MEMORANDUM

To: All PDP-1 Users

From: B. Cosell

Subject: A New Library Program: CRIB

Date: 4 January 1972

In the course of building the IMP system, we have found it convenient to have at hand charts of the various data structures and field assignments used in the program — "crib sheets". As do flowcharts, crib sheets unfortunately suffer from being a nuisance to draw. Hence, it is painful to keep them up-to-date. Since I have become rather reliant on them, I put together a little program, CRIB, to draw crib sheets.

CRIB accepts a file prepared in a special "crib sheet language" and from it produces a file which, when listed on a teletype, will be a crib sheet. Crib sheet language is not particularly natural, and the crib sheets produced are not incredibly pretty. However, the overall system seems to be fairly simple to use and is certainly much easier than doing it all by hand.

CRIB SHEET LANGUAGE

The Crib Sheet Language provides a straightforward way to specify a very simple type of data structure. Few programs actually use data structures as simple as this, hence you will almost always have to describe your structure, rather than just mechanically translating it. I have so far always been able to find some way to get a useful picture of any data structures I wanted to crib sheet.

The canonical structure for CRIB consists of a table comprising a series of distinct "structures". "Structures" consist of a basic prototype, an "entry", repeated some number of times. The "entry" comprises an integral number of words, broken up into labelled fields (which may not cross word boundaries).

The basic table definition commands are:

DT␣name, name, name, ..., name)	DEFINE TABLE — names may be up to six characters and are pretty much ignored by CRIB. DT clears all of CRIB's structure and field tables and prepares it to begin a new definition. The "current word" is set to -1 (see DF).

DS␣[# of wds, # of repetitions], [,], ... [,] CR
DEFINE STRUCTURE — sets up the basic table structure. The repetition count is treated as a text string and must be 9 or fewer characters. All of a table's structures need not be defined in a single DS command.

DF␣word #, high order bit #, # of bits in field, field id CR
DEFINE FIELD — sets up a field within some structure [which need not yet itself be declared]. If the "word #" is left out, the field will be put in the "current word"; if the "high order bit #" is left out, the field will begin at the "current bit position". The "word #" may be specified as "—", which is interpreted to mean "next word". Whenever a "word #" is specified, the "current bit position is set to Ø; if it is left out, the "current bit position" is immediately to the right of the last field defined.

ET CR
END TABLE — the accumulated structures and fields are formatted and "drawn" to the output file.

Other miscellaneous commands:

WS␣# CR
WORD SIZE — sets the number of bits in a table word. This is nominally set to 16.

FF CR
FORM FEED

END CR
causes CRIB to halt

$text CR
comment → the text is immediately copied to the output file.

Assorted Remarks:

A line of the input file in any format other than those described above is ignored.

All fields and structures must be described in strictly ascending order. You may not "go back".

For the DF command, words in a table are numbered consecutively, beginning with Ø. The number of the first word of any structure is one larger than the number of the last word of the preceding structure. Since structures are described only once, independently of their "# of repetitions", a structure takes up its "# of words" only, although in the actual table the structure occupies "repetitions" * "words" locations.

Notice that the described structures are saved until the ET is reached, at which time all of the "drawing" is done. Thus, DS and DF are, in effect, deferred, while all other commands are immediate. This is unfortunate, but true.

I have found that the heading provided by the DT command is useless, and I mostly use comments to make headings. [The null command must be DT␣↵ — don't forget the space.]

If you have any suggestions on how to make the input language better or the resultant crib sheets nicer, let me know. I am willing, but not particularly anxious, to fix up the program from time to time.

I have attached crib sheets for the IMP and TIP systems along with the files that generated them. First, these are examples of what an input file looks like, and what crib sheets look like. Second, those interested may keep these as the latest copies of the "official" IMP and TIP crib sheets.

