DIR$
        .IF NDF $$$GLB
        .PSECT $DPB$$
$$$=.
        .IFTF
        UMAP$ WDB
```

```
        .IFT
        .PSECT CS
        DIR$ #$$$,ERR
        .ENDC
        .ENDM UMAP$C


        .MACRO UMAP$S WDB,ERR
        .MCALL DIR$,MOV$
        MOV$ WDB
        MOV (PC)+,-(SP)
        .BYTE 123.,2
        DIR$ ,ERR
        .ENDM UMAP$S
```

C.7.15 WDBBK$ Macro

WDBBK$ generates a window definition block.

```
  .MACRO WDBBK$ APR,SIZ,RID,OFF,LEN,STS,SRB
  .MCALL WDBDF$
  WDBDF$                    ;Define window definition block
                                 ; symbols
  .BYTE 0,APR               ;Window ID / base APR.
  .WORD 0                   ;Virtual base address (bytes)
  .WORD SIZ                 ;Window size (32w blocks)
  .WORD RID                 ;Region ID
  .WORD OFF                 ;Offset in partition (32w blocks)
  .WORD LEN                 ;Length to map (32w blocks)
  .WORD STS                 ;Status word
  .WORD SRB                 ;Send/receive buffer virtual address

        .ENDM WDBBK$
```

C.8 RELATIVE FILES MACROS - EXPANSIONS

C.8.1 RCLOS$ Macro

RCLOS$ closes a file.

```
  .MACRO RCLOS$ FDB,ERR
  .MCALL LDFDB$,ERR$
  LDFDB$ FDB
  JSR PC,.RCLOS
  ERR$ ERR
  .ENDM RCLOS$
```

C.8.2 RFDBT$ Macro

RFDBT$ defines the relative file descriptor bits.

```
  .MACRO RFDBT$ GLOBL
  .MCALL DEFIN$
  ...GBL=0
  .IIF IDN,<GLOBL>,<DEF$G>, ...GBL=1
```

```
Relative File Flags Byte

  DEFIN$ RF.WRT,1          ;Set if bit table record
                           ; buffer dirty
  DEFIN$ RF.EXT,2          ;Set if extend is allowed
  DEFIN$ RF.BEX,4          ;Set if extend attempted when
                           ; restricted
Relative File Value Byte

  DEFIN$ RB.NEW,1          ;New bit value to set
  DEFIN$ RB.NCH,2          ;1 if not changing value
  DEFIN$ RB.VAL,4          ;Bit value read
  .MACRO RFDBT$ ARG
  .ENDM RFDBT$
  .ENDM RFDBT$
```

C.8.3 RFIND$ Macro

RFIND$ finds the next existing record.

```
  .MACRO RFIND$ FDB,LRCNM,HRCNM,ERR
  .MCALL LDFDB$,CMOV$W,ERR$
  LDFDB$ FDB
  CMOV$W LRCNM,R.RCNM+2
  CMOV$W HRCNM,R.RCNM
  JSR PC,.RFIND
  ERR$ ERR
  .ENDM RFIND$
```

C.8.4 RFOF$L Macro

RFOF$L locally defines relative file record offsets.

```
  .MACRO RFOF$L
  .MCALL RFOFF$
  RFOFF$ DEF$L
  .ENDM RFOF$L
```

C.8.5 RFOFF$ Macro

RFOFF$ defines the offsets for the relative file extension of the FDB.

```
  .MACRO RFOFF$ OFFSET
  .MCALL OFFSET,DEF$I,FDBSZ$
  FDBSZ$
  DEF$I S.FDB

Relative File Record Section

  OFFSET R.RCNM,4          ;Relative record number
  OFFSET R.CLSZ,4          ;Cluster size
  OFFSET R.FLAG,1          ;Flags byte
  OFFSET R.BTVL,1          ;Value byte
  OFFSET R.BTSZ,2          ;Bit table record size
  OFFSET R.BTBF,2          ;Bit table record buffer
  OFFSET R.BTN,2           ;Bit table number
  OFFSET R.BTRC,2          ;Bit table record number
```

```
  OFFSET S.RFD              ;Size of RFDB
  .IIF IDN,<DEF$N>,<OFFSET>, .MEXIT
  .MACRO RFOFF$ ARG
  .ENDM RFOFF$
  .ENDM RFOFF$
```

C.8.6 RGET$ Macro

RGET$ gets a relative file.

```
  .MACRO RGET$ FDB,INADR,MAXCNT,LRCNM,HRCNM,ERR
  .MCALL LDFDB$,CMOV$W,ERR$
  LDFDB$ FDB
  CMOV$W INADR,F.URBD+2
  CMOV$W MAXCNT,F.URBD
  CMOV$W LRCNM,R.RCNM+2
  CMOV$W HRCNM,R.RCNM
  JSR PC,.RGET
  ERR$ ERR
  .ENDM RGET$
```

C.8.7 ROPN$ Macro

ROPN$ opens a file.

```
  .MACRO ROPN$ FDB,FACC,LUN,FNPT,DFNB,RACC,URBA,URBS,ERR
  .MCALL FDOP$R,FDRC$R,ERR$,CMOV$B
  FDOP$R FDB,LUN,FNPT,DFNB,FACC
  FDRC$R ,RACC,URBA,URBS
  .GLOBL .ROPEN
  JSR PC,.ROPEN
  ERR$ ERR
  .ENDM ROPN$
```

C.8.8 ROPN$A Macro

ROPN$A opens a file for appending.

```
  .MACRO ROPN$A FDB,LUN,FNPT,RACC,URBA,URBS,ERR
  .MCALL ROPN$
  ROPN$ FDB,#FO.APD,LUN,FNPT,,RACC,URBA,URBS,ERR
  .ENDM ROPN$A
```

C.8.9 ROPN$M Macro

ROPN$M opens a file for modification.

```
  .MACRO ROPN$M FDB,LUN,FNPT,RACC,URBA,URBS,ERR
  .MCALL ROPN$
  ROPN$ FDB,#FO.MFY,LUN,FNPT,,RACC,URBA,URBS,ERR
  .ENDM ROPN$M
```

C.8.10 ROPN$R Macro

ROPN$R opens a file for reading.

```
.MACRO ROPN$R FDB,LUN,FNPT,RACC,URBA,URBS,ERR
.MCALL ROPN$
ROPN$ FDB,#FO.RD,LUN,FNPT,,RACC,URBA,URBS,ERR
.ENDM ROPN$R
```

C.8.11 ROPN$U Macro

ROPN$U opens a file for updating.

```
.MACRO ROPN$U FDB,LUN,FNPT,RACC,URBA,URBS,ERR
.MCALL ROPN$
ROPN$ FDB,#FO.UPD,LUN,FNPT,,RACC,URBA,URBS,ERR
.ENDM ROPN$U
```

C.8.12 ROPN$W Macro

ROPN$W opens a file for writing.

```
.MACRO ROPN$W FDB,LUN,FNPT,RACC,URBA,URBS,ERR
.MCALL ROPN$
ROPN$ FDB,#FO.WRT,LUN,FNPT,,RACC,URBA,URBS,ERR
.ENDM ROPN$W
```

C.8.13 ROPS$A Macro

ROPS$A opens a shared file for appending.

```
.MACRO ROPS$A FDB,LUN,FNPT,RACC,URBA,URBS,ERR
.MCALL ROPN$
ROPN$ FDB,#FA.SHR!FO.APD,LUN,FNPT,,RACC,URBA,URBS,ERR
.ENDM ROPS$A
```

C.8.14 ROPS$M Macro

ROPS$M opens a shared file for modification.

```
.MACRO ROPS$M FDB,LUN,FNPT,RACC,URBA,URBS,ERR
.MCALL ROPN$
ROPN$ FDB,#FA.SHR!FO.MFY,LUN,FNPT,,RACC,URBA,URBS,ERR
.ENDM ROPS$M
```

C.8.15 ROPS$R Macro

ROPS$R opens a shared file for reading.

```
.MACRO ROPS$R FDB,LUN,FNPT,RACC,URBA,URBS,ERR
.MCALL ROPN$
ROPN$ FDB,#FA.SHR!FO.RD,LUN,FNPT,,RACC,URBA,URBS,ERR
.ENDM ROPS$R
```

C.8.16 ROPS$U Macro

ROPS$U opens a shared file for updating.

```
.MACRO ROPS$U FDB,LUN,FNPT,RACC,URBA,URBS,ERR
.MCALL ROPN$
ROPN$ FDB,#FA.SHR!FO.UPD,LUN,FNPT,,RACC,URBA,URBS,ERR
.ENDM ROPS$U
```

C.8.17 ROPS$W Macro

ROPS$W opens a shared file for writing.

```
.MACRO ROPS$W FDB,LUN,FNPT,RACC,URBA,URBS,ERR
.MCALL ROPN$
ROPN$ FDB,#FA.SHR!FO.WRT,LUN,FNPT,,RACC,URBA,URBS,ERR
.ENDM ROPS$W
```

C.8.18 RPORT$ Macro

RPORT$ reports the existence of a record for a relative file.

```
.MACRO RPORT$ FDB,LRCNM,HRCNM,ERR
.MCALL RPRTC$
RPRTC$ <FDB>,#-1,<LRCNM>,<HRCNM>,<ERR>
.ENDM RPORT$
```

C.8.19 RPRTC$ Macro

RPRTC$ reports on and optionally changes the existence of a record.

```
.MACRO RPRTC$ FDB,CHGVAL,LRCNM,HRCNM,ERR
.MCALL LDFDB$,CMOV$W,CMOV$B,ERR$
LDFDB$ FDB
CMOV$B CHGVAL,R.BTVL
CMOV$W LRCNM,R.RCNM+2
CMOV$W HRCNM,R.RCNM
JSR PC,.RPRTC
ERR$ ERR
.ENDM RPRTC$
```

C.8.20 RPUT$ Macro

RPUT$ puts a relative file.

```
.MACRO RPUT$ FDB,OUTADR,OUTCNT,LRCNM,HRCNM,ERR
.MCALL LDFDB$,CMOV$W,ERR$
LDFDB$ FDB
CMOV$W OUTADR,F.NRBD+2
CMOV$W OUTCNT,F.NRBD
CMOV$W LRCNM,R.RCNM+2
CMOV$W HRCNM,R.RCNM
JSR PC,.RPUT
ERR$ ERR
.ENDM RPUT$
```

C.9 QIOMAC - QIOSYM MACRO DEFINITIONS

C.9.1 DRERR$ Macro

Defines the directive error codes returned in the directive status word. File control services (FCS) returns these codes in the F.ERR byte of the File Descriptor Block (FDB). To distinguish them from the overlapping codes from handler and file primitives, the F.ERR+1 byte in the FDB is negative for a directive error code.

```
        .MACRO DRERR$ $$$GBL
        .MCALL .QIOE.,DEFIN$
        .IF IDN,<$$$GBL>,<DEF$G>
        ...GBL=1
        .IFF
        ...GBL=0
        .ENDC
        .IIF NDF,$$MSG,$$MSG=0
```

Standard Error Codes Returned by Directives in the Directive Status Word

```
  .QIOE. IE.UPN,-01.,<INSUFFICIENT DYNAMIC STORAGE>
  .QIOE. IE.INS,-02.,<SPECIFIED TASK NOT INSTALLED>
  .QIOE. IE.PTS,-03.,<PARTITION TOO SMALL FOR TASK>
  .QIOE. IE.UNS,-04.,<INSUFFICIENT DYNAMIC STORAGE FOR SEND>
  .QIOE. IE.ULN,-05.,<UN-ASSIGNED LUN>
  .QIOE. IE.HWR,-06.,<DEVICE HANDLER NOT RESIDENT>
  .QIOE. IE.ACT,-07.,<TASK NOT ACTIVE>
  .QIOE. IE.ITS,-08.,<DIRECTIVE INCONSISTENT WITH TASK STATE>
  .QIOE. IE.FIX,-09.,<TASK ALREADY FIXED/UNFIXED>
  .QIOE. IE.CKP,-10.,<ISSUING TASK NOT CHECKPOINTABLE>
  .QIOE. IE.TCH,-11.,<TASK IS CHECKPOINTABLE>
  .QIOE. IE.RBS,-15.,<RECEIVE BUFFER IS TOO SMALL>
  .QIOE. IE.PRI,-16.,<PRIVILEGE VIOLATION>
  .QIOE. IE.RSU,-17.,<RESOURCE IN USE>
  .QIOE. IE.NSW,-18.,<NO SWAP SPACE AVAILABLE>
  .QIOE. IE.ILV,-19.,<ILLEGAL VECTOR SPECIFIED>
  .QIOE. IE.AST,-80.,<DIRECTIVE ISSUED/NOT ISSUED FROM AST>
  .QIOE. IE.MAP,-81.,<ILLEGAL MAPPING SPECIFIED>
  .QIOE. IE.IOP,-83.,<WINDOW HAS I/O IN PROGRESS>
  .QIOE. IE.ALG,-84.,<ALIGNMENT ERROR>
  .QIOE. IE.WOV,-85.,<ADDRESS WINDOW ALLOCATION OVERFLOW>
  .QIOE. IE.NVR,-86.,<INVALID REGION ID>
  .QIOE. IE.NVW,-87.,<INVALID ADDRESS WINDOW ID>
  .QIOE. IE.ITP,-88.,<INVALID TI PARAMETER>
  .QIOE. IE.IBS,-89.,<INVALID SEND BUFFER SIZE ( .GT. 255.)>
  .QIOE. IE.LNL,-90.,<LUN LOCKED IN USE>
  .QIOE. IE.IUI,-91.,<INVALID UIC>
  .QIOE. IE.IDU,-92.,<INVALID DEVICE OR UNIT>
  .QIOE. IE.ITI,-93.,<INVALID TIME PARAMETERS>
  .QIOE. IE.PNS,-94.,<PARTITION/REGION NOT IN SYSTEM>
  .QIOE. IE.IPR,-95.,<INVALID PRIORITY ( .GT. 250.)>
  .QIOE. IE.ILU,-96.,<INVALID LUN>
  .QIOE. IE.IEF,-97.,<INVALID EVENT FLAG ( .GT. 64.)>
  .QIOE. IE.ADP,-98.,<PART OF DPB OUT OF USER'S SPACE>
  .QIOE. IE.SDP,-99.,<DIC OR DPB SIZE INVALID>
```

Success Codes from Directives - Placed in the Directive Status Word

```
  DEFIN$ IS.CLR,0          ;Event flag was clear
                           ; from CLEAR EVENT FLAG directive
  DEFIN$ IS.SET,2          ;Event flag was set
                           ; from SET EVENT FLAG directive
  DEFIN$ IS.SPD,2          ;Task was suspended
  .IF EQ,$$MSG
  .MACRO DRERR$ A
  .ENDM DRERR$
  .ENDC
  .ENDM DRERR$
```

C.9.2 FILIO$ Macro

FILIO$ defines the general QIO function codes that are device independent.

