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CSC/TM-80/6208

# ISEE-3 DATA REDUCTION PROGRAMMERS GUIDE

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Prepared For
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Goddard Space Flight Center
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CONTRACT NAS 5-24350
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RENISH

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CSC
COMPUTER SCIENCES CORPORATION

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Prepared for

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By

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# ABSTRACT

This document is a guide to be used by maintenance programmers working with the ISEE-3 data reduction program EDRSAV, ENCYGEN, and ENCMRG. These programs receive the data from the ISEE-3 Cosmic Ray Studies Experiment and convert the data into 15 minute summary intervals on a flux tape which can be used by the analysis program FLUXPLOT. This guide will help the programmers with tape and data set formats, data flow, variable names, source location and system integration. These programs are an adaptation of a similar set of programs used for the Voyager Cosmic Ray Experiment.

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# SECTION 1 - INTRODUCTION

The ISEE-3 spacecraft is in a halo orbit at the LaGrange point between the Earth and the Sun. This paper is a programmers guide to the routines which process the telemetry data from the cosmic ray experiment onboard that spacecraft. The data reduction cycle takes the experimental data record (EDR) through the formation of the encyclopedia (ENCY) tape which has time ordered 15-minute summary intervals of rates and pulse height analyzed (PHA) data. All routines are under User-ID SEICC on the SACC 360/91/75 computers. All data sets are stored under the ASM2 archiving system of SACC's and in addition are backed up on tape volume ICBK01. Modifications to any source must be recorded with the ISEE librarian or data technician and the new source must be archived and backed up on ICBK01.

Each data set contains documentation in the form of a prologue and comments. In addition, there is a LOOKATME which gives a brief description of each member of each data set. There are also sample job control language (JCL) members for building and executing the routines.

This programmers guide is a general collection of documentation and tape formats. A list of important variables for ENCYGEN and ENCMRG is included in this document to aid in understanding the source code. Some detailed documentation for these programs, including flowcharts, is contained in members within the data sets.

## SECTION 2 - OVERVIEW

The overview of ISEE-3 data reduction is charted in Figure 2-1. The location of the source code is given in Figure 2-2. The central LOG which contains all production information is described in Appendix A. The production begins when the user enters the EDR tape name in the LOG using EDRLOG. EDRSAV is then used to compress the EDR tape onto the LIB tape. LIBLIST can be used to generate a formatted listing of the EDR or LIB tape. The EDR has a density of 1600 bytes per inch (BPI) and is a multi-file tape. The LIB tape has all of the EDR files merged onto one file at a density of 6250 BPI. One EDR has one week of data and one LIB has one file for each EDR and up to seven files. The EDR format is described in Appendix B. EDRSAV modifies the directory block, EDR control block, and creates a new EDR block in the LOG. ENCYGEN finds the next LIB file to process from the LOG and creates the WORK tape which is described in Appendix D. ENCYGEN modifies the directory block, ENCY-attribute block, work control block, encyclopedia control block, library block, and creates a new work block. Each WORK tape has the data in 15-minute volumes with volume 1 starting January 1, 1977. ENCMRG merges the WORK tapes onto the ENCY tape. ENCMRG modifies the directory block, ENCY-control block and work block, and creates a new encyclopedia block. The CITENCY feature is only used by Voyager and not ISEE.

LOGLIST can be used to list the contents of the LOG. ALTBLK can modify any byte of the LOG. REDOLIB can reset the LOG to process a LIB once more. TLS can be used to remove EDR tapes from the tape library system (TLS) and remove or reassign slots for the WORK tapes. ASNENC can assign new ENCY tapes to slots that are free. RMVENC can free ENCY tapes from slots and record the free slots in the LOG.

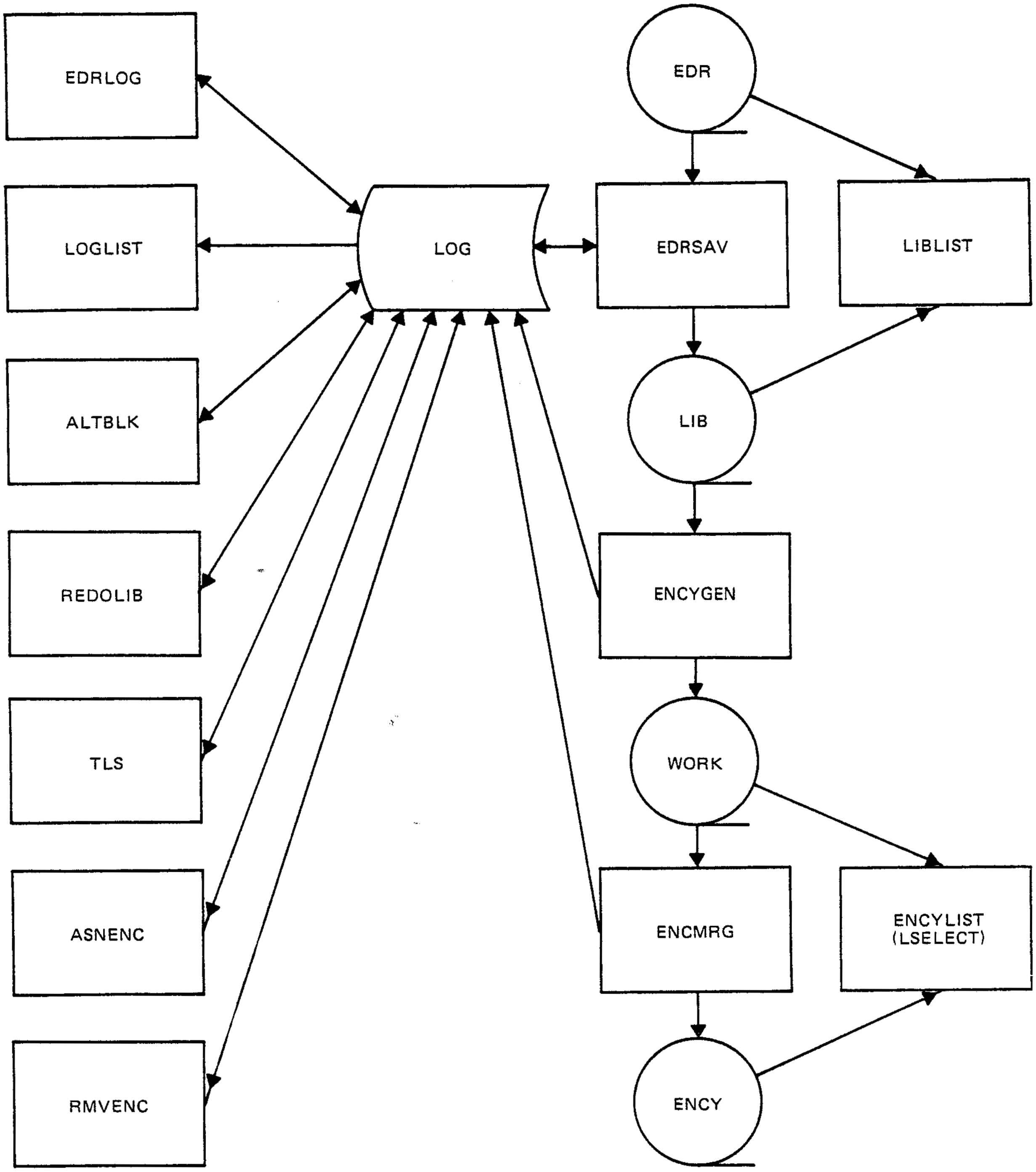


Figure 2-1. Data Flow for ISEE-3 Data Reduction

This is a description of the data sets in Figure 2-1.

| | |
|---|---|
| LOG | SEICC.LOG.DATA production information |
| EDRLOG | SEICC.EDRLOG.SOURCE enter EDR into LOG |
| LOGLIST | SEICC.LOGLIST.SOURCE formatted listing of LOG |
| ALTBLK | SEICC.ALTBLK.SOURCE alter any byte of LOG |
| REDOLIB | SEICC.REDOLIB.SOURCE reset LIB to be processed again |
| TLS | SEICC.LOGTSO.SOURCE remove EDR; WORK; assign WORK |
| ASNENC | SEICC.ASNENC.SOURCE assign new ENCY volumes |
| RMVENC | SEICC.RMVENC.SOURCE remove old ENCY volumes |
| EDRSAV | SEICC.EDRSAVE.SOURCE save EDR onto LIB tapes |
| LIBLIST | SEICC.LIBLIST.SOURCE formatted listing of EDR or LIB |
| ENCYGEN | SEICC.ENCGEN.ASM; SEICC.ENCGEN2.ASM convert LIB into WORK; SEICC.GENERAL.SOURCE |
| ENCMRG | SEICC.ENCMRG.SOURCE merge WORK onto ENCY |
| ENCYLIST | SEICC.ENCYLIST.SOURCE formatted listing of ENCY |

<u>tapes</u>:

| | |
|---|---|
| EDR | Experimental data record ≃ 1 week per tape |
| LIB | Compressed library tape. One file ≃ 1 week. |
| WORK | Fifteen minute analysis of 1 LIB file ≃ 3 weeks |
| ENCY | Merged WORK tapes ≃ 1 year per tape |

Figure 2-2. Overall Source Description and Data Sets

For more information on these routines, one can see the data set SEICC.USERGIDE.TEXT or the ISEE-3 User's Guide, or the USERGIDE member within the source code of each data set.

# SECTION 3 - PROGRAMMERS GUIDE TO ENCYGEN

The source code for ENCYGEN is divided between SEICC.ENCGEN.ASM and SEICC.ENCGEN2.ASM with some general routines in SEICC. GENERAL.SOURCE. Prologues are in SEICC.PROLOGUE.TEXT. Included here is the design document prepared by Dr. J. Childs, Computer Sciences Corporation, August 1978, which has the variables and subroutines for ENCYGEN. The source code itself contains further comments and descriptions.

This document deals with the design for the Encyclopedia Data Base Generator (ENCGEN) for the GSFC cosmic ray experiment on ISEE-C. The overall design of this system is based entirely on the Encyclopedia Generator written for the Voyager-1 and -2 cosmic ray experiments and designed by Dr. Nand Lal of CSC (1977).

The purpose of the ISEE-C ENCGEN is to take raw experiment data from the Experimenter Data Record (EDR) tapes, pack it, monitor it, summarize it, and put it into an encyclopedia format (see Appendix), in a form easily accessible by analysis programs. The major subsystems of ENCGEN consist of:

- READER - reads science data from EDR records; packs rates; dispatches data into subcom blocks
- MONITOR - monitors data quality and continuity, status changes, calibration data (marks up data within the subcom blocks)
- ANALYZER - establishes volume and chapter boundaries; fills out volume and chapter headers
- OUTPUTTER - outputs all data into verse structure. Summarizes rates; calculates spin periods; builds coincidence condition maps.

The four subsystems of ENCGEN share data and run parameters in a single common data area; the Master Control Block. The science and housekeeping data itself is processed in a region called the subcom block area. It is with this region that all major functions of the subsystems are performed.

The following tables outline the ENCGEN design. Table 3-1 is a Voyager ENCGEN routine chart, with an indication next to each module name as to whether the routine was left unchanged, modified, or deleted with the ISEE-C application. Table 3-2 is an ISEE-C ENCGEN routine chart indicating those routines that were carried over from Voyager, and those routines that were written new. Table 3-3 is a summary of changes made to the Voyager ENCYGEN in developing the ISEE-C version. Tables 3-4 through 3-7 are Input/Output charts for the four major ENCGEN subsystems--READER, MONITOR, ANALYZER, and OUTPUTTER, respectively.

Finally, the ISEE-C Encyclopedia tape format is defined in the Appendix.

Table 3-1. Voyager ENCGEN Routine Chart (1 of 3)

```
   VOYAGER  ENCYCLOPEDIA  GENERATOR

   ISEE-C  MODIFICATIONS

THE FOLLOWING IS A SUBROUTINE CHART OF THE VOYAGER ENCYCLOPEDIA
GENERATOR.  THE ROUTINES ARE MARKED FOR MODIFIED (.) AND THE
NUMBER OF LINES OF CODE MODIFIED FOR ISEE.  A BRIEF EXPLANATION
IS PLACED AT THE END .  (X) INDICATES THE ROUTINE IS DELETED FROM ISEE.

ENMAIN                       ENCGEN INITIALIZATION PROGRAM
.(2).ENCGEN                  MAIN CONTROL SECTION OF ENCYCLOPEDIA GEN
         KTIME
         YDMD
         ANPARM              ANALYZE PARAMETERS
              LOL            OPEN LCG LIBRARY BLOCK
              MOUNT
.(20)... ENINIT              INITIALIZE FLAGS AND ALLOCATE AREAS
XXXXXXXXXXXXXXRATTAB         SET UP RATES COMPRESSION TABLE
XXXXXXXXXXXXXXXXXXXDECLOG    DECIMAL TO LOG CONVERSION
XXXXXXXXXXXXXXXXXXXLOGDEC    LOG TO DECIMAL CONVERSION
.(77)........ FMGEN          SET UP PHA TAG ID MAP
         SEECCUNT            DETERMINE NUMBER OF SCIENCE ENG BLOCKS
.(50)... READER              MAIN DRIVER ROUTINE FOR READ FUNCTIONS
              FREAD          READ INPUT TAPE RECORD
.(50)........ RDSEGPRO       DETERMINE NATURE OF SEGMENT
XXXXXXXXXXXXXXXXXXXXRDSEGSCI HANDLE SCIENTIFIC DATA RECORDS
XXXXXXXXXXXXXXXXXXXXXXXXRDIDMODE         LOAD DATA MODE ATTRIBUTE TABLE
.(58).................. MARKUP           MARKS UP DATA
XXXXXXXXXXXXXXXXXXXXXXXXXXX  DPI         DATA PRESENCE INDICATORS
XXXXXXXXXXXXXXXXXXXXXXXXXXX  DGSW        DATA QUALITY SWITCHES
XXXXXXXXXXXXXXXXXXXXXXXXXXXX BASIC       MARKS UP STATUSES
.(45).................. RDIDSEG          IDENTIFIES DATA SEGMENT
.(26).................. RDESTREL         SENSE A DATAGAP
XXXXXXXXXXXXXXXXXXXXXXXXRDSAVTIM         SAVE TIMES INTO TIME ARRAY
.(80).................. DISPATCH         DISPATCH DATA INTO SUBCOM BLOCK
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXDISBTABL    SUBROUTINE LIST
.(30)....................... DISOPEN     ALLOC AND INIT NEXT SUBCOM
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXDISSETI     SET NOMINAL FOSC TIMES
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXDISSETS     DISPATCH STATUS
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXDISSETC     DISPATCH COMMAND DATA
.(80)....................... DISPPR      DISPATCH DATA
.(10)....................... DISPRI      DISPATCH RATES DATA
.(50)....................... DISPP       DISPATCH PHA DATA
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXDISFILL     PAD PHA AND RATES
.(30)....................... DISFILLP    PAD PHA DATA
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXDISCLOSE    SAVE CURRENT POINTERS
.(6)........................ DISUPDSG    UPDATE SEGMENT SOUGHT
.(14)....................... DISUPDSB    UPDATE SUPERBLOCK TIME
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXOPCODES     (FOR DISPATCHING)
XXXXXXXXXXXXXXXXXXXENGPRO                ENGINEERING RECORD PROCESSING
XXXXXXXXXXXXXXXXXXXXXXXXVALUES
XXXXXXXXXXXXXXXXXXXXXXXXSETUP
XXXXXXXXXXXXXXXXXXXXXXXXIDMXOP           IDENTIFY ENGINEERING DATA
XXXXXXXXXXXXXXXXXXXXXXXXPLGENG           PUT ENGINEERING INTO SUBCOM
XXXXXXXXXXXXXXXXXXXDECCM                 SEARCH DECOM RECORD FOR POINTERS
```

Table 3-1. Voyager ENCGEN Routine Chart (2 of 3)

```
                FNEXT                        OPEN NEXT EDR DATASET
                      FNCLOSE                CLOSE CURRENT EDR DATASET
                            LCW              CLOSE LOG WORK BLOCK
                            LCL              CLOSE LOG LIBRARY BLOCK
•(1)••••••••••••••••• FNOPNEXT               OPEN NEXT DATASET
                            LOL              OPEN LOG LIBRARY BLOCK
                            FTIO
•(64)•••••••••• MCNITOR                      MAIN DRIVER FOR MONITOR FUNCTIONS
XXXXXXXXXXXXXXXXXXXXXXMONQUAL                LOCATE DATA CYCLE TO BE MONITORED
XXXXXXXXXXXXXXXXXXXXXXMOQEVAL                MONITOR STATUS QUALITY
XXXXXXXXXXXXXXXXXXXXXXMCNSTAT                MONITOR STATUS
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXMCSMARK
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXMONCAL      MONITOR CALIBRATION
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXMCCACHK
•(5)•••••••••••••••••••••••••••••MCNTREND    PERFORM TREND CHECK
                                       MCTNCNE           INDEP OF GAIN & SUBCOM
                                       MCTGAIN           DEP ONLY ON GAIN
                                             MOTMARK     MARK TREND BITS
•(10)••••••••••••••••••••••••••••••••• MCTSUBST          DEP ONLY ON SUBCOM
•(10)••••••••••••••••••••••••••••••••• MCTBOTH           DEP ON BOTH GAIN & SUBC
                                       TRGEN             TREND CHECK MACRO
•(100)•••••••••••••••••••••••••••••••• TRTAB             TREND CHECK TABLE
                ANLYZE                       MAIN DRIVER FOR ANALYZER FUNCTION
•(30)•••••••••••••••• ANVOLD                 ESTABLISH VOLUME BOUNDARIES
XXXXXXXXXXXXXXXXXXXXXXXXXXX GETTIM           TIME TABLE INTERPOLATION
                            VONUCA           DETERMINE VOLUME NUMBER
                      ANCHPD                 ESTABLISH CHAPTER BOUNDARIES
XXXXXXXXXXXXXXXXXXXXXXXXXXX ANCHD1           PUT INFO INTO CHAPTER HEADER
•(20)•••••••••••••••• ANVOLH                 PUT DATA INTO VOLUME HEADER
•(70)•••••••••••••••• ANCHHD                 PUT DATA INTO CHAPTER HEADER
XXXXXXXXXXXXXXXXXXXXXXXXXXX ANCHOK           GET QUALITY OF COMMAND DATA
                      ANBUMP                 ADVANCE SUBCOM LIST POINTER

•(30)•••••••••• OUTPUT                       MAIN DRIVER FOR OUTPUT FUNCTIONS
                      OUTOPEN                OPEN OUTPUT DATASETS
                            LOW              OPEN LOG WORK BLOCK
                            RDJECB
                      OUVOLCUT               WRITE VOL HEADER; PRINT SUMMARY
                      UPDFEET                UPDATE TAPE FOOTAGE COUNT
•(3)••••••••••••••••• OUCHPOUT               WRITE CHAPTER HEADER
                      OURROUT                LOCATE RAW RATE VERSE IN OUTPUT
                            VERSHEAD         FILL IN PREVERSE FIELDS
                            RAWRAT           CONSTRUCT RAW RATES VERSE
                      OUCCMCUT               LOCATE AREA FOR COINC CONDITION
XXXXXXXXXXXXXXXXXXXXXXXXXXXCONMPG            CONSTRUCT COIN CONDITION MAP
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXDISHET       DISABLE HET HANDLER
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXLETDEL       DELETE LET TERM HANDLER
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXBHETDEL      BUILD HET DELETE CODE
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXHETDEL       HET DELETE TERM HANDLER
•(1)••••••••••••••••• OURSMCUT               LOCATE AREA FOR RATES SUMMARY
XXXXXXXXXXXXXXXXXXXXXXXXXXXRATESM            CONSTRUCT RATES SUMMARY
XXXXXXXXXXXXXXXXXXXXXXXXXXXRSDISP            DISPLACEMENT TABLE
•(5)••••••••••••••••• OUINITP                TRANSFER EVENT RATES INTO
                                             PHA BLOCKS
(30)••••••••••••••••• OUPHICUT               CONSTRUCT PHA HISTORY MAP
•(5)••••••••••••••••• OUPHAOUT               MOVE PHA VERSES INTO OUTPUT
•(8)••••••••••••••••••••••• OUPHASRT         SORT PHA DATA
                                  OUPHALOC   ALLOCATE NEW PHA BLOCK
                            OUPHASET         FILL PREVERSE OF PHA VERSE
                            OUPHAPUT         MOVE PHA DATA INTO OUTPUT
```