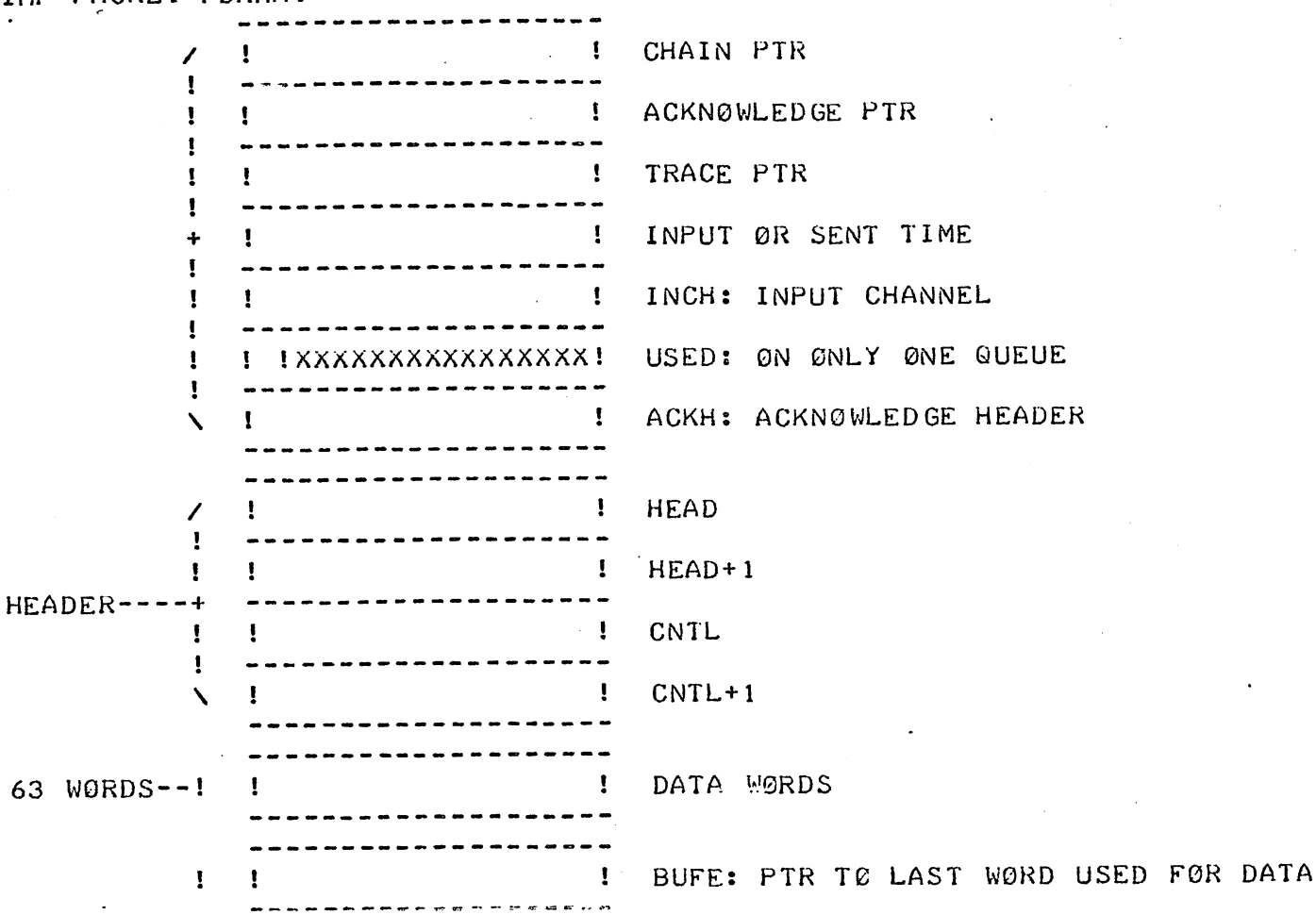
BC/jm

```
DT,
$IMP PACKET FØRMAT
DS [7,]
DF -,,16,CHAIN PTR
DF -,,16,ACKNØWLEDGE PTR
DF -,,16,TRACE PTR
DF -,,16,INPUT ØR SENT TIME
DF -,,16,INCH: INPUT CHANNEL
DF -,,1,USED: ØN ØNLY ØNE QUEUE
DF -,,16,ACKH: ACKNØWLEDGE HEADER

DS [4,HEADER]
DF -,,16,HEAD
DF -,,16,HEAD+1
DF -,,16,CNTL
DF -,,16,CNTL+1

DS [1,63 WØRDS]
DF -,,16,DATA WØRDS

DS [1,]
DF -,,16,BUFE: PTR TØ LAST WØRD USED FØR DATA
ET

FF
DT
$IMP HEADER FØRMAT FØR NET TRAFFIC
DS [4,]
DF -,,1,0
DF ,,1,FØR IMP
DF ,,1,TRACE
DF ,,1,RFNM
DF ,,1,PRIØRITY
DF ,,1,DISCARD
DF ,15,1,0 FØR REGULAR HEADER
DF -,,1,LAST PACKET
DF ,2,6,MESSAGE NUMBER
DF ,,8,DESTINATIØN
DF -,1,1,FRØM IMP
DF ,8,8,SØURCE
DF -,,8,LINK
DF ,13,3,PACKET NUMBER
ET

FF
```

```
DT
$IMP PACKET FØRMAT FØR LINE TEST MESSAGES
DS [1,],[1,]
DF -,,1,0
DF ,,1,SEND CØRE (NØ RØUTING INFØ)
DF ,4,1,I HEARD YØU
DF ,15,1,1 FØR LINE TESTS
DF -,,16,"SYNC" TIME
DS [1,NIMP]
DF -,,5,HØP CØUNT
DF ,,11,DELAY
DS [2,NH]
DF -,,16,HØST STATUS FØR SITES 0-15 [1=>DEAD]
DF -,,16,HØST STATUS FØR SITES 16-31
DS [1,]
DF -,,16,CHECKSUM
ET

FF
DT
$TRACE BLØCK FØRMAT
DS [11,]
DF -,,16,CHAIN PTR
DF -,,16,TIT: INPUT TIME
DF -,,16,TTT: TASK TIME
DF -,,16,TST: SENT TIME
DF -,,16,TAT: ACK TIME
DF -,,16,THED: HEADER
DF -,,16,   "
DF -,,16,   "
DF -,,16,   "
DF -,,16,TQUE: ØUTPUT CHANNEL
DF -,,2,TDØN: 100000=>DØNE, 140000=>RETRANS
ET

DT
$REASSEMBLY BLØCK FØRMAT
DS [5,]
DF -,,16,CHAIN PTR
DF -,,16,RID: MSG ID (SEE MSG TABLE)
DF -,,16,RID1: MSG ID
DF -,,16,RSF: PKTS IN SØ FAR
DF -,,16,RMAX: # ØF PKTS IN MSG
DS [1,8]
DF -,,16,PKT PTRS
ET

FF
```

