"INFRARED SPECTROMETRY STUDIES"
FINAL REPORT (B) - PHASE IV

STANFORD SPECTRAL DIGITAL DATA ACQUISITION SYSTEM
(1971 Version)

BY

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(A) Software (Computer Programming) - RSL 71-2
(B) Digital Data Acquisition System - RSL 71-3
(C) Spectral Data from Flights 1 and 3, Mission 108 - RSL 71-6

The Report covers the last twelve month period of the contract.

R. J. P. Lyon
Principal Investigator
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70-6 "The Multiband Approach to Geologic Mapping from Orbiting Satellites: Is it Redundant or Vital?" (by R. J. P. Lyon), now published in Remote Sensing of Environment, 1, (4), 237-244


70-8 "Pseudo-Radar: Very High Contrast Aerial Photography at Low Sun Angles" (by R. J. P. Lyon, Jose Mercado and Robert Campbell, Jr.), now published in Photogrammetric Engineering, 36, (12), 1257-1261

70-9 "Remote Sensing in Exploration for Mineral Deposits" (by R. J. P. Lyon and Keenan Lee), now published in Economic Geology, 65, 785-800

70-10 "Phenomena and Properties of Geologic Materials Affecting Microwaves - A Review" (by D. Oberste-Lehn)

70-11 "1969/70 Stanford Spectral Data Management System" (by Michael Heathman)

71-1 "Operational Calibration of an Airborne Infrared Spectrometer Over Geologically-Significant Terrains", (by R. J. P. Lyon and A. A. Marshall)

"Stanford Digital Data System." Final Report (B) -- Phase IV.


"Spectral Data from Flights 1 and 3, Mission 108." Final Report (C) -- Phase IV (IR Spectral Emittance Data - Airborne).
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I. INTRODUCTION

This report deals with the construction of the Stanford Spectral Digital Data Acquisition System. The objective of the system is to record both the spectral distribution of incoming radiation from the rock samples measured by the spectro-radiometer (Exotech Model 10-34 Circular Variable Filter (CVF) Infrared Spectro-radiometer as shown in Fig. 1.) together with other weather information.

This is a versatile and compact system which is designed for both laboratory and field measurement programs. The overall physical layouts are shown in Fig. 2 to Fig. 4.

The multichannel inputs (8 channels) of the system are as follows: Ch 1 the Spectro-radiometer, Ch 2 the radiometer (PRT-5), and Ch 3 to Ch 8 for the weather information. The system records data from channel 1 and channel 2 alternately for 48 times, before a fast sweep across the six weather channels, to form a single scan in the scan counter. The detailed description of the operation is illustrated in the block diagram in Section II and the theory of operation in Section III. The outputs are written on a 7-track magnetic tape with IBM compatible form. The format of the tape and the playback computer programs are included in Section IV and Section V respectively. The \( \mu \)-PAC digital modules (Honeywell) and a CIPHER model 70 tape recorder (Cipher Data Products) are used. One of the major characteristics of this system is that it is externally clocked by the spectro-radiometer instead of taking data at intervals of various wave lengths by using internal-clocking. The interface between the electronic circuits and the tape recorder of the system also is quite simple.

II. THE BLOCK DIAGRAM

The block diagram of the system (Fig. 5) enables us to understand its overall functions. The encoder of the Exotech CVF infrared spectro-radiometer provides three basic control signals in its function as the
Fig. 1.
Exotech Model 10 Spectroradiometer.

Fig. 2.
Data system operating on roof of Earth Science Bldg. Digital Tape recorder is hidden at rear.
Fig. 3.
Digital Data System showing:
A. Input for ID
B. Status lights
C. Wiring Board
D. Input and monitor channels (8 pairs)
   1. Spectrometer
   2. Radiometer
   3-8. Met. data