```
  .MACRO FILIO$ $$$GBL
  .MCALL .WORD.,DEFIN$
  .IF IDN,<$$$GBL>,<DEF$G>
  ...GBL=1
  .IFF
  ...GBL=0
```

General QIO Qualifier Byte Definitions

```
  .WORD. IQ.X,001,000      ;No error recovery
  .WORD. IQ.Q,002,000      ;Queue request in express queue
  .WORD. IQ.S,004,000      ;Synonym for IQ.UMD
  .WORD. IQ.UMD,004,000    ;User mode diagnostic status required
```

Express Queue Commands

```
  .WORD. IO.KIL,012,000    ;Kill current request
  .WORD. IO.RDN,022,000    ;I/O rundown
  .WORD. IO.UNL,042,000    ;Unload I/O handler task
  .WORD. IO.LTK,050,000    ;Load a task image file
  .WORD. IO.RTK,060,000    ;Record a task image file
  .WORD. IO.SET,030,000    ;Set characteristics function
```

General Device Handler Codes

```
  .WORD. IO.WLB,000,001    ;Write logical block
  .WORD. IO.RLB,000,002    ;Read logical block
  .WORD. IO.LOV,010,002    ;Load overlay (disk driver)
  .WORD. IO.ATT,000,003    ;Attach a device to a task
  .WORD. IO.DET,000,004    ;Detach a device from a task
```

Directory Primitive Codes

```
  .WORD. IO.FNA,000,011    ;Find file name in directory
  .WORD. IO.RNA,000,013    ;Remove file name from directory
  .WORD. IO.ENA,000,014    ;Enter file name in directory
```

File Primitive Codes

```
  .WORD. IO.CLN,000,007    ;Close out LUN
  .WORD. IO.ULK,000,012    ;Unlock block
  .WORD. IO.ACR,000,015    ;Access for read
  .WORD. IO.ACW,000,016    ;Access for write
  .WORD. IO.ACE,000,017    ;Access for extend
```

```
.WORD. IO.DAC,000,020    ;De-access file
.WORD. IO.RVB,000,021    ;Read viritual block
.WORD. IO.WVB,000,022    ;Write virtual block
.WORD. IO.EXT,000,023    ;Extend file
.WORD. IO.CRE,000,024    ;Create file
.WORD. IO.DEL,000,025    ;Delete file
.WORD. IO.RAT,000,026    ;Read file attributes
.WORD. IO.WAT,000,027    ;Write file attributes
.WORD. IO.APV,010,030    ;Privileged ACP control
.WORD. IO.APC,000,030    ;ACP control
.MACRO FILIO$ A
.ENDM FILIO$
.ENDM FILIO$
```

C.9.3 .IOER. Macro

This macro defines handler error codes that are returned in the I/O status block are defined through this macro. This macro then conditionally invokes the message generating macro for the QIOSYM.MSG file.

```
.MACRO .IOER. SYM,LO,MSG
DEFIN$ SYM,LO
.IF GT,$$MSG
.MCALL .IOMG.
.IOMG. SYM,LO,<MSG>
.ENDC
.ENDM .IOER.
```

C.9.4 IOERR$ Macro

This macro defines the error codes returned by device handlers and file primitives in the first word of the I/O status block. The File Control Services also return these codes in the F.ERR byte in the File Descriptor Block (FDB). The F.ERR+1 byte is 0 if F.ERR contains a handler or FCP error code.

```
.MACRO IOERR$ $$$GBL
.MCALL .IOER.,DEFIN$
.IF IDN,<$$$GBL>,<DEF$G>
...GBL=1
.IFF
...GBL=0
.ENDC
.IIF NDF,$$MSG,$$MSG=0
```

System standard codes, used by executive and drivers:

```
.IOER. IE.BAD,-01.,<BAD PARAMETERS>
.IOER. IE.IFC,-02.,<INVALID FUNCTION CODE>
.IOER. IE.DNR,-03.,<DEVICE NOT READY>
.IOER. IE.VER,-04.,<PARITY ERROR ON DEVICE>
.IOER. IE.ONP,-05.,<HARDWARE OPTION NOT PRESENT>
.IOER. IE.SPC,-06.,<ILLEGAL USER BUFFER>
.IOER. IE.DNA,-07.,<DEVICE NOT ATTACHED>
.IOER. IE.DAA,-08.,<DEVICE ALREADY ATTACHED>
.IOER. IE.DUN,-09.,<DEVICE NOT ATTACHABLE>
.IOER. IE.EOF,-10.,<END OF FILE DETECTED>
.IOER. IE.EOV,-11.,<END OF VOLUME DETECTED>
.IOER. IE.WLK,-12.,<WRITE ATTEMPTED TO LOCKED UNIT>
```

```
  .IOER. IE.DAO,-13.,<DATA OVERRUN>
  .IOER. IE.SRE,-14.,<SEND/RECEIVE FAILURE>
  .IOER. IE.ABO,-15.,<REQUEST TERMINATED>
  .IOER. IE.PRI,-16.,<PRIVILEGE VIOLATION>
  .IOER. IE.RSU,-17.,<SHARABLE RESOURCE IN USE>
  .IOER. IE.OVR,-18.,<ILLEGAL OVERLAY REQUEST>
  .IOER. IE.BYT,-19.,<ODD BYTE COUNT (OR VIRTUAL ADDRESS)>
  .IOER. IE.BLK,-20.,<LOGICAL BLOCK NUMBER TOO LARGE>
  .IOER. IE.MOD,-21.,<INVALID UDC MODULE #>
  .IOER. IE.CON,-22.,<UDC CONNECT ERROR>
  .IOER. IE.BBE,-56.,<BAD BLOCK ON DEVICE>
  .IOER. IE.STK,-58.,<NOT ENOUGH STACK SPACE (FCS OR FCP)>
  .IOER. IE.FHE,-59.,<FATAL HARDWARE ERROR ON DEVICE>
  .IOER. IE.EOT,-62.,<END OF TAPE DETECTED>
  .IOER. IE.OFL,-65.,<DEVICE OFF LINE>
  .IOER. IE.BCC,-66.,<BLOCK CHECK, CRC, OR FRAMING ERROR>
File Primitive Codes

  .IOER. IE.NOD,-23.,<CALLER'S NODES EXHAUSTED>
  .IOER. IE.DFU,-24.,<DEVICE FULL>
  .IOER. IE.IFU,-25.,<INDEX FILE FULL>
  .IOER. IE.NSF,-26.,<NO SUCH FILE>
  .IOER. IE.LCK,-27.,<LOCKED FROM READ/WRITE ACCESS>
  .IOER. IE.HFU,-28.,<FILE HEADER FULL>
  .IOER. IE.WAC,-29.,<ACCESSED FOR WRITE>
  .IOER. IE.CKS,-30.,<FILE HEADER CHECKSUM FAILURE>
  .IOER. IE.WAT,-31.,<ATTRIBUTE CONTROL LIST FORMAT ERROR>
  .IOER. IE.RER,-32.,<FILE PROCESSOR DEVICE READ ERROR>
  .IOER. IE.WER,-33.,<FILE PROCESSOR DEVICE WRITE ERROR>
  .IOER. IE.ALN,-34.,<FILE ALREADY ACCESSED ON LUN>
  .IOER. IE.SNC,-35.,<FILE ID, FILE NUMBER CHECK>
  .IOER. IE.SQC,-36.,<FILE ID, SEQUENCE NUMBER CHECK>
  .IOER. IE.NLN,-37.,<NO FILE ACCESSED ON LUN>
  .IOER. IE.CLO,-38.,<FILE WAS NOT PROPERLY CLOSED>
  .IOER. IE.DUP,-57.,<ENTER - DUPLICATE ENTRY IN DIRECTORY>
  .IOER. IE.BVR,-63.,<BAD VERSION NUMBER>
  .IOER. IE.BHD,-64.,<BAD FILE HEADER>
  .IOER. IE.EXP,-75.,<FILE EXPIRATION DATE NOT REACHED>
  .IOER. IE.BTF,-76.,<BAD TAPE FORMAT>
  .IOER. IE.ALC,-84.,<ALLOCATION FAILURE>
  .IOER. IE.ULK,-85.,<UNLOCK ERROR>
  .IOER. IE.WCK,-86.,<WRITE CHECK FAILURE>

File Control Services Codes

  .IOER. IE.NBF,-39.,<OPEN - NO BUFFER SPACE AVAILABLE FOR FILE>
  .IOER. IE.RBG,-40.,<ILLEGAL RECORD SIZE>
  .IOER. IE.NBK,-41.,<FILE EXCEEDS SPACE ALLOCATED, NO BLOCKS>
  .IOER. IE.ILL,-42.,<ILLEGAL OPERATION ON FILE DESCRIPTOR
                      BLOCK>
  .IOER. IE.BTP,-43.,<BAD RECORD TYPE>
  .IOER. IE.RAC,-44.,<ILLEGAL RECORD ACCESS BITS SET>
  .IOER. IE.RAT,-45.,<ILLEGAL RECORD ATTRIBUTES BITS SET>
  .IOER. IE.RCN,-46.,<ILLEGAL RECORD NUMBER - TOO LARGE>
  .IOER. IE.2DV,-48.,<RENAME - 2 DIFFERENT DEVICES>
  .IOER. IE.FEX,-49.,<RENAME - NEW FILE NAME ALREADY IN USE>
  .IOER. IE.BDR,-50.,<BAD DIRECTORY FILE>
  .IOER. IE.RNM,-51.,<CANNOT RENAME OLD FILE SYSTEM>
  .IOER. IE.BDI,-52.,<BAD DIRECTORY SYNTAX>
  .IOER. IE.FOP,-53.,<FILE ALREADY OPEN>
  .IOER. IE.BNM,-54.,<BAD FILE NAME>
  .IOER. IE.BDV,-55.,<BAD DEVICE NAME>
  .IOER. IE.NFI,-60.,<FILE ID WAS NOT SPECIFIED>
```

```
   .IOER. IE.ISQ,-61.,<ILLEGAL SEQUENTIAL OPERATION>
   .IOER. IE.NNC,-77.,<NOT ANSI 'D' FORMAT BYTE COUNT>

Network ACP Codes

   .IOER. IE.AST,-80.,<NO AST SPECIFIED IN CONNECT>
   .IOER. IE.NNN,-68.,<NO SUCH NODE>
   .IOER. IE.NFW,-69.,<PATH LOST TO PARTNER> ;This code must be
                                             ; odd
   .IOER. IE.BLB,-70.,<BAD LOGICAL BUFFER>
   .IOER. IE.TMM,-71.,<TOO MANY OUTSTANDING MESSAGES>
   .IOER. IE.NDR,-72.,<NO DYNAMIC SPACE AVAILABLE>
   .IOER. IE.CNR,-73.,<CONNECTION REJECTED>
   .IOER. IE.TMO,-74.,<TIMEOUT ON REQUEST>
   .IOER. IE.NNL,-78.,<NOT A NETWORK LUN>

ICS/ICR Error Codes

   .IOER. IE.NLK,-79.,<TASK NOT LINKED TO SPECIFIED ICS/ICR
                      INTERRUPTS>
   .IOER. IE.NST,-80.,<SPECIFIED TASK NOT INSTALLED>
   .IOER. IE.FLN,-81.,<DEVICE OFFLINE WHEN OFFLINE REQUEST WAS
                      ISSUED>

TTY Error Codes

   .IOER. IE.IES,-82.,<INVALID ESCAPE SEQUENCE>
   .IOER. IE.PES,-83.,<PARTIAL ESCAPE SEQUENCE>

Successful Return Codes:

   DEFIN$ IS.PND,+00.       ;Operation pending
   DEFIN$ IS.SUC,+01.       ;Operation complete, success
   DEFIN$ IS.RDD,+02.       ;(RX11) Floppy disk successful
                            ; completion of a read physical
                            ; and a deleted data mark was
                            ; seen in the sector header of
                            ; the last sector.
   DEFIN$ IS.BV,+05.        ;(A/D READ) At least one bad value
                            ; was read (remainder may be good);
                            ; bad channel is indicated by a
                            ; negative value in the buffer.