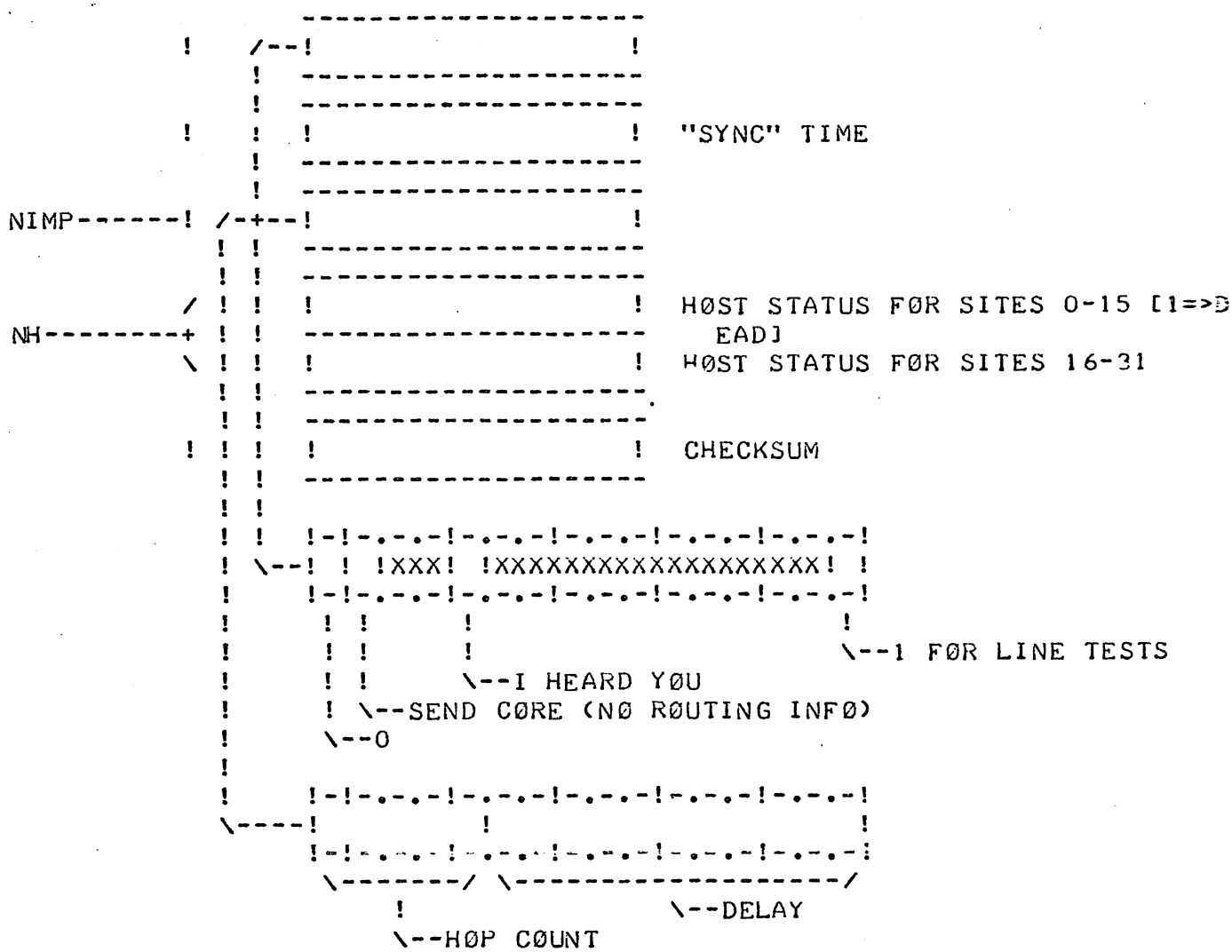
```
DT
$HØST "TWØ WØRD" QUEUE STRUCTURE
$
$   GØMMØN STØRE PTRS
DS [2,],[2,NH+1]
DF -,,16,BUFFER QUEUE START
DF -,,16,BUFFER QUEUE END
DF -,,16,BLØCK CHAIN START
DF -,,16,BLØCK CHAIN END
ET

DT
$
$      BUFFER QUEUE FØRMAT
DS [4,],[4,15. BLKS]
DF -,,16,PTR TØ NEXT BUFFER
DF -,,16,PTR TØ PREVIØUS BUFFER
DF -,,16,PTR TØ FREE BLØCK CHAIN
DF -,,16,-<# ØF FREE BLØCKS>
DF -,,16,BLØCK CHAIN PTR
DF -,,16,DATA
DF -,,16,DATA
DF -,,16,PTR TØ START ØF THIS BUFFER
ET

FF

DT
$MESSAGE TABLES
$    THERE ARE TWØ SIMILAR SETS:
$          ØNE FØR XMIT AND ØNE FØR RCV.
$
DS [1,64.],[1,64.],[1,64.]
DF -,,8,BUCKET PTR FØR HASHING ENTRY
DF ,,8,BUCKET CHAIN PTR
DF -,,8,LINK
DF ,,2,FØREIGN HØST NUMBER
DF ,10,6,FØREIGN SITE NUMBER
DF -,,1,THIS SLØT IS FREE
DF ,,1,FØREIGN "IMP" BIT
DF ,,2,LØCAL HØST NUMBER
DF ,,1,LØCAL "IMP" BIT
DF ,,3,TIMER
DF ,,1,LINK BLØCKED (XMT), MSG NUMBER NØ GØØD (RCV)
DF ,10,6,MESSAGE NUMBER
ET

END
```

IMP PACKET FØRMAT

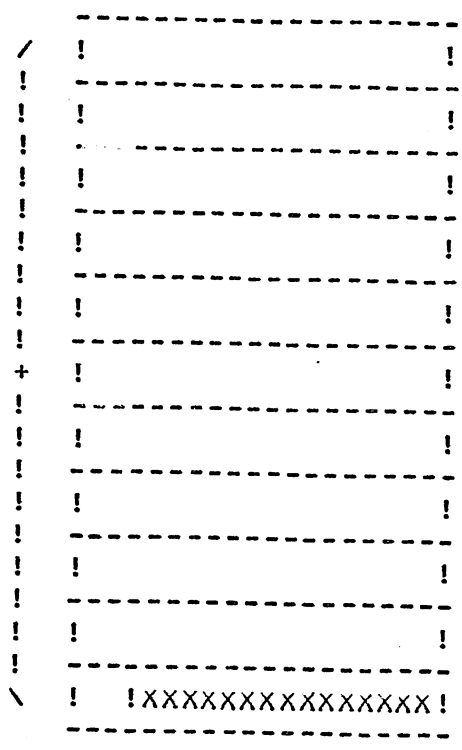


IMP HEADER FØRMAT FØR NET TRAFFIC

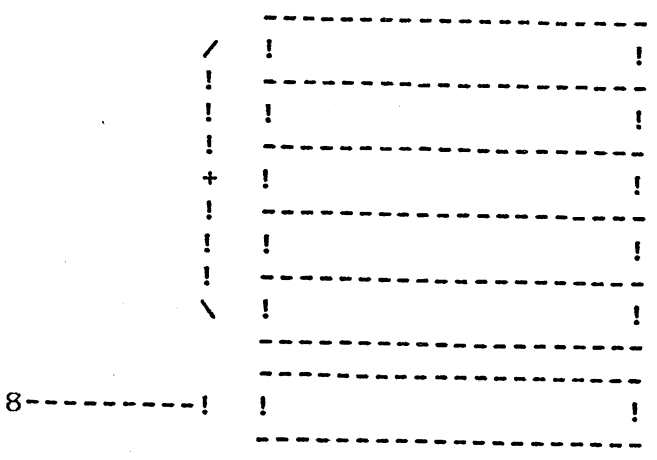
IMP PACKET FØRMAT FØR LINE TEST MESSAGES