Fig. 4.
Same with cover added. Notice status lights are different.
Fig. 5. The block diagram of the system
external clock of the system. These signals are (1) the reset, (2) the 100 PPR, and (3) the ramp function. In the data system the START-STOP SIGNAL controls the start and the initialization (the preset) of the SCAN COUNTER as well as the system. The multiplexer (MUX) switches a single-ended voltage from one of its 8 channel-inputs to its common output without changing the nature of the voltage. Then the common voltage is applied to the buffer amplifier (BUFFER), which is a unit gain noninverting device having high input impedance and low output impedance. The ANALOG and DIGITAL circuit converts the output from the buffer amplifier into 10-bits-word decimal data which are stored on the HOLDING REGISTER in the format of two-6-bits bytes. Those bytes are ready to be written on the 7-track tape of the tape recorder CIPHER through the DATA MATRIX. However, the additional 2 bits in the data matrix serve for the error checking only. The timing is controlled by the ID CONTROL. The DATA CONTROL and the WEATHER CONTROL blocks will be described in detail later in Section III.

First, the ID control gives signal to the 25-BIT COUNTER to write a "header" in the beginning of the tape. The header, providing the number of the scan, the day, the time, the sample number and the site number, is now located in the DATA MATRIX. Secondly, the DATA CONTROL block is responsible for writing Ch 1 and Ch 2 alternately for 48 times. Finally, the WEATHER CONTROL block controls the recording of the six weather channels. Furthermore, the 7-BIT COUNTER is mainly used for the weather channel selections. The circuit diagrams of the above mentioned blocks are shown in Appendicies A to L.

III. THE THEORY OF OPERATION

The theory of operation can be understood by the timing relations in the ID CONTROL, the DATA CONTROL, and the WEATHER CONTROL blocks. Thus, their timing diagrams are discussed separately as follows.
A. The ID Control Signal Sequences

At the release of the START button, a square wave pulse is generated. The negative-going edge of this square wave pulse triggers a 500 μsec write command pulse (W. C. P.) which in turn generates the 4 msec duration byte-time. This byte-time is for the tape recorder to record one data byte. At the same time the 25-bit counter is also advanced once by the negative edge of the W. C. P. The ID sequences will be stopped as soon as the 25-bit counter reaches $t_{13}$. Meanwhile, the negative output $(t_{13})$ is fed back to the enable control of the 500 μsec one shot. Hence, zero input at this enable lead will terminate the one shot from functioning. Fig. 6a shows the timing diagram of the signal sequences.

B. The Spectro-radiometer Data Channel Control Signal Sequences

As shown in Appendix B, the 100 PPR gated by $Q_a$, $Q_b$, and WEATHER will trigger the DRPOT signal in the tape recorder. The 1 μsec DRPOT will in turn trigger a 12 μsec square wave to account for the "settling time" (S. T.) of the tape recorder. The positive and the negative edges of the 12 μsec S. T. pulse trigger a 1st 4 msec byte-time pulse and a 12 μsec W. C. P. respectively. The negative edge of the 1st W. C. P and the 1st 4 msec byte-time pulse again triggers a second W. C. P. and a 2nd 4 msec byte-time pulse. At the end of the 2nd 4 msec byte-time, the DRPOT pulse is triggered. Then the above mentioned cycle repeats. The sample A/D command is a negative-going pulse. This pulse is activated whenever $Q_a$ changes state. Fig. 6b shows the timing diagram of the data control signal sequences.

C. The Weather Channels Control Signal Sequences

During the WEATHER cycle, the negative edge of the inverse "reset" pulse from Exotech triggers the DRPOT signal which in turn triggers a 12 μsec S. T. pulse and a W. C. P. The 1st and the 2nd 4 msec byte-time
Fig. 6a. The ID control signal sequences

100 ppr

DRPOT+

Settling time

1st W.C.P.

1st 4 msec

2nd 4 msec

2nd W.C.P.

Q_a

Sample A/D

Fig. 6b. The data control timing sequences
pulses are being generated in the same way as in the data control cycle. Now, the negative edge of the W.C.P. also acts as the clock signal for the 7-bit counter and the multiplexer. The weather sequence will stop when the 7-bit counter reaches \( t_7 \). At this moment an I.R.G. command is applied to the tape recorder to write a record gap on the tape. Then the tape recorder sends back a return pulse which will activate the scan counter to advance on count. A whole event cycle is now completed and the control sequences go back to the data state. Therefore, it is ready for another new spectro-radiometer recording cycle. The timing diagram of the weather channel control signal sequences is illustrated in Fig. 7.