Table 3-1. Voyager ENCGEN Routine Chart (3 of 3)

```
                              OUPHALIS   IDENTIFY VERSE PROCESSED
.(20)......... ENTERM                    TERMINATE PROCESSING
               LTERM                     CLOSE LOG BLOCK

*************************************************************************
DSECTS----
               CCM        COINCIDENCE CONDITION MAP
.(40)... CHINT      CHAPTER INTRODUCTION
.(10)... ENCMCB     MASTER CONTROL BLOCK
.(15)... GLOBAL     LIST OF GLOBAL EQUATES AND MASKS
         INREC      EDR HEADER ENTRIES (DFNHDR MACRO)
         LOGDAT     LOG BLOCKS
XXXXXXXXXMATTRIB    DATA MODE ATTRIBUTES
XXXXXXXX SEGELMNT   SEGMENT ELEMENT
.(84)... SEGHDR     EXPERIMENT DATA RECORD HEADER (SEGMENT)
         STAT       STATUS INPUT
.(50)....SUBCOM     SUBCOM BLOCK
XXXXXXXX TABLEHDR   DATA MODE TABLE PREFACES
.(70)... VERSE      OUTPUT VERSES
.(6).... VOLINT     VOLUME INTRODUCTION

UTILITY ROUTINES-----
XXXXXXXX CNVTME     PACK LINE COUNTS INTO R*8
XXXXXXXX DECLOG     DECIMAL TO LOG CONVERSION
XXXXXXXX DLCUPK     UNPACK R*8 LINE COUNT
XXXXXXXX DTMJS      UNPACK MSEC OF YEAR
XXXXXXXX DTUPK      UNPACK MSEC OF YEAR
XXXXXXXX FDSCDT     CONVERT FDSC TO FLOATING LINE COUNT
         FLOAT      TURNS FIXED INTO FLOATING POINT
         GETDATE    FETCH DATE
XXXXXXXX GETFDSC    EXTRACT FDCS FROM DATA RECORD
XXXXXXXX GETTIM     TIME INTERPOLATION ROUTINE
         INVOKE     CALL PROCEDURE
         I4TOCP     CONVERT I*4 INTO R*8
XXXXXXXX LOGDEC     LOG TO DECIMAL CONVERSION
         MOVE       GENERAL DATA MOVE ROUTINE
         MSG        GENERAL MESSAGE ROUTINE
         TIMCHK
.(10)... TIMECT     CONVERT TIME INTO R*8 MSEC

ATTRIBUTE BLOCKS------
XXXXXXXX CR1ATTR
XXXXXXXX CR2ATTR
XXXXXXXX CR3ATTR
XXXXXXXX CR6ATTR
XXXXXXXX GS3ATTR
XXXXXXXX MATTRGEN   MACRO TO GENERATE ATTRIBUTE BLOCKS

MISC----
XXXXXXXX DDCBGEN                GENERATE DATA DISPOSITION CONTROL BLOCK
XXXXXXXXXXXXX DDCBCR6           DATA DISPOSITION CONTROL BLOCK FOR CR6
XXXXXXXXXXXXX DDCB              DATA DISPOSITION CONTROL BLOCK FOR OTHERS
XXXXXXXXXXXXXXXXXX DATAGAP      ALLOCATE SUBCOM STATE AFTER DATA GAP
         LOPRCLOG               CREATE PROLOG FOR LOG BLOCK
XXXXXXXX PHAMSK                 EVENT DETECTOR CONDITIONS
XXXXXXXX RECCNT
XXXXXXXXXXXXX SKPHD
XXXXXXXX SCEDAT                 READ CARD
XXXXXXXXXXXXX SKPHD             READ CARD
XXXXXXXX STATUS                 MACRO
```

Table 3-2. ISEE-C ENCGEN Routine Chart (1 of 3)

```
            I S E E - C   E N C Y C L O P E D I A   G E N E R A T O R

   THE FOLLOWING IS A SUBROUTINE CHART OF THE ISEE-C ENCYCLOPEDIA
   GENERATOR.  (..... INDICATES A NEW ROUTINE)

   ENCMAIN              ENCGEN INITIALIZATION PROGRAM
        ENCGEN          MAIN CONTROL SECTION OF ENCYCLOPEDIA GENERATOR
              KTIME
              YOMD
              ANPARM                 ANALYZE PARAMETERS
                   LOL               OPEN LOG LIBRARY BLOCK
                   MOUNT, ETC
              ENINIT                 INITIALIZE FLAGS AND ALLOCATE AREAS
                   PMGEN             SET UP PHA TAG ID MAP
              SEBCOUNT               DETERMINE NUMBER OF SCIENCE BLOCKS
              READER                 MAIN DRIVER ROUTINE FOR READ FUNCTIONS
...............    RDVERIFY        VERIFY TAPE HEADER RECORD
...............    RDFKEEP         KEEP CERTAIN FILE HEADER DATA
                   FREAD           READ INPUT TAPE RECORD
                   RDSEGPRO        HANDLE SCIENTIFIC DATA RECORDS
.....................   PACKER          UNPACK DATA FROM EDR FORMAT
.....................   UPKQ            UNPACK DATA QUALITY INTO BYTES
.....................   UPKASC          UNPACK ANALOG/DIGITAL SUBCOMS
                        MARKUP                MARK UP DATA TO REFLECT QUALITY
                        RDIDSEG               SET CURRENT TIME
                        RDESTREL              SENSE A DATAGAP CONDITION
                        DISPATCH              DISPATCH DATA INTO SUBCOM BLOCK
                                  DISOPEN       ALLOC AND INIT NEXT SUBCOM
..........................        DISMISC       DISPATCH MISC. DATA
                                  DISPPR        DISPATCH DATA
                                  DISPP         DISPATCH PHA DATA
                                  DISFILLP      PAD PHA DATA
..........................        DISASCHI      DISPATCH ANA/DIG SUBCOM
..........................        DISCHOSE      DRIVER PROG. FOR SELECTION
..................................      CHOSE    GENERAL ROUTINE TO SELECT
                                                 ONE VALUE FROM READOUTS
..........................        DISSCC        SPACECRAFT WORDS
..........................        DISQUAL       DISPATCH QUALITY FLAGS
..........................        DISUPDSP      UPDATE SUBCOM POSITN FLAG
                                  DISUPDSB      UPDATE NEXT TIME SOUGHT
                   FNEXT           OPEN NEXT EDR DATASET
                        FNCLOSE         CLOSE CURRENT EDR DATASET
                              LCW             CLOSE LOG WORK BLOCK
                              LCL             CLOSE LOG LIBRARY BLOCK
                        FNOPNEXT        OPEN NEXT DATASET
                              LOL             OPEN LOG LIBRARY BLOCK
                              UNLOAD, LEAVE, MOUNT, POSN, ETC.
              MONITOR      MONITOR CAL. STATUS, AND BIT RATE
                   MONTREND        HET TREND CHECK
                        MOTNONE         RATE INDEP OF GAIN AND SUBCOM
                        MOTGAIN         RATE DEP ON GAIN ONLY
                        MOTSUBST        RATE DEP ON SUBCOM ONLY
                        MOTBOTH         RATE DEP ON GAIN AND SUBCOM
.....................   MOTFIND         FIND CORRECT SUBCOM
```

Table 3-2. ISEE-C ENCGEN Routine Chart (2 of 3)

```
            ANLYZE       MAIN DRIVER FOR ANALYZER FUNCTIONS
__________________ANVOLD_______ESTABLISH VOLUME BOUNDARIES____________
                       VCNUCA        DETERMINE VOLUME NUMBER
.................ANANA1        ANALCG VALUE LIMIT CHECK
                 ANCHPC        ESTABLISH CHAPTER BOUNDARIES
__________________ANVCLH_______PUT CATA INTO VOLUME HEADER____________
.................ANANA2        AVERAGE ANALOG VALUES; PUT IN CH INT
......................ANCONV________CONVERT RAW ANALOG INTO PHYSICAL__
                 ANCHHD        PUT CATA INTO CHAPTER HEADER
__________________ANBUMP_______ADVANCE SUBCOM LIST POINTER____________
            CUTPUT       MAIN CRIVER FOR OUTPUT FUNCTIONS
__________________OUTOPEN______OPEN OUTPUT DATASETS___________________
                       LOW           OPEN LOG WORK BLOCK
_______________________RDJFCB_________________________________________
                 OUVOLOUT      WRITE VCL HEADER; PRINT SUMMARY
__________________UPDFEET______UPDATE TAPE FOOTAGE COUNT______________
                 OUCHPOUT      WRITE CHAPTER HEADER
__________________OURROUT______LOCATE RAW RATE VERSE IN OUTPUT BUFFER_
                       VERSHEAC      FILL IN PREVERSE FIELDS
_______________________RAWRAT________CCNSTRUCT RAW RATES VERSE________
                 OUCCMOUT      LOCATE AREA FOR CCINC CONDITION MAP
......................CCMMPG_________CONSTRUCT COIN CONDITION MAP_____
...........................CCBDELCD      BUILD DISABLE TERMS
...........................CCDELCD_______DISABLE TERMS BUILT IN_______
                                         CCBDELCD
...........................CCDISA________DISABLE PHA EVENTS__________
                 OURSMOUT      LOCATE AREA FOR RATES SUMMARY VERSE
......................RSUM___________CONSTRUCT RATES SUMMARY VERSE____
...........................RSSUM       SUM SINGLE RATES
...........................RSVSUBR_____SUM SECTORED RATES____________
......................RSDISP        DISPLACEMENT TABLE
__________________OUINITP______TRANSFER EVENT RATES INTO PHA BLOCKS___
.................OUPHIHET      CONSTRUCT PHA HISTORY MAP FOR HET
____________________________VERSHEAD__________________________________
.................OUPHIVLT      CONSTRUCT PHA HISTORY MAP FOR VLET
____________________________VERSHEAD__________________________________
                 OUPHAOUT      MOVE PHA VERSES INTO OUTPUT BUFFER
......................OUPHASRH_______SORT HET PHA DATA________________
......................OUPHASRV      SORT VLET PHA DATA
_____________________________OUPHALOC________ALLOCATE NEW PHA BLOCK___
                       OUPHASET      FILL PREVERSE OF PHA VERSE
_______________________OUPHAPUT______MOVE PHA DATA INTO OUTPUT________
                            OUPHALIS      IDETIFY VERSE PROCESSED
.................OUSCWRCS______SPACE CRAFT WORDS VERSE (58,59,60,61,62,_
                               AND 122)
____________ENTERM_______TERMINATE PROCESSING_________________________
                 LTERM   CLOSE LOG BLOCK
______________________________________________________________________
******************************************************************
______________________________________________________________________
```

## Table 3-2. ISEE-C ENCGEN Routine Chart (3 of 3)

| | |
|---|---|
| DSECTS - | |
| CCM | COINCIDENCE CONDITION MAP |
| CHINT | CHAPTER INTRODUCTION |
| ENCMCB | MASTER CONTROL BLOCK |
| .....FILHDR | FILE HEADER RECORD |
| GLOBAL | LIST OF GLOBAL EQUATES AND MASKS |
| INREC | EDR HEADER ENTRIES (DFNHDR MACRO) |
| LOGDAT | LOG BLOCKS |
| .....MADATA | UNPACKED DATA AREA |
| SEGHDR | EXPERIMENT DATA RECORD HEADER (SEGMENT) |
| STAT | STATUS INPUT |
| SUBCOM | SUBCOM BLOCK |
| VERSE | OUTPUT VERSES |
| VOLINT | VOLUME INTRODUCTION |
| | |
| UTILITY ROUTINES - | |
| FLOAT | TURNS FIXED INTO FLOATING POINT |
| GETDATE | FETCH DATE |
| INVOKE | CALL PROCEDURE |
| IATODR | CONVERT I*A INTO R*8 |
| .....MOD | CALCULATE THE MOD OF TWO NUMBERS |
| MOVE | GENERAL DATA MOVE ROUTINE |
| MSG | GENERAL MESSAGE ROUTINE |
| TIMCHK | |
| TIMEDT | CONVERT TIME INTO R*E MSEC |
| | |
| MISC - | |
| LOPROLCG | CREATE PROLOG FOR LOG BLOCK |
| PHAMSK | |

## Table 3-3. Routine Conversion Summary (1 of 4)

```
ISEE TC VOYAGER CONVERSION

THE FOLLOWING IS A SUMMARY OF THE CHANGES MADE TO VOYAGER ENCYGEN
TO MAKE IT COMPATIBLE WITH ISEE-C FORMATS.

INITIALIZER:

          THE FOLLOWING ROUTINES WERE MODIFIED
          PMGEN FOR NEW TAPE AND INDEP SETS FOR HET AND VLET
          ENCGEN NO LONGER NEEDED SOME COPY STEPS
          ENINIT NO LONGER NEEDED TIME QUEUE

          THE FOLLOWING ROUTINES WERE DELETED
          RATTAB NO LONGER ANY RATE DECOMPRESSION
          DECLOG             "
          LOGDEC             "

READER:

          THE FOLLOWING ROUTINES WERE COMPLETELY REWRITTEN BUT THE
          BASIC FUNCTION IS THE SAME:
          MARKUP DATA DEPENDENT
          RDIDSEG   "
          RDESTREL  "
          DISPATCH TIME QUEUE DISCARDED
          DISOPEN  DATA DEPENDENT
          DISPFR    "
          DISPR1    "
          DISPP     "
          DISFILLP  "
          DISUPDSB  "
          DISUPDSG  "        (RENAMED DISUPDSP)

          THE FOLLOWING ROUTINES WERE DELETED PRIMARILY DUE TO
          LACK OF MODE ATTRIBUTES AND DIFFERENCES IN DATA.
          RDSEGSCI
          RDICMODE
          RDSAVTIM
          DISETABL
          DISSETT
          DISSETS
          DISSETC
          DISFILL
          DISCLOSE
          DPI
          DQSW
          BASIC
          OPCODES
          ENGPRO
          VALUES    ALL OF ENGPRO ROUTINES NOT NEEDED BECAUSE OF
          SETUP     LACK OF SEPARATE ENGIN RECORD
          IDMXOP
          PLOENG
          DECOM
```

### Table 3-3. Routine Conversion Summary (2 of 4)

```
           THE FOLLOWING ROUTINES WERE ADDED TO ISEE.  SEE THE
           ISEE FLOWCHART FOR DESCRIPTIONS
           PACKER
           UPKO
           UPKASC
           CHCSE
           DISCHCSE
           RDVERIFY
           RDFKEEP
           DISASCDG
           DISSCC
           DISQUAL
           DISMISC

MONITOR:

           THE FOLLOWING ROUTINES WERE COMBINED INTO MONITOR
           MONQUAL
           MOCEVAL
           MONSTAT
           MOSMARK
           MONCAL
           MOCACHK

           MONTREND WAS MODIFIED TO INCLUDE MORE LOCAL VARIABLES

           THE FOLLOWING ROUTINES WERE MODIFIED TO HANDLE TWO SUBCOMS
           MOTSUBST
           MOTBOTH

           TRTAB WAS COMPLETELY REWRITTEN FOR THE NEW RATES


           THE FOLLOWING ROUTINE WAS ADDED
           MOTFIND

ANALYZE:

          THE FOLLOWING ROUTINES WERE MODIFIED DUE TO DIFFERENT
          CHAPTER AND VOLUME INTRODUCTION DEFINITIONS, AND
          DIFFERENT SATELLITE TIME SPECIFICATIONS.
          ANCHHD
          ANVCLD
          ANVCLH

          THE FOLLOWING ROUTINES WERE ADDED TO ISEE.
          ANANA1
          ANANA2
          ANCCNV

          THE FOLLOWING VOYAGER ROUTINES WERE DELETED FROM ISEE
          DUE TO DIFFERENCES IN TIMES, CHAPTER INTRO FORMAT, AND
          LACK OF EXPLICIT COMMANDS.
          ANCHD1
          ANCMCK
          GETTIM
```

## Table 3-3. Routine Conversion Summary (3 of 4)

```
OUTPUT:

          THE FOLLOWING RCUTINES WERE MCDIFIED FOR ISEE  DUE TO A CHANGE
          IN RATE ,PHA ANC STATLS WORDS:
          OUTPUT
          CUCHFCUT  CHANGE IN RATE WCRDS
          OUFROUT            "
          RAWRAT             "
          CUCCMCUT           "
          OURSMCUT
          OUINITP
          OUFHICUT
          OUPHACUT  .
          OUPHASRT

          THE FCLLOWING ROUTINES WERE CCMPLETELY REPLACED
          DUE TO DIFFERENCES IN RATES.STATUS AND COINCIDENCE MAPS
          CONMPG  (RENAMED CCMMPG)
          RATESM
          RSDISP

          THE FOLLOWING ROUTINES WERE DELETED DUE TO DIFFERENCES
          IN HET AND LET CATA
          DISHET
          LETDEL
          BHETCEL
          HETDEL

END:
          ENTERM WAS MODIFIED TC NOT PRINT THE SECOND FILE

DSECTS.UTILITY ROUTINES. ATTRIBUTE BLOCKS.ETC.

          THE FCLLOWING ROUTINES WERE DELETED DUE TO LACK OF ATTRIBUTE
          BLCCKS ,CHANGE IN DISPCSITION OF DATA AND CHANGE IN CLOCKS.
          MAITRIB
          TABLEHOR
          CNVTME
          FDSCDT
          GETFCSC
          GETTIM
          CR1ATTR-CR6ATTR
          GS3ATTR
          MAITRGEN
          DDCBGEN
          STATUS
          RECCNT
          SKFHD
          SCEDAT
          DTMJS
          DTUPK
          DDCBCR6
          CDCB
          DATAGAP
          PHAMSK
          SEGELMNT
```

Table 3-3. Routine Conversion Summary (4 of 4)

```
THE FOLLOWING ROUTINES WERE MODIFIED TO REFLECT DIFFERENT DATA
CHINT
ENCMCB
SUBCCM
TIMEDT
VOLINT
VERSE
SEGHCR
```

## Table 3-4. READER Input/Ouput Chart (1 of 2)

### INPUT TO ISEE-C READER

VIA ENCMCB:

| | | |
|---|---|---|
| ENSCID | X'00' | SPACE CRAFT INDENTIFIER |
| ENCDAT | X | DATA TO BE PROCESSED INDICATOR |
| ENRATM0 | E'0.0' | IGNORE FOR BIT RATE 64 |
| ENRATM1 | E'64.0' | RATE ACCUM. TIME IN SEC. FOR BIT RATE 1024 |
| ENRATM2 | E'32.0' | RATE ACCUM. TIME IN SEC. FOR BIT RATE 2048 |
| ENRATM3 | E'128.0' | RATE ACCUM. TIME IN SEC. FOR BIT RATE 512 |
| ENEXPNO | F'33' | EXPERIMENT NUMBER |
| ENNEXTSW | F | @ OF SUBCOM BLOCK NEXT TO BE WRITTEN INTO |
| ENEUNIT | F'-10' | EDR DATA UNIT NUMBER |
| ENCSEBR | F | # SCIENCE RECS. TO BE READ |
| ENMSSEC | D'1000' | MILLISECONDS PER SECOND |

### ISEE-C OUTPUT FROM READER

VIA ISEE-C SUBCOM:

| | | |
|---|---|---|
| SUHSUB | H | SUBCOM POSITION FOR HET |
| SUVSUB | H | SUBCOM POSITION FOR VLET |
| SUSTATUS | F | HET STATUS WORD |
| SUVLETST | F | VLET STATUS WORD T1 T2 ENABLE |
| SUHET1GN | H | HET-1 GAIN MODE |
| SUHIGAIN | 1 | |
| SULOGAIN | 0 | |
| SUHET2GN | H | HET-2 GAIN MODE |
| SUHETCAL | X | HET CAL BIT FROM DIGITAL SUBCOM |
| SUVLTCAL | X | VLET CAL START BIT |
| SUVCALA | X | VLET CAL ALLOW BIT |
| SUGAPIND | X | DATA GAP INDICATOR |
| SUDQAL | X | DATA QUALITY ACCEPTANCE LEVEL |
| SUTQFLAG | X | TIME QUALITY FLAG |
| SUBITFLG | X | BIT RATE FLAG |
| SUSUBFLG | X | WORST OF QUALITY FLAGS OF HET AND VLET SUBCOMS |
| SUDTSTRT | D | START S/C TIME OF DATA-MILLISEC SINCE START OF Y 77. IF TIME IS NOT AVAILABLE, THIS FIELD CONTAIN THE VALUE SPECIFIED BY ENTIMPAD IN ENCMCB. ENTIMPAD WILL BE A NON-ZERO NEGATIVE NUMBER |
| SUSCC | F | SPACE CRAFT CLOCK |
| SUDQFLAG | 4F | DATA QUALITY FLAGS |

