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IM41-1062-00
SOFTWARE INSTRUCTION MANUAL
ND4410 LOW/HIGH SPEED PAPER TAPE
I/O OVERLAY PROGRAM

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INTRODUCTION

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1-2. The ND4410 Low/High Speed Paper Tape I/O Overlay Program (41-1062) is written for use with the ND4410 Single Parameter Data Acquisition and Display System. The program is an overlay for the ND4410 Basic Physics Analyzer Program (41-1060), containing pushbutton control routines for totalize and print. Also included are keyboard entry routines for store and write/read data to/from binary formatted paper tape via either a low speed or high speed punch/reader.

1-3. PROGRAM AREA

1-4. The program occupies memory core locations $\emptyset,3\emptyset\emptyset1_8$ through $\emptyset,3777_8$.

1-5. STARTING ADDRESS

1-6. The starting address of the program is $\emptyset,\emptyset2\emptyset\emptyset_8$.

1-7. EQUIPMENT CONFIGURATION

1-8. MINIMUM EQUIPMENT

1-9. The minimum equipment required for proper operation of this system is:

a. An ADC.

b. The ND4410 Function Control Module.

c. A display oscilloscope.

d. The 4K, ND812 Computer.

e. A 33ASR Teletype.

1-10. The program will operate with either a 4K, 8K, 12K or 16K ND812 memory configuration, providing maximum data storage configuration of 1K, 3K, 5K or 7K (24 bits, respectively).

1-11. OPTIONAL EQUIPMENT

1-12. The optional equipment allowed to be used with this program is:

a. A high speed paper tape punch.

b. A high speed paper tape reader.

SECTION II
PROGRAM DESCRIPTION

2-1. INTRODUCTION

2-2. This section is intended to be read in conjunction with the flow charts outlined in Section VII.

2-3. The ND4410 Low/High Speed Paper Tape I/O Overlay Program (41-1062) consists of hardware and software entry subroutines to the ND4410 Basic Physics Analyzer Program (41-1060). The hardware entry subroutines control the TOTAL and PRINT pushbuttons of the ND4410 Function Control Module. The software entry subroutines provide control for store and write/read to/from binary formatted paper tape via either the low speed or high speed punch/reader.

2-4. HARDWARE ENTRY SUBROUTINES

2-5. TOTAL PUSHBUTTON SUBROUTINE

2-6. The TOTAL pushbutton subroutine (Figure 7-1) prints the current group number and the channel locations of the left and right markers; sums the counts stored in the channels between the markers; prints the total; calculates the background and subtracts it from the total; and then prints the net total (total minus background). The formula for calculation of the background is as follows:

$$B_G = 1/2\,(C_1 + C_2)N$$

where B_G = Background
C_1 = Counts in left marker channel
C_2 = Counts in right marker channel
N = Number of channels between the markers

2-7. PRINT PUSHBUTTON SUBROUTINE

2-8. The PRINT pushbutton subroutine (Figure 7-2) prints the current group number, the channel locations of the left and right marker, and the content of each channel between the markers with channel identification for the first and every eighth channel thereafter.

2-9. SOFTWARE ENTRY SUBROUTINES

2-10. STORE SUBROUTINE

2-11. The store subroutine (Figure 7-3) permits specifying the marker defined channels of any group for storing the result of an arithmetic expression of up to three terms connected by any one of the arithmetic operations: + (add), - (subtract), * (multiply) or / (divide). The three terms can be any three groups, any three literal numbers, or any combination thereof.

2-12. The store subroutine is executed as follows:

a. Branch to select limits subroutine to select the group for storage of the result (and up to three terms), and the arithmetic operators connecting them.

b. Branch to the Get value subroutine to select the first channel specified.

c. Combine the terms of the arithmetic expression according to the convention of matrix algebra.

d. Branch to the Put value subroutine to store the result in the first channel specified.

e. Repeat steps b, c and d for each specified channel.

f. Return.

2-13. SELECT LIMITS SUBROUTINE. The Select Limits subroutine (Figure 7-4) selects the group for storage of the result of the arithmetic expression, the marker channels of the group(s) on which the arithmetic operations are to be performed, and the terms of the arithmetic expression and the operators connecting them. A term (up to three may be specified) can be any valid group or literal number from 1 to 8,388,607. The arithmetic operators can be either + (add), - (subtract), * (multiply) or / (divide).

2-14. GET VALUE SUBROUTINE. The Get Value subroutine (Figure 7-5) selects the group and channel numbers, combines them to form a memory address, and then puts the contents of the selected address into the Integer Accumulator and J and K Registers.

2-15. PUT VALUE SUBROUTINE. The Put Value subroutine (Figure 7-6) selects the group and channel numbers, combines them to form a memory address, and then stores the contents of the Integer Accumulator in the selected address.

2-16. WRITE SUBROUTINE

2-17. The Write subroutine (Figure 7-7) prints the current group number and the channel locations of the left and right markers; punches the number of channels in the marker area; selects the group and first channel number, combines them to form a memory address, and puts the contents of the selected address into the Integer Accumulator and J and K Registers; and then punches the contents in binary format on paper tape. The subroutine then checks for the last channel. If it is not the last channel, the next channel is selected and its contents are punched. After the last channel is punched, the subroutine punches the check sum and returns.

2-18. READ SUBROUTINE

2-19. The Read subroutine (Figure 7-8) prints the current group number and the channels location of the left and right markers, reads the number of channels to be read in from the paper tape and then checks if the number is greater than the number of channels in the marker area. If the number is greater, the subroutine branches to the Error subroutine (41-1060) to print an error message. If the number is less than or equal to the number of channels in the marker area, the subroutine reads the first data word from the paper tape, selects the group and first channel number, combines them to form a memory address, and then adds the data read in to the contents of the address. The subroutine then checks for the last channel. If it is not the last channel, the next data word is read from paper tape and it is added to the contents of the next channel. After the last data word is read, the subroutine checks for a zero check sum. If the check sum is not equal to zero, the subroutine branches to the Error subroutine (41-1060) to print an error message. If the check sum is equal to zero, the subroutine returns.

SECTION III
OPERATIONAL PROCEDURE

3-1. INITIALIZATION PROCEDURE

3-2. The following is a step-by-step procedure for loading and initializing the ND4410 Low/High Speed Paper Tape I/O Overlay Program (41-1062):

NOTE

Prior to performing the following procedure, load and initialize the ND4410 Basic Physics Analyzer Program (41-1060) as described in the ND4410 Single Parameter Physics Analyzer Software Instruction Manual (IM41-1060).

a. Depress the STOP key at the ND812 Computer.

b. Place the START/FREE/STOP switch at the teletype in the FREE position.

c. Load the ND4410 Low/High Speed Paper Tape I/O Overlay Program (41-1062) Tape into the teletype reader with the leader (8-level punches) over the read head.

d. Set the START/FREE/STOP switch to START.

e. Simultaneously depress the LOAD AR and NEXT WORD key at the ND812 Computer. The teletype read will step through the leader and read the program into the ND812 memory. Upon completion of read-in, the reader will stop automatically. When the reader stops, check the J Register for zero. If non-zero, reload.

NOTE

Refer to the ND812 Binary Paper Tape and Cassette Loader Program (41-0005) for loading procedures using a high speed paper tape reader or magnetic tape cassette.

f. Set the SWITCH REGISTER switches at starting address ($Ø,Ø2ØØ_8$) and depress the LOAD AR key.

g. Depress the START key. The program will cause the teletype to perform a carriage return and line feed and type an asterisk (*).

h. When the teletype types an asterisk (*), call up the desired routine from the monitor mode by depressing the appropriate pushbutton at the ND4410 Function Control Module or by typing the appropriate single letter mnemonic at the teletype keyboard.

SECTION IV
OPERATOR OR USER CONTROL

4-1. GENERAL INFORMATION

4-2. The pushbutton selected (hardware entry) commands of the ND4410 Low/High Speed Paper Tape I/O Overlay Program (41-1062) are executed by depressing the appropriate pushbutton at the ND4410 Function Control Module. The keyboard entry commands are executed by entering the appropriate single letter mnemonic at the teletype after an asterisk (*) has been typed by the program. In the following description, the portion of the command to be typed at the teletype keyboard is underlined. All other information is provided by the program.

4-3. HARDWARE ENTRY COMMANDS

4-4. TOTAL PUSHBUTTON

4-5. Depressing the TOTAL pushbutton prints the current group number and the channel locations of the left and right markers; totalizes the counts stored in the channels between the left and right markers, subtracts the background from the total, and then prints the total and the net total (total minus background). The following is an example of the information printed when the TOTAL pushbutton is depressed.

*GROUP 2 CHNL 210 - 242

*TOTAL = 10840
NET TOTAL = 4966

*

4-6. PRINT PUSHBUTTON

4-7. Depressing the PRINT pushbutton prints the current group number, the channel locations of the left and right markers, and the content of the channels between the markers with channel identification every eighth channel. The following is an example of the information printed when the PRINT pushbutton is depressed. The first number in

each row represents the channel number every eighth channel, and the remaining eight numbers represent counts stored in each of eight channels. For example, channel 210 has 171 counts, channel 211 has 188 counts, etc.

*GROUP 2 CHNL 210 - 242

210	171	188	215	229	239	242	246	299
218	309	303	379	359	427	407	473	424
226	477	456	463	469	483	404	398	379
234	379	380	287	267	247	227	220	218
242	186							

*

4-8. The print routine can be terminated at any time by depressing the RETURN pushbutton at the ND4410 Function Control Module.

4-9. SOFTWARE ENTRY COMMANDS

4-10. STORE COMMAND

4-11. The following operation adds the content of the marker defined channels (32 to 64) in groups 1 and 2 together and stores the result in the marker defined channels (32 to 64) of group 2. All data in the memory except the marker defined channels (32 to 64) of group 2 remains unchanged.