IV. THE DATA FORMAT AND THE SPECIFICATIONS OF THE SYSTEM

A. The Data Format

The tape recorder CIPHER in the system writes 7-track tapes with density of 200 bpi. These tapes are IBM compatible. The format of the tape is exhibited in Fig. 8. The header (or ID) contains 12 bytes, of which the first two bytes contain 3 BCD digits giving the number of scans; the 3rd and 4th bytes give 3 BCD digits indicating the day in a year; the next four bytes consist of 6 BCD digits showing the time in HH:MM:SS format; the ninth, the tenth bytes and the remaining 11th, 12th are for the sample and the site respectively. Next 96 words are integer*2. Each word contains 10-bits-two's-complement integer and two alternating bits for error checking. The 12 bits of an integer*2 are ordered in the following manner.

<table>
<thead>
<tr>
<th>Tape channel</th>
<th>First byte</th>
<th>Second byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2**0</td>
<td>2**5</td>
</tr>
<tr>
<td>2</td>
<td>2**1</td>
<td>2**6</td>
</tr>
<tr>
<td>4</td>
<td>2**2</td>
<td>2**7</td>
</tr>
<tr>
<td>8</td>
<td>2**3</td>
<td>2**8</td>
</tr>
<tr>
<td>A</td>
<td>2**4</td>
<td>the sign bit</td>
</tr>
<tr>
<td>B</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>
Fig. 7. The timing diagram of the weather control signal sequences.
Fig. 8. The tape format (6 bit bytes)

- The header (BCD characters)
  - day
  - sample
  - site
  - IH
  - IR
  - IS
  - IRC

- Spectrometer and radiometer data (integer*2)

- six multiplex weather data (integer*2)

- The next record

1 2 3 4 5 6 7 8 9 10 11 12 ---
The 96 words contain alternately, (1) the spectral samples over 48 different frequencies and (2) the 48 radiometer samples taken during the spectrum sweep. At the end, there are 6 words supplied from 6 different input channels of the ground meteorological information. An interrecord gap (IRG) is written at the end of the weather data, then, the next sampling cycle follows. After the system completes taking data, a file gap is written by pushing the file gap button on the panel of the system.

B. The Specifications of the Digital Data Acquisition System

This section contains general specifications of the digital data acquisition system. The detailed specifications of the tape recorder CIPHER, the Honeywell μ-PAC I/C Modules, and the Exotech 10 Spectroradiometer are in References I, II, and V.

1. Logical Levels
   logical ZERO 0.00 V to 0.35 V (max)
   logical ONE 3.50 V (min) to 6.3 V (max)

2. Temperature Range
   0° to 40° C

3. Power Supply Requirements
   (a) A/D +(24 ± 1) volts
   (b) other circuits +(6 ± 0.3) volts
   (c) lamp indicators +14 ± 4 volts

4. Current Requirements
   They are listed in the specifications for each individual μ-PAC in reference I.

5. Accuracy of the Outputs
   The output accuracy of the digital system is approximately + 0.15 volts.
6. **Wavelength Region for Exotech 10 Spectro-radiometer**

   7 to 14 μ

7. **Input Requirements**

   The input voltage of each channel should stay within

   ± 10 volts

V. **THE TAPE PROGRAMS WITH ILLUSTRATION OF DATA**

The computer programs used are the revised tape-dump programs. They are listed later in this section.

To test the digital system, we use constant DC inputs to verify the digitized outputs. An example of those outputs is illustrated in Fig. 9. For the purpose of checking each bit in the output, we printed out the hexadecimal values instead of integers. There are 6 records in Fig. 9 in which the first record is the header (or ID) and the remaining 5 records are data. Because the IBM computer does not read any record less than 18 bytes, we have had to insert 10 redundant bytes in front of the ID. Each bit of the redundant bytes has the logical level ONE. Thus, in the hexadecimal format, one data-word becomes "3F3F". The rest information in the first record is the ID in BCD format. They are interpreted as follows.