TTY Success Codes

   DEFIN$ IS.CR,<15*400+1>     ;Carriage return was terminator
   DEFIN$ IS.ESC,<33*400+1>    ;Escape (ALTMODE) was terminator
   DEFIN$ IS.CC,<3*400+1>      ;CONTROL-C was terminator
   DEFIN$ IS.ESQ,<233*400+1>   ;Escape sequence was terminator
   DEFIN$ IS.PES,<200*400+1>   ;Partial escape sequence terminator
   DEFIN$ IS.EOT,<4*400+1>     ;EOT was terminator (block mode
                               ; input)
   DEFIN$ IS.TAB,<11*400+1>    ;TAB was terminator (forms mode
                               ; input)
   DEFIN$ IS.TMO,+2.           ;Request timed out
   .IF EQ,$$MSG
   .MACRO IOERR$ A
   .ENDM IOERR$
   .ENDC
   .ENDM IOERR$
```

C.9.5 .QIOE. Macro

This macro defines the QIO error codes. This macro then invokes the error message generating macro, ".IOMG.". The QIOSYM.MSG file uses error codes -129 through -256.

```
.MACRO .QIOE. SYM,LO,MSG
DEFIN$ SYM,LO
.IF GT,$$MSG
.MCALL .IOMG.
.IOMG. SYM,<LO-128.>,<MSG>
.ENDC
.ENDM .QIOE.
```

Conditional Data for Writing a Message File

```
.MACRO .IOMG. SYM,LO,MSG
.WORD -^O<LO>
      .ASCIZ ^MSG^
.EVEN
.IIF LT,^O<$$$MAX+<LO>>,$$$MAX=-^O<LO>
      .ENDM .IOMG.
```

C.9.6 QIOSY$ Macro

This macro defines standard QUEUE I/O directive function values and IOSB return values. To invoke at assembly time (with local definition) use:

```
QIOSY$                  ;Define symbols
```

To obtain global definition of these symbols use:

```
QIOSY$ DEF$G            ;Symbols defined globally
```

This macro can be called once only. It then redefines itself as a null.

```
.MACRO QIOSY$ $$$GBL,$$$MSG
.IIF IDN,<$$$GBL>,<DEF$G>, .GLOBL QI.VER
.IF IDN,<$$$MSG>,<DEF$S>
$$$MAX=0
$$MSG=1
.IFF
$$MSG=0
.ENDC
.MCALL IOERR$
IOERR$ $$$GBL           ;I/O error codes from handlers, FCP,
                        ; FCS
.MCALL DRERR$
DRERR$ $$$GBL           ;Directive status word error codes
.IF DIF,<$$$MSG>,<DEF$S>
.MCALL FILIO$
FILIO$ $$$GBL           ;Define general QIO function codes
.MCALL SPCIO$
SPCIO$ $$$GBL           ;Device dependent I/O function codes
.MACRO QIOSY$ ARG,ARG1,ARG2  ;Reclaim macro storage
.ENDM QIOSY$
.ENDC
.ENDM QIOSY$
```

C.9.7 SPCIO$ Macro

Defines the QIO function codes that are specific to individual devices.

```
.MACRO SPCIO$ $$$GBL
.MCALL .WORD.,DEFIN$
.IF IDN,<$$$GBL>,<DEF$G>
...GBL=1
.IFF
...GBL=0
.ENDC
```

QIO Function Codes for Specific Device Dependent Functions

```
.WORD. IO.WLV,100,001   ;(DECTAPE) Write logical reverse
.WORD. IO.WLS,010,001   ;(COMM.) Write preceded by sync train
.WORD. IO.WNS,020,001   ;(COMM.) Write, no sync train
.WORD. IO.WAL,010,001   ;(TTY) Write passing all characters
.WORD. IO.WMS,020,001   ;(TTY) Write suppressible message
.WORD. IO.CCO,040,001   ;(TTY) Write with cancel CONTROL-o
.WORD. IO.WBT,100,001   ;(TTY) Write with breakthrough
.WORD. IO.WLT,010,001   ;(DISK) Write last track on RK06
.WORD. IO.WLC,020,001   ;(DISK) Write logical with write check
.WORD. IO.WPB,040,001   ;(RX11 DISK) Write physical block
.WORD. IO.WDD,044,001   ;(RX11 DISK) Write physical with
                              ; deleted data
.WORD. IO.RLV,100,002   ;(MAGTAPE,DECTAPE) Read reverse
.WORD. IO.RST,001,002   ;(TTY) Read with special terminator
.WORD. IO.RAL,010,002   ;(TTY) Read passing all characters
.WORD. IO.RNE,020,002   ;(TTY) Read without echo
.WORD. IO.RNC,040,002   ;(TTY) Read - no lower case convert
.WORD. IO.RTM,200,002   ;(TTY) Read with time out
.WORD. IO.RDB,200,002   ;(CARD READER) Read binary mode
.WORD. IO.RHD,010,002   ;(COMM.) Read, strip sync
.WORD. IO.RNS,020,002   ;(COMM.) Read, do not strip sync
.WORD. IO.CRC,040,002   ;(COMM.) Read, do not clear CRC
.WORD. IO.RPB,040,002   ;(RX11 DISK) Read physical block
.WORD. IO.ATA,010,003   ;(TTY) Attach with ASTs
.WORD. IO.GTS,000,005   ;(TTY) Get terminal support
                              ; characteristics
.WORD. IO.R1C,000,005   ;(AFC,AD01,UDC) Read single channel
.WORD. IO.INL,000,005   ;(COMM.) Initialization function
.WORD. IO.TRM,010,005   ;(COMM.) Termination function
.WORD. IO.RWD,000,005   ;(MAGTAPE,DECTAPE) Rewind
.WORD. IO.SPB,020,005   ;(MAGTAPE) Space "N" blocks
.WORD. IO.SPF,040,005   ;(MAGTAPE) Space "N" EOF marks
.WORD. IO.STC,100,005   ;(MAGTAPE) Set characteristic
.WORD. IO.SEC,120,005   ;(MAGTAPE) Sense characteristic
.WORD. IO.RWU,140,005   ;(MAGTAPE,DECTAPE) Rewind and unload
.WORD. IO.SMO,160,005   ;(MAGTAPE) Mount & set characteristics
.WORD. IO.HNG,000,006   ;(TTY) Hangup dial-up line
.WORD. IO.RBC,000,006   ;Read multichannels (buffer
                              ; defines channels)
.WORD. IO.MOD,000,006   ;(COMM.) Setmode function family
.WORD. IO.HDX,010,006   ;(COMM.) Set unit half duplex
.WORD. IO.FDX,020,006   ;(COMM.) Set unit full duplex
.WORD. IO.SYN,040,006   ;(COMM.) Specify sync character
.WORD. IO.EOF,000,006   ;(MAGTAPE) Write EOF
.WORD. IO.RTC,000,007   ;Read channel - time based
.WORD. IO.SAO,000,010   ;(UDC) Single channel analog output
.WORD. IO.SSO,000,011   ;(UDC) Single shot, single point
.WORD. IO.RPR,000,011   ;(TTY) Read with prompt
.WORD. IO.MSO,000,012   ;(UDC) Single shot, multi-point
```

```
.WORD. IO.SLO,000,013   ;(UDC) Latching, single point
.WORD. IO.MLO,000,014   ;(UDC) Latching, multi-point
.WORD. IO.LED,000,024   ;(LPS11) Write LED display lights
.WORD. IO.SDO,000,025   ;(LPS11) Write digital output register
.WORD. IO.SDI,000,026   ;(LPS11) Read digital input register
.WORD. IO.SCS,000,026   ;(UDC) Contact sense, single point
.WORD. IO.REL,000,027   ;(LPS11) Write relay
.WORD. IO.MCS,000,027   ;(UDC) Contact sense, multi-point
.WORD. IO.ADS,000,030   ;(LPS11) Synchronous A/D sampling
.WORD. IO.CCI,000,030   ;(UDC) Contact int - connect
.WORD. IO.MDI,000,031   ;(LPS11) Synchronous digital input
.WORD. IO.DCI,000,031   ;(UDC) Contact int - disconnect
.WORD. IO.XMT,000,031   ;(COMM.) Transmit specified block
                        ; with ACK
.WORD. IO.XNA,010,031   ;(COMM.) Transmit without ACK
.WORD. IO.HIS,000,032   ;(LPS11) Synchronous histogram
                        ; sampling
.WORD. IO.RCI,000,032   ;(UDC) Contact int - read
.WORD. IO.RCV,000,032   ;(COMM.) Receive data in buffer
                        ; specified
.WORD. IO.MDO,000,033   ;(LPS11) Synchronous digital output
.WORD. IO.CTI,000,033   ;(UDC) Timer - connect
.WORD. IO.CON,000,033   ;(COMM.) Connect function
                        ;(VT11) - Connect task to display
                        ; processor
.WORD. IO.CPR,010,033   ;(COMM.) Connect no timeouts
.WORD. IO.CAS,020,033   ;(COMM.) Connect with AST
.WORD. IO.CRJ,040,033   ;(COMM.) Connect reject
.WORD. IO.CBO,110,033   ;(COMM.) Boot connect
.WORD. IO.CTR,210,033   ;(COMM.) Transparent connect
.WORD. IO.GNI,010,035   ;(COMM.) Get node information
.WORD. IO.GLI,020,035   ;(COMM.) Get link information
.WORD. IO.GLC,030,035   ;(COMM.) Get link information -
                        ; clear counters
.WORD. IO.GRI,040,035   ;(COMM.) Get remote node information
.WORD. IO.GRC,050,035   ;(COMM.) Get remote node error counts
.WORD. IO.GRN,060,035   ;(COMM.) Get remote node name
.WORD. IO.CSM,070,035   ;(COMM.) Change solo mode
.WORD. IO.CIN,100,035   ;(COMM.) Change connection inhibit
.WORD. IO.SPW,110,035   ;(COMM.) Specify network password
.WORD. IO.CPW,120,035   ;(COMM.) Check network password.
.WORD. IO.NLB,130,035   ;(COMM.) NSP loopback
.WORD. IO.DLB,140,035   ;(COMM.) DDCMP loopback
.WORD. IO.STD,000,033   ;(LPA11) Start data transfer
.WORD. IO.DTI,000,034   ;(UDC) Timer - disconnect
.WORD. IO.DIS,000,034   ;(COMM.) Disconnect function
                        ;(VT11) - Disconnect task from
                        ; display processor
.WORD. IO.MDA,000,034   ;(LPS11) Synchronous D/A output
.WORD. IO.RTI,000,035   ;(UDC) Timer - read
.WORD. IO.CTL,000,035   ;(COMM.) Network control function
.WORD. IO.STP,000,035   ;(LPS11) Stop in progress function
                        ;(VT11) - Stop display processor
.WORD. IO.CNT,000,036   ;(VT11) - Continue display processor
.WORD. IO.ITI,000,036   ;(UDC) Timer - initialize
```

ICS/ICR QIO Functions

```
.WORD. IO.CTY,000,007   ;Connect to terminal interrupts
.WORD. IO.DTY,000,015   ;Disconnect from terminal interrupts
.WORD. IO.LDI,000,016   ;Link to digital interrupts
.WORD. IO.UDI,010,023   ;Unlink from digital interrupts
.WORD. IO.LTI,000,017   ;Link to counter module interrupts
```

```
  .WORD. IO.UTI,020,023    ;Unlink from counter module
                           ; interrupts
  .WORD. IO.LTY,000,020    ;Link to remote terminal interrupts
  .WORD. IO.UTY,030,023    ;Unlink from remote terminal
                           ; interrupts
  .WORD. IO.LKE,000,024    ;Link to error interrupts
  .WORD. IO.UER,040,023    ;Unlink from error interrupts
  .WORD. IO.NLK,000,023    ;Unlink from all interrupts
  .WORD. IO.ONL,000,037    ;Unit online
  .WORD. IO.FLN,000,025    ;Unit offline
  .WORD. IO.RAD,000,021    ;Read activating data

IPll I/O Functions

  .WORD. IO.MAO,010,007   ;Multiple analog outputs
  .WORD. IO.LEI,010,017   ;Link event flags to interrupt
  .WORD. IO.RDD,010,020   ;Read digital data
  .WORD. IO.RMT,020,020   ;Read mapping table
  .WORD. IO.LSI,000,022   ;Link to DSI interrupts
  .WORD. IO.UEI,050,023   ;Unlink event flags
  .WORD. IO.USI,060,023   ;Unlink from DSI interrupts
  .WORD. IO.CSI,000,026   ;Connect to DSI interrupts
  .WORD. IO.DSI,000,027   ;Disconnect from DSI interrupts
  .MACRO SPCIO$ A
  .ENDM SPCIO$
  .ENDM SPCIO$
```

C.9.8 UMDIO$ Macro

Defines the I/O codes for user-mode diagnositcs. All diagnostic functions are implemented as a subfunction of I/O code 10 (octal).