TRACE BLØCK FØRMAT

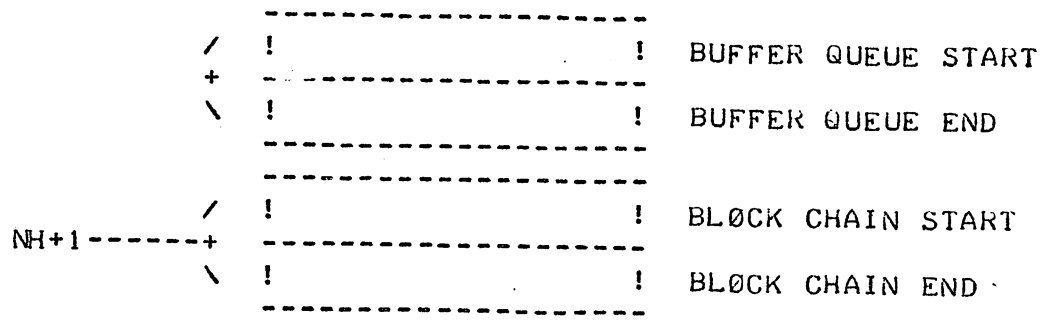


REASSEMBLY BLØCK FØRMAT

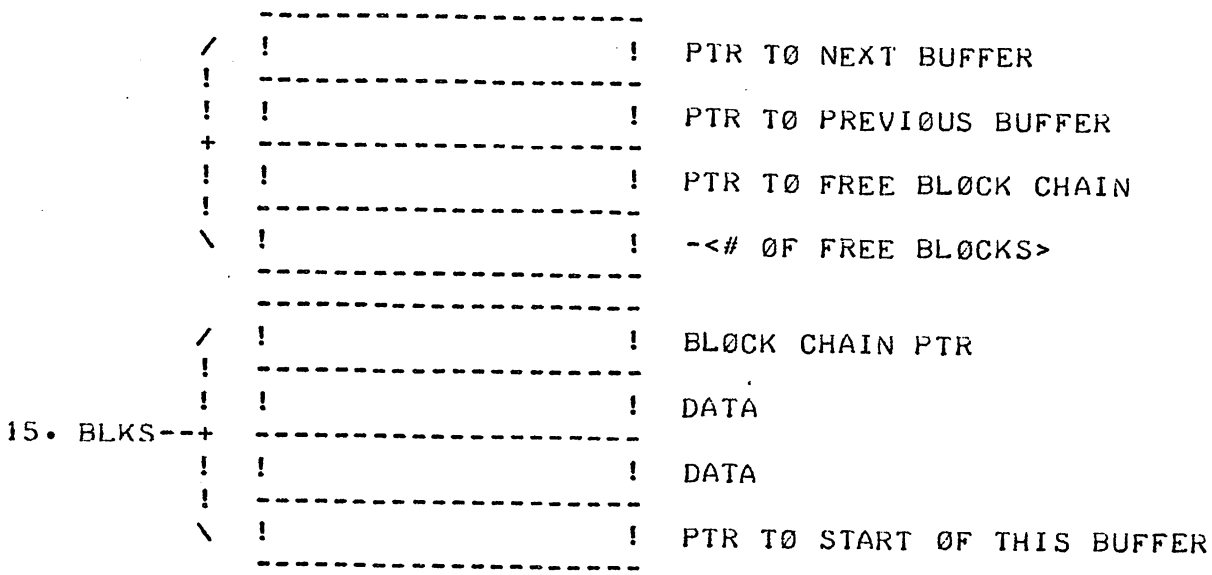


HØST "TWØ WØRD" QUEUE STRUCTURE

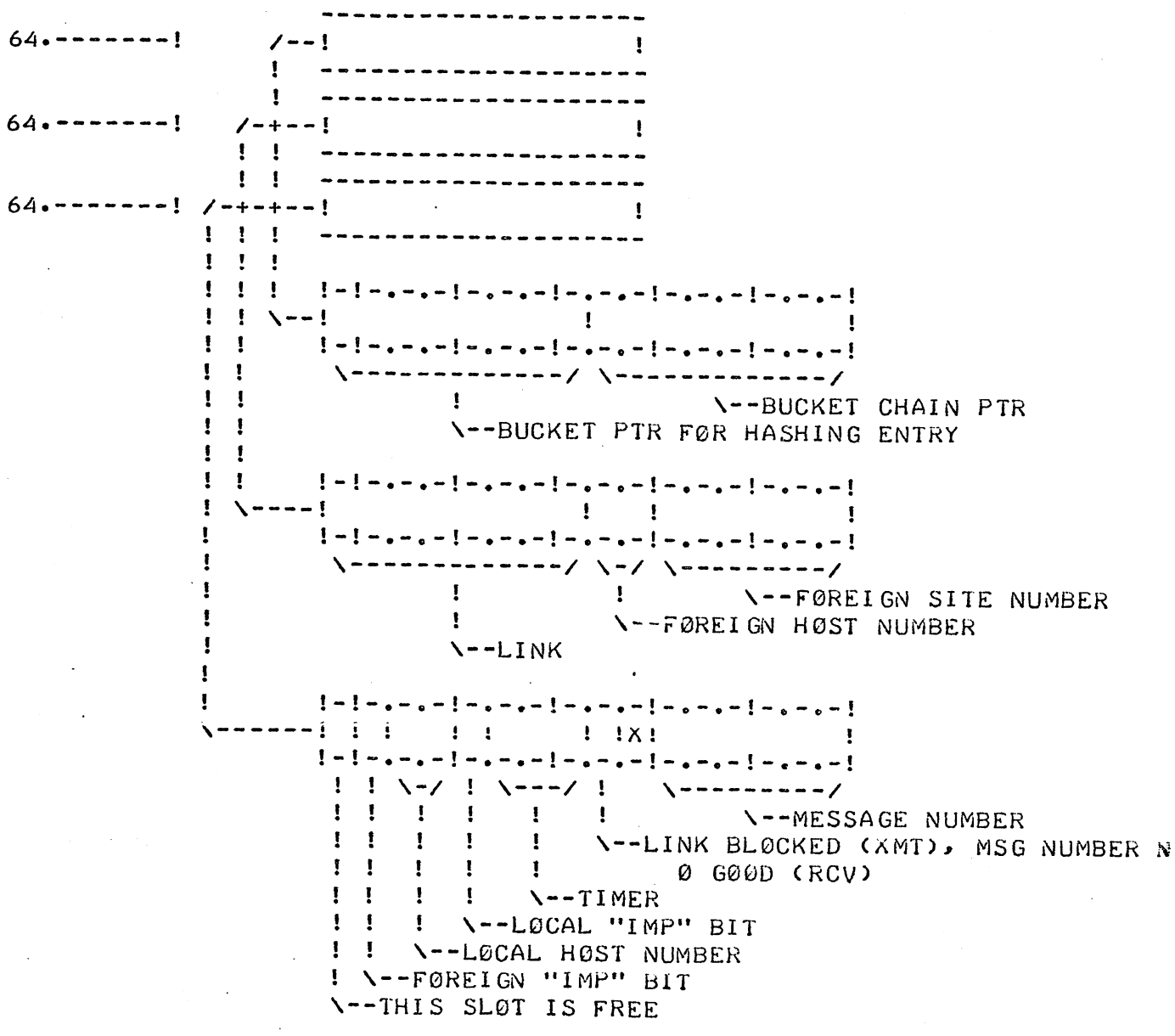
CØMMØN STØRE PTRS



BUFFER QUEUE FØRMAT



MESSAGE TABLES
THERE ARE TWØ SIMILAR SETS:
ØNE FØR XMIT AND ØNE FØR RCV



```
DT ECHWD1,CBITS
DS [1,DEVICE]
DF -,,10,1ST CHAR TØ ECHØ WITH
DF ,,1,MDIESC: LØØK FØR CØMMANDS
DF ,,1,MDIEDT: DØ EDITING
DF ,,1,MDTØL: TERMINATE ØN LINEFEED
DF ,,1,MDTØE: TERMINATE ØN EØM
DF ,,1,MDLØG: BEGIN LØGIN SEQUENCE
DF ,,1,MDDIVT: THIS DEVICE BEING DIVERTED TØ
ET

DT ECHWD2,DBITS
DS [1,DEVICE]
DF -,,10,2ND CHAR TØ ECHØ WITH
DF ,,1,HELLØ TC GØ
DF ,12,2,MDECH1,MDECH2: ECHØ MØDE
DF ,,1,MDDRUM: DØN'T RESET DRUM INPUT
DF ,,1,MDDRI: DØN'T RESET DRUM ØUTPUT
ET

DT RATE,CØDE,SIZE,RBITS
DS [1,DEVICE]
DF -,,1,MØFIND: HUNT WHEN DEVICE DISCØNNECTS
DF ,3,4,DEVICE ØUTPUT RATE
DF ,,2,CHAR SIZE
DF ,,4,DEVICE INPUT RATE
DF ,,3,CØDE CØNVERSIØN
ET

FF

DT NN
DS [1,DEVICE]
DF -,,4,CTR
DF ,,1,REVERSE BREAKING
DF ,,1,EXPECTING CIRCLE D
DF ,,1,ATTN KEY HIT
DF ,,2,CASE
DF ,,1,GØT A CR ØN INPUT
DF ,,1,IN INPUT MØDE
DF ,,1,IN ØUTPUT MØDE
DF ,,1, PTTC [0 => CØRRES]
DF ,14,2,TYPE ØF 2741
ET

DT M
DS [1,DEVICE]
DF -,,8,LØC ØF PRINTHEAD
DF ,14,1,CR CØNTRØL [FØR ØDEC]
DF ,15,1,JUST ØUTPUTTED A CR
ET
```

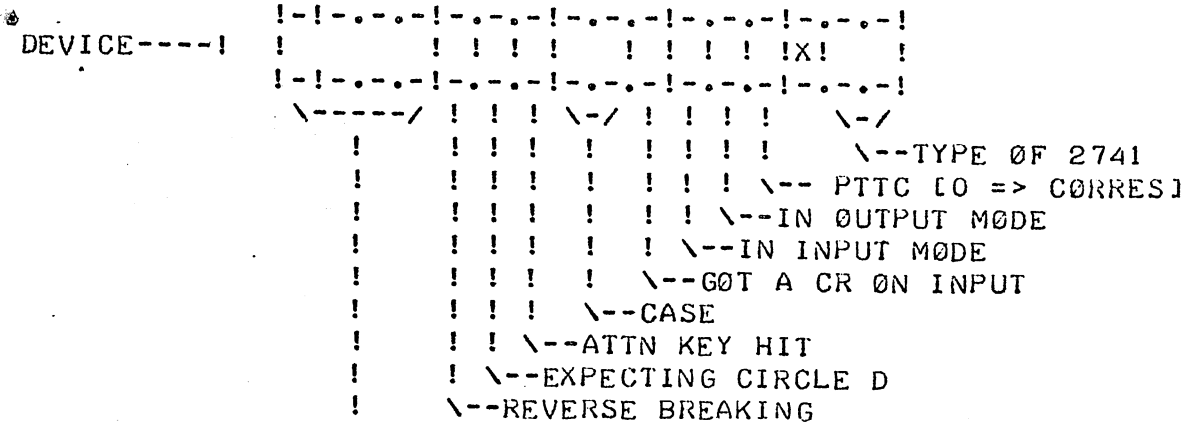
```
FF

DT ALLØC