*STORE IN GROUP: 2 (SPACE) CHNL 32 - 64
RESULT OF: GROUP: 1 + : GROUP 2 (RETURN)

*

4-12. The following operation adds 625 (125 multiplied by 5) to the content of each of the marker defined channels (32 to 64) in group 1 and stores the result in the marker defined channels (32 to 64) of group 2. All data in memory except the marker defined channels (32 to 64) of group 2 remains unchanged.

*STORE IN GROUP: 2 (SPACE) CHNL 32 - 64
RESULT OF: 125 * : 5 + : GROUP 1 (RETURN)

*

4-13. The Store Command permits specifying the marker defined channels of any group for storing the result of an arithmetic expression of up to 3 terms connected by any one of the arithmetic operators: + (add), - (subtract), * (multiply), or / (divide). The three terms can be any 3 groups, any 3 literal numbers or any combination thereof. Depressing the RETURN key after any of the terms makes that term the last one and causes the routine to evaluate the arithmetic expression and store the result in the group specified.

4-14. The Store Command is specified by typing S after an asterisk (*) is typed. After S is typed, the routine prints STORE IN GROUP: and waits for entry of the resultant group number. The resultant group can be any valid group number. Entry of the resultant group must be terminated by depressing the SPACE bar. When the SPACE bar is depressed, the routine prints CHNL, the left marker channel, dash (-) and the right marker channel; performs a carriage return and line feed, prints RESULT OF: and waits for entry of the first term.

4-15. A group is specified as a term by typing G, whereupon the routine prints GROUP: and waits for input of a group number. Depressing the ALT MODE key causes the routine to echo the last group number entered and wait for entry of an arithmetic operator (+, -, * or /). Otherwise any valid group number may be entered. Entry of a group or literal number must be terminated by typing one of the four arithmetic operators (+, -, * or /) or by depressing the RETURN key. If one of the four arithmetic operators is entered, the routine will echo a colon (:) and wait for entry of the next term. If the RETURN key is depressed, the routine will perform the specified arithmetic operations and store the result in the specified group. Upon completion of the store operation, the routine performs a carriage return and line feed and types an asterisk (*).

4-16. The specified arithmetic operations are evaluated from left to right according to the conventions of Matrix Algebra, i.e., the content of each defined channel in a group is combined with the corresponding channel of the next group by the arithmetic operator connecting the groups, and the result is stored in the corresponding channel of the resultant group. Literal numbers are treated as scalers in that they are combined with the content of each defined channel in a group according to the arithmetic operators connecting them with the group. The store routine can be terminated at any time by depressing the RETURN pushbutton at the ND4410 Function Control Module.

4-17. WRITE COMMAND

4-18. The following operation outputs the portion of the spectrum contained in the marker defined channels (64 to 128) of group 1 in binary format at either the high speed or low speed (teletype) paper tape punch.

*WRITE GROUP 1 CHNL 64 - 128

*

4-19. The Write Command prints the current group number and the channel locations of the left and right markers at the teletype and then punches the following information at either the low speed (teletype) or high speed paper tape punch.

a. Leader/trailer consisting of sprocket punches only.

b. Three character (8 bits each) indicating the number of data channels in the marker defined area.

c. Data, 24 bits in binary format (3 characters, 8 bits each).

d. A check sum consisting of one 8 bit character.

e. Leader/trailer.

4-20. The low speed (teletype) punch is selected as the readout device for the Write Command by setting the SWITCH REGISTER Switches at the ND812 Computer to non-zero. i.e., by setting any one of the SWITCH REGISTER Switches to a "1" (up). The high speed punch is selected as the readout device for the Write Command by setting the SWITCH REGISTER switches at the ND812 Computer to zero, i.e., by setting all the SWITCH REGISTER switches to "Ø" (down).

NOTE

Prior to performing the Write Command load the selected punch with paper tape.

4-21. The Write Command is specified by typing W after an asterisk (*) is typed. After W is typed, the routine causes the teletype to print WRITE GROUP, the current group number, CHNL, the left marker channel location, dash (-) and the right marker channel location and perform a carriage return and line feed, and then initiates the write operation. Upon completion of the write operation, the routine causes the teletype to type an asterisk (*).

NOTE

After the teletype performs the carriage return and line feed, turn on the selected punch.

4-22. READ COMMAND

4-23. The following operation reads a spectrum from binary formatted paper tape at either the low speed (teletype) or high speed reader and adds it to the portion of the spectrum contained in the marker defined channels (64 to 128) of group 1.

*READ GROUP: 1 CHNL 64 - 128

*

4-24. The binary format of the paper tape must be the same as described for the Write Command and the number of channels to be read in must be less than or equal to the current number of channels between the markers. If the number of channels read in is less than the current number of channels in the between markers, only those channels which correspond to the channels read in will be altered. Attempting to read in more channels than there are in the current marker area will result in an error indication. Refer to Table 5-1.

4-25. The Read Command prints the current group number and the channel locations of the left and right markers at the teletype, and then reads the data from the binary formatted paper tape at either the low speed (teletype) or high speed paper tape reader and adds it to the contents of the channels between the markers of the current group.

4-26. The low speed (teletype) paper tape reader is selected as the read-in device for the Read Command by setting the SWITCH REGISTER Switches at the ND812 Computer to non-zero, i.e., by setting any one the SWITCH REGISTER switches to a "1" (up). The high speed paper tape reader is selected as the read in device for the Read Command by setting the SWITCH REGISTER switches to zero, i.e., by setting all the SWITCH REGISTER switches to "Ø" (down).

NOTE

Prior to performing the Read Command, place the paper tape in the selected reader with the leader over the read head.

4-27. The Read Command is specified by typing R after an asterisk (*) is typed. After R is typed, the routine causes the teletype to print READ GROUP, the current group number, CHNL, the left marker channel location, dash (-), and the right marker channel location and perform a carriage return and line feed, and then initiates the read operation. Upon completion of the read operation, the routine causes the teletype to type an asterisk (*). Correct read in is indicated by the check sum being zero. A non-zero check sum will result in an error indication. Refer to Table 5-1.

NOTE

After the teletype performs the carriage return and line feed, turn on the selected reader.

SECTION V
ERROR DIAGNOSTICS

5-1. ERROR INDICATION

5-2. Execution of an illegal operation will result in an error message being typed at the teletype. Table 5-1 lists the error messages and their causes.

Table 5-1. Error Indications

ERROR MESSAGE	CAUSE
ERROR: 99XXXX	Depressing an unassigned pushbutton.
ERROR: 62XXXX	Depressing an unassigned teletype key.
ERROR: 72XXXXX	Entering a group number greater than the number of groups selected.
ERROR: 70XXXXX	Entering a character other than an arithmetic operator (+, -, *, /).
ERROR: 77XXXXX	Reading in a group of channels larger than the current number of channels in the marker area.
ERROR: 82XXXXX	Check sum $\neq$ 0 upon completion of read-in.

NOTE

The least significant digits indicated by X's in Table 5-1 for the ERROR message may change depending upon which illegal operation was performed. However, the two most significant digits will be the same for the same type of error.

SECTION VI
COMMAND SUMMARY

6-1. HARDWARE ENTRY COMMANDS

6-2. The following summarizes the hardware entry commands described in Section IV.

1. TOTAL PUSHBUTTON - Totalizes the counts stored in the channels between the markers and prints the current group, the marker channels, the total and the net total (total minus background) at the teletype.

2. PRINT PUSHBUTTON - Prints the current group, the marker channels and the content of each channel between the markers at the teletype with channel identification every eighth channel.

6-3. SOFTWARE ENTRY COMMANDS

6-4. The following summarizes the software entry commands described in Section IV.

1. STORE COMMAND - Permits specifying the marker defined channels of any group for storing the result of an arithmetic expression of up to three terms. The three terms can be any three group, any three literal numbers, or any combination thereof.

2. WRITE COMMAND - Prints the current group and the marker channels at the teletype, and then punches the content of each channel between the markers of the current group in binary format at either the low speed (teletype) or high speed paper tape punch.

3. READ COMMAND - Prints the current group and the marker channels at the teletype, and then reads the data from the binary format paper tape at either the low speed (teletype) or high speed paper tape reader and adds it to the data contained in the channels between the markers of the current group.

SECTION VII
FLOW CHARTS

7-1. Figures 7-1 through 7-8 depict the flow of the individual subroutines.