Table 3-4. READER Input/Output Chart (2 of 2)

| | | |
|---|---|---|
| SUORBIT | 0F | ORBITAL POSITION IN METERS |
| SUOPGSEX | F | |
| SUOPGSEY | F | |
| SUOPGSEZ | F | |
| SUOPGLAG | F | ORBITAL POSITION FLAG |
| SUPREVSU | AL4 | @ OF SUBCOM BLOCK THAT LOGICALLY PRECEDES THIS |
| SUNEXTSU | AL4 | @ OF NEXT SUBCOM BLOCK |
| SUHETPHA | 32D | AREA WHERE HET PHA EVENTS ARE STORED |
| SUVLTPHA | 32D | AREA WHERE VLET PHA EVENTS ARE STORED |
| SURATES | 24F | AREA WHERE HET RATE COUNTS ARE STORED |
| SUVLTRAT | 16F | AREA WHERE VLET RATE COUNTS ARE STORED |
| SUHSCTRS | F | HET SECTORED RATE SUM |
| SUVSCTRS | F | VLET SECTORED RATE SUM |
| SUVLETAN | H | VLET ANALOG HOUSEKEEPING |
| SUHETPM | H | HET POWER MONITOR |
| SUVLTPM | H | VLET POWER MONITOR |
| SUHETTH | H | HET THERMISTOR |
| SUVLTTH | H | VLET THERMISTOR |
| | 0F | |
| SUSPIN | F | SPIN IN MILLISECONDS |
| SUSCWORD | 96F | MF58,59,60,61,62,122 WORDS |

## Table 3-5. MONITOR Input/Output Chart

### MONITOR DESIGN DOCUMENT

| | | |
|---|---|---|
| INPUT: | VIA ENCMCB | |
| | ENNEXTSR | @ OF TOP OF FILLED SUBCOM QUEUE |
| | ENNEXTSW | @ OF BOTTOM OF FILLED SUBCOM QUEUE |
| | VIA SUBCOM | |
| | SUGAPIND | GAP INDICATOR IN A DUMMY SUBCOM |
| | SUSTATUS | HET STATUS SET < 0 IF BAD |
| | SUFLAG | DISPOSITION FLAG SET TO 0 |
| | SUHSUB | HET SUBCOM TO DEFINE STATUS CYCLE |
| | SUVLETST | VLET STATUS SET < 0 IF BAD |
| | SUVLTCAL | VLET CAL |
| | SUVCALA | VLET CAL ENABLE |
| | SUHETCAL | HET CAL |
| | SUPREVSU | SUBCOM @ CHAIN |
| | SUNEXTSU | SUBCOM @ CHAIN |
| | SURATES | RATES WORDS FOR TREND CHECK |
| OUTPUT: | VIA SUBCOM | |
| | SUFLAG | DISPOSITION FLAG SET TO -1 IF TO IGNORE<br>ONE STATUS CYCLE SET TO IGNORE FOR BAD STATUS, CHANGE IN BITRATE AND DATA GAP.<br>TWO STATUS CYCLES SET TO IGNORE FOR CHANGE IN STATUS<br>A STATUS CYCLE IS TWO SUBCOMS, EVEN AND ODD |
| | SUQFLAG | SET TO -1 IF BAD STATUS |
| | SUSFLAG | SET TO -1 IF STATUS CHANGED |
| | SUCALFLG | SET TO -1 IF CALBRATION MODE |
| | SUBFLAG | SET TO -1 IF BIT RATE CHANGED |
| | SURATES | FIRST BYTE OF EACH RATE WORD SET TO INDICATE TREND (SEE ENCYCLOPEDIA TAPE FORMAT) |
| | SUCHSMC | CALIBRATION MODE SET AS LONG AS MODE IS ON<br>NOT NOMINAL STATUS SET AS LONG AS NOT NOMINAL<br>STATUS CHANGE SET IN FIRST GOOD STATUS CYCLE<br>BITRATE CHANGE SET IN FIRST GOOD STATUS CYCLE<br>(SEE ENCYCLOPEDIA TAPE FORMAT) |
| | SUHETCAL | HET CAL |
| | SUAUTO1 | HET1 AUTO GAIN |
| | SUAUTO2 | HET2 AUTO GAIN |

Table 3-6. ANALYZER Input/Output Chart (1 of 3)

## ANALYZER DESIGN DOCUMENT

INPUT TO ANALYZER VIA ENCMCB

| | | |
|---|---|---|
| ENNEXTSW | F | @ OF SUBCOM BLOCK NEXT TO BE WRITTEN INTO |
| ENNEXTSR | F | @ OF SUBCOM BLOCK NEXT TO BE READ |
| ENPRUNIT | F'6' | PROG MESSAGE LOG UNIT |
| ENVOLINT | F | @ OF VOLUME INTRODUCTION |
| ENCHPINT | F | @ OF CHAPTER INTRODUCTION AREA |
| ENVOLEN | D'900000' | NUMBER OF MILLISECOND/VOLUME |
| ENKEEP | F'32' | NUMBER OF SUBCOMS TO PRESERVE BEFORE NEW DATA |

INPUT TO ANALYZER VIA SUBCOM

| | | |
|---|---|---|
| SUSTATUS | F | HET STATUS WORD |
| SUVLETST | F | VLET STATUS WORD T1 T2 ENABLE |
| SUHETCAL | X | HET CAL BIT FROM DIGITAL SUBCOM |
| SUHCALA | X | HET CAL ALLOW BIT FROM STATUS |
| SUVLTCAL | X | VLET CAL START BIT |
| SUVCALA | X | VLET CAL ALLOW BIT |
| SUGAPIND | X | DATA GAP INDICATOR |
| SUDQAL | X | DATA QUALITY ACCEPTANCE LEVEL |
| SUAUTO1 | X | HET-I AUTO GAIN INDICATOR |
| SUAUTO2 | X | HET-II AUTO GAIN INDICATOR |
| SUCHSMC | X | CHAPTER SUBJECT MATTER CODE |
| SUTQFLAG | X | TIME QUALITY FLAG |
| SUBITFLG | X | BIT RATE FLAG |
| SUDTSTRT | D | START S/C TIME OF DATA-MILLISEC SINCE START OF YR |
| SUSCC | F | SPACE CRAFT CLOCK |
| SUDQFLAG | 4F | DATA QUALITY FLAGS |
| SUFLAG | H | OVER ALL EVALUATION FLAG |
| SUORBIT | 0F | ORBITAL POSTION IN METERS |
| SUPREVSU | AL4 | @ OF SUBCOM BLOCK THAT LOGICALLY PRECEDES THIS BLOCK |
| SUNEXTSU | AL4 | @ OF NEXT SUBCOM BLOCK |
| SUVLETAN | H | VLET ANALOG HOUSEKEEPING |
| SUHETPM | H | HET POWER MONITOR |
| SUVLTPM | H | VLET POWER MONITOR |
| SUHETTH | H | HET THERMISTOR |
| SUVLTTH | H | VLET THERMISTOR |
| SUSPIN | F | SPIN IN MILLISECONDS |

Table 3-6. ANALYZER Input/Output Chart (2 of 3)

OUTPUT FROM ANALYZER VIA ENCMCB

| | | |
|---|---|---|
| ENANDONE | X | ANALYZER COMPLETION CODE |
| ENNEXTSR | F | @ OF SUBCOM BLOCK NEXT TO BE READ |
| ENCHPLOC | 16F | 8 PAIRS OF @ OF FIRST AND LAST SUBCOMS FOR EACH OF A MAXIMUM OF 8 CHAPTERS. |

OUTPUT FROM ANALYZER VIA VOLUME INTRODUCTION

| | | |
|---|---|---|
| VOVOVOLN | F | VOLUME NUMBER |
| VOVSTRT | 0CL10 | START TIME OF VOLUME |
| VONMCHP | H | NUMBER OF CHAPTERS IN VOLUME |
| VOCHSMC | 8X | SUBJECT MATTER CODE FOR CHAPTERS IN VOLUME |

OUTPUT FROM ANALYZER VIA CHAPTER INTRODUCTION

| | | |
|---|---|---|
| CHCHSMC | X | CHAPTER SUBJECT MATTER CODE |
| CHVOLN | F | VOLUME NUMBER |
| CHDTSTRT | 0CL8 | STARTING S/C TIME OF DATA INCLUDED |
| CHDTEND | 0CL8 | ENDING S/C TIME OF DATA |
| CHSTSCC | F | STARTING TIME, SPACECRAFT CLOCK |
| CHHETST1 | F | HET COMMAND STATUS, FIRST 3 BYTES |
| CHHETST2 | F | HET COMMAND STATUS,SECOND 3 BYTES |
| CHVLETC | H | VLET CALIBRATION: |
| CHHETC | H | HET CALIBRATION |
| CHNMMR | H | NUMBER OF MINOR FRAMES IN CHAPTER |
| CHDQ00 | H | SUM OF MINOR FRAMES PADDED (00) |
| CHDQ01 | H | SUM OF MINOR FRAMES WITH BAD DATA QUALITY (01) |
| CHDQ10 | H | SUM OF MINOR FRAMES WITH GOOD DATA QUALITY (10) |
| CHDQ11 | H | SUM OF MINOR FRAMES WITH EXCELLENT QUALITY (11) |
| CHTQ00 | H | SUM OF MF WITH QUICK LOOK DATA (00) |
| CHTQ01 | H | SUM OF MF WITH TIME QUALITY (01) |
| CHTQ10 | H | SUM OF MF WITH TIME QUALITY (10) |
| CHTQ11 | H | SUM OF MF WITH TIME QUALITY (11) |
| CHVLETAN | 0CL32 | ANALOG VALUES, AVERAGED FOR CHAPTER. |
| CHHETPM | F | HETS POWER MONITOR, MV |
| CHVLETPM | F | VLETS POWER MONITOR,MV |
| CHHETTH | F | HETS THERMISTOR, DEGREES C |
| CHVLETTH | F | VLETS THERMISTOR, DEGREES C |
| CHOPGSEX | F | ORBITAL POSITION (GSEX), AVERAGE FOR CHAPTER |
| CHOPGSEY | F | ORBITAL POSITION (GSEY), AVERAGE FOR CHAPTER |

Table 3-6. ANALYZER Input/Output Chart (3 of 3)

| | | |
|---|---|---|
| CHOPGSEZ | F | ORBITAL POSITION (GSEZ), AVERAGE FOR CHAPTER |
| CHSPINPD | F | SPIN PERIOD(MSEC(, AVERAGE FOR CHAPTER |
| CHDELSPN | F | MAXIMUM SPIN DEVIATION (MSEC) |
| CHNOWILD | H | SUM OF MINOR FRAMES WITH NORMAL SPIN READOUTS |
| CHWILD | H | SUM OF MINOR FRAMES WITH 'WILD' SPIN READOUTS |
| CHBITR | H | BIT RATE |

Table 3-7. OUTPUTTER Input/Output Chart (1 of 3)

## OUTPUTTER DESIGN DOCUMENT

```
1.  INPUT VIA ENCMCB - MASTER CONTROL BLOCK.  THE FOLOWING IS BROKEN
    INTO SECTIONS.
    A.  DATA QUALITY FLAGS AND RECORD KEEPING DATA
        ENDQAL    X      DATA QUALITY ACCEPTANCE LEVEL
        ENSTARTV F       START VOLUME #
        ENENDV   F       LAST VOLUME # PROCESSED
    B.  PHA PROCESSING
        EN@PMSKH F       @ HET PHA MASK TABLE
        EN@PMSKV F       @ VLET PHA MASK TABLE
        EN@PMAPH F       @ HET PHA MAP TABLE
        EN@PMAPV F       @ VLET PHA MAP TABLE
        EN#PTYPE F       # PHA VERSES
        ENMAXPB  F       # BLOCKS ALLOC FOR PHA SORT
        ENPBSIZE F       # PHA EVENTS PER PHA VERSE
        ENLPHA   F       LENGTH PHA SORT AREA
        EN@PHA   F       @ PHA SORT AREA
        EN1STPV  F       DATA TYPE OF FIRST PHA VERSE
        EN@PHISH F       @ DATA TYPES IN HET PHA HISTORY VERSE
        EN@PHISV F       @ DATA TYPES IN VLET PHA HISTORY VERSE
    C.  ADDRESSES
        ENVOLINT F       @ VOLUME INTRODUCTION
        ENCHPINT F       @ CHAPTER INTRODUCTION
        ENCHPLOC 16F     8 PAIRS (MAX.) OF FIRST AND LAST
                         SUBCOMS PER CHAPTER
    D.  I/O
        ENPRUNIT F       PROG. MESSAGE LOG UNIT
        ENSCUNIT F       LOGICAL UNIT FOR SCIENCE MESSAGES
        ENCDCB   DCB     OUTPUT TAPE LOGICAL UNIT
        ENENEXIT F       JFCB FOR OUTPUT ENCYCLOPEDIA TAPE
        ENCJFCB  176C    JFCB BLOCK FOR OUTPUT TAPE UNIT
    E.  OUTPUT TAPE TRACKER
        ENBPFEET D       #BITS PER FEET
        ENIRGAP  D       # FEET PER INTER-RECORD GAP
        ENFTMAX  D       MAXIMUM AMT. OF FEET OF USE ON OUTPUT TAPE
        ENFTOUT  D       CURRENT AMT. OF FEET USED ON OUTPUT TAPE
    F.  LOG INTERFACE
        ENLOGDAT F       @COMMON BLOCK LOGDAT
```

Table 3-7. OUTPUTTER Input/Output Chart (2 of 3)

G. UTILITY

| | | |
|---|---|---|
| ENDCONVT | 2D | FLOATING POINT CONVERSION AREA |
| ENL1 | F | PRINT CODE FOR L*1 DATA |
| ENL4 | F | PRINT CODE FOR L*4 DATA |
| ENI2 | F | PRINT CODE FOR I*2 DATA |
| ENI4 | F | PRINT CODE FOR I*4 DATA |
| ENR4 | F | PRINT CODE FOR R*4 DATA |
| ENR8 | F | PRINT CODE FOR R*8 DATA |

2. INPUT TO OUTPUTTER VIA CHAPTER INTRODUCTION

| | | |
|---|---|---|
| CHCHSMC | X | CHAPTER SUBJECT MATTER CODE |

3. INPUT TO OUTPUTTER VIA VOLUME INTRODUCTION

4. SUBCOM - BLOCKS OF 64 MINOR FRAMES ASSOC. WITH EACH CHAPTER

| | | |
|---|---|---|
| SUHSUB | H | SUBCOM POSITION FOR HET |
| SUVSUB | H | SUBCOM POSITION FOR VLET |
| SUSTATUS | F | HET STATUS WORD |
| SUHET1GN | H | HET-1 GAIN MODE |
| SUHET2GN | H | HET-2 GAIN MODE |
| SUGAPIND | X | DATA GAP INDICATOR |
| SUPREVSU | F | @ OF PREVIOUS SUBCOM |
| SUNEXTSU | F | @ OF NEXT SUBCOM |
| SUHETPHA | 32D | AREA WHERE HET PHA EVENTS ARE STORED MARKED FOR QUALITY |
| SUVLIPHA | 32D | AREA WHERE VLET PHA EVENTS ARE STORED MARKED FOR QUALITY |
| SURATES | 24F | AREA WHERE HET RATE COUNTS ARE STORED MARKED FOR TREND AND QUALITY |
| SUVLTRAT | 16F | AREA WHERE VLET RATE COUNTS ARE STORED MARKED FOR TREND AND QUALITY |
| SUHSCTRS | F | SECTORED HET RATES,SUMMED AND MARKED FOR TREND AND QUALITY |
| SUVSCTRS | F | SECTORED VLET RATES, SUMMED AND MARKED FOR TREND AND QUALITY |
| SUSPIN | F | SPIN TIME IN MILLISECONDS |
| SUBITFLG | X | BIT RATE FLAG |
| SUSCWORD | 96F | MF 58, 59, 60, 61, 62, 122 WORDS |

## Table 3-7. OUTPUTTER Input/Output Chart (3 of 3)

### MAJOR OUTPUT

1. THE FOLLOWING ARE PLACED ON THE ENCYCLOPEDIA TAPE
    - A. VOLUME INTRODUCTION
    - B. CHAPTER INTRODUCTION
    - C. VERSES
2. ENCMCB

| | | |
|---|---|---|
| ENRTCODE | F | RETURN CODE FROM SUBROUTINE LOW |
| ENWRKBLK | 16F | WORK BLOCK, RETURNED FROM SUBROUTINE LOW |
| ENFTOUT | D | AMT. OF FEET CURRENTLY USED ON OUTPUT TAPE |

3. LOGDAT - COMMON THAT INTERFACES WITH LOG AND SUBROUTINE LOW

## SECTION 4 - PROGRAMMERS GUIDE TO ENCMRG

The purpose of ENCMRG is to combine the WORK tapes onto the encyclopedia (ENCY) data base. ENCMRG merges one WORK tape at a time and works by copying old volumes from the ENCY tape until the WORK volumes can be inserted or an overlap exists. An overlap is resolved by taking the volume with the greatest data quality sum or in the case of nearly identical volumes, the WORK volume is merged. In each run of ENCMRG, at least one new ENCY tape is created and made active. It contains the merged volumes from the old ENCY tape and the WORK tape.

This section includes the list of variables used most often, along with an explanation for each variable. The ENCMRG program is written almost exclusively in IBM assembler and to aid in debugging, a commentary and prologue has been added to the source code which is in SEICC. ENCMRG. SOURCE. In addition, there is a member called LOOKATME which gives a rough idea of what each member does. There is also a member called FLOWCHART which is a flow chart of subroutine linkages.

ENCMRG modifies the LOG and changes the status on the ENCY blocks. An active status is '00' and an inactive block status is '01'. The WORK blocks are not linked to the ENCY blocks except indirectly by volume numbers. The LOGLIST program has an option to list all ENCY blocks or just the active ones.