<table>
<thead>
<tr>
<th></th>
<th>Hex</th>
<th>Decimal</th>
</tr>
</thead>
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<tr>
<td>day</td>
<td>1419</td>
<td>456</td>
</tr>
<tr>
<td>time (HH:MM:SS)</td>
<td>210C 1419</td>
<td>12:34:56</td>
</tr>
<tr>
<td>sample</td>
<td>0726</td>
<td>789</td>
</tr>
<tr>
<td>site</td>
<td>1008</td>
<td>012</td>
</tr>
</tbody>
</table>

The record Nos. 2 to 6 in Fig. 9 are data. Each of the records has 204 bytes in which the first 192 bytes are from alternating spectrometer and radiometer inputs, the remaining 12 bytes are from 6 weather channel inputs. The relation among the hexadecimal, the decimal data words,
Fig. 9. An example of the computer output from the tape playback programs. (The explanation is in Section V.)
and the output voltages is shown in the following example

<table>
<thead>
<tr>
<th>Hex</th>
<th>Decimal</th>
<th>Output (volts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3F3F</td>
<td>1023</td>
<td>+10.00</td>
</tr>
<tr>
<td>0000</td>
<td>0</td>
<td>-10.00</td>
</tr>
<tr>
<td>0020</td>
<td>0</td>
<td>-10.00</td>
</tr>
<tr>
<td>0010</td>
<td>512</td>
<td>0.00</td>
</tr>
<tr>
<td>0030</td>
<td>512</td>
<td>0.00</td>
</tr>
<tr>
<td>270F</td>
<td>497</td>
<td>-0.29</td>
</tr>
<tr>
<td>260F</td>
<td>492</td>
<td>-0.39</td>
</tr>
<tr>
<td>3D12</td>
<td>605</td>
<td>+1.82</td>
</tr>
<tr>
<td>3C12</td>
<td>604</td>
<td>+1.80</td>
</tr>
<tr>
<td>2B0F</td>
<td>491</td>
<td>-0.41</td>
</tr>
<tr>
<td>2A0F</td>
<td>490</td>
<td>-0.43</td>
</tr>
<tr>
<td>2918</td>
<td>777</td>
<td>+5.18</td>
</tr>
<tr>
<td>2D0F</td>
<td>493</td>
<td>-0.37</td>
</tr>
</tbody>
</table>

The accuracy of the outputs is approximately within ± 0.15 volts, resulting from the variations of the first three bits in the first byte of a data word, that is the system is 10-bit but the accuracy is 7-bits. The computer programs are listed as follows.
PROGRAM TRKLOAD -- TRUCK TAPE TO DISK

THIS PROGRAM READS TRUCK TAPES AND CREATES TWO OUTPUT FILES.
DATA RECORDS ARE STORED IN A DIRECT ACCESS DATASET, AND
IDENTIFICATION RECORDS ARE STORED IN A SEQUENTIAL DATASET
WITH PointERS TO THE CORRESPONDING DATA.

SPECTAPE -- DDNAME OF TRUCK TAPE.
NO DCB PARAMETERS REQUIRED.

DIRECT -- DDNAME OF DATA OUTPUT FILE.
DCB=(DSORG=DA,BLKSIZE=204)

FT10F001 -- DDNAME OF IDENTIFICATION FILE.
DCB=(RECFM=FR,LRECL=40,BLKSIZE=3520)

FT05F001 -- DDNAME OF IDENTIFICATION LISTING FILE.
FT04F001 -- DDNAME OF DATA LISTING FILE.
FT05F001 -- DDNAME OF PARAMETER INPUT FILE.
&PARMS LIST=F, ERRCNT=10, TERR=F, &END