DS [1,DEVICE]
DF -,,16,BIT ALLØC LEFT (-1=INF)
ET

DT ALLØCM
DS [1,DEVICE]
DF -,,16,MSG ALLØC LEFT (-1=INF)
ET

DT ALLØCØ
DS [1,DEVICE]
DF -,,16,# ØF CHARS IN LAST MSG RCVD
ET

FF

DT HØSTAB,HAT1,HAT2,HAT3,HAT4
$HATS 1-4 ØVERLAY CØNSECUTIVE BLØCKS ØF HØSTAB
DS [1,HAT1]
DF -,,1,MSKBSY: ØUTPUT IN PRØGRESS
DF ,,5,HØSTAB FØR HØSTS 0-63
DS [1,HAT2]
DF -,,1,MØCARR: CARRIER ØN
DF ,,4,HØSTAB FØR HØSTS 64-127
DS [1,HAT3]
DF -,,1,MDDVTE: BEING DIVERTED TØ
DF ,,4,HØSTAB FØR HØSTS 128-191
DS [1,HAT4]
DF -,,1,MDVKT1: BREAK CØUNTER
DF ,,4,HØSTAB FØR HØSTS 192-255
ET

DT
DS [1,HØSTAB]
DF -,1,1,TIMING ØUT BLØCKED CØNTRØL LINK
DF ,,1,CTL LINK BLØCKED
DF ,,1,SEND A RESET
DF ,,1,SEND AN ERP
DF ,,1,SEND AN RRP
ET
```

```
FF
DT SØCKS1,SØCKS2,SØCKR1,SØCKR2
DS [1,SØCKS1]
DF -,,16,SEND SØCKET, WØRD 1
DS [1,SØCKR1]
DF -,,16,RECEIVE SØCKET, WØRD 1
DS [1,SØCKS2]
DF -,,16,SEND SØCKET, WØRD 2
DS [1,SØCKR2]
DF -,,16,RECEIVE SØCKET, WØRD 2
ET

DT HØSTS
DS [1,DEVICE]
DF -,,8,PTR TØ CØMMAND LANGUAGE STATE
DF ,,8,HØST TØ SEND TØ
ET

DT HØSTR
DS [1,DEVICE]
DF -,,8,LINK
DF ,,8,HØST TØ RCV FRØM
ET


DT PSTATE,MØDEMØ,CHARC
DS [1,DEVICE]
DF -,,8,CHARC: CHARS/MSG
DF ,,5,MØDEM: HANGS UP DATASET
DF ,,3,SND CØNNECTIØN STATE
ET

DT QSTATE,CAPT,DEV
DS [1,DEVICE]
DF -,,1,MDLNKB: DATA LINK BLØCKED
DF ,1,6,CAPT: DEVICE ØWNING THIS ØNE
DF ,,6,DEV: # ØF DEV ØWNED BY THIS ØNE
DF ,,3,RCV CØNNECTIØN STATE
ET
```