## ABBREVIATIONS AND TERMINOLOGY

| | |
|---|---|
| DCB | Data CONTROL block |
| VOL | Volume |
| IBM | International Business Machines |
| SER | Serial |
| Intro | Introduction |
| Block | Record of log |
| Record | Record of tape |
| Ency | Encyclopedia |
| LOG | Data set describing satellite tapes, runs etc. |
| @ | Address |
| # CHAPTER | Number of chapters in volume |
| @LASTBLK | @ of last block in list |
| ATFENCY | @ of first ency block |
| ATFVOL | First volume for these attributes |
| ATLENCY | @ of last ency block |
| ATLVOL | Last vol in attribute block |
| ATTRIB | DSECT describing MATTRIB |
| CASEFLAG | Flag indicating which case to process |
| CHCHPN | ID for chapter in ency tape |
| CHINT | DSECT for chapter |
| CHNMVER | Number of verses in chapter |
| CHVOLN | Volume number of chapter |
| COPYBEG | Vol to begin copy with |
| COPYDCB | DCB of unit to copy from |
| COPYEND | Vol to end copy with |
| COPYINT | @ of vol intro to copy |
| CVOLUME | Vol number returned by copy |
| DILAST | Last block allocated |
| DIMAXBLK | Number of blocks in the log dataset |
| DIRECT | DSECT describing directory block |
| DWORD | Area for conversion to double precision |
| ENB@ENB | Address of this ency block |

| | |
|---|---|
| ENBBLKCT | Number of blocks written |
| ENBENEXT | @ of next ency block of same attributes |
| ENBEVOL | End vol on this ency tape |
| ENBLK | DSECT describing ency block |
| ENBSER | Serial number of ency tape in ency block |
| ENBSTAT | Status of this block |
| ENBSVOL | Start vol of ency block |
| ENCFENCY | @ of first ency block |
| ENCLENCY | @ of last ency block |
| ENCMDSN | Ency data set name |
| ENCMVSER | Ency vol-ser |
| ENCNTL | DSECT describing MENCNTL |
| ENCSERL | Last ency serial number |
| IHADCB | IBM DCB dsect |
| JFCBDSNM | IBM dataset name |
| JFCBVOLS | IBM volume serial |
| LOACTIVE | =0, indicates active block |
| LOATTRIB | =2, ID of attribute block |
| LOBLKLEN | =64, length of a block |
| LODEAD | ='01' indicates inactive block |
| LOENBLK | =16, ID of ency block |
| LOPBEGUN | ='40' indicates processing has begun |
| LOPCOMP | ='20' indicates processing has completed |
| LOPROCESS | ='80' indicates block ready to process |
| LVOLUME# | Last volume processed |
| M@ATTRIB | @ of attribute block |
| M@DIRECT | @ of directory block in MUPDCNTL |
| M@LENCY | @ of last ency block |
| M@SATID | @ of satellite ID as found in parm field |
| M@SATLIT | @ of satellite block |
| MATLENCY | @ of LAST ency block of same attributes |
| MATTRIB | Area of attribute block |
| MAXBLK | Maximum number of blocks that may be written on = 5000 |

| | |
|---|---|
| MDIRECT | Area for directory block |
| MENBACT | Action flag in ency chained block |
| MENBENB | Area within chained block containing ency block |
| MENBLEN | Length of chained block |
| MENBLK | Area containing ency block |
| MENBLOCK | DSECT describing MNENBPTR |
| MENBNEXT | Next block in chain |
| MENBPTR | First node of chained list of old ency blocks |
| MENCNTL | Area for ency control block |
| MLENCY | Area for last ency block |
| MLREAD | External call for reading log |
| MNENBLK | Area for new ency block |
| MNENBPTR | Node of new ency block chain |
| MNENCDCB | New ency DCB |
| MOENCDCB | Old ency tape DCB |
| MOENCINT | @ of vol intro from old ency tape |
| MRECORD | Current block number |
| MRGCNTL | DSECT for merge variables |
| MRGDAY | Day of run |
| MRGMON | Month of run |
| MRGYR | Year of run |
| MSATLIT | Area for satellite block |
| MUPDCNTL | Work area for update in last block of log |
| MUPDFLAG | Flag in MUPDCNTL, 0=normal |
| MWKCNTL | Area for work control block |
| MWORKDCB | Work tape DCB |
| MWORKINT | @ of vol intro from work tape |
| MWRKBLK | Area for work block |
| ODQSUM | Sum of data quality flags in old ency tape volume |
| OVERLBEG | Vol with which overlap begins |
| OVERLEND | Vol after which overlap ends |

| | |
|---|---|
| OVOLUME | Old ency tape volume |
| PROCFLAG | Process flag, 0=not done |
| PROCTEMP | Save area for work end vol |
| RETURN | =1, flat to return chained block to log |
| VEBODY | DSECT for verse body |
| VECHPN | Chapter number of verse |
| VERSE | DSECT describing verse introduction |
| VEVOLN | Volume number of verse |
| VODQSUM | Sum of data quality flags in current volume |
| VOLINT | DSECT describing vol intro |
| VOLUME# | Volume being processed |
| VONMCHP | Number of chapters in volume |
| VOVOCHPN | =0, identifier for vol intro record |
| VOVOVOLN | Intro vol number |
| WDQSUM | Sum of data quality flags in work volume |
| WKCMDSN | Work tape data set name |
| WRKBLK | DSECT describing MWRKBLK |
| WRKMDISP | Merge disposition in work block |
| WVOLUME | Volume number of work tape |

# APPENDIX A - A DESCRIPTION OF THE ISEE LOG

The LOG is a sequential data set called SEICC.LOG.DATA. Each record is 64 bytes and contains information as described in this appendix. The original initialization of the LOG was done by INTLOG from SEICC.INTLOG.ASM. All of the data reduction routines access or modify blocks in the LOG. The LOG ISEE is the same as for Voyager (MJS) except in the EDR blocks where ISEE has the number of EDR files and in the library blocks where ISEE has seconds instead of FDSC counts.

# MJS LOG

## Types of Blocks and Code Assignment

| Block Identifier Code | Description |
|---|---|
| 00 | Directory Block |
| 01 | Satellite Block |
| 02 | Ency-Attribute Block |
| 03 | EDR Control Block |
| 04 | Library Control Block |
| 05 | Work Control Block |
| 06 | Encyclopedia Control Block |
| 07 | CITENCY Control Block |
| 13 | EDR Block |
| 14 | Library Block |
| 15 | Work Block |
| 16 | Encyclopedia Block |
| 17 | CITENCY Block |

# MJS LOG - 2

1000\0000
1100

## Structure of Processing Disposition Byte

use CO for 'do not process'

| Type | Description | | | |
|---|---|---|---|---|
| 0 | Marked for processing | 80 | EO | E1 |
| 1 | Processing has begun | | | |
| 2 | Processing was completed | | | |
| 3 | Spare | | | |
| 4-7 | Processing completion code | | | |
| | = 0 no errors | | | |
| | = 1 errors detected | | | |
| | = 15 serious error | | | |

## Structure of Slot Allocation Status Byte

| Bit | Description | | | |
|---|---|---|---|---|
| 0 | Slot allocation requested | CO | EO complete | FO removed |
| 1 | Slot allocated | | | |
| 2 | Slot is removable | | | |
| 3-7 | Spare | | | |

# DIRECTORY BLOCK

| Byte | Byte Length | Description |
|---|---|---|
| 0 | 1 | Block identifier code, = 0 |
| 1 | 1 | Year of creation |
| 2 | 1 | Month of creation |
| 3 | 1 | Day of creation |
| 4 | 2 | Address of previous block of this type, = 0 |
| 6 | 2 | Address of next block of this type, = 0 |
| 8 | 2 | Number of blocks in data set |
| 10 | 2 | Address of last block allocated |
| 12 | 2 | Number of satellite entries |
| 14 | 2 | Maximum number of satellite entries, = 3 |
| 16 | 1 | S/C id. code |
| 17 | 1 18-19<br>20-23<br>24-27<br>28-31 | Number of characters in satellite id. |
| 18 19 - 30 | 12 | Satellite id. (alphanumeric) |
| 30 - 31 - 32 | 2 | Address of Satellite block for this satellite |
| 32-47 | 16 | Same as 16-31 above for second satellite |
| 48-63 | 16 | Same as 16-31 above for third satellite |

# SATELLITE BLOCK

| Byte | Byte Length | Description |
|---|---|---|
| 0 | 1 | Block identifier code, = 1 |
| 1 | 1 | Year of creation |
| 2 | 1 | Month of creation |
| 3 | 1 | Day of creation |
| 4 | 2 | Address of previous block of this type, = 0 |
| 6 | 2 | Address of next block of this type, = 0 |
| 8 | 2 | Address of first Ency-Attribute block |
| 10 | 2 | Address of EDR Control block |
| 12 | 2 | Address of Library Control block |
| 14 | 2 | Address of Work Control block |
| 16 | 2 | Address of Encyclopedia Control block |
| 18 | 2 | Address of CITENCY Control block |

# ENCY-ATTRIBUTE BLOCK

| Byte | Byte Length | Description |
|---|---|---|
| 0 | 1 | Block identifier code, = 2 |
| 1 | 1 | Year of creation |
| 2 | 1 | Month of creation |
| 3 | 1 | Day of creation |
| 4 | 2 | Address of previous block of this type |
| 6 | 2 | Address of next block of this type |
| 8 | 2 | Record volume length in seconds |
| 10 | 1 | Data Quality Acceptance ON mask |
| 11 | 1 | Data Quality Acceptance OFF mask |
| 12 | 4 | Verse presence mask |
| 16 | 2 | Address of first work block |
| 18 | 2 | Address of first encyclopedia block |
| 20 | 4 | 4 character Mnemonic for this encyclopedia |
| 24 | 2 | Address of last work block |
| 26 | 2 | Unused |
| 28 | 4 | First encyclopedia volume |
| 32 | 4 | Last encyclopedia volume |
| 36 | 2 | Last encyclopedia block |
| 38 | 2 | Number of characters in title* |
| 40 | - | Character title of encyclopedia |

*Not actively used at present

word 6
mnemonic

# EDR CONTROL BLOCK

| Byte | Byte Length | | Description |
|---|---|---|---|
| 0 | 1 | 1 | Block identifier code, = 3 |
| 1 | 1 | | Year of creation |
| 2 | 1 | | Month of creation |
| 3 | 1 | | Day of creation |
| 4 | 2 | 2 | Address of previous block of this type, = 0 |
| 6 | 2 | | Address of next block of this type, = 0 |
| 8 | 2 | 3 | Address of first EDR block |
| 10 | 2 | | Address of last EDR block |
| 12 | 2 | 4 | Address of EDR block last modified |
| 14 | 2 | | |
| 16 | 4 | 5 | First slot assigned to EDR's |
| 20 | 4 | 6 | Last slot assigned to EDR's |

# LIBRARY CONTROL BLOCK

| Byte | Byte Length | Description |
|---|---|---|
| 0 | 1 | Block identifier code, = 4 |
| 1 | 1 | Year of creation |
| 2 | 1 1 | Month of creation |
| 3 | 1 | Day of creation |
| 4 | 2 | Address of previous block of this type, = 0 |
| 6 | 2 2 | Address of next block of this type, = 0 |
| 8 | 2 | Address of first library block |
| 10 | 2 3 | Address of last library block |
| 12 | 2 | Address of last library block modified |
| 14 | 2 4 | |
| 16 | 2 9 | First library volume serial |
| 18 | 2 10 5 | Last library volume serial |
| 20 | 4 11-12 | First library slot |
| 24 | 4 13-14 | Last library slot |
| 28 | 2 | Last library volume serial written on |
| 30 | 2 8 | Last data set sequence number on above |
| 32 | 2 9 | Feet used on volume corresp. to last library serial above |
| 34 | 2 | Maximum amount of tape to be written (in feet) = 1800 feet |
| 36 37 | 18 | Model volume DSN (17 char)<br>$V\begin{pmatrix}A\\B\\C\end{pmatrix}$.AAXXXXXX<br>IC<br>~~2 JPL char. JPL number~~ |
| 54 +55 | 6 | Model volume serial = ~~$M\begin{pmatrix}1\\2\end{pmatrix}$ W000~~<br>ICL |

# WORK CONTROL BLOCK

| Byte | Byte Length | Description |
|---|---|---|
| 0 | 1 | Block identifier code, = 5 |
| 1 | 1 | Year of creation |
| 2 | 1 | Month of creation |
| 3 | 1 | Day of creation |
| 4 | 2 | Address of previous block of this type, = 0 |
| 6 | 2 | Address of next block of this type, = 0 |
| 8 | 2 | Address of 1st block |
| 10 | 2 | Address of last work block |
| 12 | 2 | First work volume serial |
| 14 | 2 | Last work volume serial |
| 16 | 4 | First work slot |
| 20 | 4 | Last work slot |
| 24 | 18 | Model volume DSN (17 char)<br>$V\binom{A}{B}.$ |
| 42 | 6 | Model volume serial<br>$M\binom{1}{2}W000$ |
| 48 | 2 | Last serial used |

# ENCYCLOPEDIA CONTROL BLOCK

| Byte | Byte Length | Description |
|---|---|---|
| 0 | 1 | Block identifier code, = 6 |
| 1 | 1 | Year of creation |
| 2 | 1 | Month of creation |
| 3 | 1 | Day of creation |
| 4 | 2 | Address of previous block of this type, = 0 |
| 6 | 2 | Address of next block of this type, = 0 |
| 8 | 2 | Address of lst encyclopedia block |
| 10 | 2 | Address of last encyclopedia block |
| 12 | 2 | First encyclopedia volume serial |
| 14 | 2 | Last encyclopedia volume serial |
| 16 | 4 | First encyclopedia slot |
| 20 | 4 | Last encyclopedia slot |
| 24 | 6 | Model volume name (6 char) |
| 30 | 2 | Last ENCY serial used |
| 32 | 2 | Maximum number of blocks |
| 34 | 18 | Model volume DSN (18 char) |

# CITENCY CONTROL BLOCK

| Byte | Byte Length | Description |
|---|---|---|
| 0 | 1 | Block identifier code, = 7 |
| 1 | 1 | Year of creation |
| 2 | 1 | Month of creation |
| 3 | 1 | Day of creation |
| 4 | 2 | Address of previous block of this type, = 0 |
| 6 | 2 | Address of next block of this type, = 0 |
| 8 | 2 | Address of first CITENCY block |
| 10 | 2 | Address of last CITENCY block |
| 12 | 2 | First CITENCY volume serial |
| 14 | 2 | Last CITENCY volume serial |
| 16 | 4 | First CITENCY slot |
| 20 | 4 | Last CITENCY slot |
| 24 | 6 | Model volume name (6 char) |
| 30 | 2 | Address of free CITENCY volume block |
| 32 | 2 | Maximum amount of tape to be written on |

# EDR BLOCK

| Byte | Byte Length | Description |
|---|---|---|
| 0 | 1 | Block identifier code, = 13 0D |
| 1 | 1 | Year of creation 4E |
| 2 | 1 | Month of creation 0C |
| 3 | 1 | Day of creation 0F |
| 4 | 2 | Address of previous block of this type |
| 6 | 2  2 | Address of next block of this type |
| 8 | 6 5-7 | Volume serial (JPL number) |
| 14 15+16 | 2 3,4 | 2 characters in JPL number |
| 16 | 1 | Slot allocation status |
| 17 | 1 5 | Year received |
| 18 | 1 | Month received |
| 19 | 1 | Day received |
| 20 | 4 6 | Slot number |
| 24 | 2 7 | Address of library entry |
| 26 | 2 | Number of records |
| 28 | 2 8 | Number of errors |
| 30 | 2 | Maximum number of files |
| 32 | 2 | |
| 34 | 2 | ① ② ③ ④ Number of entries that follow that were processed (retries at processing) |
| 36 | 1 | (37) (41) (45) (49) Processing disposition |
| 37 | 1 | Year of processing |
| 38 | 1 | Month of processing |
| 39 | 1 | Day of processing |
| 40-43 | 4 | Same as 36-39 above |
| 44-47 | 4 | Same as 36-39 above |
| 48-51 | 4 | Same as 36-39 above |

processing disp of 'C0' must be reset to '80' to match pointer number

at # = 3 not sure can reprocess; set to 2

# LIBRARY BLOCK

| Byte | Byte Length | Description |
|---|---|---|
| 0 | 1 | Block identifier code, = 14 |
| 1 | 1 | Year of creation |
| 2 | 1 | Month of creation |
| 3 | 1 | Day of creation |
| 4 | 2 | Address of previous block of this type |
| 6 | 2 | Address of next block of this type |
| 8 | 8 (R*8) | Start seconds since 1/1/77 |
| 16 | 8 (R*8) | End seconds since 1/1/77 |
| 24 | 2 | Library tape volume serial |
| 26 | 2 | Library tape file sequence |
| 28 | 2 | Address of EDR block |
| 30 | 2 | Number of entries to follow that processing was completed |
| 32 | 1 | Processing disposition |
| 33 | 1 | Year of processing |
| 34 | 1 | Month of processing |
| 35 | 1 | Day of processing |
| 36 | 2 | Address of Ency-Attribute block |
| 38 | 2 | Address of work block |
| 40-47 | 8 | Same as 32-39 above |
| 48-55 | 8 | Same as 32-39 above |
| 56-63 | 8 | Same as 32-39 above |

byte 31

32 disp
33 yr
34 mo
35 day
36 37 @ Ency att
38 39 @ work block

40
41
42
43
44 45
46 47

48..
49
50
51
52 53
54 55

56
57
58
59
60 61
62 63

## WORK BLOCK

| Byte | Byte Length |  | Description |
|---|---|---|---|
| 0 | 1 |  | Block identifier code, = 15 |
| 1 | 1 |  | Year of creation |
| 2 | 1 | 1 | Month of creation |
| 3 | 1 |  | Day of creation |
| 4 | 2 |  | Address of previous block of this type |
| 6 | 2 | 2 | Address of next block of this type |
| 8 | 2 |  | Address of Ency-Attribute block |
| 10 | 2 | 3 | Address of work block of same Ency-Attribute |
| 12 | 2 |  | Address of next work block of same attribute |
| 14 | 2 | 4 | Number of library blocks |
| 16 | 4 | 5 | Start record volume number |
| 20 | 4 | 6 | End record volume number |
| 24 | 1 |  | Merge processing disposition |
| 25 | 1 | 7 | Spare |
| 26 | 2 |  | Address of encyclopedia block — check w Ned |
| 28 | 1 |  | CITENCY processing disposition |
| 29 | 1 |  | Spare |
| 30 | 2 |  | Address of CITENCY block |
| 32 | 30 |  | List of address of library blocks corresponding to byte 14 above, each address takes 2 bytes |
| 62 | 2 |  | Work tape serial number |

words(3,)(32)

## ENCYCLOPEDIA BLOCK

| Byte | Byte Length | Description |
|---|---|---|
| 0 | 1 | Block identifier code, = 16 |
| 1 | 1 | Year of creation |
| 2 | 1 | Month of creation |
| 3 | 1 | Day of creation |
| 4 | 2 | Block number = Address of previous block of ~~this~~ type |
| 6 | 2 | = Address of next block of this type |
| 8 | 2 | Address of attribute block |
| 10 | 2 | Address of previous encyclopedia block for same Ency-Attribute |
| 12 | 2 | Address of next encyclopedia block for same Ency-Attribute |
| 14 | 2 | Current block count for this serial* |
| 16 | 4 | Start record volume number |
| 20 | 4 | End record volume number |
| 24 | 2 | Volume serial of encyclopedia tape |
| 26 | 2 | = @ of this Ency block* |
| 28 | 1 | Status of this block (00 = active 01 = dead)* |
| 29 | spare | |
| 30 | 2 slot alloc | Slot number freed by RMVENC |
| | 4 | |

*Documentation added 11/10/78 EWR

# CITENCY BLOCK

| Byte | Byte Length | Description |
|---|---|---|
| 0 | 1 | Block identifier code, = 17 |
| 1 | 1 | Year of creation |
| 2 | 1 | Month of creation |
| 3 | 1 | Day of creation |
| 4 | 2 | Address of previous block of this type |
| 6 | 2 | Address of next block of this type |
| 8 | 2 | Volume serial of 'raw verse only' encyclopedia |
| 10 | 2 | Volume serial of 'all but raw rates' encyclopedia |
| 12 | 4 | Slot of 'raw verse only' |
| 16 | 4 | Slot of 'all but raw rates' |
| 20 | 1 | Slot allocation status |
| 21 | 1 | Year sent |
| 22 | 1 | Month sent |
| 23 | 1 | Day sent |
| 24 | 3 | Date acknowledged, year<br>month<br>day |
| 27 | 1 | Spare |
| 28 | 2 | Address of work block |

# APPENDIX B - A DESCRIPTION OF THE EDR AND LIB FORMAT

The data tapes are fixed blocks with a record length of 3528 bytes. Each physical record consists of four logical records, 220 words each and an extra eight bytes. Each EDR has a file header record of 3528 bytes followed by data records. Each LIB tape has one multi-file EDR merged into one file so that the EDR file headers appear as records within the file. This was done so that the Voyager ENCYGEN design could be used for ISEE.