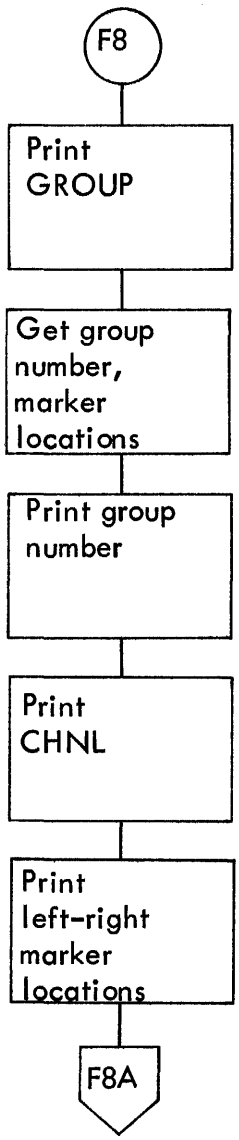

Figure 7-1. TOTAL Pushbutton Subroutine (Sheet 1 of 2)

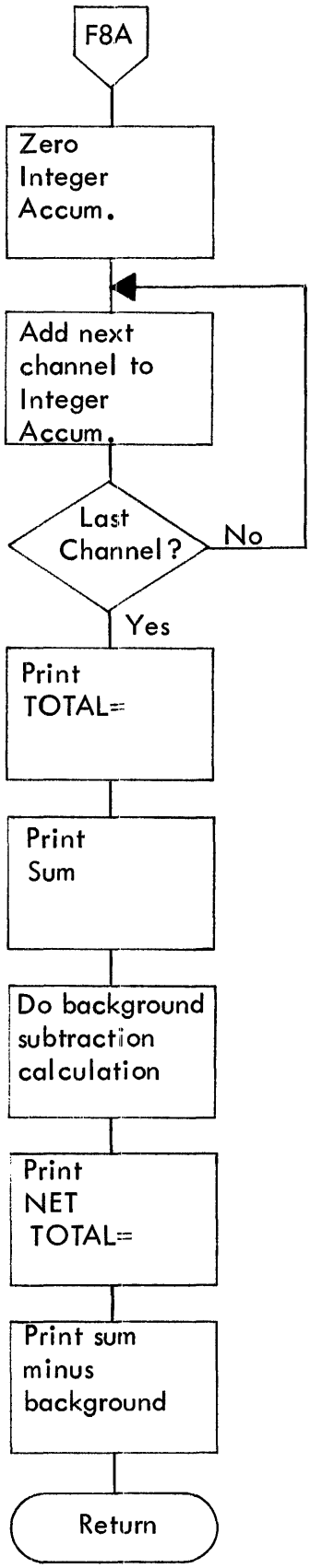

Figure 7-1. TOTAL Pushbutton Subroutine (Sheet 2 of 2)

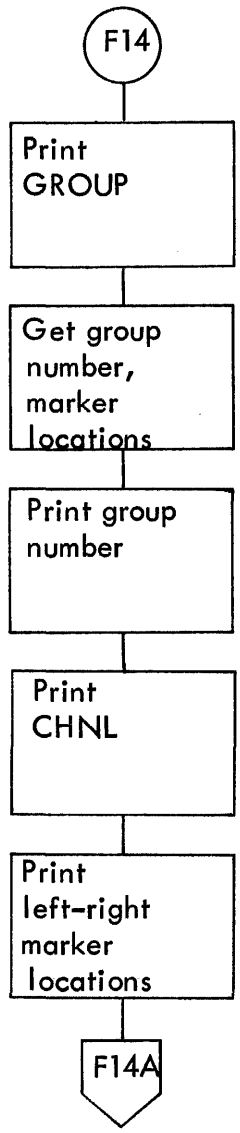

Figure 7-2. PRINT Pushbutton Subroutine (Sheet 1 of 2)

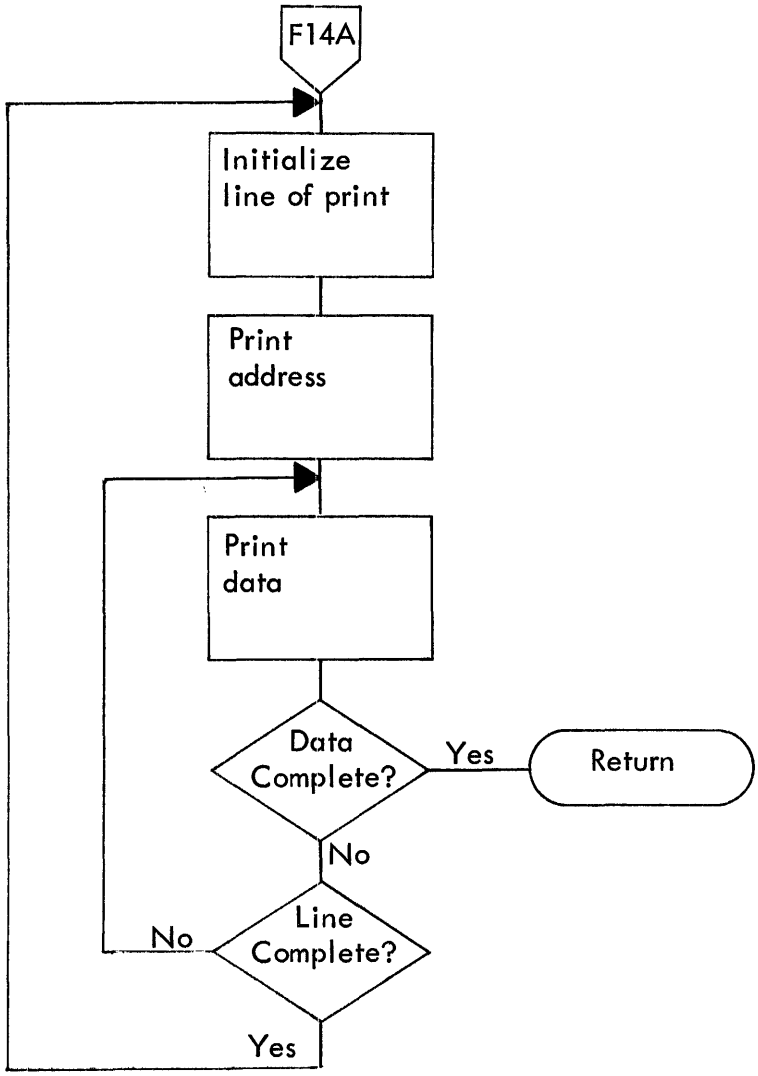

Figure 7-2. PRINT Pushbutton Subroutine (Sheet 2 of 2)

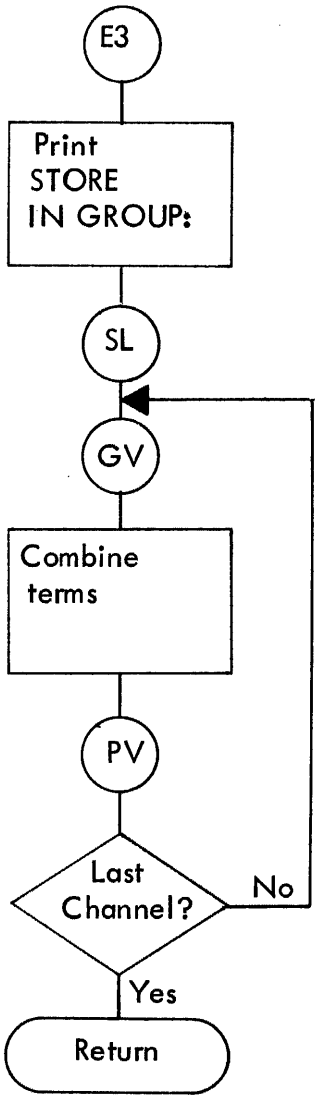

Figure 7-3. Store Subroutine

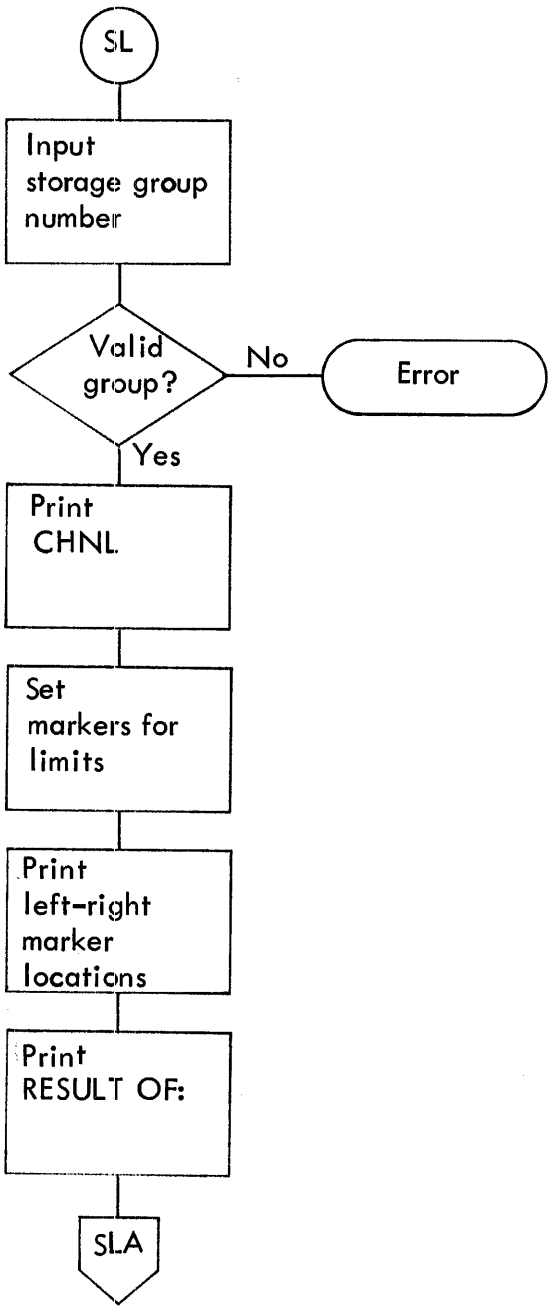

Figure 7-4, Select Limits Subroutine (Sheet 1 of 3)