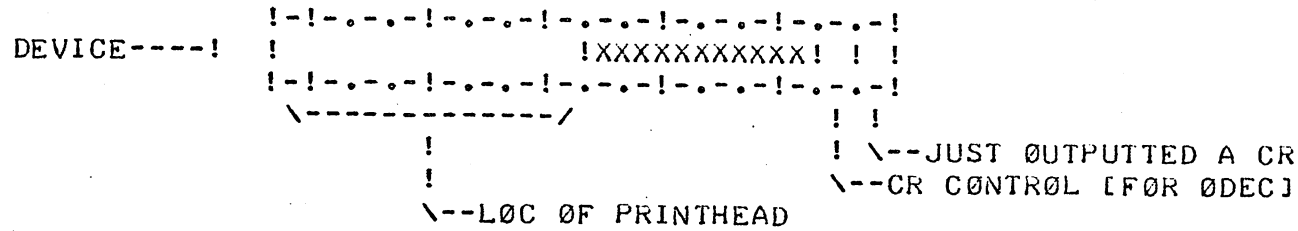
```
FF
DT ERRØR
DS [1,DEVICE]
DF -,,16,ERRØR MSG CØNTRØL
ET

DT MØRE,MBITS
$MØRE AND MBITS ARE DEVICE INDEXED TABLES
$MØRE IS ALSØ A CØNNECTIØN-INDEXED TABLE ØVERLAYING BØTH ØF THEM
DS [1,MØRE],[1,MBITS]
DF -,,1,M1GØTØ: ØUTPUT WAITING
DF ,,1,MØSALL: SEND AN ALLØCATE
DF ,,1,MDSPAN: PUT SYNC IN DATA STREAM TØ NETWØRK
DF ,,1,MDSINT: SEND AN HP INTERRUPT
DF ,,2,TIMEC3,TIMEC1: TIMEØUT REPLY TØ CLØSE ØN SEND SØCKET
DF -,,1,MDØVER: ØVERRUN [SEND DATA TØ NET]
DF ,4,2,TIMEØUT REPLY TØ CLØSE ØN RCV SØCKET
ET

FF

$INPUT CØNTRØL TABLES
DT JUMPIN,NEXTTN,CNTTN,BIGBUF
DS [1,JUMPIN],[1,NEXTTN],[1,CNTTN],[1,BIGBUF]
DF -,,16,DISPATCH ADDRESS ØN NEXT INPUT
DF -,,16,INPUT CHAR PTR
DF -,,16,CTR FØR RØØM LEFT IN BUFFER
DF -,,16,PTRS TØ ENDS ØF INPUT BUFFERS
ET

$ØUTPUT CØNTRØL TABLES
DT ØIJMP,ØUTNXT,BYTCNT,ØUCØPY
DS [1,ØIJMP],[1,ØUTNXT],[1,BYTCNT],[1,ØUCØPY]
DF -,,16,DISPATCH TØ FIND NEXT ØUTPUT CHAR
DF -,,16,PTR TØ NEXT CHAR TØ GØ
DF -,,16,CTR ØF CHARS LEFT IN THIS ØUTPUT
DF -,,1,TB: WHICH DØUBLE BUFFER IS IN USE
DF ,,15,PTRS TØ ENDS ØF ØUTPUT BUFFERS
ET


END
```

```
ECHWD1
CBITS

                !-!-.-.-!-.-.-!-.-.-!-.-.-!-.-.-!
 DEVICE----!    !                   ! ! ! ! ! ! !
                !-!-.-.-!-.-.-!-.-.-!-.-.-!-.-.-!
                 \-----------------/ ! ! ! ! ! !
                          !          ! ! : : ! \--MDDIVT: THIS DEVICE BEIN
                          !          ! ! ! ! !       G DIVERTED TØ
                          !          ! ! ! ! \--MDLØG: BEGIN LØGIN SEQUENC
                          !          ! ! ! !       E
                          !          ! ! ! \--MDTØE: TERMINATE ØN EØM
                          !          ! ! \--MDTØL: TERMINATE ØN LINEFEED
                          !          ! \--MDIEDT: DØ EDITING
                          !          \--MDIESC: LØØK FØR CØMMANDS
                          \--1ST CHAR TØ ECHØ WITH

ECHWD2
DBITS
                !-!-.-.-!-.-.-!-.-.-!-.-.-!-.-.-!
 DEVICE----!    !                   ! !X!   ! ! !
                !-!-.-.-!-.-.-!-.-.-!-.-.-!-.-.-!
                 \-----------------/ !   \-/ ! !
                          !          !     !  ! \--MDDRI: DØN'T RESET DRUM
                          !          !     !  !       ØUTPUT
                          !          !     !  \--MDDRUM: DØN'T RESET DRUM I
                          !          !     !        NPUT
                          !          !     \--MDECH1,MDECH2: ECHØ MØDE
                          !          \--HELLØ TØ GØ
                          \--2ND CHAR TØ ECHØ WITH

RATE
CØDE
SIZE
RBITS
                !-!-.-.-!-.-.-!-.-.-!-.-.-!-.-.-!
 DEVICE----!    ! !XXX!       !   !       !     !
                !-!-.-.-!-.-.-!-.-.-!-.-.-!-.-.-!
                 !     \-----/ \-/ \-----/ \---/
                 !        !     !     !      \--CØDE CØNVERSIØN
                 !        !     !     \--DEVICE INPUT RATE
                 !        !     \--CHAR SIZE
                 !        \--DEVICE ØUTPUT RATE
                 \--MØFIND: HUNT WHEN DEVICE DISCØNNECTS
```