IMPLICIT INTEGER*2 (A-Z)
INTEGER KEY/1/, COUNT/0/, PRINT/6/, INDEX/10/, DUMP/4/, LRECL
INTEGER ERRCNT/10/, CARD/5/, NERR/0/, NIDS/0/, NINV/0/, NREADS/0/
INTEGER JUMP, DATE(5), I, J, K, L, M, N
INTEGER DTLEN, IDLEN/20/, DTSIZ/48/
LOGICAL LIST/.FALSE./, TERR/.FALSE./
DIMENSION SAVEID(6)

DEFINE DIGITIZED (0,1023) TO DECIVOLTS (-100,100) FORMULA
DVOLT(RAW) = (200*RAW - 102300) / 1023

DEFINE AND READ NAMELIST
NAMELIST /PARMS/ ERRCNT, LIST, TERR
READ (CARD,PARMS,END=2)

CONTINUE

INITIALIZE
DTLEN = DTSIZ*4 + 12
IF (TERR) CALL NOERR

CALL DATER (DATE)
WRITE (PRINT,65) DATE

CALL RDTRK (LRECL)
NREADS = NREADS + 1
IF (LRECL .EQ. IDLEN) GOTO 12
IF (LRECL .LT. 0) GOTO 80
IF (LRECL .EQ. 0) STOP

BUFL = LRECL/2
WRITE (PRINT,61) NREADS, LRECL, (INPA(J), J = 1,BUFL)
NINV = NINV + 1
GOTO 11

DO 10 I = 1,6
SAVEID(I) = IDENT(I)
SAVKEY = KEY

READ INPUT TAPE
ASSIGN 20 TO JUMP
CALL RDTRK (LRECL)
NREADS = NREADS + 1

IF (LRECL .EQ. DTLEN) GOTO 30
IF (LRECL .EQ. IDLEN) GOTO 1*0
IF (LRECL .EQ. 0) GOTO 50
IF (LRECL .LT. 0) GOTO 80

BAD LRECL IGNORE RECORD
NINV = NINV + 1
BUFL = LRECL/2
WRITE (PRINT,61) NREADS, LRECL, (INPA(J), J = 1,BUFL)
WRITE (PRINT,67)
GOTO 20

DATA RECORD FOUND
DO 31 M = 1,DTSIZ
SPECT(M) = DVOLT(SPECT(M))
31 RADIO(M) = DVOLT(RADIO(M))
DO 32 M = 1,6
MULT(M) = DVOLT(MULT(M))

CALL DALOAD (SPECT, KEY)
IF (.NOT. LIST) GOTO 49

WRITE (DUMP,72) KEY, (SPECT(N), N = 1,DTSIZ)
WRITE (DUMP,73) (RADIO(N), N = 1,DTSIZ)
WRITE (DUMP,74) MULT
KEY = KEY + 1
COUNT = COUNT + 1
GOTO 20

IDENTIFICATION RECORD FOUND

IF (COUNT .NE. 0) GOTO 47

IDENTIFICATION RECORD CONTAINS NO DATA
WRITE (PRINT,62) SAVEID
NINV = NINV + 1
GOTO 45

WRITE IDENTIFICATION RECORD

NIDS = NIDS + 1
WRITE (INDEX,66) SAVEID, SAVKEY, COUNT
WRITE (PRINT,64) NIDS, SAVEID, SAVKEY, COUNT
SAVKEY = KEY
COUNT = 0

DO 46 1 = 1,6
SAVEID(1) = IDENT(1)
GOTO 20

END OF FILE EXIT

IF (COUNT .NE. 0) GOTO 48

IDENTIFICATION RECORD CONTAINS NO DATA
WRITE (PRINT,62) SAVEID
NINV = NINV + 1
GOTO 60

WRITE FINAL IDENTIFICATION RECORD

NIDS = NIDS + 1
WRITE (INDEX,66) SAVEID, SAVKEY, COUNT
WRITE (PRINT,64) NIDS, SAVEID, SAVKEY, COUNT

NREADS = NREADS - 1
KEY = KEY - 1
WRITE (PRINT,63) NREADS, NIDS, KEY, NINV, NERR
IF (LIST) WRITE (DUMP,63) NREADS, NIDS, KEY, NINV, NERR
STOP