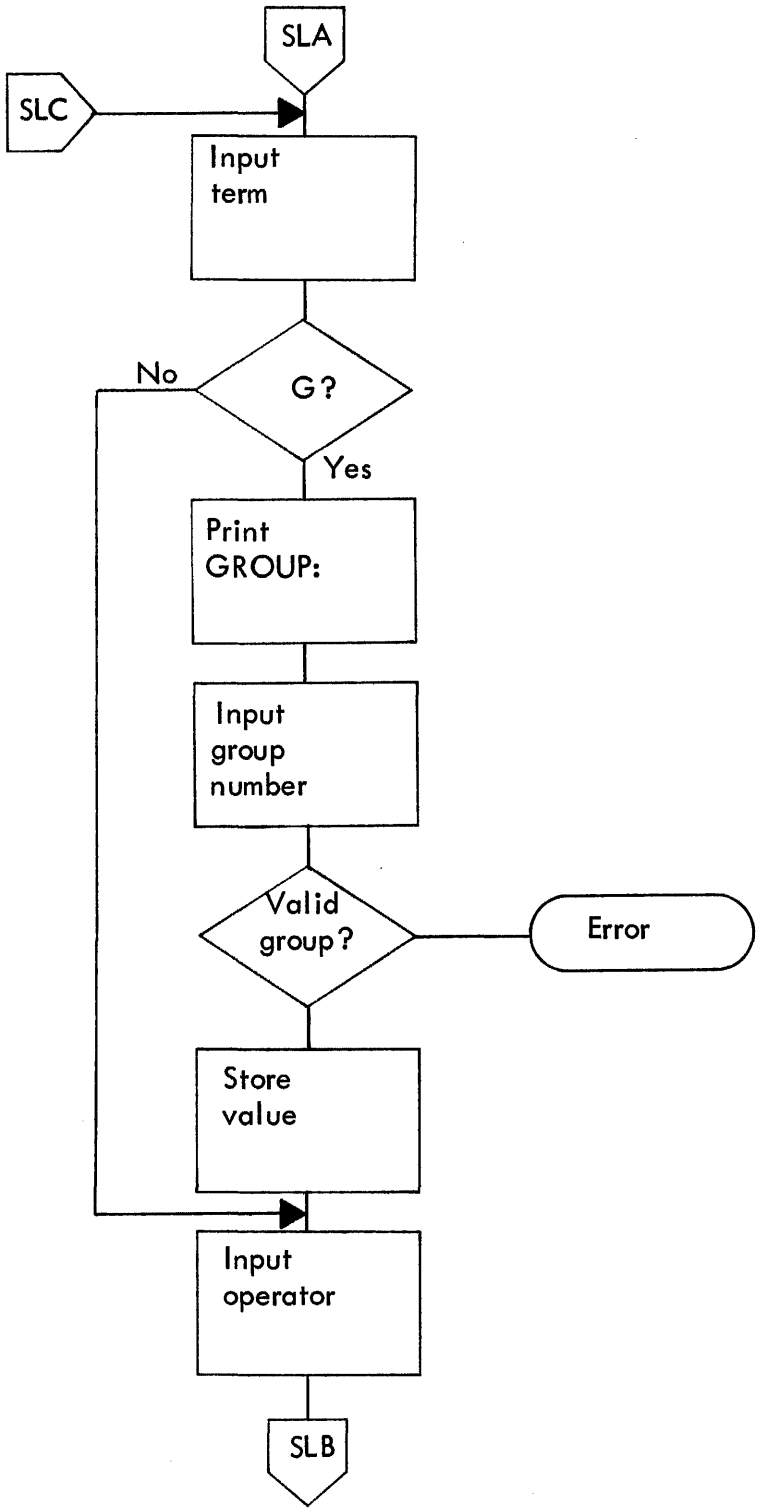

Figure 7-4. Select Limits Subroutine (Sheet 2 of 3)

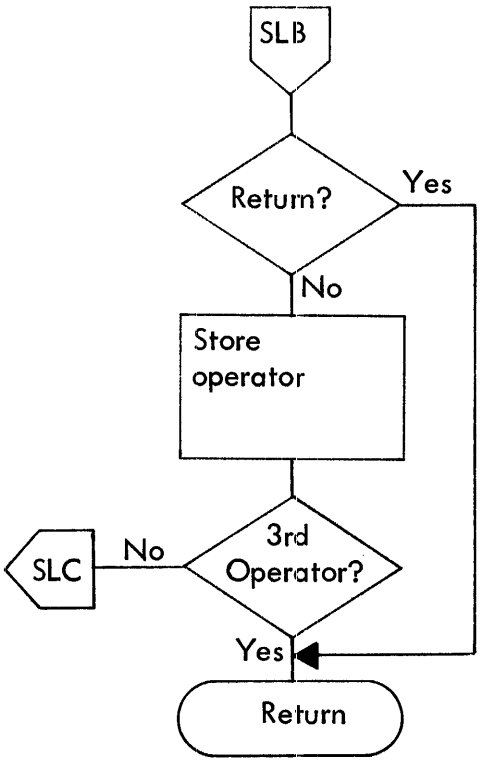

Figure 7-4. Select Limits Subroutine (Sheet 3 of 3)

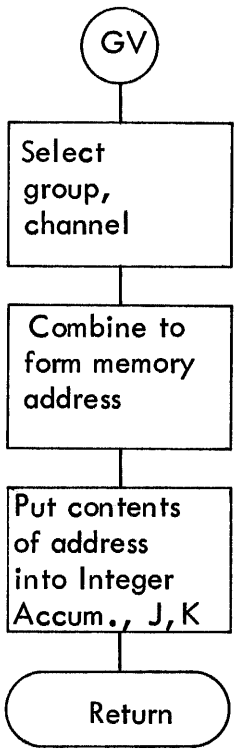

Figure 7-5. Get Value Subroutine

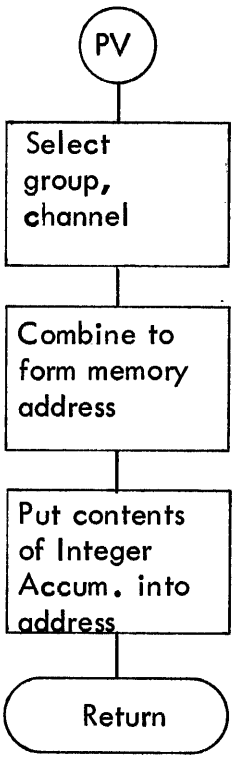

Figure 7-6. Put Value Subroutine

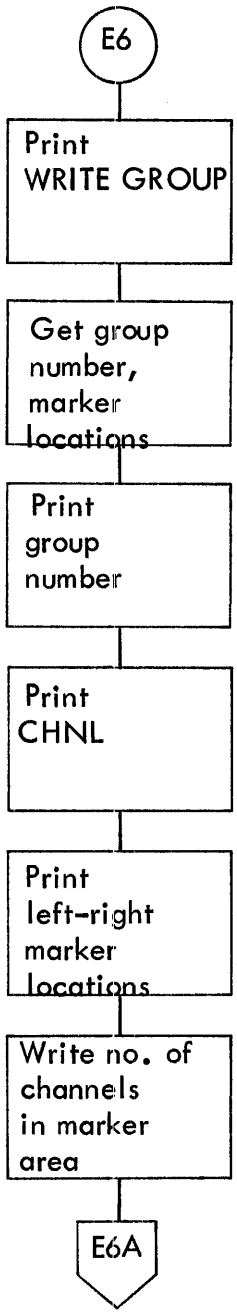

Figure 7-7. Write Subroutine (Sheet 1 of 2)

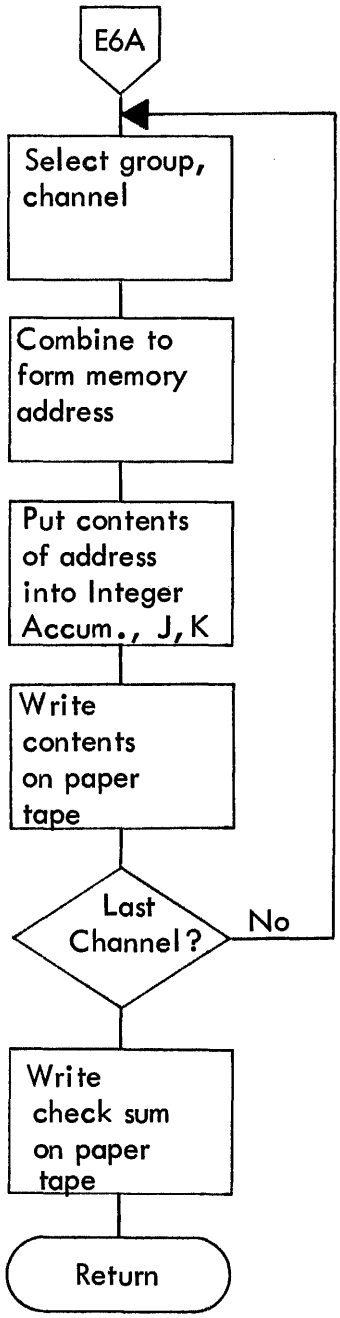

Figure 7-7. Write Subroutine (Sheet 2 of 2)