.NN


DEVICE----!
!-!-.-.-!-.-.-!-.-.-!-.-.-!-.-.-!
!
!X!
\-----/
\-/
\--TYPE ØF 2741
\-- PTTC [0 => CØRRES]
\--IN ØUTPUT MØDE
\--IN INPUT MØDE
\--GØT A CR ØN INPUT
\--CASE
\--ATTN KEY HIT
\--EXPECTING CIRCLE D
\--REVERSE BREAKING
\--CTR

M


DEVICE----!
!-!-.-.-!-.-.-!-.-.-!-.-.-!-.-.-!
!XXXXXXXXXXX!
\-------------/
\--JUST ØUTPUTTED A CR
\--CR CØNTRØL [FØR ØDEC]
\--LØC ØF PRINTHEAD

ALLØC

```
DEVICE----!  !                  !  BIT ALLØC LEFT (-1=INF)
```

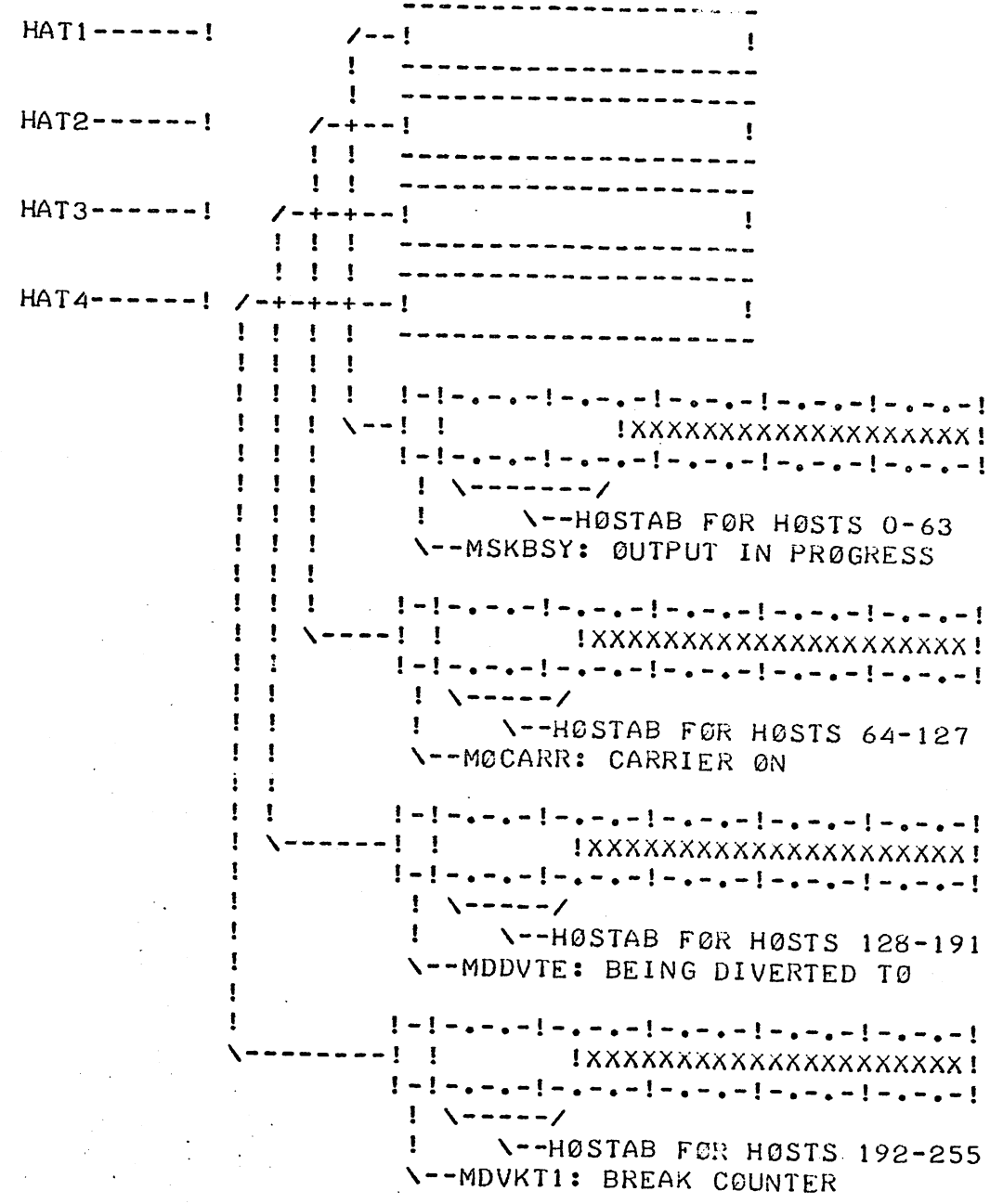
ALLØCM

```
DEVICE----!  !                  !  MSG ALLØC LEFT (-1=INF)
```