READ ERROR ROUTINE

WRITE (PRINT,69) NREADS, (INPA(J), J = 1,160)
NERR = NERR + 1
IF (NERR .LE. ERRCNT) GOTO JUMP, (11, 20)

TOO MANY ERRORS
WRITE (PRINT,71) NREADS
STOP

FORMATS
C 61  FORMAT ('//RSL042I RECORD',15,' INVALID',14,' BYTES//' * ('RSL042I',16Z6))
C 62  FORMAT ('//RSL040I IDENTIFICATION RECORD CONTAINS NO DATA//' * 'RSL040I DAY IS ',19/' * 'RSL040I TIME IS ',313/' * 'RSL040I SAMPLE IS ',19/' * 'RSL040I SITE IS ',19///)
C 63  FORMAT ('1RSLO00I',16,' RECORDS READ'/ * 'RSLO00I',16,' IDENTIFICATION RECORDS SAVED'/ * 'RSLO00I',16,' DATA RECORDS SAVED'/ * 'RSLO00I',16,' INVALID RECORDS FOUND'/ * 'RSLO00I',16,' PERMANENT READ ERRORS'/ * 'RSLO00I',16,' NORMAL END OF RUN')
C 64  FORMAT ('T15,14,' ) DAY =',14,' ; TIME =',313,' ; SAMPLE =',14,' ; SITE =',14,' ; START =',15,' ; COUNT =',13)
C 65  FORMAT ('1',T35,'IDENTIFICATION RECORDS SAVED ON ',5A4//' 66  FORMAT (815)
C 67  FORMAT (///)
C 69  FORMAT ('//RSL044I RECORD NO',15,' PERMANENT READ ERROR//' * 10('RSL044I',16Z6///))
C 71  FORMAT ('//RSL046I I/O ERROR COUNT EXCEEDED ',15,' RECORDS READ')
C 72  FORMAT ('1',T32,'RECORD NO',15,' SPECTROMETER DATA'//(8110))
C 73  FORMAT ('//RADIOMETER DATA'//(8110))
C 74  FORMAT ('//MULTIPLEXED DATA'//(6110)
END
//LKED EXEC PGM=IEWL,PARM=(LET,LST,XREF),COND=(5,LT)
//SYSUT1 DD DSN=SYS1.U1,DCB=KEYLEN=0,DISP=OLD
//SYSLIN DD DSN=&PUNCH,DISP=(OLD,DELETE)
//SYSMOD DD DSN=JO32.PROGLIB(TRKLOAD),VOL=SER=SYS12,UNIT=2314,DISP=OLD
//SYSLIB DD DSN=SYS1.FORTLIB,DISP=SHR
//DD DSN=JO32.SUBLIB,VOL=SER=SYS12,UNIT=2314,DISP=SHR
//SYSPRINT DD SYSOUT=A
//GO EXEC PGM=*.LKED.SYSLMOD,COND=(5,LT)
//FT06F001 DD SYSOUT=A
//FT04F001 DD SYSOUT=A,DCB=(RECFM=FA,BLKSIZ=133)
//FT10F001 DD DSN=JO32.TRUCK.INDEXV5,VOL=SER=SYS15,UNIT=2314,
// DISP=(NEW,KEEP,DELETE),SPACE=(TRK,10,RLSE),
// DCB=(RECFM=FB,LRECL=40,BLKSIZ=3520)
//SPECTAPE DD DSN=JO32.TRUCK.TEST.DATA5,VOL=SER=SYS14,UNIT=2314,
// DISP=SHR
//DIRECT DD DSN=JO32.TRUCK.DATA5,VOL=SER=SYS15,UNIT=2314,
// DISP=(NEW,KEEP,DELETE),SPACE=(TRK,10,RLSE),
// DCB=(BLKSIZE=204,DSORG=DA)
//FT05F001 DD *
&PARMS LIST=T, &END
SUBROUTINE RDTRK (LRECL)