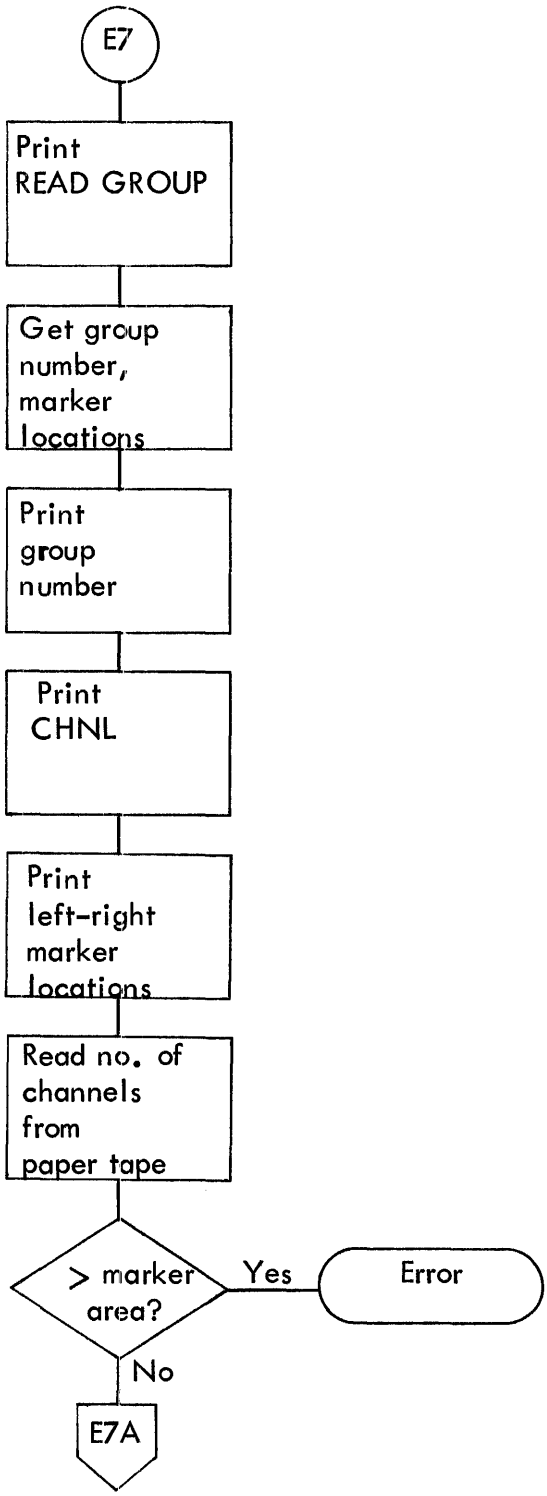

Figure 7-8. Read Subroutine (Sheet 1 of 2)

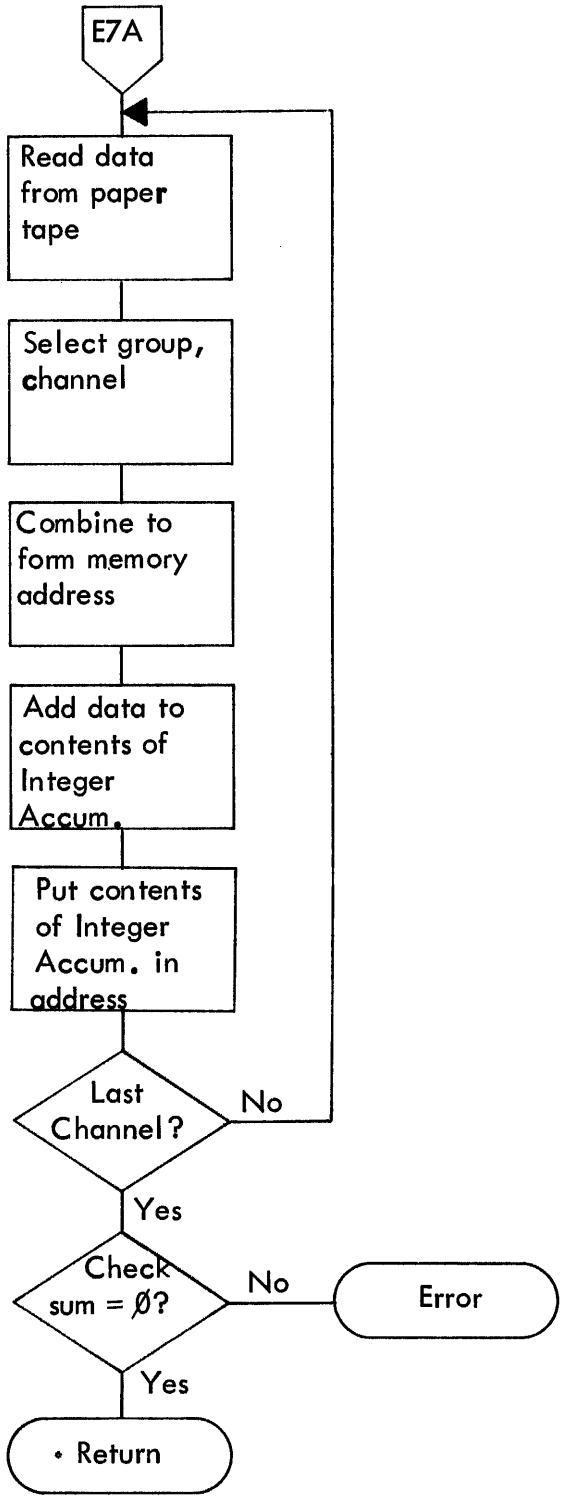

Figure 7-8. Read Subroutine (Sheet 2 of 2)