EXPERIMENT NO. 33

| | | | |
|---|---|---|---|
| Experimenter: Von Rosenvinge<br>Computer word length: 32-bits | FILE HEADER RECORD | Filled out with o's to be 220 words x 4 + 8 bytes separate physical record 3528 bytes.<br>Tape type: 9 track, 1600 |

| Item No. | Data Offset Bytes | Data Offset Words | Field Size (bits) | Item Description 32 |
|---|---|---|---|---|
| 1 | | 0 | 1440 | GSFC Tag ✓ |
| 46 | | 45 | 31 | Satellite ID Number ✓ |
| 47 | | | 32 | Recording Station Number ✗ |
| 48 | | | 32 | Experiment ID Number ( ) |
| | | | | Start Time of Data at the S/C, corrected for light-time |
| 49 | | | 32 | Year |
| 50 | | | 32 | Day of Year |
| 51 | | | 32 | Milliseconds of Day |
| | | | | Stop Time of Data |
| 52 | | | 32 | Year |
| 53 | | | 32 | Day of Year |
| 54 | | | 32 | Milliseconds of Day |
| | | | 32 | Last Clock in this File |
| | | | | Next File Start Time |
| | | | 32 | Year |
| | | | 32 | Day of Year |
| | | | 32 | Milliseconds of Day |
| | | | 32 | Next File Start Clock |
| | | | 32 | "Percentage" of Data Recovered in this File |
| | | | 32 | Number of Minor Frames in File (Actual) |
| | | | 32 | Bit Rate (2048, 1024, 512) |
| | | | 32 | Shipping Group Number |
| | | | 32 | Reel Sequence Number |
| | | | 32 | File Number on this Tape |
| | | 65<br>66 | 32 | Orbital Position Flag 0 = Definitive orbit<br>1 = Predicted orbit<br>2 = No orbit; propogation delay not computed |

EXPERIME NO. 33

Experimenter: Von Rosenvinge

Tape Type: 9 Track 1600

Computer Word Length: 32-bits

| Item No | Data Offset | | Field Size (bits) | Item Description | |
|---|---|---|---|---|---|
| | Bytes | Words | | | |
| | 48<br>489 | 12<br>⋮ | 56<br>⋮<br>56 | MFW – 5, 6, 7, 8, 9, 10, 11 (frame 0)<br>⋮<br>5, 6, 7, 8, 9, 10, 11 (frame 63) | 112 Words |
| | 496<br>685 | 124 | 24<br>⋮<br>24 | MFW – 61, 62, 63 (frame 0)<br>⋮<br>61, 62, 63 (frame 63) | 48 Words |
| 2F4 | 688 | 172 | 512 | MFW – 58 0-63 ASC#1 | 16 Words |
| | 752 | 189 | 512 | MFW – 59 0-63 DSC | 16 Words |
| | 816 | 204 | 512 | MFW – 122 0-63 ASC#2 | 16 Words |
| | 880 | 220 ← | | Start Of Next Logical Period | |

$$\frac{880 \text{ bytes}}{\text{Logical Record}} \times \frac{4 \text{ Logical Records}}{\text{Physical Record}} = 3520 \text{ bytes} + 8 = 3528 \text{ bytes/record}$$

882
4)3528
32
32
32

EXPERIMENT NO. 33

Experimenter: Von Rosenvinge

Computer Word Length: 32-bits

## LOGICAL HEADER RECORD

Tape Type: 9 Track 1600

| Item No. | Data Offset | | Field Size (bits) | Item Description |
|---|---|---|---|---|
| | Bytes | Words | | |
| 1 | 0 | 0 | 16 | Experimenter ID Number |
| | 2 | | 16 | Day of Year January 1 - Day 1 |
| 2 | 4 | 1 | 32 | Milliseconds of Day |
| 3 | 8 | 2 | 32 | Spacecraft Clock |
| 4 | 12 | 3 | 32 | Average Frame Period (microseconds) |
| 5 | 16 | 4 | 8 | Frame Counter |
| | 17 | | 8 | Fill Flag for Logical Record (00 = fill somewhere, 11 = no fill) |
| | 18 | | 8 | Bit Rate Flag (00 = other, 1~~0~~ = low, 2 = high, 3 = other) |
| | 19 | | 8 | Time Quality Flags (only uses 2 bits) |
| 6 | 20 | 5 | 32 | Data Quality Flags (16 Frames) |
| | 24 | 6 | 32 | Data Quality Flags (16 Frames) |
| | 28 | 7 | 32 | Data Quality Flags (16 Frames) |
| | 32 | 8 | 32 | Data Quality Flags (16 Frames) |
| | 36 | 9 | 32 | Orbital Position ($GSE_x$) |
| | 40 | 10 | 32 | Orbital Position ($GSE_y$) |
| | 44 | 11 | 32 | Oribtal Position ($GSE_z$) |

★ reversed ~3/1987

| | |
|---|---|
| 2048 | 2 |
| 1024 | 1 |
| 512 | 3 |
| 256 | 5 |
| 128 | 4 |
| 64 | 0 |
| 32 | 6 |
| 16 | 7 |

- Fill flag - 00 = fill data at some point in logical record
  11 = no fill data in logical record

- Bit rate indicator - 00 = other (64)
  01 = low bit rate (1024)
  10 = high bit rate (2048)
  11 = other (512)

Compare with previous page

- Time quality - 00 = quick look, no checks on time quality, could be off by five second average time used for corrections.
  01 = fraction smoothed and delay corrected but unverified by other stations
  10 = smoothed, delay corrected and verified, after adjusting the ground station time
  11 = same as 10 but no adjustment required to ground station time

- Time corrected for delay due to light time data quality flags (2 bits per minor frame) convolutionally coded data = 1 bit parity per bit of data
  00 = fill data, data presence indicator
  01 = poor quality, s/c clock or frame sync errors
  10 = good (undecoded, coded data but not decoded, or uncoded data, no s/c or frame sync errors)
  11 = excellent (decoded, coded data and parity checked)

- Orbital position in solar ecliptic inertial coordinates (meters)
  - $GSE_x$
  - $GSE_y$
  - $GSE_z$

# APPENDIX C - A DESCRIPTION OF THE TELEMETRY FORMAT

This appendix consists of a document prepared by Tycho von Rosenvinge, October 1976, which describes the telemetry from the spacecraft. The EDR contains a selection of the words from the telemetry. This document is useful for understanding all of the data reduction routines.

# ISEE-C MEDIUM ENERGY
# COSMIC RAY EXPERIMENT
# TELEMETRY DESCRIPTION

Tycho von Rosenvinge
October 1, 1976

(REVISED JUNE 15, 1978)

# ISEE-C TYH FORMAT

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | VLET<br>PHA<br>5 | 6 | RATES<br>7 | HET<br>RATES<br>8 | PHA<br>9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |
| 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 |
| 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | ANA<br>S/C 1<br>58 | DIG<br>S/C<br>59 | 60 | 61 | 62 | 63 |
| 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 |
| 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 |
| 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 |
| 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 | 121 | ANA<br>S/C 2<br>122 | 123 | 124 | 125 | 126 | 127 |

DMU Telemetry Format Convolutional Mode

**1 MINOR FRAME**

128 bytes
1 minor frame word = 8 bits

# ISEE-C TYH DATA FORMAT

| MINOR FRAME WORD | PARAMETER |
|---|---|
| 5 | VLET PHA DATA |
| 6 | |
| 7 | VLET RATES, FLAGS & PHA STATUS BITS |
| 8 | HET RATES |
| 9 | HET PHA DATA |
| 10 | |
| 11 | |
| 58 | ANALOG SUBCOM #1 |
| 59 | DIGITAL SUBCOM |
| 122 | ANALOG SUBCOM #2 |

ANALOG SUBCOM 1 (BY POSITIONS, = STEPS)

| STEP # | |
|---|---|
| 51 | VLETS ANALOG HOUSEKEEPING |
| 52 | HETS POWER MONITOR |
| 53 | VLETS POWER MONITOR |

ANALOG SUBCOM 2

| STEP # | |
|---|---|
| 17 | HETS THERMISTOR |
| 19 | VLETS THERMISTOR |

DIGITAL SUBCOM (BY POSITIONS, = STEPS) [illegible]

| STEP # | |
|---|---|
| 43 | HET SUBCOM BITS AND COMMAND STATUS AS FOLLOWS: |
| 44 | |
| 45 | |
| 46 | |

Step# = mf# (0-63)
UPKASC

| STEP #/Bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | |
|---|---|---|---|---|---|---|---|---|---|
| 43 | S5 | S4 | S3 | S2 | S1≡0 | HG1 | HG2 | CAL | S1≡0 |
| 44 | CD8 | CD7 | CD6 | - | - | - | - | CD1 | |
| 45 | CD16 | CD15 | - | - | - | - | - | CD9 | |
| 46 | CD24 | CD23 | - | - | - | - | - | CD17 | |
| 43 | S5 | S4 | S3 | S2 | S1≡1 | HG1 | HG2 | CAL | S1≡1 |
| 44 | CD32 | CD31 | - | - | - | - | - | CD25 | |
| 45 | CD40 | CD39 | - | - | - | - | - | CD33 | |
| 46 | CD48 | CD47 | - | - | - | - | - | CD41 | |

(By convention, Bit 7 is read out first in time and Bit 0 last)

HET SUBCOM POSITION = (S4)(S3)(S2)(S1)

COMMAND BIT ASSIGNMENT FOLLOWS:

CD1 - Dummy Bit (Always 0 in Readout).
CD2 - Suppress $A_2$ Term (HET-I).
CD3 - " $B_2$ " " .
CD4 - " $\overline{G}_1$ " " , B Stopping Only.
CD5 - " $C_1$ " " .
CD6 - " $C_4$ " " .
CD7 - " $\overline{G}_1$ " " , Other Than B Stopping.
CD8 - Delete AS Analysis (HET-I).
CD9 - " BSE " " .
CD10 - " BSp " " .
CD11 - " PEN " " .
CD12 - Suppress $A_2$ Term (HET-II).
CD13 - " $B_2$ " " .
CD14 - " $\overline{G}_1$ " " , B Stopping Only.
CD15 - " $C_1$ " " .
CD16 - " $C_4$ " " .
CD17 - " $\overline{G}$ " " , Other Than B Stopping.
CD18 - Delete AS Analysis " .
CD19 - " BSe " " .
CD20 - " BSp " " .

(CONTINUED)

COMMAND BIT ASSIGNMENT (CONT'D):

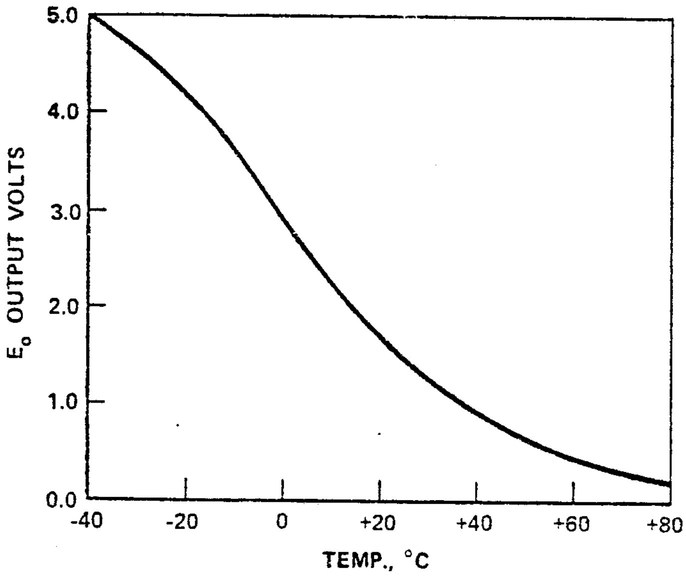
CD21 - Delete PEN Analysis (HET-II).
CD22 - Power Off $G_4$ (HET-I).
CD23 - " " $G_3$ " .
CD24 - " " $G_2$ " .
CD25 - " " $G_1$ " .
CD26 - " " $B_2$ " .
CD27 - " " $B_1$ " .
CD28 - " " $A_2$ " .
CD29 - " " $A_1$ " .
CD30 - " " $C_4$ " .
CD31 - " " $C_3$ " .
CD32 - " " $C_2$ " .
CD33 - " " $C_1$ " .
CD34 - " " $G_4$ (HET-II).
CD35 - " " $G_3$ " .
CD36 - " " $G_2$ " .
CD37 - " " $G_1$ " .
CD38 - " " $B_2$ " .
CD39 - " " $B_1$ " .
CD40 - " " $A_2$ " .
CD41 - " " $A_1$ " .
CD42 - " " $C_4$ " .
CD43 - " " $C_3$ " .
CD44 - " " $C_2$ " .
CD45 - " " $C_1$ " .
CD46 - CAL ENABLE (1 → CAL ENABLED).

$$\left.\begin{array}{l} \text{CD47 - } HG_1 = S_5 \cdot CD47+CD49 \cdot \overline{CD47} \\ \text{CD48 - } HG_2 = S_5 \cdot CD48+CD50 \cdot \overline{CD48} \end{array}\right\} \text{HG} = 1 \rightarrow \text{HIGH GAIN}$$

The HETS and VLETS power monitors nominally sit at +4.0 volts when the experiment is ON and at ground when the experiment is OFF. For definition purposes, any value > 2.5 volts = ON; ≤ 2.5 volts = OFF. The analog subcom 8-bit readout value must be multiplied by .02 volts to obtain the voltage level at the input to the analog subcom converter. Hence 5.10 volts is the converter full scale.

The thermistor conversion table for all thermistors is as follows:

| DIGITAL READOUT | TEMPERATURE °C |
|---|---|
| 17 | +70 |
| 20 | +65 |
| 24 | +60 |
| 28 | +55 |
| 33 | +50 |
| 39 | +45 |
| 46 | +40 |
| 53 | +35 |
| 62 | +30 |
| 72 | +25 |
| 84 | +20 |
| 97 | +15 |
| 111 | +10 |
| 126 | + 5 |
| 142 | 0 |
| 158 | - 5 |
| 174 | -10 |
| 190 | -15 |
| 200 | -20 |
| 230 | -30 |
| 249 | -40 |
| 255 | -50 |



## VLET DATA

Data for the VLET system includes:

1. Pulse height analysis data (PHA data)
2. Rates data
3. Analog housekeeping
4. Power monitor and temperature data

The positions in a minor frame where these are read out have been indicated on the preceeding pages. We will now discuss each in turn in more detail.

The pattern of PHA and rates data readouts is indicated on the next page. A single PHA event corresponds to a single particle entering one of the two VLET telescopes. The data for a single PHA event consists of a DI pulse-height (11 bits), a DII pulse-height (11 bits), an E pulse-height (10 bits) and event tag bits Po and Pl. The three pulse-heights for a single event can be read out in 2 minor frames (words 5 and 6) as shown on the next page. However the Po and Pl tags are read out for two events at a time in word 7, frames 3, 7, 11, . . . as indicated. Thus the pulse height data and tag data for two PHA events is read out in four minor frames. The null event (no particle detected) is characterized by DI=DII=E=0. Pl tells whether the event was detected in Telescope 1 or in telescope 2; the state of the Po bit classifies the event as one of two different event types. Po and Pl indicate the set of storage registers from which readout occurs and need not be zero for null-events.

The VLET system contains 8 non-sectored rate counters and 8 sectored rate counters.

At the end of each block of 64 minor frames (minor frames 0-63) the contents of all 16 of these rate registers are transferred for read-out during the next block of 64 minor frames. The registers are then immediately cleared and any subcommutators are advanced in position. Non-sectored rate counters then immediately resume counting until the end of the new block of 64 minor frames. Each sectored rate counter counts a particular event rate only when the corresponding telescope is looking in a particular direction, i.e. the spin plane is divided into 8 different azimuthal sectors and to each sector corresponds one of the eight sector rate counters. After the end of one block of 64 minor frames, counting into the sector rate registers doesn't resume until the sun spike occurs. Events are then counted successively into the 8 different sector rate counters for 8, 16 or 32 complete spins depending upon whether the spacecraft bit-rate is 2048 IBPS, 1024 IBPS or 512 IBPS respectively. The nominal spin period is 3 seconds. Complete accumulation will therefore be finished by the end of the 64 minor frame block.

Each VLET rate register read-out (sectored and non-sectored) consists of 24 bits read out in word 7. Every fourth readout of word 7 contains tag/status information, however, so the contents of one rate register is read out every four minor frames and all 16 rate registers are read out in

64 minor frames (see Page 9. Register R1 is read out first, R2 next and so on through R8, then sector rate register SR1 is read out followed by SR2, . . . SR8.

The rate counter subcommutation and rate coincidence conditions are indicated in the table on Page 10. For 8-level subcommutation, the subcommutator position ≡ [(S2)(S1)(S0)] octal. The S2, S1 and S0 bits are obtained from word 7, frames 3, 7 and 11 (modulo 16) respectively as shown on Page 9.

NOTE: ALL RATES REGISTERS (HET & VLET) ACCUMULATE DATA FOR 64 MINOR FRAMES AND READ OUT THE RESULTS DURING THE NEXT 64 MINOR FRAMES; THUS RATE READOUTS IN ONE 64 MINOR FRAME BLOCK SHOULD BE ASSOCIATED WITH THE SUBCOM POSITIONS READ OUT IN THE PRECEDING 64 MINOR FRAME BLOCK. THE HET AND VLET SUBCOMS ARE INDEPENDENT OF EACH OTHER.

The VLET analog housekeeping (step 51 on the spacecraft analog subcom #1) is further subcommed by 8 inside the experiment using the same subcommutator clock (S2)S1)(S0) as used for the VLET rate registers:

| | PARAMETER | (S2) | (S1) | (S0) | ANALOG SUBCOM READOUT DESIGNATION |
|---|---|---|---|---|---|
| $V_0$ = | +12 V | 0 | 0 | 0 | $X_0$ |
| $V_1$ = | +6 V | 0 | 0 | 1 | $X_1$ |
| $V_2$ = | Thermistor 3 | 0 | 1 | 0 | $X_2$ |
| $V_3$ = | Thermistor 4 | 0 | 1 | 1 | $X_3$ |
| $V_4$ = | Spare | 1 | 0 | 0 | $X_4$ |
| $V_5$ = | Spare | 1 | 0 | 1 | $X_5$ |
| $V_6$ = | -6 V | 1 | 1 | 0 | $X_6$ |
| $V_7$ = | -12 V | 1 | 1 | 1 | $X_7$ |

The VLETS Power Monitor (analog subcom #1, step 53) nominally sits at 4.0 volts when the experiment is ON and at ground when the experiment is OFF.

The spacecraft analog subcom has a linear range from 0 to 5.10 V. Hence, the following conversions are necessary to relate the subcom readout X's with the appropriate voltage:

$V_o = 0.06 \times X_o$ volts.

$V_1 = 0.04 \times X_1$ volts.

$V_6 = 0.4 \times X_6 - 0.44 \times X_1$ volts.

$V_7 = 0.0444 \times X_7 - 0.0733 \times X_o$ volts.

The thermistor temperature conversions are the same as given on Page 5. $X_o$ is read in the same 64 minor frame block as the one in which $S_2$, $S_1$ and $S_o$ are zero, etc. (i.e., this is unlike the rates).

The VLETS Power Monitor (Analog Subcom #1, Step 53) nominally sits at 4.0 volts when the experiment is ON and at ground when the experiment is OFF. See Page 5 for further details.

VLET status readout is as indicated on Page 9. Systems 1 and 2 are both enabled when their status bits are zero. The PHA enable/disable commands are executed when they are received. The internal stimulus is not turned on, however, until the beginning of the first 64 minor frame block after the command is received. It remains on for 8x64 minor frame blocks and then automatically shuts itself off. It may also be commanded off. The internal stimulus system is ON during the 8x64 minor frame blocks which have the CAL ON bit set to 1. PHA events from the internal stimulus may continue to be read out for as many as eight pulse-height events after the system shuts off. The 64 minor frame block following the turn-off of the internal stimulus will contain rates accumulated when it was on, even though the CAL ON bit is reset to zero.

The VLET PHA counters are quite different from those for the HET. The counters for DI and DII start counting from zero and have no overflow protection. The E counter starts counting from zero and freezes at all ones if overflow is detected. (The HET PHA counters start counting from 1 and freeze at zero if overflow is detected.)