```
  .MACRO UMDIO$ $$$GBL
  .MCALL .WORD.,DEFIN$
  .IF IDN <$$$GBL>,<DEF$G>
...GBL=1
  .IFF
...GBL=0
  .ENDC

General User-mode Qualifier Bit

  .WORD. IQ.UMD,004,000    ;User mode diagnostic request

User-mode Diagnostic Functions.

  .WORD. IO.HMS,000,010    ;(DISK) Home seek or recalibrate
  .WORD. IO.BLS,010,010    ;(DISK) Block seek
  .WORD. IO.OFF,020,010    ;(DISK) Offset position
  .WORD. IO.RDH,030,010    ;(DISK) Read disk header
  .WORD. IO.WDH,040,010    ;(DISK) Write disk header
  .WORD. IO.WCK,050,010    ;(DISK) Writecheck (non-transfer)
  .WORD. IO.RNF,060,010    ;(DECTAPE) Read block number forward
  .WORD. IO.RNR,070,010    ;(DECTAPE) Read block number reverse
  .WORD. IO.LPC,100,010    ;(MAGTAPE) Read longitudinal parity
                           ; character
  .WORD. IO.ERS,110,010    ;(MAGTAPE) Erase tape

Macro Redefinition to Null

  .MACRO UMDIO$ A
        .ENDM
        .ENDM UMDIO$
```

C.9.9 .WORD. Macro

This macro defines the symbol SYM where LO is the low order byte and HI is the high byte.

```
   .MACRO .WORD. SYM,LO,HI
   DEFIN$ SYM,<^O<HI*400+LO>>
   .ENDM .WORD.
```

C.10 SNAP CONTROL BLOCK AND SNAPSHOT DUMP MACROS

The following macros are the macros for the snapshot dump debugging aid.

C.10.1 SNAP$ Macro

SNAP$ requests a snpashot dump.

```
   .MACRO SNAP$ CTL,EFN,ID,L1,H1,L2,H2,L3,H3,L4,H4,?LBL1,?LBL2
   .MCALL SNPDF$,WTSE$S,SDAT$S,RQST$S,CLEF$S
   SNPDF$
   .IIF NB <CTL>, MOV CTL,..SPBK+SB.CTL
   .IIF NB <EFN>, MOV EFN,..SPBK+SB.EFN
   .IIF NB <ID>, MOV ID,..SPBK+SB.ID
...SNP = SB.LM1
   .IRP X,<L1,H1,L2,H2,L3,H3,L4,H4>
   .IF NB <X>
   MOV X,..SPBK+...SNP
   .ENDC
...SNP = ...SNP+2
   .ENDM
   CLEF$S ..SPBK+SB.EFN                    ;Clear event flag
   BCS LBL2
   SDAT$S #..SPBK+SB.PMD,#..SPBK           ;Send snap information
   BCS LBL2
   RQST$S #..SPBK+SB.PMD                   ;Request task "PMD..."
   BCC LBL1
   CMP #IE.ACT,@#$DSW                      ;O.K. if task already
                                           ;active
   BEQ LBL1
   SEC
   BR LBL2
LBL1:   WTSE$S ..SPBK+SB.EFN               ;Wait for snapshot to
                                           ;finish
LBL2:
   .ENDM SNAP$
```

C.10.2 SNPBK$ Macro

SNPBK$ generates a snap control block.

```
   .MACRO SNPBK$ DEV,UNIT,CTL,EFN,ID,L1,H1,L2,H2,L3,H3,L4,H4
```

SNPBK$ never generates more than one block.

```
   .IF DF ..SPBK
   .IIF NE <..SPBK-.>, .MEXIT
   .ENDC
```

```
  .MCALL SNPDF$
  SNPDF$
```

The following code builds the control block.

```
..SPBK::.WORD CTL                ;Control word
        .ASCII /DEV/             ;Send out device name
        .IF NE .-<..SPBK+SB.DEV+2>
        .ERROR                   ;Invalid device name "DEV"
        .MEXIT
        .ENDC
        .BYTE UNIT,0             ;Device unit number & unused
        .WORD EFN                ;Event flag number
        .WORD ID                 ;Snapshot identification word
        .WORD L1,H1              ;Dump address limits
        .WORD L2,H2
        .WORD L3,H3
        .WORD L4,H4
        .RAD50 /PMD.../          ;Snapshot task name
        .ENDM SNPBK$
```

C.10.3 SNPDF$ Macro

SNPDF$ generates snap offset and bit definitions.

```
  .MACRO SNPDF$ GBL
  .IF IDN <GBL>,<DEF$G>
  .GLOBL SB.CTL,SB.DEV,SB.UNT,SB.EFN,SB.ID,SB.LM1,SB.PMD
  .GLOBL SC.HDR,SC.LUN,SC.OVL,SC.STK,SC.WRD,SC.BYT
  .ENDC
```

C.11 STATE AND KEYWORD TABLE GENERATION MACROS

These macros initialize table generation - they are called once at the start of each finite state machine description. The user must supply labels for the state and keyword tables.

C.11.1 ISTAT$ Macro

```
  .MACRO ISTAT$ STTBL,KEYTBL
  .MCALL MTRAN$
  .IF DF $RONLY
  .PSECT $STATE,D,RO
  .IFF
  .PSECT $STATE,D
  .ENDC
STTBL::
  .IF DF $RONLY
  .PSECT $KTAB,D,RO
  .IFF
  .PSECT $KTAB,D
  .ENDC
KEYTBL::
  .IF DF $RONLY
  .PSECT $KSTR,D,RO
```

```
.IFF
.PSECT $KSTR,D
.ENDC
$$$KEY = -1
$$$FLG = -1
$EXIT = 0
$LAMDA = 300
$NUMBR = 302
$STRNG = 304
$BLANK = 306
$SUBXP = 310
$EOS   = 312
$DNUMB = 314
$RAD50 = 316
$ANY   = 320
$ALPHA = 322
$DIGIT = 324
.PSECT
.ENDM ISTAT$
```

C.11.2 MTRAN$ Macro

MTRAN$ sends out the last transition entry.

```
.MACRO MTRAN$
.PSECT $STATE
.IF EQ $$$FLG+1
$$$FLG = 0
.MEXIT
.ENDC
$$$TYP
.BYTE $$$FLG
.IF NE $$$FLG&1
$$$EXT
.ENDC
.IF NE $$$FLG&2
$$$ACT
.ENDC
.IF NE $$$FLG&10
$$$BIT
.ENDC
.IF NE $$$FLG&4
.WORD $$$STA
.IFF
.IF EQ $$$FLG&200
.ERROR "BAD DEFAULT TRANSITION"
      .ENDC
.ENDC
$$$FLG = 0
.ENDM MTRAN$
.LIST
```

C.11.3 STATE$ Macro

STATE$ declares a state.

```
.MACRO STATE$ LABEL
.PSECT $STATE
$$$FLG = $$$FLG!200
MTRAN$
```

```
  .IF NB LABEL
LABEL:  .ENDC
  $$$FLG = -1
  .PSECT
  .ENDM STATE$
```

C.11.4 TRAN$ Macro

TRAN$ specifies a state transition.

```
  .MACRO TRAN$ TYPE,LABEL,ACTION,MASK,ADDR
  .PSECT $STATE
  MTRAN$
  .IF NB ACTION
  $$$FLG = $$$FLG!2
  .MACRO $$$ACT
  .WORD ACTION
  .ENDM $$$ACT
  .ENDC
  .IF NB MASK
  $$$FLG = $$$FLG!30
  .IF B ADDR
  .ERROR "MASK ADDRESS NOT PRESENT"
  .ENDC
  .MACRO $$$BIT
  .WORD MASK,ADDR
  .ENDM $$$BIT
  .ENDC
  .IF NB LABEL
  $$$FLG = $$$FLG!4
  $$$STA = LABEL
  .ENDC
  .IRPC X,<TYPE>
  .IF IDN <X>,<">
  .PSECT $KSTR
  $$$TMP = .
  .ASCII TYPE<377>
  .PSECT $KTAB
  .WORD $$$TMP
  .MACRO $$$TYP
  .BYTE $$$KEY!200
  .ENDM $$$TYP
  $$$KEY = $$$KEY+1
  .IF GT $$$KEY-63.
  .ERROR "TOO MANY KEYWORDS"
  .ENDC
  .MEXIT
  .ENDC
  .IF IDN <X>,<!>
  $$$FLG = $$$FLG!1
  .MACRO $$$EXT
  .WORD 0'TYPE
  .ENDM $$$EXT
  .MACRO $$$TYP
  .BYTE $SUBXP
  .ENDM $$$TYP
  .MEXIT
  .ENDC
  .MACRO $$$TYP
  .BYTE TYPE
  .ENDM $$$TYP
  .MEXIT
```

```
  .ENDM
  .PSECT
  .ENDM TRAN$
```

C.12 SUBMIT FILE TO PRINT SPOOLER (PRT...) MACRO (PRINT$)

C.12.1 PRINT$ Macro

The PRINT$ macro takes the following form:

```
  PRINT$ FDB,ERR
```

where:

```
  FDB=Address of the FDB of the file to submit.
  ERR=Address of error routine.

  .MACRO PRINT$ FDB,ERR,?LBL,A,B,C,D,E,F,?LBL2
  .MCALL CALL,CLOSE$,LDR0$,GLUN$S
  LDR0$ FDB                ;Load FDB address into R0
  TST F.BDB(R0)            ;File open?
  BEQ LBL                  ;If eq no
  MOV R1,-(SP)             ;Save R1 and R2
  MOV R2,-(SP)
  MOV R3,-(SP)             ;Save R3
  MOV SP,R1                ;Save pointer to end of send buffer
  SUB #<8.*2>,SP           ;Allocate a get LUN info buffer
  MOV SP,R2                ;Save its address in R2
  MOVB F.LUN(R0),R3        ;Get LUN in R3
  GLUN$S R3,R2             ;Get real device name and unit
  MOV G.LUCW(R2),R3        ;Save characteristics word 1
  MOV R0,R2                ;Copy FDB address
  ADD #F.FNB+N.DID+6,R2    ;Point to end of directory ID
  MOV -(R2),-(R1)          ;Push directory ID
  MOV -(R2),-(R1)
  MOV -(R2),-(R1)
  ADD #N.FID+6-N.DID,R2    ;Point to end of file ID
  MOV -(R2),-(R1)          ;Push file ID
  MOV -(R2),-(R1)
  MOV -(R2),-(R1)
  CLRB -(R1)               ;Clear LUN information flags byte
  ADD #N.FVER+2-N.FID,R2   ;Point to end of filename, type,
                           ; version
  MOV -(R2),-(SP)          ;Push file version number
  MOV -(R2),-(SP)          ;Push file type
  MOV -(R2),-(SP)          ;Push filename
  MOV -(R2),-(SP)
  MOV -(R2),-(SP)
  MOV SP,R1                ;Set pointer to send buffer
  CLOSE$ R0                ;Close file
  BCS LBL2                 ;Skip on error
  BIT #FD.REC!FD.OSP,R3    ;Record oriented or spooled device?
  BNE LBL2                 ;If ne yes
  MOV R0,R2                ;Save FDB address
  MOV #RPRT,R0             ;Get "PRT" in RAD-50
  CALL $DSPAT              ;Send data to ...PRT or PRT...
  MOV R0,F.ERR(R2)         ;Get return status
  MOV R2,R0                ;Restore FDB address
LBL2:   ROR R1                   ;Save carry
```

```
  ADD #<13.*2>,SP          ;Clean stack
  ROL R1                   ;Restore carry
  MOV (SP)+,R3              ;Restore R3
  MOV (SP)+,R2             ;Restore R1 and R2
  MOV (SP)+,R1
  .IF NB ERR
  BCC LBL                  ;If CC okay
  CALL ERR                 ;Call error routine
  .ENDC
LBL:                             ;Reference label
  .ENDM PRINT$
```

C.13 SET/GET SYMBOL (TTSYM$) MACRO EXPANSIONS

C.13.1 TTSYM$ Macro

The TTSYM$ macro file is used by RSX-11D, IAS, and RSX-11M terminal drivers. However, the RSX-11M terminal driver uses only a limited number of the symbols in this file. The TTSYM$ macro defines all the symbols required for terminal SET and GET characteristics.