SECTION VIII
PROGRAM LISTING

8-1. A listing of the ND4410 Low/High Speed I/O Overlay Program (41-1062) as produced by Pass 3 of the ND812 BASC-12 General Assembler Program (41-0001) is provided on the following pages.

```
/ND41-1062-00            2775-3777        S.A. * N.A.
/EXTENDED PUSHBUTTON H/L SPEED READ/PUNCH I/O FOR 4410 PHYSICS
/VERSION A

/ 42    4/11/72
/ MG

            *41


0041  4541  RED,    4541            /(R)EAD
0042  4475           4475


0043  0047  GG,     0047            /G
0044  7575           7575



0045  0077  NET,    0077            /NET TOTAL *
0046  5645           5645
0047  6400           6400
0050  6457  TOT,    6457            /TOTAL *
0051  6441           6441
0052  5400           5400
0053  3575           3575


0054  6457  STR,    6457            /(S)TORE IN G
0055  6245           6245
0056  0051           0051
0057  5675           5675



0060  0043  CHNL,   0043            /CHNL (CHANNEL)
0061  5056           5056
0062  5475           5475

0063  6251  RITE,   6251            /(W)RITE
0064  6445           6445
0065  0075           0075

0066  6245  RES,    6245            /RESULT OF
0067  6365           6365
0070  5464           5464
0071  0057           0057
0072  4675           4675
```

```
                *MOREF                          /MORE LOW INTERRUPT FLAG CHECK
0075  0362              RETRN

                *HREAD                          /HIGH SPEED REA INITIAL RETURN
0153  0362              RETRN

                *INITO                          /PROVISION FOR OVERLAY INITIALIZATION
0166  0212              NOOLAY

                *INICOM                         /NORMAL RETURN REGISTER RESTORE
0170  0362              RETRN

                *HIPUN                          /HIGH SPEED PUNCH INITIAL RETURN
0175  0362              RETRN

                *MOREH                          /MORE HIGH LEVEL INTERRUPTS
0321  1400              IDLE
0322  1400              IDLE

                *LOFLO                          /LISTMODE OVERFLOW ACQUIRE OFF
0410  2025              AQOFF

                *ITMOUT                         /ADC TIME OUT
0411  0336              NOCTB

                *OLYEXT                         /PROVISION FOR OVERLAY SERVICE
2074  2062              AQEXIT+1

                *LDF+4                          /PROVISION FOR OVERLAY STATUS
2256  0000              0000

                *TAB1+2
2306  0122              0122      /READ
2307  0127              0127      /WRITE
2310  0000              0000      /SPARE
2311  0123              0123      /STORE
2312  0000              0000      /SPARE
2313  0000              0000      /SPARE
2314  0000              0000      /SPARE
2315  0000              0000      /SPARE
2316  0000              0000      /SPARE
2317  0000              0000      /SPARE
2320  0000              0000      /SPARE

                *CHARX+3
2323  3701              READ
2324  3727              WRITE
2325  2120              UNUSED
```

```
2326  3030          STORE
2327  2120          UNUSED
2330  2120          UNUSED
2331  2120          UNUSED
2332  2120          UNUSED
2333  2120          UNUSED
2334  2120          UNUSED
2335  2120          UNUSED          /CAN NOT BE CHANGED


            *TABLE+7
2345  2775          TOT0    /TOTALIZE       SPARE 1

            *TABLE+15
2353  3037          PNT0    /PRINT          SPARE 2
2354  2120          UNUSED  /WAS ID0
2355  2120          UNUSED

/E1295
```

```
                *TTYP+1

2775   0000   TOT0,    0                /TOTALIZE BETWEEN MARKERS
2776   2203            ADDL 3
2777   6440            JPS  PNT0
3000   0640   X101,    TWJPS
3001   2403            UNPACK
3002   0050            TOT              /PRINTS TOTAL =
3003   7045            XCT  X103        /JPS IM
3004   3400            IOUT             /PUT TOTAL IN TTY BUFFER
3005  >5474            ISTR CCHAN       /SAVE TOTAL  FOR BKG SUBTR
3006   5271            ILOD@ CEINST     /LOAD C(M2) VALUE
3007   4671            IADD@ C1I        / DO BKG CALCULATION
3010  >6674            IDIV@ TWOI
3011   7034            IMUL NCHAN       /BKG= 1/2(C1 + C2)N
3012   4467            IADD CCHAN       /SUBT FROM TOTAL
3013   0000            IEXT
3014   7114            XCT  X101        /JPS UNPACK
3015   0003            TTY
3016   7116            XCT  X101        /JPS UNPACK
3017   0045            NET              /PRINT NET TOTAL =
3020   0340            TWISZ            /FORCE INEC TO ECHO
3021   2106            ECHOF
3022   0640            TWJPS
3023   2140            INEC
3024   2505            LORD             /PRINT NET VALUE
3025   7125            XCT  X101        /JPS UNPACK
3026   0035            PCRLF            /PRINTS CR-LF
3027   6332            JMP@ TOT0

3030   0000   STORE,   0                /DATA MANIPULATION
3031   7131   X107,    XCT  X101        /JPS UNPACK
3032   0054            STR              /PRINT "(S)TORE IN G"
3033   5460            STJ  SFLAG       /SET DATA MANIPULATION
3034   2204            ADDL  4
3035   7004            XCT  X119        /JPS ALLF
3036   6306            JMP@ STORE

3037   0000   PNT0,    0                /PRINT BETWEEN MARKERS
3040   3453            ISZ  SFLAG
3041   6462   X119,    JPS  ALLF
3042   7111            XCT  X107        /JPS UNPACK
3043   0035            PCRLF            /PRINTS CR-LF
3044   6305            JMP@ PNT0

3045   0000   NCHAN,   0                /NO. CHNLS BETWEEN L,R MARKERS
3046   0000            0

3047   0000   GCOMP,   0                /COMPUTE PUT V OR GET V INST
3050   0640   X103,    TWJPS
```

```
3051   2441            IM
3052   5242            ILOD@ MGCR1             /COMPUTE N CHANNELS
3053   4036            ISUB BCHAN
3054   4627            IADD@ ONEI
3055   6000            INEG
3056   5511            ISTR NCHAN      /SAVE NO. CHNLS BETWEEN MARKERS
3057   5422            ISTR CCHAN      /CCHAN= -NO. CHNLS BETWEEN MARKERS
3060   5027            ILOD GSTRT      /SET UP GETV OR PUTV. INST
3061   4430            IADD BCHAN      /ADD BEGINNING CHNL
3062   4221            ISUB@ ONEI
3063   7221            IMUL@ TWOI
3064   4421            IADD INST       /SET UP ADDRESS IN INST
3065   0000            IEXT
3066   0554            TWSTK F0
3067   3442  IPNTR,   PUTV+1
3070   3501            ISZ  IPNTR
3071   5702            STJ@ IPNTR
3072   3503            ISZ  IPNTR
3073   5007            LDJ  CCHAN+1
3074   1516            SIN  CLR J      /END CHAN LESS THAN START CHAN?
3075  >6677            JPS@ ERRXI      /YES, ERROR
3076   6327            JMP@ GCOMP

3077   3472  CEINST,   EINST           /POINTER TO DATA FOR BKG SUBT.
3100   3402  C1I,      C1              /POINTER TO LEFT MARKER VALUE
3101   1000  CCHAN,    1000            / -NO. CHNLS BETWEEN MARKERS
3102   0000            0
3103   1541  ONEI,     IN1             /CONSTANT = 1
3104   1642  TWOI,     IN2             /CONSTANT = 2
3105   0000  INST,     0
3106   0554            TWSTK F0
3107   4000  GSTRT,    4000            /GROUP STATING CHNL
3110   0000            0
3111   0001  BCHAN,    1               /BEGINNING CHNL
3112   0000            0
3113   0000  SFLAG,    0               /PUSH BUTTON INDICATOR
3114   1270  MGCR1,    MGCR            /POINTER TO RIGHT MARKER CHNL
3115   3757  BTAB,     TABL1           /POINTER TO SUBROUTINE ADDR TABLE
3116   0544  STTW,     TWSTJ F0
3117   0514  LDTW,     TWLDK F0
3120   3441  PUTVP,    PUTV            /POINTER TO PUT VALUE ROUTINE
3121   3766  GETVP,    GETV            /POINTER TO GET VALUE ROUTINE
3122   3275  CHNGTP,   CHNGET          /POINTER TO GROUPS AND CHNL ROUTINE


/E1931
```

```
3123  0000  ALLF,   0
3124  4507          ADJ  BTAB        /BUILD ACTIVITY POINTER
3125  5420          STJ  POINT1
3126  5110          LDJ  STTW
3127  5521          STJ  INST+1
3130  5110          LDJ  PUTVP
3131  5542          STJ  IPNTR
3132  6710          JPS@ CHNGTP      /SET UP PUTV STRING
3133  5112          LDJ  GETVP
3134  5545          STJ  IPNTR
3135  5116          LDJ  LDTW
3136  5530          STJ  INST+1
3137  6446          JPS  DTASET      /SET UP GETV STRING
3140  0640          TWJPS            /GO DO INITIAL ACTIVITY
3141  3522          PRA
3142  0640  ALOOP,  TWJPS            /GO EXECUTE GETV STRING
3143  3454          STERM
3144  0620          TWJMP@           /GO DO OPERATE ACTIVITY
3145  3115  POINT1, BTAB
3146  3535          ISZ  BCHAN       /UPDATE CURRENT CHANNEL NUMBER
3147  6002          SKIP
3150  3536          ISZ  BCHAN+1
3151  3550          ISZ  CCHAN       /UPDATE CHANNEL COUNT
3152  6110          JMP  ALOOP
3153  3551          ISZ  CCHAN+1     /FINISHED?
3154  6112          JMP  ALOOP
3155  6332          JMP@ ALLF        /YES, CALLER DOES FINAL ACTIVITY

3156  2211  OPER1,  ADDL 11          /MULTIPLY= 71
3157  2214  OPER2,  ADDL 14          /DIVIDE  = 65
3160  2206  OPER3,  ADDL 6           /ADD     = 45
3161  2314  OPER4,  SUBL 14          /SUBTRACT= 41
3162  1501  OPER6,  SNZ  J           /EXIT?
3163  5020  OPER5,  LDJ  C4000       /YES, EXIT = 4000
3164  0560  X114,   TWSTJ@          /STORE IN GETV STRING
3165  3067  IPNTRP, IPNTR
3166  3701  X115,   ISZ@ IPNTRP
3167  1516          SIN  CLR J       /EXIT?
3170  6032          JMP  DLOOP
3171  7024          XCT  X104        /JPS UNPACK
3172  3764          CRLF
3173  6212          JMP@  DTASET     /YES, RETURN TO ALLF

3174  2120  ERRXI,  UNUSED          /POINTER TO ERROR MESAGE ROUTINE
3175  0015  C15,    15              /RETURN
3176  0051  C51,    51              /CONSTANT FOR SETTING UP ILOD INST
3177  0052  C52,    52              /*
3200  0053  C53,    53              /+
3201  0055  C55,    55              /-
3202  0057  C57,    57              //
```

```
3203  4000  C4000,  4000
3204  0000  CNTR3,  0                  /OPERATION COUNTER(3=MAX)

3205  0000  DTASET, 0
3206  1510          CLR  J
3207 <2574  X113,   SMJ  SFLAG        /PUSHBUTTON?
3210  6003          JMP  .+3
3211  6446          JPS  STEND        /YES, CALC. GETV STRING FOR PUSH BUTTO
3212  6305          JMP@ DTASET
3213  2203          ADDL 3            /SET UP OPERATION COUNTER
3214  5510          STJ  CNTR3
3215  0640  X104,   TWJPS
3216  2403          UNPACK            /PRINT "RESULT OF"
3217  0066          RES
3220  5122          LDJ  C51          /SET ILOD IN GETV STRING
3221  6137          JMP  OPER6
3222  5335  DLOOP,  LDJ@ IPNTRP       /NOW SET UP DATA FETCH
3223  5402          STJ  IPNTR1
3224 >7075          XCT  X139         /TWJPS INEC
3225  3067  IPNTR1, IPNTR            /INPUT AND ECHO LITERAL OR GROUP NO.
3226  0500  X109,   TWLDJ            /PICKUP INPUT CHARACTER
3227  2320          CHARX
3230  2442          SMJ  C107         /G?
3231  6035          JMP  GRPSET       /YES, GO COMPUTE ADDRESS
3232  3105          DSZ  IPNTR1       /NO, SET IM INST FOR LITERAL MODE
3233  5306          LDJ@ IPNTR1
3234  4531          ADJ  C4000
3235  5710          STJ@ IPNTR1
3236  3751          ISZ@ IPNTRP
3237  3752          ISZ@ IPNTRP
3240  7112  OPER,   XCT  X109
3241  2430          SMJ  C40          /TEST FOR SPACE
3242  6632          JPS@ FCHARP               /GO FETCH OPER. OR RETN. CHAR
3243  3137          DSZ  CNTR3
3244  2547          SMJ  C15                  /RETURN
3245  6162          JMP  OPER5
3246  2546          SMJ  C53          /+?
3247  6167          JMP  OPER3        /YES
3250  2547          SMJ  C55          /NO= -?
3251  6170          JMP  OPER4        /YES
3252  2553          SMJ  C52          /NO= *?
3253 <6175          JMP  OPER1        /YES
3254  2552          SMJ  C57          /NO= /?
3255 <6176          JMP  OPER2        /YES
3256  6762  X102,   JPS@ ERRXI        /NO , NO LEGAL OPERATOR

3257  0000  STEND,  0                  /CALC GET V STRING FOR PUSH BUTTON
3260  1510          CLR  J
3261 <7175          XCT  X114         /STJ IPNTR
3262 <7174          XCT  X115         /ISZ IPNTR
```

```
3263  0640  X116,   TWJPS
3264  3047          GCOMP              /GO COMP PUTV OR GETV INST
3265  6306          JMP@ STEND

3266  6463  GRPSET, JPS  GRPGET       /FETCH NEW GROUP START CHAN.
3267  7104          XCT  X116          /GO BUILD GETV FETCH INST.
3270  6130          JMP  OPER

3271  0040  C40,    40                 /SPACE
3272  0107  C107,   107                /G
3273  0115  C115,   115                /M ***REMOVE VERSION B***
3274  0245  FCHARP, FCHAR              /POINTER TO FETCH CHAR ROUTINE

3275  0000  CHNGET, 0                  /DETERMINE GROUPS AND CHNL VALUES
3276  1510          CLR  J
3277  7170  X105,   XCT  X113         /SMJ SFLAG, /PUSHBUTTONS?
3300  6006          JMP  GPRIN
3301  7032          XCT  X112          /JPS IM, YES, PRESET DISPLAY GROUP
3302  5242          ILOD@ GROPS1
3303  5652          ISTR@ GSTRTI
3304  0000          IEXT
3305  7012          XCT  X122          /SET INEC TO ECHO
3306  7171  GPRIN,  XCT  X104         /JPS UNPACK
3307  0043          GG                 /PRINT "G"
3310  6441          JPS  GRPGET        /GO COMPUTE GROUP START CHAN.
3311  7103  X110,   XCT  GPRIN        /JPS UNPACK
3312  0060          CHNL               /"CHNL" IS PRINTED
3313  7020          XCT  X112          /BCHAN= L MARKER, MGCRG= R MARKER