## BIT STRUCTURE, VLET PHA/RATE READOUTS

| | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WORD 5 | | | | | | | | WORD 6 | | | | | | | | WORD 7 | | | | | | | | |
| ← PHA DATA → | | | | | | | | | | | | | | | | ← RATE/TAGS → | | | | | | | | |
| Z 11 | Z 10 | Z 9 | Z 8 | Z 7 | Z 6 | Z 5 | Z 4 | Z 3 | Z 2 | Z 1 | Y 11 | Y 10 | Y 9 | Y 8 | Y 7 | B 24 | B 23 | B 22 | B 21 | B 20 | B 19 | B 18 | B 17 | FRAMES 0, 4, 8,... |
| MSB ← DI → | | | | | | | | | | | ← DII → | | | | | MSB | | | | | | | | |
| Y 6 | Y 5 | Y 4 | Y 3 | Y 2 | Y 1 | X 10 | X 9 | X 8 | X 7 | X 6 | X 5 | X 4 | X 3 | X 2 | X 1 | B 16 | B 15 | B 14 | B 13 | B 12 | B 11 | B 10 | B 9 | FRAMES 1, 5, 9,... |
| DII → | | | | | | ← E → LSB | | | | | | | | | | | | | | | | | | |
| Z 11 | Z 10 | Z 9 | Z 8 | Z 7 | Z 6 | Z 5 | Z 4 | Z 3 | Z 2 | Z 1 | Y 11 | Y 10 | Y 9 | Y 8 | Y 7 | B 8 | B 7 | B 6 | B 5 | B 4 | B 3 | B 2 | B 1 | FRAMES 2, 6, 10,... |
| MSB ← DI → | | | | | | | | | | | ← DII → | | | | | | | | | | | | LSB | |
| Y 6 | Y 5 | Y 4 | Y 3 | Y 2 | Y 1 | X 10 | X 9 | X 8 | X 7 | X 6 | X 5 | X 4 | X 3 | X 2 | X 1 | A 8 | A 7 | A 6 | A 5 | A 4 | A 3 | A 2 | A 1 | FRAMES 3, 7, 11,... |
| DII → | | | | | | ← E → LSB | | | | | | | | | | | | | | | | | | |

BIT CONTENTS

X = E PHA
Y = DII PHA
Z = DI PHA
B = RATE
$A_i$ = TAGS AND STATUS

$P_1$ 0 = TELESCOPE 1
1 = TELESCOPE 2

$P_o$ 0 = EVENT TYPE 0
1 = EVENT TYPE 1

| Frame # Modulo 16 | |
|---|---|
| 3 | S2 (VLET) |
| 7 | S1 (VLET) |
| 11 | S0 (VLET) |
| 15 | CAL ALLOW |

$A_1$ = { 3 S2 (VLET); 7 S1 (VLET); 11 S0 (VLET); 15 CAL ALLOW }

$A_2$ = CAL ON

$A_3$ = $P_1$ } TAGS FOR PHA EVENT IN
$A_4$ = $P_o$ } FRAMES (2,3),(6,7), . . .

$A_5$ = TELESCOPE 2 PHA ENABLE

$A_6$ = TELESCOPE 1 PHA ENABLE

$A_7$ = $P_1$ } TAGS FOR PHA EVENT
$A_8$ = $P_o$ } IN FRAMES (0,1),(4,5), . . .

VLET ANALOG SUBCOM POSITION = (S2)(S1)(S0)

## VLET RATE FORMAT (REVISED 9/2/76)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| S2 = 8x64W7 | | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| S1 = 4x64W7 | | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| S0 = 2x64W7 | | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| T1 | R1 | ⑬ DΣ1 | DΣ1 | DΣ1 | DΣ1 | DΣ1 | DΣ1 | DΣ1 | DΣ1 |
| | R2 | DΣ2 | DΣ2 | DΣ2 | DΣ2 | DΣ2 | DΣ2 | DΣ2 | DΣ2 |
| | R3 | DΣ1E1 | DΣ1E2 | DΣ1E1 | DΣ1E2 | DΣ1E1 | DΣ1E2 | DΣ1E1 | DΣ1E2 |
| T2 | R4 | ⑮ DΣ1 | DΣ1 | DΣ1 | DΣL | DΣ1 | DΣ1 | DΣ1 | DΣ1 |
| | R5 | DΣ2 | DΣ2 | DΣ2 | DΣ2 | DΣ2 | DΣ2 | DΣ2 | DΣ2 |
| | R6 | DΣ1E1 | DΣ1E2 | DΣ1E1 | DΣ1E2 | DΣ1E1 | DΣ1E2 | DΣ1E1 | DΣ1E2 |
| | R7 | ⑫ DT2 | ⑪ DT1 * | DT2 | DT1 | DT2 | DT1 | DT2 | DT1 |
| | R8 | DIT1 | DIIT1 | ET1 | FT1 | DIT2 | DIIT2 | ET2 | FT2 |
| | RSE | DΣ1T1 | DT1 | DΣ1T2 | DT2 | DΣ1T1 | DT1 | DΣ1T2 | DT2 |

D = DIDII$\overline{F}$    T1 = TELESCOPE 1,   T2 = TELESCOPE 2

USE SUBCOM POSITION SAMPLE FROM PRECEDING 64 MINOR FRAME DATA BLOCK

▭ = length of subcom cycle

* NOTE 2,1 ORDER!

## HET DATA

The TYH High-Energy Telescope (HET) produces three types of digital data (rate data, PHA data and command status data), and 3 analog parameters. One complete data cycle requires 16 blocks of 64 minor frames, or 1024 minor frames. A single 64 minor frame block format is shown in Figure 1.* Word 8 contains all the HET rate data, consisting of 16 consecutive 22-bit rate counter readouts, followed by 8 additional 20-bit sectored rate counter readouts, for a total of 512 bits in the 64 8-bit words. The first bit in the sequence (i.e., the first bit readout in time) appears in minor frame #0 and is the MSB ($2^{21}$) of rate counter #1; this is designated $R1_{22}$. The succeeding bits ($R1_{21}$, $R1_{20}$, $R1_{19}$ . . . $R_1$) complete the readout of R1, followed by R2 ($R2_{22}$, $R2_{21}$ . . . $R2_1$) and so on until all 16 rate counters and the 8 sectored rate counters (SR1 through SR8) have been readout. This represents 1/16 of a complete rate data cycle and corresponds to a single position of the rate counter commutator. The commutator position is read out as the S4, S3, S2 and S1 bits in the digital subcom (S4 is MSB) of the preceding 64 minor frame block. The logical rates, i.e., the required coincidence anticoincidence conditions among various elements of each telescope, are shown in Fig. 2.+ Some rates are not commutated at all (R3, R4, R11 and R12, for example), and represent the same coincidence condition regardless of the state of the S1-S4 bits and the $HG_i$ bits (high gain/low gain) for each telescope. Other rates may be commutated between two quantities using only the S1 bit (e.g., R5) or only the $HG_i$ bit (R1). R2 and R10, however, are commutated using both $HG_i$ and the S1, S2 bits as well. The singles rates from each telescope element are commutated modulo 16 in R8 and R16 using all the bits S1, S2, S3, S4.

PHA (pulse-height analysis) data for selected events appears as a 48-bit sequence starting in the MSB of Word 9 of even-numbered frames and ending with the LSB of Word 11 of odd-numbered frames. The first 12 bits read out (T12-T1 in Fig. 1) are tag bits which identify the event type (A STopping, B STopping, or PENetrating), the telescope, the sector orientation of the spacecraft at the time of the particle detection, the penetration range of the particle through the C stack, and other housekeeping parameters of that event. The remaining 36 bits contain three 12-bit numbers representing the amplitude of three selected detector signals. Fig. 1 illustrates the various PHA addresses and identifies which detector quantity is represented for each of the PHA event types.

Command status data is read out in the digital subcom. Eight subcom words, i.e., 128 minor frames, are required for a complete readout of all 48 status bits. Each block of 64 minor frames, however, contains one readout of the rate commutation position and the two gain bits, one for each telescope. See page 3. Command status changes whenever a command is received; i.e., it is not aligned with 128 minor frame boundaries.

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* Drawing labelled TYH High Energy Telescope, ISEE-C Telemetry Format, p. 12.

\+ Drawing labelled ISEE HET Rate Table, p. 13.

| | WORD 8 | | | | | | | | WORD 9 | | | | | | | | WORD 10 | | | | | | | | WORD 11 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MINOR FRAME NO. | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 0 | $R1_{22}$ | $R1_{21}$ | $R1_{20}$ | $R1_{19}$ | $R1_{18}$ | $R1_{17}$ | $R1_{16}$ | $R1_{15}$ | T12 | T11 | T10 | T9 | T8 | T7 | T6 | T5 | T4 | T3 | T2 | T1 | (MSB) ← | | | | PHA ADDRESS 1 → | | | | | | | (LSB) |
| 1 | $R1_{14}$ | $R1_{13}$ | $R1_{12}$ | $R1_{11}$ | $R1_{10}$ | $R1_9$ | $R1_8$ | $R1_7$ | (MSB) ← | | | PHA ADDRESS 2 | | | | | | | | → (LSB) | (MSB) ← | | | | PHA ADDRESS 3 → | | | | | | | (LSB) |
| 2 | $R1_6$ | $R1_5$ | $R1_4$ | $R1_3$ | $R1_2$ | $R1_1$ | $R2_{22}$ | $R2_{21}$ | | | | | | | | | PHA DATA AS ABOVE REPEATED EVERY 2 FRAMES | | | | | | | | | | | | | | | |
| 3 | $R2_{20}$ | $R2_{19}$ | $R2_{18}$ | $R2_{17}$ | $R2_{16}$ | $R2_{15}$ | $R2_{14}$ | $R2_{13}$ | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | $R2_{12}$ | $R2_{11}$ | $R2_{10}$ | $R2_9$ | $R2_8$ | $R2_7$ | $R2_6$ | $R2_5$ | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | $R2_4$ | $R2_3$ | $R2_2$ | $R2_1$ | $R3_{22}$ | $R3_{21}$ | $R3_{20}$ | $R3_{19}$ | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | $R3_{18}$ | $R3_{17}$ | $R3_{16}$ | $R3_{15}$ | $R3_{14}$ | $R3_{13}$ | $R3_{12}$ | $R3_{11}$ | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | $R3_{10}$ | $R3_9$ | $R3_8$ | $R3_7$ | $R3_6$ | $R3_5$ | $R3_4$ | $R3_3$ | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | $R3_2$ | $R3_1$ | $R4_{22}$ | $R4_{21}$ | $R4_{20}$ | $R4_{19}$ | $R4_{18}$ | $R4_{17}$ | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | $R4_{16}$ | $R4_{15}$ | $R4_{14}$ | $R4_{13}$ | $R4_{12}$ | $R4_{11}$ | $R4_{10}$ | $R4_9$ | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | $R4_8$ | $R4_7$ | $R4_6$ | $R4_5$ | $R4_4$ | $R4_3$ | $R4_2$ | $R4_1$ | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | $R5_{22}$ | $R5_{21}$ | $R5_{20}$ | $R5_{19}$ | – | – | – | – | | | | | | | | | | | | | | | | | | | | | | | | |
| – | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| – | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 21 | – | – | – | – | $R8_4$ | $R8_3$ | $R8_2$ | $R8_1$ | | | | | | | | | | | | | | | | | | | | | | | | |
| 22 | $R9_{22}$ | $R9_{21}$ | $R9_{20}$ | $R9_{19}$ | – | – | – | – | | | | | | | | | | | | | | | | | | | | | | | | |
| – | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| – | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 32 | – | – | – | – | $R12_4$ | $R12_3$ | $R12_2$ | $R12_1$ | | | | | | | | | | | | | | | | | | | | | | | | |
| 33 | $R13_{22}$ | $R13_{21}$ | $R13_{20}$ | $R13_{19}$ | – | – | – | – | | | | | | | | | | | | | | | | | | | | | | | | |
| – | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| – | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 43 | – | – | – | – | $R16_4$ | $R16_3$ | $R16_2$ | $R16_1$ | | | | | | | | | | | | | | | | | | | | | | | | |
| 44 | $SR(1)_{20}$ | $SR(1)_{19}$ | $SR(1)_{18}$ | $SR(1)_{17}$ | $SR(1)_{16}$ | $SR(1)_{15}$ | $SR(1)_{14}$ | $SR(1)_{13}$ | | | | | | | | | | | | | | | | | | | | | | | | |
| 45 | $SR(1)_{12}$ | $SR(1)_{11}$ | $SR(1)_{10}$ | $SR(1)_9$ | $SR(1)_8$ | $SR(1)_7$ | $SR(1)_6$ | $SR(1)_5$ | | | | | | | | | | | | | | | | | | | | | | | | |
| 46 | $SR(1)_4$ | $SR(1)_3$ | $SR(1)_2$ | $SR(1)_1$ | $SR(2)_{20}$ | $SR(2)_{19}$ | $SR(2)_{18}$ | $SR(2)_{17}$ | | | | | | | | | | | | | | | | | | | | | | | | |
| 47 | $SR(2)_{16}$ | $SR(2)_{15}$ | $SR(2)_{14}$ | $SR(2)_{13}$ | $SR(2)_{12}$ | $SR(2)_{11}$ | $SR(2)_{10}$ | $SR(2)_9$ | | | | | | | | | | | | | | | | | | | | | | | | |
| 48 | $SR(2)_8$ | $SR(2)_7$ | $SR(2)_6$ | $SR(2)_5$ | $SR(2)_4$ | $SR(2)_3$ | $SR(2)_2$ | $SR(2)_1$ | | | | | | | | | | | | | | | | | | | | | | | | |
| 49 | $SR(3)_{20}$ | $SR(3)_{19}$ | $SR(3)_{18}$ | – | – | – | – | – | | | | | | | | | | | | | | | | | | | | | | | | |
| 50 | – | – | – | – | – | – | – | – | | | | | | | | | | | | | | | | | | | | | | | | |
| 51 | $SR(3)_4$ | $SR(3)_3$ | $SR(3)_2$ | $SR(3)_1$ | $SR(4)_{20}$ | $SR(4)_{19}$ | $SR(4)_{18}$ | $SR(4)_{17}$ | | | | | | | | | | | | | | | | | | | | | | | | |
| 52 | – | – | – | – | – | – | – | – | | | | | | | | | | | | | | | | | | | | | | | | |
| 53 | – | – | – | – | $SR(4)_4$ | $SR(4)_3$ | $SR(4)_2$ | $SR(4)_1$ | | | | | | | | | | | | | | | | | | | | | | | | |
| 54 | $SR(5)_{20}$ | $SR(5)_{19}$ | $SR(5)_{18}$ | – | – | – | – | – | | | | | | | | | | | | | | | | | | | | | | | | |
| 55 | – | – | – | – | – | – | – | – | | | | | | | | | | | | | | | | | | | | | | | | |
| 56 | $SR(5)_4$ | $SR(5)_3$ | $SR(5)_2$ | $SR(5)_1$ | $SR(6)_{20}$ | $SR(6)_{19}$ | $SR(6)_{18}$ | – | | | | | | | | | | | | | | | | | | | | | | | | |
| 57 | – | – | – | – | – | – | – | – | | | | | | | | | | | | | | | | | | | | | | | | |
| 58 | – | – | – | – | $SR(6)_4$ | $SR(6)_3$ | $SR(6)_2$ | $SR(6)_1$ | | | | | | | | | | | | | | | | | | | | | | | | |
| 59 | $SR(7)_{20}$ | $SR(7)_{19}$ | $SR(7)_{18}$ | $SR(7)_{17}$ | – | – | – | – | | | | | | | | | | | | | | | | | | | | | | | | |
| 60 | – | – | – | – | – | – | – | – | | | | | | | | | | | | | | | | | | | | | | | | |
| 61 | – | $SR(7)_3$ | $SR(7)_2$ | $SR(7)_1$ | $SR(8)_{20}$ | $SR(8)_{19}$ | $SR(8)_{18}$ | $SR(8)_{17}$ | | | | | | | | | | | | | | | | | | | | | | | | |
| 62 | – | – | – | – | – | – | – | – | | | | | | | | | | | | | | | | | | | | | | | | |
| 63 | – | – | – | – | – | $SR(8)_3$ | $SR(8)_2$ | $SR(8)_1$ | | | | | | | | | | | | | | | | | | | | | | | | |

| | TAGS | | | | | | | | | | | | PHA 1 | PHA 2 | PHA 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AST: | $C_2 \oplus C_4$ | C3 | C1 | SA | G2 | $G_1 \bar{G}_3$ | TEL ID | HG | SCTR 3 | SCTR 2 | EVENT ID | SCTR 1 | $A_1$ | $A_2$ | $C_1 + C_2 + C_3$ |
| | | | | | | | | | | | (0) | | | | |
| BST: | $C_2 \oplus C_4$ | C3 | C1 | SB | G2 | $G_1 \bar{G}_3$ | TEL ID | HG | SCTR 3 | SCTR 2 | EVENT ID | SCTR 1 | $B_1$ | $B_2$ | $C_2 + C_3 + C_4$ |
| | | | (0) | | | | | | | | (1) | | | | |
| PEN: | $C_2 \oplus C_4$ | C3 | C1 | SB | G2 | $G_1 \bar{G}_3$ | TEL ID | HG | SCTR 3 | SCTR 2 | EVENT ID | SCTR 1 | $B_1$ | $C_1$ | $C_2 + C_3 + C_4$ |
| | | | (1) | | | | | | | | (1) | | | | |

| "G" | $G_2$ | $G_1 \bar{G}_3$ | |
|---|---|---|---|
| 0 | 0 | 0 | $\bar{G}_1 \bar{G}_2 \bar{G}_3$ |
| 1 | 0 | 1 | $G_1 \bar{G}_2 \bar{G}_3$ |
| 2 | 1 | 1 | $G_1 G_2 \bar{G}_3$ |
| 3 | 1 | 0 | $G_1 G_2 G_3$ |

| "C" | $C_1$ | $C_3$ | $C_2+C_4$ | |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | $\bar{C}_1 \bar{C}_2 \bar{C}_3 \bar{C}_4$ |
| 1 | 1 | 0 | 0 | $C_1 \bar{C}_2 \bar{C}_3 \bar{C}_4$ |
| 2 | 1 | 0 | 1 | $C_1 C_2 \bar{C}_3 \bar{C}_4$ |
| 3 | 1 | 1 | 1 | $C_1 C_2 C_3 \bar{C}_4$ |
| – | 1 | 1 | 0 | $C_1 C_2 C_3 C_4$ |
| 4 | 0 | 0 | 1 | $\bar{C}_1 \bar{C}_2 \bar{C}_3 C_4$ |
| 3 | 0 | 1 | 1 | $\bar{C}_1 \bar{C}_2 C_3 C_4$ |
| 2 | 0 | 1 | 0 | $\bar{C}_1 C_2 C_3 C_4$ |

## TYH HIGH ENERGY TELESCOPE
## ISEE-C TELEMETRY FORMAT

# Sectors

| Subbeam State | High Gain | Low Gain |
|---|---|---|
| 0 | IIAS | II ASZ3 |
| 1 | ~~II BSP~~ IAS✓ | I ASZ3 |
| 2 | II BSP | II BSZ2 |
| 3 | ~~II BSe~~ I BSP | I BSZ2 |
| 4 | II BS4P | II BSZ2 |
| 5 | I BS4P | I BSZ2 |
| 6 | II BSe | II BSZ2 |
| 7 | I BSe | I BSZ2 |
| 8 | repeat | repeat |
| 15 | | |

Low Gain

ASZ3

A SZ3

II BSZ2

~~I~~ BSZ2

5

## ISEE HET RATE TABLE

| COUNTER | RATE | HG I | HG II | S1 | S2 | S3 | S4 | DET. |
|---|---|---|---|---|---|---|---|---|
| R1 | $A_1(A_2)(\overline{C}_4)(\overline{G}_1)\ \overline{G}_2$ | | 1 | | | | | |
| | $A_1(A_2)SA(\overline{C}_4)\overline{G}_3$ | | 0 | | | | | |
| R2 | $B_1\ (B_2)SB(\overline{C}_1)(\overline{G}_1)\ \overline{G}_2$ | | 1 | 3/4'S* | | | | |
| | $B_1\ (B_2)(C_4)\overline{SB}(\overline{C}_1)\overline{G}_1$ | | 1 | 1/4 * | | | | |
| | $B_1\ (B_2)SB(\overline{C}_1)\ \overline{G}_3$ | | 0 | | | | | |
| R3 | $B_1\ (B_2)(C_1)$ | | – | | | | | |
| R4 | $B_1\ (B_2)(C_1)\ \overline{G}_1$ | | – | | | | | |
| | | | | | | | | |
| R5 | $B_1\ (B_2)(C_4)\overline{C}_3 SB\ \overline{G}_1$ | | – | 0 | | | | |
| | $B_1\ (B_2)(C_4)\overline{C}_3\ \overline{SB}\ \overline{G}_1$ | | – | 1 | | | | |
| R6 | $B_1\ (B_2)(C_4)C_3\overline{C}_2 SB\ \overline{G}_1$ | | – | 0 | | | | HET-II |
| | $B_1\ (B_2)(C_4)C_3\overline{C}_2\overline{SB}\ \overline{G}_1$ | | – | 1 | | | | |
| R7 | $B_1\ (B_2)(C_4)C_3C_2(\overline{C}_1)SB\ \overline{G}_1$ | | – | 0 | | | | |
| | $B_1\ (B_2)(C_4)C_3C_2(\overline{C}_1)\overline{SB}\ \overline{G}_1$ | | – | 1 | | | | |
| R8 | $A_1$ | | – | 0 | 0 | 0 | 0 | |
| | $A_2$ | | – | 1 | 0 | 0 | 0 | |
| | $C_1$ | | – | 0 | 1 | 0 | 0 | |
| | $C_2$ | | – | 1 | 1 | 0 | 0 | |
| | $B_1$ | | – | 0 | 0 | 1 | 0 | |
| | $SA_1$ | | – | 1 | 0 | 1 | 0 | |
| | $SA_2$ | | – | 0 | 1 | 1 | 0 | |
| | SB | | – | 1 | 1 | 1 | 0 | |
| | $C_3$ | | – | 0 | 0 | 0 | 1 | |
| | $C_4$ | | – | 1 | 0 | 0 | 1 | |
| | $B_2$ | | – | 0 | 1 | 0 | 1 | |
| | $G_1$ | | – | 1 | 1 | 0 | 1 | |
| | $B_1$ } | | – | 0 | 0 | 1 | 1 | |
| | $SA_1$ } REPEAT BLOCK | | – | 1 | 0 | 1 | 1 | |
| | $SA_2$ } | | – | 0 | 1 | 1 | 1 | |
| | SB } | | – | 1 | 1 | 1 | 1 | |
| R9-R16 | IDENTICAL TO R1 - R8 | – | | – | – | – | – | HET-I |
| SR a | $A_1(A_2)(\overline{C}_4)(\overline{G}_1)\ \overline{G}_2$ | | 1 | 0 | 0 | 0 | | HET-II |
| b | $B_1\ (B_2)\ SB\ (\overline{C}_1)(\overline{G}_1)\ \overline{G}_2$ | | 1 | 0 | 1 | 0 | | |
| c | $B_1\ (B_2)(C_4)\ SB\ (\overline{C}_1)(\overline{G}_1)\overline{G}_2$ | | 1 | 0 | 0 | 1 | | |
| d | $B_1\ (B_2)(C_4)(\overline{C}_1)\overline{SB}(\overline{G}_1)\ \overline{G}_2$ | | 1 | 0 | 1 | 1 | | |
| | REPEAT a,b,c,d FOR HET-I | 1 | | 1 | – | -- | | HET-I |
| e | $A_1(A_2)\ SA\ (\overline{C}_4)\ \overline{G}_3$ | | 0 | 0 | 0 | 0 | | HET-II |
| e | $A_1(A_2)\ SA\ (\overline{C}_4)\ \overline{G}_3$ | 0 | | 1 | 0 | 0 | | HET-I |
| f | $B_1\ (B_2)\ SB(\overline{C}_1)\ \overline{G}_2$ | | 0 | 0← | $\overline{0 \cdot 0}$ | | | HET-II |
| f | REPEAT f FOR HET-II | 0 | | 1 | $\overline{0 \cdot 0}$ | | | HET-I |

↑

$\overline{0 \cdot 0}$

both not zero

subcom = (S4)(S3)(S2)(S1)

NOTES:

R1, R9 RATES CORRESPOND TO THE A-STOPPING EVENT TYPE FOR HETS I AND II.