TONY MARSHALL -- STANFORD REMOTE SENSING LAB

LRECL -- SIZE IN BYTES OF CURRENT RECORD, SET TO ZERO
      ON EOF READS.
SPECTAPE -- DDNAME FOR INPUT DATA SET
TDATA -- FORTRAN COMMON, HALFWORD INTEGERS

COMMON /TDATA/ INPA(200), IDENT(6), SPECT(48), RADIO(48), MULT(6)

THIS FORTRAN CALLABLE SUBROUTINE READS AND CONVERTS DATA
READ FROM 7-TRACK MAG TAPE GENERATED BY STANFORD'S SG-4
SPECTROMETER SYSTEM.
THE RAW DATA IS CONTAINED IN TWO DIFFERENT RECORD FORMATS
EACH OF A DIFFERENT PHYSICAL LENGTH AND DATA RECORDING MODE.
THE IDENTIFICATION RECORD CONTAINS DATA IN A PACKED BCD
FORMAT WHERE EACH PAIR OF SIX BIT BYTES CONTAIN THREE
FOUR BIT BCD CHARACTERS.

TAPE DATA FORMAT: 001FGHIJ 000ABCDN
CONVERTED FORMAT: 00000000 ABCDFGHJ

TAPE BCD FORMAT: 00EF IJKL 00ABCD GH
CONVERTED FORMAT: ABCD + 10*EFGH + 100*IJKL

THE DATA IS RETURNED IN COMMON TO FORTRAN, ALL NUMBERS
ARE CONVERTED TO 16 BIT TWO'S COMPLEMENT INTEGERS.

--------------------------------------------------------------------------------
SPACE 2
L LRECL,0(0,PARM) GET ARG ADDRESS
SR COUNT,COUNT SET COUNT TO ZERO
TITLE 'OPEN, READ, CLOSE SECTION'
TOPEN SPECTAPE,READ
OPEN (SPECTAPE)
TOPEN SPECTAPE,READ
WTO 'RSL1001 SPECTAPE DD CARD MISSING'
ABEND 20,DUMP
SPACE
READ SPECTAPE,READ
CHECK 'RSL1001 SPECTAPE, READ'
SPACE
LTR COUNT,COUNT
BM EXIT
L CBASE,=V(TDATA)
USING INPA,CBASE
BAL LINKR,BLKSIZE
SPACE
C COUNT,=A(SGIDSIZ)
BE IDCONV
C COUNT,=A(SGDTLSIZ)
BE DATACONV
B EXIT
SPACE
EODAO CLOSE (SPECTAPE,LEAVE)
EXIT ST COUNT,0(0,LRECL)
L SAVER,4(0,SAVER)
RETURN (14,12)
TITLE 'IDENTIFICATION CONVERSION ROUTINE'
IDCONV DS OH
BCD DAY,SGDAY
BCD TIMEH,SGTIME
BCD TIMEM,SGTIME+2
BCD SAMPLE,SGSAMPLE
BCD SITE,SGSITE
SPACE
SR TEMP,TEMP
LH TEM2,TIMEM
D TEMP,=F'100'
STH TEMP,TIMES
ST TEM2,CSAVE
LH TEM2,TIMEH
SR TEMP,TEMP
D TEMP,=F'10'
STH TEM2,TIMEH
MH TEMP,=H'10'
A TEMP,CSAVE
STH TEMP,TIMEM
B EXIT
CSAVE DS F
TITLE 'DATA CONVERSION ROUTINE'
DATACONV DS OH
LA POINT,SGCHANLA
LA STEP,4
LA LIMIT,SGMULT-4
SR INDEX,INDEX
**DLOOP**

SPACE

DS \( \text{OH} \)

TENBIT SPECT(\text{INDEX}), 0(0, \text{POINT})

TENBIT RADIO(\text{INDEX}), 2(0, \text{POINT})

LA \text{INDEX}, 2(0, \text{INDEX})

EXIT \text{POINT}, \text{STEP}, \text{DLOOP}

SPACE

LA \text{LIMIT, 6}

SR \text{INDEX, INDEX}

**MLOOP**

DS \( \text{OH} \)