3314  5234          ILOD@ MGCLG        /LEFT MARKER CHNL
3315  5605          ISTR@ BCHANP
3316  0000          IEXT
3317  0340  X122,   TWISZ              /FORCE INEC TO ECHO
3320  2106          ECHOF
3321  7005  X139,   XCT  X111         /TWJPS INEC
3322  3111  BCHANP, BCHAN
3323  7104  X137,   XCT  X122         /TWISZ ECHOF
3324  7113  CHANS,  XCT  X110         /NO= JPS UNPACK
3325  3765          TO                 /"TO"
3326  0640  X111,   TWJPS
3327  2140          INEC
3330  1270  ECHANP, MGCR              /RIGHT MARKER CHNL PRINTED
3331  7120          XCT  X110          /JPS UNPACK
3332  3764          CRLF               /PERFORMS CR-LF
3333  0640  X112,   TWJPS
3334  2441          IM
3335  5210          ILOD@ GRPWI
3336  4306          ISUB@ ECHANP       /CHECK IN END CHNL TOO LARGE
3337  0000          IEXT
3340  1602          SIP  K
3341  7163  X120,   XCT  X102         /JPS ERROR END CHANNEL TOO LARGE
```

```
3342  6563          JPS  STEND      /DO LAST ELEMENT IN STRING
3343  6346          JMP@ CHNGET

3344  1660  GROPS1, GROUPS          /POINTER TO CURRENT GROUP
3345  1664  GRPWI,  GROUPW          /POINTER TO GRP WIDTH-NOT GRP1
3346  1644  IN2K,   IN2000         /CONSTANT = 2000
3347  1666  GRP1WI, GROP1W         /POINTER TO GROUP1 WIDTH VALUE
3350  1266  MGCLG,  MGCL           /POINTER TO LEFT MARKER CHNL

3351  0000  GRPGET, 0              /COMPUTE NEW GROUP START CHAN.
3352  7141  X138,   XCT  X110      /TWJPS UNPACK
3353  0022          GPW            /PRINT "(G)ROUP"
3354  7126  X121,   XCT  X111      /JPS INEC
3355  3107  GSTRTI, GSTRT
3356  5301          LDJ@ GSTRTI
3357  1503          SIP  SNZ J     /GREATER THAN 0?
3360  7117          XCT  X120      /NO, ERROR-JPS ERROR ROUTINE
3361  0400          TWSBJ
3362  1662          GROUPN
3363  1507          SIN  SIZ J     /DOES GROUP EXIST?
3364  6104          JMP  .-4       /NO, ERROR
3365  5116          LDJ  GRP1WI    /FETCH GROUP 1 WIDTH POINTER
3366  3311          DSZ@ GSTRTI    /IS IT GROUP 1?
3367  2202          ADDL 2         /NO, CHANGE TO NORMAL WIDTH
3370  5523          STJ  GRPWI
3371  7136  X130,   XCT  X112      /JPS IM, NOW COMP. START CHAN.
3372  5325          ILOD@ GRPWI    /LOAD GROUP WIDTH
3373  7316          IMUL@ GSTRTI   /MULT BY GROUP NO. INPUT
3374  4327          ISUB@ GRPWI    /SUBT GROUP WIDTH
3375  4726          IADD@ GRP1WI
3376  4730          IADD@ IN2K
3377  5722          ISTR@ GSTRTI
3400  0000          IEXT
3401  6330          JMP@ GRPGET
/E4089
```

```
3402  0000  C1,      0                 /COUNTS AT LEFT MARKER
3403  0000            0
3404  3765  GETVI,   GETV-1            /POINTER TO GET VALUE STACK-1

3405  3046  PRB,     DSZ  SGRP         /"SGRP" USED FOR TEMPORARY COUNTER
3406  6013           JMP  PRB1
3407  7116  X118,    XCT  X130         /OUTPUT CHANNEL ID JPS IM
3410  5366           ILOD@ BCHANP
3411  3400           IOUT              /PUT CHNL NO. IN TTY BUFFER
3412  0000           IEXT
3413  7141  X117,    XCT  X138         /TWJPS UNPACK
3414  3764           CRLF              /PERFORM CR-LF
3415  7102           XCT  X117         /JPS UNPACK
3416  0005           TTY+2             /PRINT CHNL NO.
3417  2210           ADDL 10           /SET UP FOR 8 DATA VALUES PER LINE
3420  5433           STJ  SGRP         /"SGRP" USED FOR TEMPORARY COUNTER
3421 <7176  PRB1,    XCT  X137         /ISZ ECHOF,FORCE ECHO FROM INEC
3422  7146           XCT  X121         /JPS INEC
3423  3472  EINSTP,  EINST             /PRINT DATA(7 DIGITS MAX.)
3424  0600  X106,    TWJMP
3425  3146           ALOOP+4

3426  7117  TOB,     XCT  X118         /JPS IM
3427  4443           IADD EINST        /TOTALIZE-ADD NEXT CHNL
3430  0000           IEXT
3431  3022           DSZ  SGRP         /SKIPS FIRST TIME ONLY
3432  3421           ISZ  SGRP
3433  6002           JMP  .+2
3434  7110           XCT  X106         /JMP ALOOP+4
3435  5533           STJ  C1           /SAVE COUNTS AT LEFT MARKER
3436  0550           TWSTK
3437  3403           C1+1
3440  7114  X131,    XCT  X106         /JMP ALOOP+4

3441  0000  PUTV,    0                 /STORE STRING FOR STERM
3442  0544  PINST1,  TWSTJ F0          /STORE LEAST
3443  4000           4000
3444  3501           ISZ  .-1
3445  1374           ROTD JK 14
3446  7104           XCT  PINST1       /STORE MOST
3447  3504           ISZ  PINST1+1
3450  6307           JMP@ PUTV
3451  3507           ISZ  PINST1       /FIELD CHANGE
3452  6311           JMP@ PUTV



3453  0000  SGRP,    0                 /TEMPORARY COUNTER

3454  0000  STERM,   0                 /EXECUTE GETV STRING
```

```
3455  5151           LDJ  GETVI
3456  5400           STJ  FIRST
3457  5200  SLOOP,  LDJ@ FIRST       /FETCH IM INST
3460  5437           STJ  ININST
3461  5200           LDJ@ FIRST       /FETCH LOAD OR STORE INST
3462  5410           STJ  EINST
3463  5200           LDJ@ FIRST
3464  5407           STJ  EINST+1
3465  5000           LDJ  FIRST
3466  5447           STJ  REWT
3467  5030           LDJ  ININST
3470  1512           SIP  CLR J       /LITERAL?
3471  6017           JMP  DOLIT       /YES, BYPASS DATA FETCH
3472  0514  EINST,   TWLDK F0         /MAY BE DATA
3473  4000           4000
3474  3501           ISZ  .-1
3475  5102           LDJ  .-2
3476  1504           INC  J
3477  5636           STJ@ REWT        /UPDATE FOR NEXT TIME
3500  3035           DSZ  REWT
3501  1511           SNZ CLR J
3502  3633           ISZ@ REWT
3503  1374           ROTD JK 14       /MOVE DATA IF ANY TO J
3504  7112           XCT  EINST
3505  0550           TWSTK
3506  3473           EINST+1
3507  5515           STJ  EINST
3510  5007  DOLIT,   LDJ  ININST     /FETCH IM INST
3511  1146           SFTZ J 6
3512  1501           SNZ  J           /FINISHED?
3513  6337           JMP@ STERM       /YES, RETURN
3514  2225           ADDL ININST-EINST       /SET ADDRESS TO EINST
3515  5402           STJ  ININST      /NO, DO COMPUTATION
3516  7170  X126,    XCT  TOB         /JPS IM
3517  7400  ININST,  INOP
3520  0000           IEXT
3521  6142           JMP  SLOOP


3522  0000  PRA,     0                /INITIAL ACTIVITY ROUTINE
3523  1514           CLR  INC J
3524  5551           STJ  SGRP        /"SGRP" USED FOR TEMPORARY COUNTER
3525  1510           CLR  J
3526  5650           STJ@ LORDK       /CLEAR INT ACC
3527  5645           STJ@ HORDK
3530  6306           JMP@ PRA

3531  7113  STB,     XCT  X126        /YES, GO STORE DATA
3532  0000           IEXT
3533  6572           JPS  PUTV
```

```
3534 <7174  X108,   XCT  X131        /JMP ALOOP+4

3535  0000  REWT,   0

3536  2563  REA,    SMJ  SGRP        /FIRST TIME?
3537  6014         JMP  DRDF        /NO, GO READ DATA
3540  5447         STJ  SUM         /CLAER SUM AREA
3541  6423         JPS  DRD         /READ NO. CHNLS
3542  7124  X204,  XCT  X126        /JPS IM
3543  4242         ISUB@ CHANP
3544  0000         IEXT
3545  1602         SIP  K           /NO,CHNLS TOO LARGE
3546  6664         JPS@ ERR         /YES, PRINT ERROR MESSAGE
3547  7105         XCT  X204        /JPS IM
3550  4635         IADD@ CHANP      /SET UP CHNL COUNTER
3551  5634         ISTR@ CHANP
3552  0000         IEXT
3553  6411  DRDF,  JPS  DRD         /GO READ DATA
3554  1120         AJK J
3555  4432         ADJ  SUM         /UPDATE CHECK SUM
3556  5431         STJ  SUM
3557  7115         XCT  X204        /JPS IM
3560  7400         INOP             /CAN MAKE INEG (6000) TO SUBT FROM GRP
3561  4567         IADD EINST       /ALWAYS ADDS TO CURRENT GROUP
3562  0000         IEXT
3563  6130         JMP  STB+2       /GO STORE DATA BETWEEN MARKS

3564  0000  DRD,    0                /READ 24 BITS
3565  6446         JPS  RCHAR
3566  6403         JPS  RD
3567  6402         JPS  RD
3570  6304         JMP@ DRD

3571  0000  RD,     0                /READ ROUTINE
3572  1350         SFTZ JK 10
3573  0550  X206,  TWSTK            /SAVE ROTATED VALUE
3574  2506  HORDK, HORD
3575  0540         TWSTJ
3576  2505  LORDK, LORD
3577  6434         JPS RCHAR        /READ 8 BIT DATA
3600  0510  X205,  TWLDK            /STORE IN HORD, LORD
3601  2506         HORD
3602  4704         ADJ@ LORDK
3603  5705         STJ@ LORDK
3604  6313         JMP@ RD



3605  3101  CHANP,  CCHAN           /POINTER TO NO. CHNL BETWEEN MARKERS
```

```
3606  0200  P200,   0200              /BLANKS COUNTER
3607  0000  SUM,    0                 /CHECK SUM STORAGE AREA



3610  2670  WRA,    SMJ@ SGRPP        /FIRST TIME?
3611  6011          JMP  WNORM        /NO
3612  5503          STJ  SUM
3613  5064          LDJ  RETRNP       /DISABLE KEYBD INTERRUPT
3614  5633          STJ@ LR
3615  6433          JPS  BLANKS
3616  7154  X203,   XCT  X204        /JPS IM
3617  5312          ILOD@ CHANP       /PUT OUT NO. CHNLS
3620  0000          IEXT
3621  6450          JPS  WRT
3622  7104  WNORM,  XCT  X203        /JPS IM
3623  5253          ILOD@ EINP1
3624  0000          IEXT              /PICK UP DATA
3625  1120          AJK  J            /UPDATE CHECK SUM
3626  4517          ADJ  SUM
3627  5520          STJ  SUM
3630  6441          JPS WRT           /GO WRITE DATA
3631 <7175          XCT  X108         /JMP ALOOP+4

3632  2120  ERR,    UNUSED            /POINTER TO ERROR ROUTINE

3633  0000  RCHAR,  0                 /READ CHAR ROUTINE
3634  7401          TIF               /ADVANCE TTY READER
3635  0640          TWJPS
3636  0000  RINST,  0                 /HS, TTY READ A CHAR
3637  1501          SNZ  J            /ZERO?
3640  2640          SMJ@ SGRPP        /YES-FIRST TIME?
3641  6002          JMP  .+2          /NO, READ CHAR.
3642  6106          JMP  RCHAR+1      /J = 0 AND SGRP =1
3643  1610          CLR  K
3644  0550          TWSTK
3645  3453          SGRP              /CLEAR SGRP
3646  6313          JMP@ RCHAR

3647  0264  LR,     LOREAD            /POINTER TO TTY RETURN

3650  0000  BLANKS, 0
3651  5143          LDJ  P200         /PUT OUT 200 BLANKS
3652  5626          STJ@ SGRPP
3653  1510          CLR  J
3654  6613          JPS@ WINST        /GO WRITE BLANK
3655  3223          DSZ@  SGRPP       /200?
3656  6102          JMP  .-2          /NO, WRITE MORE
3657  6307          JMP@ BLANKS       /YES, RETURN
```

```
3660  0000  WCHAR,  0                 /WRITE DATA
3661  7161          XCT  X205         /TWLDK HORD
3662  5364          LDJ@ LORDK        /PUT DATA IN J,K
3663  1370          ROTD JK 10
3664  7171          XCT  X206         /TWSTK HORD
3665  5767          STJ@ LORDK        /SAVE ROTATED DATA
3666  0640          TWJPS
3667  0000  WINST,  0                 /GO WRITE EIGHT BITS OF DATA
3670  6310          JMP@ WCHAR


3671  0000  WRT,    0                 /WRITE DATA
3672  6512          JPS  WCHAR
3673  6513          JPS  WCHAR
3674  6514          JPS  WCHAR
3675  6304          JMP@ WRT

3676  3472  EINP1,  EINST             /POINTER TO DATA
3677  0362  RETRNP, RETRN             /ADDRESS FOR NORMAL RETURN
3700  3453  SGRPP,  SGRP
/E4015
```

```
3701  0000  READ,   0              /READ FROM PAPER TAPE
3702  1010          LJSW           /SW REG = 0 IF HS READER
3703  1505          SIZ  J         /SW REG = NON-0 IF LS(TTY) READER
3704  5135          LDJ  LR
3705  1501          SNZ  J
3706  5044          LDJ  HR
3707  5641          STJ@ RINSTP    /SET UP HS/LS READ COMMAND
3710  0640  X132,   TWJPS          /(R)EAD
3711  2403          UNPACK
3712  0041          RED            /PRINT READ
3713  2201          ADDL 1
3714  5642          STJ@ SFLAGP    /FAKE PUSH BUTTON COMMAND
3715  2201          ADDL 1         /SET UP POINTER TO ACTIVITY TABLE
3716  7024          XCT  X133      /JPS TO ALLF
3717  6564          JPS  RCHAR     /GO READ CHECK SUM
3720  1204          LKFJ
3721  5234          LDJ@ SUMP
3722  2027          ANDF F0377
3723  1121          SJK  J         /SUBT CHECK SUM FROM SUM
3724  1505          SIZ  J         /NON ZERO RESULT?
3725  6773          JPS@ ERR       /YES,CHECK SUM ERROR ON READ
3726  6325          JMP@ READ


3727  0000  WRITE,  0              /WRITE TO PAPER TAPE
3730  1010          LJSW           /SW REG = 0 IF HS PUNCH
3731  1505          SIZ  J         /SW REG = NON-0 IF LS(TTY) PUNCH
3732  5022          LDJ  LW
3733  1501          SNZ  J
3734  5017          LDJ  HW
3735  5546          STJ  WINST     /SET UP HS/LS PUNCH COMMAND
3736  7126          XCT  X132      /JPS UNPACK
3737  0063          RITE
3740  2201          ADDL 1         /SET UP FOR TABL ADDR
3741  5615          STJ@ SFLAGP
3742  0640  X133,   TWJPS          /GO TO ALL FUNCTION ROUTINE
3743  3123          ALLF
3744  5211          LDJ@  SUMP     /PUT OUT CHECK SUM
3745  6756          JPS@ WINST     /GO PUNCH CHECK SUM AND TRAILER
3746 <6576          JPS BLANKS     /GO PUNCH 200 BLANKS
3747  6320          JMP@ WRITE

3750  3636  RINSTP, RINST          /POINTER TO READ INSTRUCTION
3751  0377  F0377,  377
3752  0153  HR,     HREAD          /HIGH SPEED READER RETURN ADDR.
3753  0175  HW,     HIPUN          /HIGH SPEED PUNCH RETURN ADDR.
3754  0242  LW,     LOPRNT         /LOW SPEED READ/PUNCH RETURN
3755  3607  SUMP,   SUM            /POINTER TO CHECK SUM
3756  3113  SFLAGP, SFLAG          /PUSH BUTTON COMMAND INDICATOR
```