ALLØCØ

```
DEVICE----!  !                  !  # ØF CHARS IN LAST MSG RCVD
```

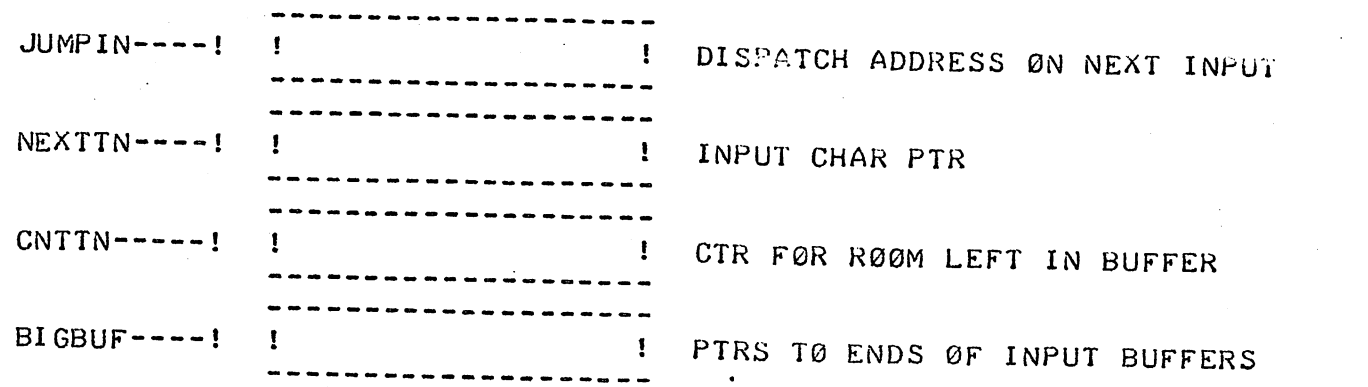
HØSTAB
HAT1
HAT2
HAT3
HAT4
HATS 1-4 ØVERLAY CØNSECUTIVE BLØCKS ØF HØSTAB



```
SØCKS1
SØCKS2
SØCKR1
SØCKR2
                  --------------------
SØCKS1----!       !                  !   SEND SØCKET, WØRD 1
                  --------------------
                  --------------------
SØCKR1----!       !                  !   RECEIVE SØCKET, WØRD 1
                  --------------------
                  --------------------
SØCKS2----!       !                  !   SEND SØCKET, WØRD 2
                  --------------------
                  --------------------
SØCKR2----!       !                  !   RECEIVE SØCKET, WØRD 2
                  --------------------

HØSTS
                  !-!-.-.-!-.-.-!-.-.-!-.-.-!-.-.-!
DEVICE----!       !                 !               !
                  !-!-.-.-!-.-.-!-.-.-!-.-.-!-.-.-!
                   \-------------/ \-------------/
                          !                 \--HØST TØ SEND TØ
                          \--PTR TØ CØMMAND LANGUAGE STATE

HØSTR
                  !-!-.-.-!-.-.-!-.-.-!-.-.-!-.-.-!
DEVICE----!       !                 !               !
                  !-!-.-.-!-.-.-!-.-.-!-.-.-!-.-.-!
                   \-------------/ \-------------/
                          !                 \--HØST TØ RCV FRØM
                          \--LINK

PSTATE
MØDEMØ
CHARC
                  !-!-.-.-!-.-.-!-.-.-!-.-.-!-.-.-!
DEVICE----!       !                 !       !     !
                  !-!-.-.-!-.-.-!-.-.-!-.-.-!-.-.-!
                   \-------------/ \-------/ \---/
                          !             !       \--SND CØNNECTIØN STATE
                          !             \--MØDEM: HANGS UP DATASET
                          \--CHARC: CHARS/MSG

QSTATE
CAPT
DEV
                  !-!-.-.-!-.-.-!-.-.-!-.-.-!-.-.-!
DEVICE----!       ! !           !           !     !
                  !-!-.-.-!-.-.-!-.-.-!-.-.-!-.-.-!
                   ! \---------/ \---------/ \---/
                   !       !           !       \--RCV CØNNECTIØN STATE
                   !       !           \--DEV: # ØF DEV ØWNED BY THIS ØNE
                   !       \--CAPT: DEVICE ØWNING THIS ØNE
                   \--MDLNKB: DATA LINK BLØCKED
```

```
*ERRØR
                  --------------------
DEVICE----!       !                  !  ERRØR MSG CØNTRØL
                  --------------------

MØRE
MBITS
MØRE AND MBITS ARE DEVICE INDEXED TABLES
MØRE IS ALSØ A CØNNECTIØN-INDEXED TABLE ØVERLAYING BØTH ØF THEM
                  --------------------
MØRE------!    /--!                  !
          !    !  --------------------
          !    !  --------------------
MBITS-----! /--+--!                  !
           ! !   --------------------
           ! !
           ! !  !-!-.-.-!-.-.-!-.-.-!-.-.-!-.-.-!
           ! \--!  ! ! ! !   !XXXXXXXXXXXXXXXXXXX!
           !    !-!-.-.-!-.-.-!-.-.-!-.-.-!-.-.-!
           !     ! ! ! ! \-/
           !     ! ! ! !  \--TIMEC3,TIMEC1: TIMEØUT REPLY TØ CLØSE ØN
         ! !     ! ! ! !       SEND SØCK
           !     ! ! ! \--MDSINT: SEND AN HP INTERRUPT
           !     ! ! \--MDSPAN: PUT SYNC IN DATA STREAM TØ NETWØRK
           !     ! \--MØSALL: SEND AN ALLØCATE
           !     \--M1GØTØ: ØUTPUT WAITING
           !
           !    !-!-.-.-!-.-.-!-.-.-!-.-.-!-.-.-!
           \----! !XXXXX!   !XXXXXXXXXXXXXXXXXXX!
                !-!-.-.-!-.-.-!-.-.-!-.-.-!-.-.-!
                 !       \-/
                 !        \--TIMEØUT REPLY TØ CLØSE ØN RCV SØCKET
                 \--MDØVER: ØVERRUN [SEND DATA TØ NET]
```

INPUT CØNTRØL TABLES
JUMPIN
NEXTTN
CNTTN
BIGBUF



ØUTPUT CØNTRØL TABLES
ØIJMP
ØUTNXT
BYTCNT
ØUCØPY