* R2, R10 RATES CORRESPOND TO THE B-STOPPING EVENT TYPE FOR HETS I AND II (IN HIGH GAIN THE B-STOPPING EVENT TYPE DEFINITION IS TIME MULTIPLEXED FOR 3/4 AND 1/4 OF THE TIME BETWEEN TWO DEFINING CONDITIONS; $1/4 \equiv S_1 = S_2 = 1$.)
R3, R11 = PEN

$SA = SA_1 \cdot SA_2$

$(\sim)$ = DENOTES TERMS WHICH MAY BE DELETED FROM LOGICAL EXPRESSIONS BY COMMAND.

HG = 0 ⇒ LOW GAIN; HGI ⇒ HET I; HGII ⇒ HET II
HET I AND HET II GAINS ARE THE SAME WHEN IN AUTOMATIC GAIN CHANGING MODE BUT EACH MAY BE COMMANDED TO A FIXED GAIN INDEPENDENTLY.

NOTE REPEAT BLOCK FOR SINGLES RATES; E.G. IN ONE FULL SUBCOM CYCLE THE B1 SAMPLE TIME IS TWICE THAT FOR, SAY, B2.

NOTE: NO ( ) AROUND $\overline{G}_3$, UNLIKE MJS.

ALL RATE EQUATIONS CONTAIN A STROBE TERM TO ESTABLISH A COINCIDENCE APERTURE OF ~ 3 μ SEC. THE STROBE OCCURS 5.5 μ SEC AFTER THE FIRST OF THE FOLLOWING BECOMES TRUE: $A_1$, $B_1$, $(B_2)$, $(C_1)$, $(C_4)$

BIT STATES : BLANK ⇒ NOT RELEVANT
– ⇒ 0 OR 1

BITS HGI, HGII, S1, S2, S3, S4 ARE QUOTED HERE FOR ACCUMULATE TIME; RATES ARE ACCUMULATED DURING ONE 64 MINOR FRAME BLOCK AND READ OUT IN THE NEXT 64 MINOR FRAME BLOCK; THE STATES OF BITS HGI, HGII, S1, S2, S3, S4 READ OUT IN A 64 MINOR FRAME BLOCK CORRESPOND TO THE RATES IN THE FOLLOWING 64 MINOR FRAME BLOCK.

DELETION OF $(C_1)$ IS CONTROLLED BY THE SAME COMMAND BIT AS FOR DELETION OF $(\overline{C}_1)$ AND SIMILARLY FOR $(C_4)$ AND $(\overline{C}_4)$. A SINGLE COMMAND BIT CONTROLS DELETION OF $(\overline{G}_1)$ TERMS IN R1 AND HET-II SECTOR RATES; A SEPERATE COMMAND BIT CONTROLS DELETION OF $(\overline{G}_1)$ TERM IN R2; SIMILARLY FOR HET-I.

The HET internal stimulus, however, is turned on at the beginning of the first 64 minor frame block after the internal stimulus command (P88, provided CD46=CAL ENABLE bit = 1) is received. The internal stimulus system then stays on for 16x64 minor frames (1 complete sybcom cycle) and then automatically shuts itself off. The internal stimulus may be shut off earlier by resetting the CAL ENABLE bit (CD46) to zero. Note that the CAL bit in the HET status data is set during the 16x64 minor frame blocks during which the internal stimulus is ON. Corresponding rate data extends into the following 64 minor frame block. PHA data accumulated while the internal stimulus is on can extend as much as 3 event readouts after the time it is shut off (i.e., a CAL bit = 0 in a 64 minor frame block is not a guarantee that this block contains no data from the internal stimulus).

HET null PHA events consist of a string of 48 zeros. The lowest PHA channel value for a non-null HET event is 1; a pulse-height readout of zero for a non-null event implies overflow of the corresponding counter; i.e., top of range. The tag bit field could be tested alone as a test for null events since it should be all zeros only for null events.

## ISEE-C Sector Rates (HET + VLET).

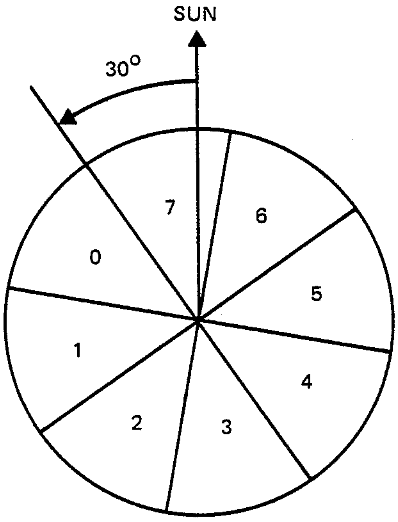
Nominal spin rate = 20 RPM → Spin Period T = 3 seconds. One complete readout of 8 sector rate counter contents takes 64 minor frames or 32 seconds at 2048 IBPS. At the end of a 64 minor frame block the contents of the 8 sector rate counters are transferred for readout during the next such block; the next rate to be sectored is selected by advancing the appropriate sub-com by one step and clearing the 8 counters. When the next sun-pulse is detected, rate accumulation begins in the first sector rate counter. One-eighth of a revolution later the rate pulses are switched from the first sector rate counter to the second for the next one-eighth of a spin and so on. At the end of one complete spin counting is resumed in counter one. The process stops after n complete spins, where n is bit-rate dependent:

| IBPS | n |
|---|---|
| 2048 | 8 |
| 1024 | 16 |
| 512 | 32 |

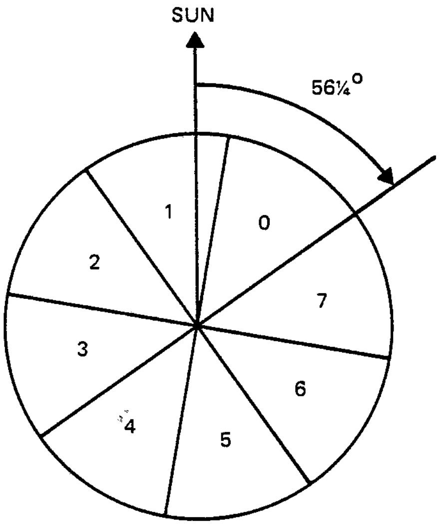
To obtain counts per second, divide the number of events counted by nxT/8 seconds.

The sun-pulse may be derived from either the Panoramic Attitude Sensor System (PAS) or from the Fine Sun Sensor System (FSS). The PAS and FSS systems are located in facets 6 and 14 respectively, 180° apart. However, each is canted by 22-1/2° and the sun-pulse from the FSS is delayed by 180° so that the sun-pulse is generated when sunlight is normally incident on facet 5 (actually the PAS pulse comes 0.35° later than this). The facets are numbered 1 to 16 according to a right-hand rule, the rotation of the spacecraft follows a right-hand rule and the spin axis will point to the North Ecliptic pole ±1°. The VLETS are located in facet 8 with their symmetry axes in the spin plane and rotated from a normal to facet 8 by 15° towards facet 7. The HETS are located such that their symmetry axes lie in the spin plane, the A-ends looking in a direction parallel to a vector from the center of the spacecraft to the junction of facets 2 and 3. This leads to the patterns on page 16.

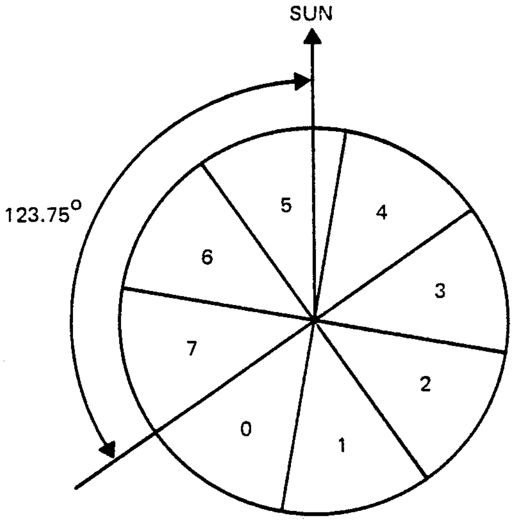
The VLET sector rates are accumulated in 24 bit counters; the HET sectored rates are accumulated in 20 bit counters.



VLET SECTORS



HET
A-STOPPING
SECTORS



HET
B-STOPPING
SECTORS

# APPENDIX D - A DESCRIPTION OF THE WORK AND ENCY FORMAT

The ISEE-C library consists of encyclopedias. The encyclopedia is organized into volumes. Each volume is defined by a fifteen-minute interval that starts at an integral fifteen-minute boundary, i.e., on the hour, fifteen minutes after the hour, thirty minutes after the hour, and forty-five minutes after the hour. The clock used for the purpose of determining time is the Universal time at the spacecraft. Each volume is assigned a unique number which is the number of fifteen-minute intervals elapsed before the volume since the start of calendar year 1977. A volume comprises of an integral number of instrument subcom sequences, and therefore may contain experiment data for a time interval which differs from the time interval of the volume by as much as one subcom sequence. A volume begins with an introduction which identifies the volume and provides information regarding volume contents. Following the introduction, there may be one or more chapters.

A chapter contains data obtained under the same instrument conditions (status, analog), and begins with an introduction. The introduction identifies the chapter and provides a general description of chapter contents, and conditions that may have led to the creation of this chapter. A chapter is terminated when either a change in experiment status occurs, or there is a gap in the data. The chapter introduction identifies the actual start-time and end-time of data included in the chapter. A number of verses follow the chapter introduction.

A verse contains all data of a specified type that was acquired within the time span covered by the chapter. Each verse begins with a preface that identifies the verse as belonging to a particular chapter of a volume and describes the type of data contained in the verse. The data follows the preface in a format appropriate to the type of data.

The formats of an ISEE-C encyclopedia volume introduction, a chapter introduction, and a verse are presented below. Tables A-1 through A-6 provide additional details on these formats.

## 0.0 VOLUME INTRODUCTION

| AW | Word | Byte | Length | Name | Description |
|---|---|---|---|---|---|
| 1 | 1 | 0 | 1 | VOCHPN | Chapter number (≡0) |
| | | 1 | 1 | VOVERN | Verse number (≡0) |
| 2 | | 2 | 1 | EPN | Encyclopedia Program Version |
| | | 3 | 1 | SCID | Satellite Identification |
| 3-4 | 2 | 4 | 4 | VOVOLN | Volume number |
| | | 8 | 6 | EPDT | Encyclopedia Program Date |
| | | 8 | 2 | EPYR | (Year - 1900) |
| | | 10 | 2 | EPMON | Month of year |
| | | 12 | 2 | EPDY | Day of month |
| | | 14 | 6 | VCDT | Volume Creation Date |
| | | 14 | 2 | VCYR | (Year - 1900) |
| | | 16 | 2 | VCMN | Month of year |
| | | 18 | 2 | VCDY | Day of month |
| | 6 | 20 | 10 | VSTRT | Time of Volume (Start Time) |
| 11 | | 20 | 2 | VSYR | (Year - 1900) |
| 12 | | 22 | 2 | VSMO | Month of year |
| 13 | | 24 | 2 | VSDY | Day of month |
| 14 | | 26 | 2 | VSHR | Hour of day |
| 15 | | 28 | 2 | VSMN | Minute of hour |
| | | 30 | 2 | | Spare |
| 17 | | 32 | 2 | NMCHP | Number of chapters in the volume (may be zero) |
| | | 34 | 48 | APRMV | Twelve 2-HW fields, one for each of the analog parameters, that define acceptably range of variation of the parameters, in units of the parameter.<br>HW 0 - minimum acceptable value<br>1 - maximum acceptable value<br>For parameters for which is a percentage change is acceptable, HW 0 is set = 255, and HW 1 contains acceptable variation, in parts 256. |
| | | 82 | 2 | | Spare |

Flight calendar time

| Byte | Length | Name | Description |
|---|---|---|---|
| 84 | 2 | (VO) DQSUM | Weighted sums of data quality for volume |
| 86 | 2 | MFSUM | Sum of minor frames for volume |
| 88 | 8 | CHSMC | Subject matter code for each of the chapters in the volume. One byte field identifies each of the chapters in the volume according to the following code: |
| | | | 80 Bit 0 - 0-status not nominal<br>1-status not nominal |
| | | | 40 1 - 0-real data<br>1-calibration data (HET or VLET) |
| | | | 20 2 - 0-analog parameters within tolerance<br>1-unusual analog parameters |
| | | | 10 3 - 0-no time gap<br>1-time gap in data |
| | | | 08 4 - 0-no bit rate change<br>1-bit rate change |
| | | | 04 5 - Spare |
| | | | 02 6 - 0-same status<br>1-change in status |
| | | | 01 7 - Spare |
| 96 | 1 | DQAL | Data quality acceptance level (determines quality threshold for rates to be summarized) |
| 97-99 | 3 | | Spare |

## n.0 CHAPTER INTRODUCTION n≥1

| Byte | Length | Name | Description |
|---|---|---|---|
| 0 | 1 | CHCHPN | Chapter Number (≥1) |
| 1 | 1 | CHVERN | Chapter Verse Number - 0 |
| 2 | 1 | | Spare |
| 3 | 1 | CHCHSMC | Subject Matter Code |

ie, not $day = \frac{hour}{24} + 1$
but $day = \frac{hour}{24}$

| HW | Byte | Length | 4 | Name | Description |
|---|---|---|---|---|---|
| | 4 | 4 | | CHVOLN | Volume Number |
| | 8 | 8 | | DTSTRT | Starting S/C time of data included |
| | 8 | 2 | 5 | DTYR | Year - 1900 |
| | 10 | 2 | 6 | DTHR | Hour of year |
| | 12 | 2 | 7 | DTSC | Second of hour |
| | 14 | 2 | | DTMSC | Millisecond of second |
| | 16 | 8 | | DTEND | Ending S/C time of data |
| | 16 | 2 | | ENDYR | Year - 1900 |
| | 18 | 2 | | ENDHR | Hour of year |
| | 20 | 2 | | ENDSC | Second of hour |
| | 22 | 2 | | ENDMSC | Millisecond of second |
| | 24 | 4 | | STSCC | Starting time, S/C clock |
| | 28 | 2 | | VLETC | VLET Calibration (high order byte - CAL allow |
| | 30 | 2 | | HETC | HET Calibration (low order byte - CAL start |
| 18 | 34 | 2 | | NMVER | Number of verses in chapter |
| | 36 | 100 | | CHCN | Chapter Contents Table•nth byte of this field points to the verse containing nth type of data |
| | 136 | 4 | | VLETST | VLET status T1:T2 enable right justified |
| 36 | 140 | 12 | | CHSTA | HET Command Status, six 2-byte words 1st byte = 0 -5, 2nd byte = status |
| | 152 | 2 | | NMMF | Total number of minor frames in chapter |

includes extra 24 hrs

ie $\frac{hour}{24}$ = day of year → calendar

Jan 1 is day 1 in hours

this number ~~data~~ type of 1st mf

| Byte | Length | Name | Description |
|---|---|---|---|
| | | | Data Quality: |
| 154 | 2 | DQ00 | Σmf padded (00) |
| 156 | 2 | DQ01 | Σmf with bad data quality (01) |
| 158 | 2 | DQ10 | Σmf with good data quality (10) |
| 160 | 2 | DQ11 | Σmf with excellent data quality (11) |
| | | | Time Quality: |
| 162 | 2 | TQ00 | Σmf of quick look data (00) |
| 164 | 2 | TQ01 | Σmf with time quality 01 |
| 166 | 2 | TQ10 | Σmf with time quality 10 |
| 168 | 2 | TQ11 | Σmf with time quality 11 |
| 170 | 2 | | Spare |
| | | | Analog Parameters, average for chapter |
| | | | low order HW - value |
| | | | high order HW -<br>0 - value read out in this chapter<br>1 - value inferred<br>2 - value not available |
| 172 | 4 | VP12V | VLET +12 volts, mv |
| 176 | 4 | VP6V | VLET +6 volts, mv |
| 180 | 4 | VTH3 | VLET Thermistor 3, °c |
| 184 | 4 | VTH4 | VLET Thermistor 4, °c |
| 188 | 4 | | VLET Spare 1, raw |
| 192 | 4 | | VLET Spare 2, raw |
| 196 | 4 | VM6V | VLET -6 volts, mv |
| 200 | 4 | VM12V | VLET -12 volts, mv |
| 204 | 4 | HETPM | HETS Power Monitor, mv |
| 208 | 4 | VLETPM | VLETS Power Monitor, mv |
| 212 | 4 | HETTH | HETS Thermistor, °c |
| 216 | 4 | VLETTH | VLETS Thermistor, °c |

Data Type 0 - Raw Rates Data 1/chapter

| | Name | Description | Length (bytes) |
|---|---|---|---|
| PREVERSE+0 | HCMPS | HET Commutator position for the first set of rate readouts | 1 |
| +1 | VCMPS | VLET Commutator position for the first set of rate readouts | 1 |
| +2 | GAIN1 | HET1 gain mode for the first set of readouts (0=low gain; 1= high gain) | 1 |
| +3 | GAIN2 | HET2 gain mode | 1 |
| +4 | AUTO1 | HET1 automatic gain switching (0=yes; 1=no) | 1 |
| +5 | AUTO2 | HET2 automatic gain switching | 1 |
| +6 | NSEQ | Number of rate sequences in the verse (i.e., groups of 64 minor frames) | 2 |
| +8 | RATE | 40 *NSEQ rate words in the format in Table A-2. | 16 HET unsectored 6-21<br>8 HET sectored 22-29<br>8 VLET unsectored 30-37<br>8 VLET sectored 38-45 |

4

-X- can't change in a chapter

words

40

Data Type 1 - Coincidence Condition Map (Length = 300 bytes)

| | | |
|---|---|---|
| PREVERSE+0 | CCM | One 16-bit word for each of the first 150 rates in Table A-3. Each word indicates the presence of terms in coincidence condition applicable to the corresponding rate. The format of the entries is shown in Table A-4. |