```
  .MACRO TTSYM$ $$$GBL
  .MCALL DEFIN$
  ...GBL=0
  .IF IDN,<$$$GBL>,<DEF$G>
  ...GBL=1
  .ENDC

  DEFIN$ TC.WID,1.         ;Line width
  DEFIN$ TC.LPP,2.         ;Lines per page
  DEFIN$ TC.RSP,3.         ;Receiver speed
  DEFIN$ TC.XSP,4.         ;Transmitter speed
  DEFIN$ TC.STB,5.         ;Two stop bits
  DEFIN$ TC.ISL,6.         ;Subline on interface
  DEFIN$ TC.RAT,7.         ;Read-ahead type
  DEFIN$ TC.TTP,8.         ;Terminal type
  DEFIN$ TC.SCR,9.         ;Script line
  DEFIN$ TC.SCP,10.        ;Scope
  DEFIN$ TC.HFL,11.        ;Horizontal fill requirement
  DEFIN$ TC.VFL,12.        ;Vertical fill
  DEFIN$ TC.NL ,13.        ;ASCII newline terminal
  DEFIN$ TC.SFF,14.        ;Simulate formfeed and vertab
  DEFIN$ TC.HFF,15.        ;HARDWARE FORMFEED AND VERTAB
  DEFIN$ TC.LVF,16.        ;LA36 vertical fill
  DEFIN$ TC.HHT,17.        ;Hardware horizontal tab
  DEFIN$ TC.NST,18.        ;Non-standard hardware tab
  DEFIN$ TC.BSP,19.        ;Hardware backspace
  DEFIN$ TC.ACR,20.        ;Automatic carriage return required
  DEFIN$ TC.SMR,21.        ;Small character input enabled
  DEFIN$ TC.SMP,22.        ;Small character input required
                                 ; (/lower case input)
  DEFIN$ TC.SMO,23.        ;Small character output enabled
  DEFIN$ TC.CCF,24.        ;CONTROL-C flushes type-ahead and read
  DEFIN$ TC.ALT,25.        ;Alternative ALTMODE recognition
  DEFIN$ TC.IMG,26.        ;IAS - messages inhibited
  DEFIN$ TC.NKB,27.        ;No keyboard
  DEFIN$ TC.NPR,28.        ;No printer
  DEFIN$ TC.ESQ,29.        ;Escape sequence recognition
  DEFIN$ TC.LCP,30.        ;Local copy line
```

```
  DEFIN$ TC.PAR,31.       ;Parity recognition/generation
                                ; required
  DEFIN$ TC.EPA,32.       ;Even parity
  DEFIN$ TC.DLU,33.       ;Dialup line
  DEFIN$ TC.BLK,34.       ;Block mode terminal
  DEFIN$ TC.FRM,35.       ;Forms mode terminal
  DEFIN$ TC.HLD,36.       ;Terminal hold mode
  DEFIN$ TC.TAP,37.       ;Low speed paper tape reader
  DEFIN$ TC.CEQ,38.       ; compatible escape sequences
  DEFIN$ TC.NEC,39.       ; terminal in no-echo mode
  DEFIN$ TC.SLV,40.       ; terminal in slave mode
  DEFIN$ TC.PRI,41.       ; terminal is privileged
  DEFIN$ TC.UC0,42.       ;User characteristic 0
  DEFIN$ TC.UC1,43.       ;User characteristic 1
  DEFIN$ TC.UC2,44.       ;User characteristic 2
  DEFIN$ TC.UC3,45.       ;User characteristic 3
  DEFIN$ TC.UC4,46.       ;User characteristic 4
  DEFIN$ TC.UC5,47.       ;User characteristic 5
  DEFIN$ TC.UC6,48.       ;User characteristic 6
  DEFIN$ TC.UC7,49.       ;User characteristic 7
  DEFIN$ TC.UC8,50.       ;User characteristic 8
  DEFIN$ TC.UC9,51.       ;User characteristic 9
  DEFIN$ TC.MAX,52.       ;This must be one greater
                          ; than the highest value used
                          ; for a symbol

Set Characteristic Error Codes

  DEFIN$ SE.ICN,1.        ;Wrong characteristic name
  DEFIN$ SE.FIX,2.        ;Attempt to change fixed
                          ; characteristic
  DEFIN$ SE.BIN,3.        ;Wrong value for binary
                          ; characteristic
  DEFIN$ SE.VAL,4.        ;Wrong value for non-binary
                          ; characteristic
  DEFIN$ SE.TER,5.        ;Wrong terminal type
  DEFIN$ SE.SPD,6.        ;Wrong speed for interface
  DEFIN$ SE.SPL,7.        ;Wrong split speed for interface
  DEFIN$ SE.PAR,8.        ;Wrong parity type for interface
  DEFIN$ SE.LPR,9.        ;Other wrong line parameters
  DEFIN$ SE.NSC,10.       ;Interface does not have settable
                          ; characteristics
  DEFIN$ SE.UPN,11.       ;No space to save default
                          ; characteristics
  DEFIN$ SE.NIH,12.       ;Characteristic not assembled in
                          ; handler

Subfunction Codes for the Set Characteristics Function

  DEFIN$ SF.SSC, 2400!020 ;Set single characteristic
  DEFIN$ SF.SMC, 2400!040 ;Set multiple characteristics
  DEFIN$ SF.RDF, 2400!060 ;Restore default
  DEFIN$ SF.STT, 2400!100 ;Set terminal type
  DEFIN$ SF.STS, 2400!120 ;Set terminal type and speed
  DEFIN$ SF.GSC, 2400!140 ;Get single characteristic
  DEFIN$ SF.GMC, 2400!160 ;Get multiple characteristics
  DEFIN$ SF.GAC, 2400!200 ;Get all characteristics
  DEFIN$ SF.SAC, 2400!220 ;Set all characteristics
  DEFIN$ SF.DEF, 010      ;Set default characteristics

Speed Types

  DEFIN$ S.0   ,1.
  DEFIN$ S.50  ,2.
```

```
  DEFIN$ S.75   ,3.
  DEFIN$ S.100  ,4.
  DEFIN$ S.110  ,5.
  DEFIN$ S.134  ,6.
  DEFIN$ S.150  ,7.
  DEFIN$ S.200  ,8.
  DEFIN$ S.300  ,9.
  DEFIN$ S.600  ,10.
  DEFIN$ S.1200,11.
  DEFIN$ S.1800,12.
  DEFIN$ S.2000,13.
  DEFIN$ S.2400,14.
  DEFIN$ S.3600,15.
  DEFIN$ S.4800,16.
  DEFIN$ S.7200,17.
  DEFIN$ S.9600,18.
  DEFIN$ S.EXTA,19.
  DEFIN$ S.EXTB,20.

Terminal Types

  DEFIN$ T.UNK0,0.          ;Unknown (unspecified)
  DEFIN$ T.AS33,1.          ;ASR33
  DEFIN$ T.KS33,2.          ;KSR33
  DEFIN$ T.AS35,3.          ;ASR35
  DEFIN$ T.L30S,4.          ;LA30S
  DEFIN$ T.L30P,5.          ;LA30P
  DEFIN$ T.LA36,6.          ;LA36
  DEFIN$ T.VT05,7.          ;VT05
  DEFIN$ T.VT50,8.          ;VT50
  DEFIN$ T.VT52,9.          ;VT52
  DEFIN$ T.VT55,10.         ;VT55
  DEFIN$ T.VT61,11.         ;VT61
  DEFIN$ T.L180,12.         ;LA180S
  DEFIN$ T.SCR0,13.         ;Script line
  DEFIN$ T.USR0,14.         ;User terminal 0
  DEFIN$ T.USR1,T.USR0+1    ;User terminal 1
  DEFIN$ T.USR2,T.USR1+1    ;User terminal 2
  DEFIN$ T.USR3,T.USR2+1    ;User terminal 3
  DEFIN$ T.USR4,T.USR3+1    ;User terminal 4

Bits for Return from 'GET TERMINAL SUPPORT'

  DEFIN$ F1.ACR,000001      ;Auto CR/LF on long lines
  DEFIN$ F1.BTW,000002      ;Break through write
  DEFIN$ F1.BUF,000004      ;Intermediate buffering
  DEFIN$ F1.UIA,000010      ;Unsolicited input ASTs
  DEFIN$ F1.CCO,000020      ;Cancel CONTROL-O on write
  DEFIN$ F1.ESQ,000040      ;Escape sequence support
  DEFIN$ F1.HLD,000100      ;Hold screen support
  DEFIN$ F1.LWC,000200      ;Lower case conversion
  DEFIN$ F1.RNE,000400      ;Read no echo
  DEFIN$ F1.RPR,001000      ;Read with prompt
  DEFIN$ F1.RST,002000      ;Read with special terminators
  DEFIN$ F1.RUB,004000      ;Scope rubouts
  DEFIN$ F1.SYN,010000      ;XON/XOFF
  DEFIN$ F1.TRW,020000      ;Transparent read/write
  DEFIN$ F1.UTB,040000      ;Buffering in task buffer
  DEFIN$ F1.VBF,100000      ;EXEC buffers are variable length
  DEFIN$ F2.SCH,000001      ;Set characteristics
  DEFIN$ F2.GCH,000002      ;Get characteristics
  DEFIN$ F2.DCH,000004      ;Dump/restore characteristics
```

```
  DEFIN$ F2.DKL,000010     ;Historical 11D/IAS IO.KIL
  DEFIN$ F2.ALT,000020     ;ALTMODE is echoed
  DEFIN$ F2.SFF,000040     ;Formfeed can be simulated

Subfunction Bits for Terminal Handler QIOs.
Note: A complete list of terminal handler function and subfunction
codes appears in this appendix under QIOMAC.

  DEFIN$ TF.RST,001 ; [IO.RLB/IO.RPR] Read with special
                    ;                 terminators
  DEFIN$ TF.BIN,002 ;                 Send prompt as PASS ALL
  DEFIN$ TF.RAL,010 ;                 Read pass all
  DEFIN$ TF.RNE,020 ;                 Read with no echo
  DEFIN$ TF.RNC,040 ;                 Read with no case
                    ;                 conversion
  DEFIN$ TF.XOF,100 ;                 Send XOF after prompt
  DEFIN$ TF.TMO,200 ;                 Read with timeout
  DEFIN$ TF.WAL,010 ; [IO.WLB] Write pass all
  DEFIN$ TF.WMS,020 ;          Write suppressible message
  DEFIN$ TF.CCO,040 ;          Cancel CONTROL-O
  DEFIN$ TF.WBT,100 ;          Break through read
  DEFIN$ TF.SYN,200 ;          Synchronous write
  DEFIN$ TF.AST,010 ; [IO.ATT] Specify ASTs in attach
  DEFIN$ TF.ESQ,020 ;          Recognise escape sequences

  .MACRO TTSYM$ A
  .ENDM
  .ENDM TTSYM$
```

APPENDIX D

LISTING OF CONDITIONAL ASSEMBLY PARAMETERS

D.1 LISTING OF CONDITIONAL ASSEMBLY PARAMETERS

The following is a listing of all the conditional assembly parameters that are possible on the RSX-11M system. Many of these may not apply to your system but are listed here for your convenience.