TENBITMULT(\text{INDEX}), SGMULT(\text{INDEX})

LA \text{INDEX}, 2(0, \text{INDEX})

BCT \text{LIMIT, MLOOP}

B \text{EXIT}

TITLE 'ROUTINE TO TURN OFF ERROR RETRY BITS'

ENTRY \text{NOERR}

SPACE

USING *

NOERR

OI SPECTAPE+49, X'OC'

BR 14

DROP 15

TITLE 'INPUT BLKSIZE ROUTINE'

**BLKSIZE**

DS \( \text{OH} \)

L \text{POINT, DECB+16}

L \text{TEMP, 12(0, POINT)}

N \text{TEMP, MASK}

L \text{COUNT, SPECTAPE+60}

N \text{COUNT, MASK}

SR \text{COUNT, TEMP}

BR \text{LINKR}

RETURN

**MASK**

DC X'0000FFFF'

**SYNAD**

DS \( \text{OH} \)

SYNADAF ACMETH=BSAM

STM 14,1, ERRSAV

SAVE OS REGISTERS

MVC STATUS(27), =CL27'RSL110I I/O ERROR INFO --'

MVC STATUS+27(78), 50(PARM)

HTOP STATUS, LIMIT=20, MF=E

L COUNT, =F'-1'

SET ERROR FLAG

SYNADRLS

LM 14,1, ERRSAV

RESTORE THE REGISTERS

BR 14

RETURN TO CHECK MODULE
REGISTER DEFINITIONS

/*
 * EXEC PGM=IEBCOM,PARM=(LET,LIST,XREF,NCAL),CCNO=(5,LT)
 * SYSLIN DD DSN=SYS1.U11,DCB=KEYLEN=0,DISP=OLD
 * SYSLMOD DD DSN=J032.SUBLIB(RDTRK),VOL=SFR=SYS12,UNIT=2314,DISP=OLD
 * SYSPRINT DD SYSOUT=A
 */
VI. ACKNOWLEDGEMENT

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VII. REFERENCES


III. Instruction manual, X-Mod-113-105, power supplies, Preston Scientific Incorporated.


VIII. APPENDICIES

A. The operational procedures:

(1) Mount the 7-track tape on the CIPHER.
(2) Turn on the power of the CIPHER.
(3) Turn on the power supplies of the system: (a) \( +6 \text{ V} \),
     (b) \( +18 \text{ V} \), (c) \( +24 \text{ V} \).
(4) Push load button (the ready light should be on when the silver marker of the tape passes the sensor to the right).
(5) Set the ID (i.e., the day, the time, the sample number, and the site number).
(6) Set scan number at 000.
(7) Turn on power of Exotech-10
(8) Load liquid \( \text{N}_2 \) into the Hg Cd Te detector.
(9) Set the ramp speed and turn on the switch of the electronic package of Exotech.
(10) Adjust the temperature null of Exotech.
(11) Push the START button (the complete light should be on).
(12) Set the number of scans.
(13) Plug in the inputs (i.e., channel-1, channel-2, and six weather channels--be sure that the inputs are less than \( +10 \text{ V} \) and larger than \( -10\text{ V} \), any voltage beyond this range would damage the A/D converter!!)
(14) Push the FILE GAP button after the scan is over.
(15) Repeat (5) to (14) if any more operations have to be made.
(16) Turn off the switch of the electronic package of Exotech and press the FILE GAP button three times at the end of recording.
(17) Turn off the power supplies, rewind the tape, and turn off the power of CIPHER.
B. The data control circuit.
C. The weather control circuit.
D. The ID control circuit and the gating for 1st and 2nd five bits.
E. The multiplexer and A/D hookup.
F. The 7- and 25-bit counters.
G. The scan counter.
H. The 10-bit holding register.
I. The main control circuit (start/stop).
J. The 64 ppr and the reset pulses generator.
K. The data matrix.
L. The multiplexer and the status indicators.
(5) Mux and A/D Hookup
25 Bit Counter
Main Control (start/stop)

64 PPR and Reset Pulses Generator

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