Date Type 2 - Rate Summary

| | | | |
|---|---|---|---|
| PREVERSE+0 | RSM | Two hundred fifty-four rate summary blocks (16 bytes each) corresponding to the rates in Table A-3. The format is in Table A-5. | 254x16 |

## Data Type 3 - VLET PHA History

| | | | |
|---|---|---|---|
| PREVERSE+0 | NUMPHA | Number of VLET PHA events in this chapter | 4 |
| +4 | | Spare | |
| +8 | EVPREV | One byte field for each of the 16 PHA events that preceded the first PHA event in this chapter. Each byte contains the data type of the corresponding event. In the event of data discontinuity between previous volume and the current volume, these fields are padded. | 16 |
| +24 | EVID | One byte field for each event in this chapter. Byte contains data type of the event. (Padded=all bits on; Null event=all bits off)<br>Record filled to double-word boundary. | |

## Data Type 4 - HET PHA History

(Same as data type 3, except HET)

## Data Types 5 - 22:

| | | | |
|---|---|---|---|
| PREVERSE+0 | PHARAT | Rate summary block for the corresponding rate | 16 |
| +16 | PHAEV | Number of events corresponding to data type | 4 |
| +20 | | Spare | |
| +24 | PHA | PHA events; 8-byte entry for each event in the format in Table A-6. | |

## Data Type 23 - Spacecraft Words

| | | |
|---|---|---|
| PREVERSE+0 | SCBL | Number of blocks of spacecraft words |
| +4 | | Space |
| +8 | | (6 * 64 bytes) * SCBL spacecraft data words. |

TABLE A-1. DATA TYPES

| Code | Description |
|---|---|
| 0 | Raw Rates |
| 1 | Coincidence condition map |
| 2 | Rate Summary |
| 3 | VLET PHA Summary |
| 4 | HET PHA Summary |
| 5 | ✓ HET-I AST, High Gain |
| 6 | ✓ HET-I, Low Gain , AST |
| 7 | ✓ HET-I, High Gain , BSTP |
| 8 | ✓ HET-I, BSTE, High Gain |
| 9 | ✓ HET-I BST, Low Gain |
| 10 | ✓ HET-I PEN, High Gain |
| 11 | ✓ HET-I PEN, Low Gain |
| 12-18 | HET-II (same as 5-11) |
| 19 | VLET-I, event type 0 |
| 20 | VLET-I, event type 1 |
| 21 | VLET-II, event type 0 |
| 22 | VLET-II, event type 1 |
| 23 | Spacecraft words |

12 HET-II AST, High
13 HET-II, AST, LO
14 HET-II, BSTP, Hi
15 HET-II, BSTE, HI
16 HET-II BST, Lo
17 HET-II PEN, Hi
18 HET-II PEN, LO

## TABLE A-2. RATE WORD FORMAT

raw rate verse

| Byte | Bit | Description | |
|---|---|---|---|
| 0 | 0 | Fill data flag (0=no fill; 1=fill) | 80 |
| | 1-2 | Worst Data Qualtiy Flag for minor frames required for this rate | 60 |
| | 3 | Bad spin value flag (sectored rates only) (0=spin nominal 1="wild" spin) | 10 |
| | | Trend check indicators | |
| | 4 | failed forwared trend check (1=fail) | 08 |
| | 5 | failed backword trend check (1=fail) | 04 |
| | 6 | applied forwared trend check (1=applied) | 02 |
| | 7 | applied backword trend check (1=applied) | 01 |
| 1-3 | | Rate Counts | |

## TABLE A-3. LOCATION OF RATE SUMMARY BLOCKS IN RATE SUMMARY TEXT

| | Description | | Symbol |
|---|---|---|---|
| 1 | HET-I, High Gain, | $A_1$ $[A_2]$ $[\bar{C}_4]$ $[\bar{G}_1]$ $\bar{G}_2$ | AS |
| 2 | " " | $B_1$ $[B_2]$ SB $[\bar{C}_1]$ $\bar{G}_1$ $\bar{G}_2$ | BSp |
| 3 | " " | $B_1$ $[B_2]$ $[C_4]$ $\overline{SB}$ $[\bar{C}_1]$ $\bar{G}_1$ | BSe |
| 4 | " " | $B_1$ $[B_2]$ $[C_1]$ | PENH |
| 5 | " " | $B_1$ $[B_2]$ $[C_1]$ $\bar{G}_1$ | PGH |
| 6 | " " | $B_1$ $[B_2]$ $[C_4]$ $\bar{C}_3$ SB $\bar{G}_1$ ← | BS4p |
| 7 | " " | $B_1$ $[B_2]$ $[C_4]$ $\bar{C}_3$ $\overline{SB}$ $\bar{G}_1$ | BS4e |
| 8 | " " | $B_1$ $[B_2]$ $[C_4]$ $C_3$ $\bar{C}_2$ SB $\bar{G}_1$ | BS3p |
| 9 | " " | $B_1$ $[B_2]$ $[C_4]$ $C_3$ $\bar{C}_2$ $\overline{SB}$ $\bar{G}_1$ | BS3e |
| 10 | " " | $B_1$ $[B_2]$ $[C_4]$ $C_3$ $C_2$ $[\bar{C}_1]$ SB $\bar{G}_1$ | BS2p |
| 11 | " " | $B_1$ $[B_2]$ $[C_4]$ $C_3$ $C_2$ $[\bar{C}_1]$ $\overline{SB}$ $\bar{G}_1$ | BS2e |
| 12 | HET-I, Low Gain, | $A_1$ $[A_2]$ SA $[\bar{C}_4]$ $\bar{G}_3$ | ASZ3 |
| 13 | " " | $B_1$ $[B_2]$ SB $[\bar{C}_1]$ $\bar{G}_3$ | BSZ2 |
| 14-21 | " " | (same as 4-11, except Low Gain) PENL,PGL, BS4Z2, BS4, BS3Z2, BS3, BS222, BSZ | |
| 22-42 | HET-II (same as 1-21, except HET-II) | | |
| 43-50 | Sectored, HET-I, High Gain | $A_1$ $[A_2]$ $[\bar{C}_4]$ $[\bar{G}_1]$ $\bar{G}_2$ | AS |
| 51 | | $A_1$ $[A_2]$ $[\bar{C}_4]$ $[\bar{G}_1]$ $\bar{G}_2$, summed | AS |
| 52-59 | | $B_1$ $[B_2]$ SB $[\bar{C}_1]$ $[\bar{G}_1]$ $\bar{G}_2$ | BSp |
| 60 | | $B_1$ $[B_2]$ SB $[\bar{C}_1]$ $[\bar{G}_1]$ $\bar{G}_2$, summed | BSp |
| 61-68 | | $B_1$ $[B_2]$ $[C_4]$ SB $[\bar{C}_1]$ $[\bar{G}_1]$ $\bar{G}_2$ | BS~~p~~4P ← |
| 69 | | $B_1$ $[B_2]$ $[C_4]$ SB $[\bar{C}_1[$ $[\bar{G}_1]$ $\bar{G}_2$, summed | BS~~p~~4P ← |
| 70-77 | | $B_1$ $[B_2]$ $[C_4]$ $[\bar{C}_1]$ $\overline{SB}$ $[\bar{G}_1]$ $\bar{G}_2$ | BSe |
| 78 | | $B_1$ $[B_2]$ $[C_4]$ $[\bar{C}_1]$ $\overline{SB}$ $[\bar{G}_1[$ $\bar{G}_2$, summed | BSe |
| 79-86 | Sectored, HET-I, Low Gain | $A_1$ $[A_2]$ SA $[\bar{C}_4]$ $\bar{G}_3$ | ASZ3 |
| 87 | | $A_1$ $[A_2]$ SA $[\bar{C}_4]$ $\bar{G}_3$, summed | ASZ3 |
| 88-95 | | $B_1$ $[B_2]$ SB $[\bar{C}_1]$ $\bar{G}_2$ | BSZ2 |
| 96 | | $B_1$ $[B_2]$ SB $[\bar{C}_1]$ $\bar{G}_2$, summed | BSZ2 |

| | Description | | Symbol | |
|---|---|---|---|---|
| 97-150 | Sectored, HET-II, (same as 43-96, except HET II) | | | |
| 151 | VLET-I | $D_I\ D_{II}\ \bar{F}\ \Sigma_1$ | DΣ1 | LZ2 |
| 152 | | DΣ1-DΣ2 | DΣ1-DΣ2 | LZ≠2 |
| 153 | | $D_I\ D_{II}\ \bar{F}\ \Sigma_2$ | DΣ2 | LZ3 |
| 154 | | $D_I\ D_{II}\ \bar{F}\ \Sigma_1\ E_1$ | DΣLEL | LZ2E1 |
| 155 | | $D_I\ D_{II}\ \bar{F}\ \Sigma_1\ E_2$ | DΣ1E2 | LZ2E2 |
| 156 | | $D_1\ D_{II}\ \bar{F}$ | D | L |
| 157-162 | VLET-II (same as 151-155, except VLET-II) | | | |
| 163-170 | Sectored, VLET-I | $D_I\ D_{II}\ \bar{F}\ \Sigma_1$ | DΣ1 | LZ2(1) |
| 171 | | $D_I\ D_{II}\ \bar{F}\ \Sigma_1$, summed | | |
| 172-179 | | $D_I\ D_{II}\ \bar{F}$ | D | L(1) |
| 180 | | $D_I\ D_{II}\ \bar{F}$, summed | | |
| 181-188 | Sectored, VLET-II | $D_1\ D_{11}\ \bar{F}\ \Sigma_1$ | DΣ1 | |
| 189 | | $D_1\ D_{11}\ \bar{F}\ \Sigma_1$, summed | | |
| 190-197 | | $D_1\ D_{11}\ \bar{F}$ | D | |
| 198 | | $D_1\ D_{11}\ \bar{F}$, summed | | |
| 199 | HET-I, High Gain | $A_1$ | A1 | |
| 200 | " " | $A_2$ | A2 | |
| 201 | | $C_1$ | C1 | |
| 202 | | $C_2$ | C2 | |
| 203 | | $C_3$ | C3 | |
| 204 | | $C_4$ | C4 | |
| 205 | | $B_2$ | B2 | |
| 206 | | $B_1$ | B1 | |
| 207 | | $SA_1$ | SA1 | |
| 208 | | $SA_2$ | SA2 | |
| 209 | | SB | SB | |
| 210 | | $G_1$ | GL | |

|  | Description |  | Symbol |
|---|---|---|---|
| 211-222 | HET-I, Low Gain (same as 199-210 except Low Gain) |  |  |
| 223-246 | HET-II, (same as 199-222 except HET-II0 |  |  |
| 247 | VLET-I | $D_I$ | DI |
| 248 | " | $D_{II}$ | DII |
| 249 | " | E | E |
| 250 | " | F | F |
| 251-254 | VLET-II (same as 247-250 except VLET-II) |  |  |

---

Although $A_2$, $B_2$, $C_1$, and $C_4$ are everywhere deletable, the $G_1^1$ is only deletable in BSP. The $G_1$ is only deletable in sectored rates and $AS_1$.

[ ] = deletable term

# TABLE A-4. BIT ASSIGNMENTS FOR COINCIDENCE CONDITION MAP

| Bit | HET |
|---|---|
| 0 | $A_1$ |
| 1 | $A_2$ |
| 2 | $C_1$ |
| 3 | $C_2$ |
| 4 | $C_3$ |
| 5 | $C_4$ |
| 6 | $B_2$ |
| 7 | $B_1$ |
| 8 | SA |
| 9 | SB |
| 10 | $G_1$ Other than B stopping, CD7, and sectored |
| 11 | $G_2$ |
| 12 | $G_3$ |
| 13 | $G_1'$ B stopping only, CD4, unsectored |
| 14 | 0 |
| 15 | 0 |

One in a bit position implies that the corresponding term is presented. Whether coincidence/anti-coincidence is determined by rate definitions.

Bit 15 is set if the data type is disabled.

## TABLE A-5. RATE SUMMARY BLOCK FORMAT

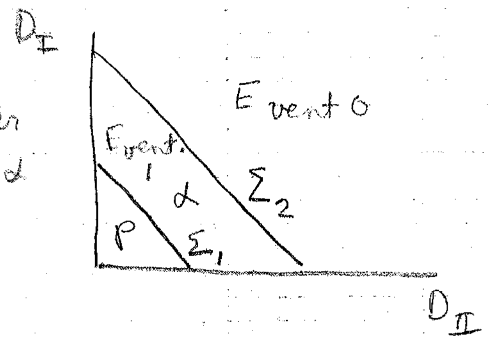
| Byte | | Description | |
|---|---|---|---|
| 0-3 | | Accumulated counts for this rate, excluding readouts which (a) appeared in a minor frame for which bit errors exceeded tolerance, or (b) failed trend check. | trend checked |
| 4-7 | | Time in seconds over which the counts above were accumulated. | |
| 8-11 | Counts | Accumulated counts for this rate, excluding readouts for which data quality was unacceptable or gain mode was unavailable. | un trend checked |
| 12-15 | Live Time | Time in seconds over which the counts in the preceding word were accumulated. | |

ISEE-C TYH PHA EVENT TAGS:

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VLET | | | | | | | | | TEL 1 ENAB | TEL 2 ENAB | EVENT I.D. | TEL I.D. |
| HET | $C_2 \oplus C_4$ | $C_3$ | $C_1$ | SB | $G_2$ | $G_1\overline{G_3}$ | TEL I.D. | HG | SECT 3 | SECT 2 | EVENT I.D. | SECT 1 |
| BIT | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |

EVENT TYPES:

| | EVENT I.D. | TYPE |
|---|---|---|
| VLET | 0 | $D\mathcal{E}_2$ some α + heavier |
| | 1 | $D\mathcal{E}_1 - D\mathcal{E}_2$ some p & α |
| HET | 0 | AST |
| | 1 | BST IF $C_1 = 0$<br>PEN IF $C_1 = 1$ |



8 bytes 16 bits

## TABLE A-6. PHA EVENT FORMAT

| 8<br>Byte | Bit | Description |
|---|---|---|
| 0-1 | 0-1 | Worst Data Quality Flag for minor frames required for this PHA event. |
| | 2-3 | Spare |
| | 4-15 | PHA Tag bits |
| 2-3 | 0-3 | 0 |
| | 4-15 | PHA 1 Readout |
| 4-5 | 0-3 | 0 |
| | 4-15 | PHA 2 Readout |
| 6-7 | 0-3 | 0 |
| | 4-15 | PHA 3 Readout |

need PHA merge pc

Tel enable bits = 0, normal

| | | | | |
|---|---|---|---|---|
| | | | | verse lt |
| Vlet Tag | 0 | event 0 | VLET-I | 19 |
| | 1 | Event 0 | VLET-II | 21 |
| | 2 | Event 1 | VLET-I | 20 |
| | 3 | Event 1 | VLET-II | 22 |

5/31/77
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# ISEE-C HET EVENT TYPE VERSE DEFINITIONS (1 VERSE PER EVENT TYPE)

| EVENT TYPE | CORRESPONDING EVENT TYPE RATE | SHORT LABEL | TAG BITS | | | | |
|---|---|---|---|---|---|---|---|
| | | | EVENT ID BIT | $C_1$ | SB | HG | TEL/ID |
| AS, HI GN | $A_1(A_2)(\bar{C}_4)(\bar{G}_1)\bar{G}_2$ | AS | 0 | — | — | 1 | |
| AS, LO GN | $A_1(A_2)SA(\bar{C}_4)\bar{G}_3$ | ASZ3 | 0 | — | — | 0 | |
| BSe, HI GN | $B_1(B_2)(C_4)\overline{SB}(\bar{C}_1)\bar{G}_1$ | BSE | 1 | 0 | 0 | 1 | |
| BSp, HI GN | $B_1(B_2)SB(\bar{C}_1)(\bar{G}_1)\bar{G}_2$ | BSP | 1 | 0 | 1 | 1 | |
| BS, LO GN | $B_1(B_2)SB(\bar{C}_1)\bar{G}_3$ | BSZ2 | 1 | 0 | — | 0 | |
| PEN, HI GN | $B_1(B_2)(C_1)$ | PENH | 1 | 1 | — | 1 | |
| PEN, LO GN | $B_1(C_2)(C_1)$ | PENL | 1 | 1 | — | 0 | |

NULL EVENTS: 48 ZEROES (TAG + PHA1 + PHA2 + PHA3)

EACH OF THE ABOVE EVENT TYPES CORRESPONDS TO TWO VERSES, ONE FOR HET-I AND ONE FOR HET-II.

EVERY NON-NULL EVENT FITS INTO ONE OF THE ABOVE CATEGORIES; EVENTS WHICH ARE INCONSISTENT IN SOME WAY WILL BE IDENTIFIED AT A LATER STAGE IN PROCESSING ([illegible])

## ISEE-C TYH PHA EVENT TAGS:

| | | | | |
|---|---|---|---|---|
| VLET | | TEL 1 ENAB | TEL 2 ENAB | EVENT I.D. | TEL I.D. |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HET | $C_2 \oplus C_4$ | $C_3$ | $C_1$ | SB | $G_2$ | $G_1 \bar{G}_3$ | TEL I.D. | HG | SECT 3 | SECT 2 | EVENT I.D. | SECT 1 |
| BIT | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |

EVENT TYPES:

| | EVENT I.D. | TYPE |
|---|---|---|
| VLET | 0 | $D\mathcal{E}_2$ |
| | 1 | $D\mathcal{E}_1 - D\mathcal{E}_2$ |
| HET | 0 | AST |
| | 1 | BST IF $C_1 = 0$<br>PEN IF $C_1 = 1$ |

| TAGS | | | | | | | | | | | | PHA 1 | PHA 2 | PHA 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $C_2 \oplus C_4$ | $C_3$ | $C_1$ | SA | $G_2$ | $G_1 \bar{G}_3$ | TEL ID | HG | SCTR 3 | SCTR 2 | EVENT ID | SCTR 1 | $A_1$ | $A_2$ | $C_1 + C_2 + C_3$ |
| | | | | | | | | | | (0) | | | | |
| $C_2 \oplus C_4$ | $C_3$ | $C_1$ | SB | $G_2$ | $G_1 \bar{G}_3$ | TEL ID | HG | SCTR 3 | SCTR 2 | EVENT ID | SCTR 1 | $B_1$ | $B_2$ | $C_2 + C_3 + C_4$ |
| | | (0) | | | | | | | | (1) | | | | |
| $C_2 \oplus C_4$ | $C_3$ | $C_1$ | SB | $G_2$ | $G_1 \bar{G}_3$ | TEL ID | HG | SCTR 3 | SCTR 2 | EVENT ID | SCTR 1 | $B_1$ | $C_1$ | $C_2 + C_3 + C_4$ |
| | | (1) | | | | | | | | (1) | | | | |

| "G" | $G_2$ | $G_1 \bar{G}_3$ | |
|---|---|---|---|
| 0 | 0 | 0 | $G_1 \bar{G}_2 \bar{G}_3$ |
| 1 | 0 | 1 | $G_1 \bar{G}_2 \bar{G}_3$ |
| 2 | 1 | 1 | $G_1 G_2 \bar{G}_3$ |
| 3 | 1 | 0 | $G_1 G_2 G_3$ |

| "C" | $C_1$ | $C_3$ | $C_2+C_4$ | |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | $\bar{C}_1 \bar{C}_2 \bar{C}_3 \bar{C}_4$ |
| 1 | 1 | 0 | 0 | $C_1 \bar{C}_2 \bar{C}_3 \bar{C}_4$ |
| 2 | 1 | 0 | 1 | $C_1 C_2 \bar{C}_3 \bar{C}_4$ |
| 3 | 1 | 1 | 1 | $C_1 C_2 C_3 \bar{C}_4$ |
| – | 1 | 1 | 0 | $C_1 C_2 C_3 C_4$ |
| 4 | 0 | 0 | 1 | $\bar{C}_1 \bar{C}_2 \bar{C}_3 C_4$ |
| 3 | 0 | 1 | 1 | $\bar{C}_1 \bar{C}_2 C_3 C_4$ |
| 2 | 0 | 1 | 0 | $\bar{C}_1 C_2 C_3 C_4$ |

TYH HIGH ENERGY TELESCOPE
ISEE-C TELEMETRY FORMAT