```
Parameter       Definition

A$$CHK          ;Address checking
A$$CPS          ;ACP support
A$$D01          ;AD01-D A/D convertors
A$$F11          ;AFC11 A/D convertors
A$$NSI          ;ANSI magtape support
A$$PRI          ;ALTER PRIORITY directive
A$$R11          ;AR11 laboratory peripheral systems
A$$RDA          ;AR11 D/A option
A$$TRP          ;AST support
B$$OOT          ;Bootstrap ROM address
C$$CKP          ;Checkpointing support
C$$INT          ;Connect interrupt vector support
C$$LIS          ;Command language interpreter support
C$$ORE          ;Size of dynamic storage region
C$$OVL          ;Overlaid network ACP
C$$R11          ;CR11 card readers
C$$RSH          ;Crash reporting
C$$RUN          ;Crash unit number
D$$B11          ;DA11-B parallel line interfaces
D$$BUG          ;Panic dump routine
D$$E11          ;DL11-E line interfaces
D$$H11          ;DH11 asynchronous line multiplexers
D$$IAG          ;User mode diagnostics
D$$ISK          ;Nonresident task support
D$$J11          ;DJ11 asynchronous line multiplexers
D$$L11          ;DL11/A/B/C/D line interfaces
D$$M11          ;DM11BB modem control interfaces
D$$P11          ;DP11 line interfaces
D$$Q11          ;DQ11 synchronous line interfaces
D$$SHF          ;Automatic dynamic memory compaction
D$$U11          ;DU11 line interfaces
D$$W11          ;DUP11 line interfaces
D$$YNC          ;Dynamic checkpoint allocation
D$$YNM          ;Dynamic memory allocation support
D$$Z11          ;DZ11 asynchronous line multiplexers
D$$ZMD          ;DZ11 modem support
E$$DVC          ;Log device errors and timeout
E$$EAE          ;EAE support
E$$NSI          ;Log undefined interrupts
E$$PER          ;Log parity error traps
```

LISTING OF CONDITIONAL ASSEMBLY PARAMETERS

Parameter	Definition
E$$XPR	;EXTEND PARTITION (task) directive
F$$AST	;Asynchronous FPP
F$$LPP	;Floating point processor support
F$$LTP	;FIS support
F$$LVL	;File structure level support
G$$TPP	;GET PARTITION PARAMETERS directive
G$$TSS	;GET SENSE SWITCHES directive
G$$TTK	;GET TASK PARAMETERS directive
G$$WRD	;Include $GTWRD code
I$$Cll	;ICS/ICR-11 industrial control subsystems
I$$CAD	;ICS/ICR-11 A/D convertor modules
I$$CDA	;ICS/ICR-11 D/A modules
I$$CDS	;ICS/ICR-11 digital sense input modules
I$$CIM	;ICS/ICR-11 digital interrupt modules
I$$CLK	;ICS/ICR-11 task activation from interrupts
I$$CLT	;ICS/ICR-11 bi-stable output modules
I$$CR	;ICR-11 remote units
I$$CRS	;ICS/ICR-11 status recovery
I$$CSS	;ICS/ICR-11 single shot output modules
I$$CTI	;ICS/ICR-11 I/O counter modules
I$$CWD	;ICS/ICR-11 error count
I$$Gll	;KG11 CRC option
I$$RAR	;Install, request, and remove on exit
I$$RDN	;I/O rundown
I$$Sll	;DRS/DSS-11 input/output modules
I$$SDR	;DRS-11 output modules
I$$SDS	;DSS-11 input modules
I$$SLK	;Task activation from interrupts
I$$SPW	;DRS-11 status restore on power recovery
I$$SRC	;DRS-11 command register address
I$$SSC	;DSS-11 command register address
K$$CNT	;Count register address
K$$CSR	;Programmable clock CSR address
K$$Gll	;KG11 CRC option
K$$LDC	;Load count value
K$$TPS	;Ticks per second
K$$Wll	;KW11-Y support
L$$llR	;Fast printer support
L$$50H	;50HZ line frequency
L$$ASG	;Logical device assignment support
L$$DRV	;Loadable driver support
L$$Pll	;LP/LS/LV11/LA180 line printers
L$$PSl	;LPS11 laboratory peripheral systems
L$$SBF	;LPS11 bandwidth filtering
L$$SDA	;LPS11 D/A option
L$$SDR	;LPSDR-A present
L$$SGR	;LPS11 gain ranging option
L$$SIl	;LSI-11 processor
LD$AD	;Loadable ADDRV
LD$AF	;Loadable AFDRV
LD$AR	;Loadable ARDRV
LD$CR	;Loadable CRDRV
LD$CT	;Loadable CTDRV
LD$DB	;Loadable DBDRV
LD$DF	;Loadable DFDRV
LD$DK	;Loadable DKDRV
LD$DM	;Loadable DMDRV
LD$DP	;Loadable DPDRV
LD$DS	;Loadable DSDRV
LD$DT	;Loadable DTDRV
LD$DX	;Loadable DXDRV
LD$LP	;Loadable LPDRV

LISTING OF CONDITIONAL ASSEMBLY PARAMETERS

```
Parameter       Definition

LD$LS           ;Loadable LSDRV
LD$MM           ;Loadable MMDRV
LD$MT           ;Loadable MTDRV
LD$PP           ;Loadable PPDRV
LD$PR           ;Loadable PRDRV
LD$TT           ;Loadable TTDRV
LD$XB           ;Loadable XBDRV
LD$XL           ;Loadable XLDRV
LD$XM           ;Loadable XMDRV
LD$XP           ;Loadable XPDRV
LD$XQ           ;Loadable XQDRV
LD$XU           ;Loadable XUDRV
LD$XW           ;Loadable XWDRV
M$$CRX          ;External MCR functions
M$$CRB          ;MCR command buffer length
M$$EXT          ;11/70 extended memory support
M$$FCS          ;FCS/file system support
M$$IXD          ;Mixed RH11 drive types
M$$MGE          ;Memory management
M$$MUP          ;Multi-user protection
M$$NET          ;Network ACP support
M$$OVR          ;Overlayed MCR
N$$CON          ;Number of simultaneous logical channels
N$$MOV          ;Size of BLXIO 'MOV' table
N$$MXM          ;Maximum network data message size
N$$TMO          ;Network control message timeout period
P$$D70          ;11/70 cache parity support
P$$GMX          ;Get mapping context
P$$LAS          ;Program logical address extensions
P$$P11          ;PC11 paper tape punch
P$$P45          ;Rotating data lights
P$$R11          ;PR11 paper tape reader
P$$RFL          ;Powerfail recovery
P$$RTY          ;Parity memory
P$$SRF          ;SEND/RECEIVE by REFERENCE
P$$TPT          ;Point-to-point network support
P$$WRD          ;Include $PTWRD code
Q$$CRC          ;DQ11 CRC option support
Q$$HPT          ;DQ11 protocol option support
Q$$OPT          ;Pre-allocate I/O packets
R$$11S          ;RSX-11S system
R$$11M          ;RSX-11M system
R$$611          ;RK611 disk cartridge controllers
R$$6OF          ;RK06 offset recovery support
R$$6WC          ;RK611 write check support
R$$DER          ;CORAL deallocation error checking
R$$EXV          ;Extend Executive to 20k
R$$F11          ;RF11 fixed head disk controllers
R$$JPO          ;Offset recovery support
R$$JS1          ;RJ/RWS03-04 fixed head disk controllers
R$$JP1          ;RJ/RWP04-05-06 disk pack controllers
R$$K11          ;RK11 cartridge disk controllers
R$$KWC          ;RK11 write check support
R$$LOD          ;Remote task loading
R$$NDC          ;Clock ticks per scheduling interval
R$$LKL          ;RMS-11 block locking
R$$NDH          ;Highest priority class to consider
R$$NDL          ;Lowest priority class
R$$P11          ;RP11-C/E disk pack controllers
R$$SND          ;SEND/RECEIVE directives
R$$X11          ;RX11 disk controllers
S$$ECC          ;Shared Executive ECC code
```

LISTING OF CONDITIONAL ASSEMBLY PARAMETERS

Parameter	Definition
S$$WPC	;Clock ticks per swapping interval
S$$WPR	;Swapping priority
S$$WRG	;Console switch register present
S$$YSZ	;Size of physical memory in 32W blocks
T$$18S	;LA180S support
T$$30P	;LA30P support
T$$All	;TAll dual cassettes
T$$ACR	;Automatic CR/LF
T$$BTW	;Breakthrough write
T$$BUF	;Terminal input checkpointing
T$$C11	;TC11 DECtape controllers
T$$CCA	;Unsolicited input AST
T$$CCO	;Write with control-O cancellation
T$$CTR	;Control-R support
T$$ESC	;Escape sequence support
T$$GMC	;Get terminal characteristics
T$$GTS	;Get terminal driver support
T$$HLD	;Hold-screen support
T$$J16	;TJ/TWU16-45 magtape controllers
T$$KMG	;Task termination/device not ready messages
T$$LWC	;Settable case conversion (lower case)
T$$M11	;TM/TMA/TMB11 magtape controllers
T$$MAN	;DM11BB answer baud rate
T$$MIN	;Baseline terminal driver
T$$RNE	;Read with no echo
T$$RPR	;Read with prompt or after prompt
T$$RST	;Read with special terminator
T$$RUB	;CRT rubout
T$$SMC	;Set terminal characteristics
T$$SYN	;Terminal-host synchronization support
T$$TRW	;Transparent terminal read/write
T$$UTB	;User terminal input buffering
T$$VBF	;Variable length terminal input buffers
T$$ZAN	;DZ11 answer baud rate
U$$ACH	;Number of channels per module
U$$ADM	;ADU01 or IAD-IA module description
U$$AOM	;Analog output modules
U$$CIM	;Digital interrupt module description
U$$CSM	;Digital sense intput module
U$$D11	;UDC11 Universal digital controller
U$$LTM	;Bi-stable output module description
U$$MHI	;High part of UNIBUS address
U$$MLO	;Low part of UNIBUS address
U$$MRN	;Address of next available UMR
U$$NIP	;Uni-polar A/D sampling
U$$SSM	;Single-shot output modules
U$$TIM	;I/O counter module description
V$$CTR	;Address of highest vector plus 4
V$$S2S	;VS60 drives two CRT monitors
V$$S60	;VS60 graphics display subsystem
V$$T11	;VT11 graphics display subsystem
X$$DBT	;Executive debugging tool
X$$M11	;DMC11 line interfaces

APPENDIX E

GENERAL FAULT ISOLATION

E.1 INTRODUCTION

This Appendix is a guide containing some general hints about fault isolation in the RSX-11M system. It is not an all-inclusive guide, but it does offer suggestions to get you started in the right direction. Other aids that may help you:

- RSX-11M Crash Dump Analyzer Manual
- IAS/RSX-11 ODT Reference Manual (for the Online Debugging Tool)
- RSX-11M User Mode Diagnostics Reference Manual
- Executive Debug Tool (XDT) and Panic Dump, described in the RSX-11M Guide to Writing an I/O Driver
- RSX-11M Task Builder Reference Manual (for Post Mortem and Snapshot Dumps)

E.2 FAULT CLASSIFICATIONS

Four possible causes can be identified when the system faults:

1. A user-state task has faulted such that it causes the system to fault (unmapped systems only)
2. A user-written driver has faulted such that it causes the system to fault
3. The RSX-11M system software itself has faulted
4. The host hardware has faulted.

You should immediately determine which of these four cases is the source of the fault. This section outlines the procedures that may help you to uncover the source of the fault. Correcting the fault is assumed to be your responsibility.

E.3 SERVICING FAULTS

Faults manifest themselves in roughly four ways. They are listed here in the order of increasing difficulty of isolation.

1. If XDT is included in your system, an unintended trap to XDT occurs.

2. The system displays text indicating a crash has occurred and halts.

3. The system halts but displays nothing.

4. The system is in an unintended loop.

Regardless of fault manifestation, you should immediately obtain pertinent fault isolation data.

Case 1--The system has trapped to XDT

The trap may or may not be intended (for example, you may not have removed a previously set breakpoint). If the trap is not intended, type the X command. This causes XDT to jump to location 40(8), from which the Executive stack and register dump routine (if present), followed by either Panic Dump or the Crash Dump Analyzer (CDA) support routine (if present), will be invoked. If, however, you have some idea of the source of the problem (for example, a recent coding change), then you can use XDT to examine pertinent data structures and code.

Case 2 - The system has displayed text indicating a crash occurred

If the text consists of output from the Executive stack and register dump routine, all the basic information describing the state of the system has been displayed. If the text has been produced by the CDA support routine, follow the procedure for obtaining and formatting a memory dump as outlined in the RSX-11M Crash Dump Analyzer Reference Manual.

Case 3--The system has halted but displays no information

Before taking any action, examine and record the following information:

- Current PS and PC
- General registers
- Executive stackpointer and stack
- Executive PARs on a mapped system
- Pertinent device registers

The procedure depends on the particular PDP-11 processor. Consult the appropriate PDP-11 Processor Handbook for details.

After preserving the PS and PC, invoke your resident debugging aid: enter 40(8) in the switch register, press LOAD ADDR, and then press START. The contents of 40(8) cause the successive invocation of:

1. The Executive stack and register dump routine (if present)

2. Either Panic Dump or CDA support routine (if present)

Case 4 - System is in an unintended loop

Proceed as follows:

1. Halt the processor
2. Record PC and PS and any pertinent device registers, as in Case 3 above.

You may then want to step through a number of instructions in an attempt to locate the loop. For this attempt to be meaningful you must first disable the system clock. Proceed as follows:

1. Examine the contents of word 777546 (if your system has a line frequency clock) or word 772540 (if it has a programmable clock).
2. Clear bit 6 in this word and redeposit the word. This disables the clock.
3. The system will not run unless you reenable the clock.
4. After trying to locate the loop and reenabling the clock, transfer to location 40(8) as in Case 3.

E.3.1 Gathering Pertinent Fault Isolation Data

Before proceeding with locating the fault, you should to dump the system common (SYSCM). SYSCM contains a number of critical pointers and listheads. Find the file SYSCM in the Executive memory allocation map listing, then enter the appropriate limits into the Panic Dump Routine.

Alternately, you can run the Crash Dump Analyzer as a task; or, if XDT is included in your system and a program condition causes a processor trap, control transfers automatically to XDT and typing X at your terminal causes control to be transfered to the crash dump routine.

In addition, you should to dump the Dynamic Storage Region and the device tables. The Dynamic Storage Region starts in the module INITL and the device tables are in SYSTB.

At this point, you have the following data:

- PS
- PC
- The stack
- R0 through R6

- The Dynamic Storage Region
- The Device Tables
- System common

These data are the minimum required to trace the fault effectively.

E.3.2 Tracing Faults

Three pointers in SYSCM are critical in fault tracing. These pointers are described below:

$STKDP - Stack Depth Indicator

This data item indicates which stack was being used at the time of the crash. $STKDP plays an important role in determining the origin of a fault. The following values apply.

```
+1  --  User (task-state) stack
 0  --  System stack (system processing)
-1  --  Interrupt processing only
```

$TKTCB - Pointer to the Current Task Control Block (TCB)

The current TCB is the TCB of the user-level task in control of the CPU.

$HEADR - Pointer to the Current Task Header

The $HEADR word points to the header of the task currently running. The task header provides additional data to help isolate the fault. Figures E-1 and E-2 show the layout of task headers for unmapped and mapped systems.

The first word in the header is the user task's stack pointer (SP) the last time it was saved. If the user task branches wildly into the Executive, the Executive terminates the user task, but the system continues to function (possibly erroneously on an unmapped system). On a mapped system, only a privileged task can enter and corrupt the Executive. Knowing the user task's stack pointer provides one more link in the chain that may lead to the resolution of the fault.

The header (as pointed to by $HEADR) also contains the last-saved register set, just before the header guard word (the last word in the header, pointed to by H.GARD).

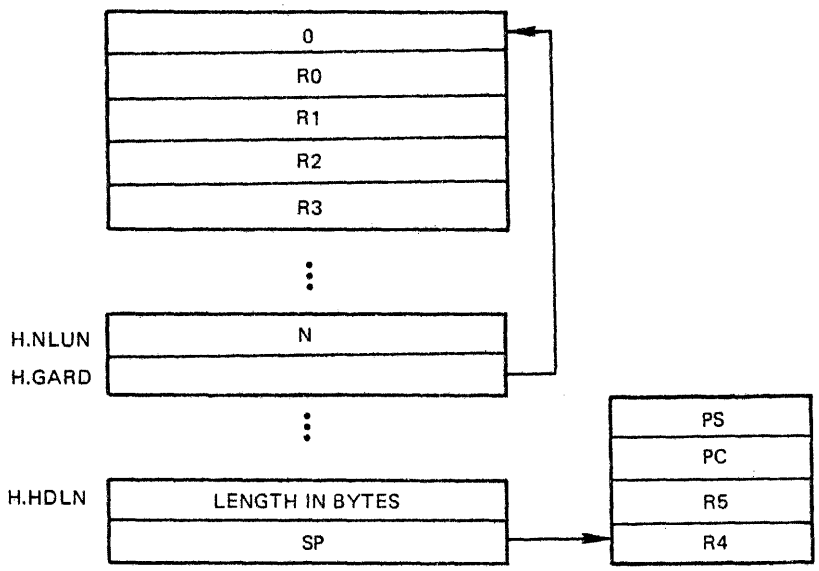


Figure E-1 Task Header on an Unmapped System

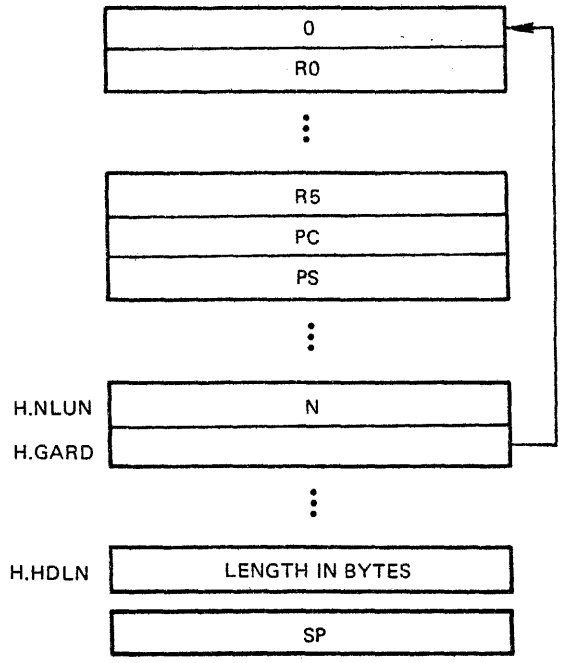


Figure E-2 Task Header on a Mapped System

E.3.2.1 **Tracing Faults Using a Display of the Executive Stack and Registers** - To trace a fault after a display of the Executive stack and register contents, first examine the system stack pointer. Usually an Executive failure is the result of an SST-type trap within the Executive. If an SST does occur within the Executive, the origin to the call on the crash reporting routine is in the SST service module. (The crash call is initiated by issuing an IOT at a stack depth of zero or less.)

A call to crash also occurs in the Directive Dispatcher when an EMT is issued at a stack depth of zero or less, or a trap instruction is executed at a depth of less than zero. The stack structure in the case of an internal SST fault is shown in Figure E-3.

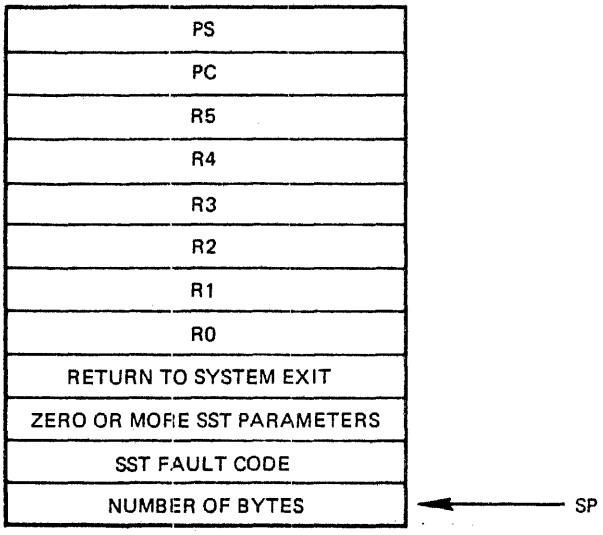


Figure E-3 Stack Structure: Internal SST Fault

The fault codes are:

0	Odd address and traps to 4
2	Memory protect violation
4	Break point or trace trap
6	IOT instruction
10	Illegal or reserved instruction
12	Non-RSX EMT instruction
14	Trap instruction
16	11/40 floating point exception
20	SST abort - bad stack
22	AST abort - bad stack
24	Abort via directive
26	Task load read failure
30	Task checkpoint read failure
32	Task exit with outstanding I/O
34	Task memory parity error

The PC points to the instruction following the one which caused the SST failure. The number of bytes is the number normally transferred to the user task's stack when the particular type of SST occurs. If the number is 4, an abnormal SST fault occurred, and only the PS and PC are transferred. There are no SST parameters.

If the failure is detected in $DRDSP the stack is the same as that shown in Figure E-3, except the number of bytes, the SST fault code (the fault codes are listed above), and the SST parameters are not present. The crash report message, however, will indicate that the failure occurred in $DRDSP.

One SST-type failure, stack underflow, does not result in the stack structure of Figure E-3. To determine where the crash occurred, first establish the stack structure; this can be deduced by the value of the SP and the contents of the top word on the stack. If the stack structure is that of Figure E-3, then the failure occurred in $DRDSP, or was a normal SST crash. If the stack structure is that of Figure E-4, then an abnormal SST crash has occurred.

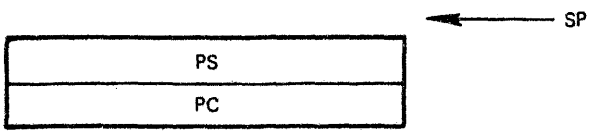


Figure E-4 Stack Structure: Abnormal SST Fault

Abnormal SST failures occur when it is not possible to push information on the stack without forcing another SST fault. When this situation occurs, a direct jump to the crash reporting routine occurs rather than an IOT crash. The PS and PC on the stack are those of the actual crash, and the address printed out by the crash-reporting routine is the address of the fault rather than the address of the IOT that crashes the system. Note that the crash reporting routine removes the PC and PS of the IOT instruction from the stack, which in this case is incorrect. Thus, the SP appears to be 4 bytes greater than it really is (as in Figure E-4).

You now have all the information needed to isolate the cause of the failure.

E.3.2.2 **Tracing Faults When the Processor Halts Without Display** - To trace a fault when the processor halts but displays no information (Case 3 as described above), first examine $STKDP, $TKTCB, and $HEADR. Tracing failures in this case is difficult because the system stack is not directly associated with the cause of a failure.

By examining $STKDP, you can determine the system state at the time of the failure. If the system was in user state, examine the user task's stack. The examination focuses on scanning the stack for addresses that may be subroutine links that can ultimately lead to a thread of events isolating the fault. This is essentially the aim of looking at the system stack if $STKDP is zero or less.

Frequently, a fault can occur that causes the SP to point to the Top of Stack (TOS)+4. This fault results from issuing an RTI when the top two items on the stack are data instead of the return address (PC) and processor status (PS) for the routine being returned to. A wild branch occurs followed, most probably, by a halt.

Figure E-5 shows a case in which two data items are on the stack when the program executes an RTI. TOS points to a word containing 40100. This word will be the new PC. Suppose that location 40100 contains a halt. After the RTI and the halt occurs, the SP points four bytes above the previous location, and fault tracing should begin from the previous SP.

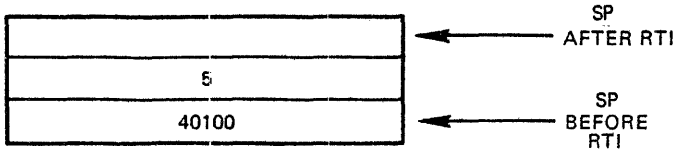


Figure E-5 Stack Structure: Data Items on Stack

This type of fault also occurs when an RTS instruction is executed with an inconsistent stack; that is, a stack with the wrong contents for the correct execution of the RTS instruction. The RTS instruction pops the top element off the stack. The top element of the stack becomes the new PC or occupies a register depending on the form of the RTS instruction. However, in any case, SP points to TOS+2 after an RTS instruction.

A scan of the contents of the general registers may give some hint as to the neighborhood in which a fault (or the sequence of events leading up to the fault) occurred.

If the fault occurred in a new driver, the buffer address and count words in the UCB (U.BUF, U.BUF+2, U.CNT), and the activity flags (US.BSY and S.STS) are frequent sources of clues. Other locations in both the UCB and SCB may also provide information that may help locate the source of the fault.

E.3.2.3 Tracing Faults After an Unintended Loop - To trace a fault when an unintended loop has occurred, first halt the processor. After you halt the processor, the same state exists as in tracing faults when the processor halts without display (as described above). Follow the same tracing procedure described there. A specific suggestion is to check for a stack overflow loop. Patterns of data successively duplicated on the stack indicate a looping failure.

E.3.2.4 Additional Hints for Tracing Faults -

E.3.2.5 I/O Packets - Another item to check is the current (or last) I/O packet, the address of which is found in S.PKT of the SCB. The packet function (I.FCN) defines the last activity performed on the unit.

If trouble occurred in terminating an I/O request, a scan of the free block list for the system Dynamic Storage Region may provide some insight. This list starts at the address contained in $CRAVL, a cell in SYSCM. Because all I/O packets are built in the system's Dynamic Storage Region, their memory is returned to the Dynamic Storage Region when they are successfully terminated. Following the link pointers in this region may reveal whether I/O completion proceeded to that point. In systems with QIO optimization, $PKAVL (SYSCM) points to a list of I/O packet-sized blocks of dynamic memory that are not linked into the $CRAVL chain. Normally, the last completed I/O packet is the first in the $PKAVL list.

A frequent error for an interrupt-driven device is to terminate an I/O packet twice when the device is not properly disabled on I/O completion and an unexpected interrupt occurs. This action ultimately produces a double deallocation of the same packet of dynamic memory. Double deallocation of a dynamic buffer in RSX-11M causes a loop in the routine $DEACB (in the CORAL module) on the next deallocation (of a block of higher address) after the second deallocation of the same block. At that time, R2 and R3 both contain the address of the I/O packet memory that has been doubly deallocated. If XDT has been included in the system, the deallocation routine checks for bad deallocation and crashes the system if it occurs. Note, that queue I/O optimization, which employs pre-allocated I/O packets, may cause a double-deallocation error to get by. This may happen if the I/O packet in question does not become deallocated and is put in a separate list. To avoid this, use the SET /MAXPKT=0 command to temporarily void the optimization.

E.3.2.6 **System Stack Pointer** - Use the system stack pointer to find the current position of the system stack. The system stack will contain addresses or instructions of code that was being executed prior to the crash (this is only true if the $STKDP is less than 1). From this point, all call activity can be traced, with the help of the listings, back to the original $SWSTK or EMT377 call.

APPENDIX F

SYSTEM TUNING

This appendix is a brief synopsis of ways to improve the performance of an RSX-11M system. There may be many conflicting trade-offs and requirements in your particular installation; therefore, some techniques may not be applicable to your situation. This appendix is not intended to be the last word in system tuning, but is written in the nature of a general approach to system tuning and contains some of the techniques and concepts you can use to improve performance.

F.1 HARDWARE CONSIDERATIONS

The most obvious approach to improving system performance is to upgrade the hardware to faster and/or larger capacity devices. If your applications make heavy demands upon CPU time, it makes sense to upgrade to a faster processor. If your application involves many disk transfers, more CPU memory may be needed to reduce the number of transfers or fixed head disks may be needed to reduce transfer time. Heavily overlaid tasks require many disk transfers. If this constantly occurs, more memory may allow fewer task overlays. The use of memory management directives instead of overlaid tasks could improve system performance in this case. Also, consider the use of resident overlays or multiple copies of F11ACP, one for each volume, if you must use overlaid tasks with high I/O requirements. However, resident overlays require more memory.

F.2 MEMORY LAYOUT

The memory layout of your particular system is an important factor that affects system throughput. The following procedures improve throughput:

- If your CPU has enough memory, put the following system programs in separate partitions to avoid their checkpointing each other:

  MCR, F11ACP, TKTN, SHUFFLER

- Load loadable drivers into special driver partitions to avoid fragmenting memory.

- Arrange to have PLAS dynamic regions in their own special partitions.

F.3 EXECUTIVE SOFTWARE OPTIONS

The options listed below are covered in detail in the RSX-11M System Generation Manual. The most important options that affect system performance include:

- Choice of F11ACP - If your memory is big enough, install BIGFCP as memory-resident to greatly improve disk access time. Install separate copies of F11ACP for each disk if file access is frequent and occurs to many different disks. The /ACP switch in the Mount command selects the copy of F11ACP for that particular disk.

- Dynamic checkpoint allocation on the fastest system disk on your system.

- Shuffling - The Shuffler, a nonresident privileged task for mapped systems compacts memory in a system-controlled partition. This task minimizes memory fragmentation and provides better memory usage. The Shuffler is a SYSGEN option.

- Round-robin scheduling - Selection of the round-robin scheduling option during SYSGEN ensures that tasks in a range of priorities share the use of memory. This is important when many CPU-bound tasks within a specified range of priorities are running at the same time.

- Swapping - This SYSGEN option allows tasks to be checkpointed by tasks of equal priority when many tasks of equal priority are competing for memory. The checkpointing option is a pre-requisite.

- Memory management directives - Allows tasks to access a greater span of physical memory than their normal 32K addressing capability allows.

- Loadable device drivers - Loadable drivers may slow down I/O a bit, however, they occupy memory only when needed.

- Queue I/O speed optimizations - I/O throughput is increased at the expense of additional Executive code. Because of this option, I/O packets are pre-allocated, which makes them quickly available for QIOs.

- Install, request, and remove on exit support - This option conserves Dynamic Storage Region space by allowing tasks to be memory resident only when active, but does not increase throughput.

- Checkpointing on terminal input - This SYSGEN option allows more copies of terminal I/O-bound tasks to be run than normally could be run in a given amount of memory.

- Error logging - This option can be useful when information about system errors (device errors, timeouts, cache and memory parity errors) is needed. However, file space is needed for the records and this option automatically includes support for checkpointing and the Send/Receive directives.

- Size of dynamic storage region - It is possible to exhaust dynamic memory during the running of RSX-11M. This can occur if a large number of tasks are installed, if many volumes are mounted, or if a number of other conditions are present. This

problem can manifest itself in the lack of any response from the system. Although the system looks like it is operating successfully, it cannot accept any MCR commands or complete the execution of presently running tasks because they all require dynamic memory. Another manifestation of the problem may be I/O errors being received by tasks or failures in the Loader due to pool allocation failures. The only solution to this problem is to bootstrap the system and make more dynamic space available (SET /POOL), remove tasks, mount fewer volumes, rebuild FCP with space for more file control blocks in its partition, or rebuild the system with more dynamic memory. See the RSX-11M System Generation Manual for a complete and detailed discussion of dynamic memory - its uses and its users.

- VMR installable Loader task - The Loader task occupies 2200(8) bytes and is one of the Executive tasks. Installing and fixing the Loader in its own partition releases the 2200(8) bytes for use in the Dynamic Storage Region.

F.4 FILE SYSTEM OPTIONS

Many options of the INI and MOU commands can change performance. The more important options are:

/EXT default extension block count - Unless this block count is specified, the file has a default block count of five, whether it uses all five blocks or not. If the default is used and the file is larger than five blocks, the file is not continuous and more accesses are required for the file. If the file uses less than five blocks, all five blocks are reserved for the file and no other file can use them. On the other hand, if you specify one as the block count, the file gets only the number of blocks it needs but it may require many accesses to access the whole file. To conserve space and reduce the number of file accesses, be as specific as possible about the number of blocks that your files need.

/INDX index file position - The position of the index file in large volumes is important because of seek time. Rather than have the index file at the beginning or end of a volume, position it, either by block number or the MID key word, at the mid-point of the volume. In the case of small volumes, such as a floppy-disk, putting the index file at the mid-point will limit the maximum size of the work files on the disk. In this case, put the index file at the beginning or end of the volume.

/LRU memory buffers to speed up directory searches - LRU specifies the number of 512-byte buffers to be maintained in memory. The buffers contain only the most recently accessed directories. The default is three buffers. If your application is working with a small number of directories, the defaults may be sufficient. However, if many directories are being scanned frequently, access time will improve if you specify a higher number than three. However, more buffers use more memory.

/WIN mapping pointer count - WIN specifies the number of mapping pointers to be allocated for file windows. The default is seven pointers. The pointers point to contiguous blocks of the file on the disk. Access to fragmented files may be optimized by increasing the number of pointers. However, additional memory may be freed by reducing the number of pointers for files with little or no fragmentation.

F.5 HELPFUL HINTS

- Avoid entering CTRL/C to explicitly request MCR. Typing CNTRL/C slows down response to other users needing MCR facilities.

- Use indirect command files to MAC and TKB whenever possible, especially if the commands are long. If you do this, MAC or TKB spend less time competing for resources.

- When task building or assembling large programs, insert all modules in a created library and specify each module by name. This reduces the number of times that TKB or MAC have to open files.

- If you are doing SYSGEN with a mapped baseline system and your system has enough memory, create a separate 32K partition and install PIP, BIGTKB, and BIGMAC in this partition; this shortens the time taken for SYSGEN.

- If you have the room, install BIGTKB and BIGMAC with a large /INC. This reduces the system overhead that TKB and MAC would cause when they executed Extend Task directives.

- Install PIP with an increment (/INC). In general, run utilities in the largest possible partition.

- If your system uses RMS, build the library modules as memory-resident.

- Use the following form, shown as an example, to call utilities whenever you want to use a utility once:

```
>PIP command <CR>
```

  Using this form reduces the time that PIP (or any other utility) spends competing for the memory resource. However, if you intend to use a utility to perform multiple operations, use:

```
>PIP
PIP> command <CR>
PIP> command <CR>
PIP> command <CR>
CTRL/Z
>
```

- Use the print spooler as much as possible. This avoids leaving utilities in memory while printing on the line printer.

- To save memory space by reducing task size, you may want to build a resident (sharable) library containing frequently-used FORTRAN routines. For the same reason, you may want to produce a position-independent library containing all the FCS modules required by a set of programs that are intended to run simultaneously. FCSRES.MAC and FORRES.MAC files are provided on the distribution disk. Building a FORTRAN and FCS resident library is described in the RSX-11M System Generation Manual.

- Plan the overlay structure of your tasks. You may possibly achieve a large reduction in disk accesses by careful planning.

- Avoid putting all the files needed by an application in a single UIC. Having all files in a single UIC slows down directory searches as each block can hold 32 entries only (8 words per entry). Many more disk accesses are required to search for the 300th file in a single UIC than the 30th file in the last of 10 UICs.

- RMDEMO does add some overhead to the system's operation. It is not necessary to run RMDEMO continously, only when the information that it supplies is required. However, if you do not run RMDEMO continuously, you may not be able to observe the system when a problem occurs (for example, dangerously low and decreasing pool space).

F.6 SOME USEFUL COMMANDS

There are four commands that can give you a description of your system that may be useful when you tune your system. They are the Tasklist, the Partition Definitions, the Task List, and the Active Task List commands. These commands are more fully described in the RSX-11M Operator's Procedures Manual.

TASK LIST - Short Version

The Tasklist command displays on the entering terminal a brief description of each installed task. The display contains, from left to right:

1. Task name
2. Task version identification
3. Partition name
4. Task priority
5. Size of task in bytes (8)
6. Load device identification
7. Disk address logical block number (8)
8. Task memory state

Format:

TAS

Example:

```
...LDR 07.05  LDRPAR 248. 00002200 LB0:-01035303 FIXED
TKTN   03.3   SYSPAR 248. 00010000 LB0:-01126742
RMDEMO X03.03 GEN    225. 00013700 SY0:-00352100
MTAACP 0006   GEN    200. 00013000 DS0:-00000777
F11MSG V0010  GEN    200. 00005400 SY0:-01053030
...MCR 01     GEN    160. 00025000 LB0:-01051676
                        .
                        .
                        .
                      ETC.
```

PARTITION DEFINITIONS

The Partition Definitions command displays on the entering terminal a description of each memory partition in the system.

The display consists of five columns that specify (in order from left to right):

1. Partition name

2 Partition base address (8)

3. Partition size (8)

4. Partition kind: main partition (MAIN) or subpartition (SUB)

5. Partition type

   TASK for user-controlled
   COM for common
   DEV for device registers
   SYS for system-controlled
   Taskname for task region
   D ...MIC for dynamically created region
   DRIVER for region occupied by a loadable driver

Format:

PAR

Example:

```
Name      Base      Size      Type
LDR       000000    000000    MAIN TASK
SYSPAR    120000    010000    MAIN TASK
FCPPAR    130000    026000    MAIN TASK
PMDPAR    156000    020000    MAIN TASK
SPLPAR    156000    010000    SUB  TASK
DRVPAR    176000    014000    MAIN SYS
          176000    001600    SUB  DRIVER - DB:
          177600    000500    SUB  DRIVER - DS:
          200300    001000    SUB  DRIVER - DK:
          201300    001100    SUB  DRIVER - DT:
          202400    001000    SUB  DRIVER - LP:
          203400    003100    SUB  DRIVER - MM:
GEN       212000    546000    MAIN SYS
          212000    013400    SUB  (RMDEMO)
          225400    045700    SUB  (...EDI)
                      .
                      .
                      .
                    ETC.
```

TASK LIST - Long Version

The Task List command displays on the entering terminal the names, descriptions, and status of all installed tasks or of a specific installed task in the system.

The display contains, reading from left to right, the following information for each task:

- Task name
- Task control block physical address (8)
- Partition name
- Partition control block physical address (8)
- Partition base and limit physical address (8)
- Task's running priority and default priority
- Task status flags
- TI terminal physical device unit
- I/O count (10)
- Task local event flags
- Task registers and processor status word (memory-resident tasks only)

Format:

```
TAL [taskname]
```

Example:

```
. LDR. 052220  LDR    052164 00000000-00000000 PRI - 248.  DPRI - 248.
   STATUS:  -CHK FXD STP PRV
   TI - CO0:  IOC - 0.  EFLG - 000001 000000 PS - 170000  PC - 041350
   REGS 0-6  000162 004030 177777 105312 064254 105260 052132
TKTN   105010  SYSPAR 107734 00110000-00120000 PIR - 248.  DPRI - 248.
   STATUS:  -EXE OUT -CHK -PMD PRV
   TI - CO0:  IOC - 0. EFLG - 000001 000000
                                  .
                                  .
                                  .
                                ETC.
```

ACTIVE TASK LIST

This command displays on the entering terminal the names, descriptions, and status of all active tasks in the system or the status of a specified active task (taskname). The display is the same as the Task List command.

Format:

```
ATL [taskname]
```

F.7 A USEFUL TOOL

RMDEMO is a privileged task that displays in a highly visual and active manner information concerning task activity in an RSX-11M system. The display usually runs continuously on a video terminal with cursor control (the VT05B or the VT52). Certain versions of the task allow a once-only display on any record-oriented device.

The display features include:

1. Current date and time;
2. The currently active task;
3. All tasks, loaded drivers, and common blocks that are currently in memory, displayed in a graphic fashion to show their individual memory requirements and location relative to other tasks;
4. The number of active tasks currently in memory, the number not currently resident, and the total amount of memory occupied by each group;
5. The current amount of available system dynamic memory (POOL space), including the largest available block and the number of fragments;
6. A graphical display of the partition information;
7. The number of hours that have elapsed since RMDEMO was initiated (this is system up time if the STARTUP_CMD file automatically runs RMDEMO when your system comes up).
8. The number of free blocks available on the system device and one or more additional mounted FILES-11 volumes;
9. The system error sequence count.

RMDEMO scales the display to the memory size of the computer on which it is executing. The amount of memory displayed on the screen is always the next largest power of 2 in K-words. For a 28K system, it displays 32K. For a 256K system, 256K is displayed and the available memory just fills the screen.

You should consider task locations and sizes that RMDEMO displays to be approximate only. RMDEMO provides a visual display and is a system debugging tool; however, it should not be used for accurate measurement of task size and location.

A complete description of RMDEMO can be found in the RSX-11M System Generation Manual.

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