/E1186

```
3757  3405  TABL1,  PRB             /PRINT ROUTINE
3760  3610          WRA             /WRITE ROUTINE
3761  3536          REA             /READ ROUTINE
3762  3426          TOB             /TOTALIZE ROUTINE
3763  3531          STB             /STORE ROUTINE


3764  7775  CRLF,   7775            /CR-LF

3765  1575  TO,     1575            / - (DASH)

3766  0000  GETV,   0               /GET STRING FOR STERM
3767  0514          TWLDK F0
3770  4000          4000
3771  0000          0
3772  0000          0
3773  0000          0
3774  0000          0
3775  0000          0
3776  0000          0
3777  0000          0
/E0235
```

```
SE 5354
ALLF    = 3123
ALOOP   = 3142
BCHAN   = 3111
BCHANP  = 3322
BLANKS  = 3650
BTAB    = 3115
C1      = 3402
C107    = 3272
C115    = 3273
C15     = 3175
C1I     = 3100
C40     = 3271
C4000   = 3203
C51     = 3176
C52     = 3177
C53     = 3200
C55     = 3201
C57     = 3202
CCHAN   = 3101
CEINST  = 3077
CHANP   = 3605
CHANS   = 3324
CHNGET  = 3275
CHNGTP  = 3122
CHNL    = 0060
CNTR3   = 3204
CRLF    = 3764
DLOOP   = 3222
DOLIT   = 3510
DRD     = 3564
DRDF    = 3553
DTASET  = 3205
ECHANP  = 3330
EINP1   = 3676
EINST   = 3472
EINSTP  = 3423
ERR     = 3632
ERRXI   = 3174
F0377   = 3751
FCHARP  = 3274
GCOMP   = 3047
GETV    = 3766
GETVI   = 3404
GETVP   = 3121
GG      = 0043
GPRIN   = 3306
GROPS1  = 3344
GRP1WI  = 3347
```

```
GRPGET  = 3351
GRPSET  = 3266
GRPWI   = 3345
GSTRT   = 3107
GSTRTI  = 3355
HORDK   = 3574
HR      = 3752
HW      = 3753
IN2K    = 3346
ININST  = 3517
INST    = 3105
IPNTR   = 3067
IPNTR1  = 3225
IPNTRP  = 3165
LDTW    = 3117
LORDK   = 3576
LR      = 3647
LW      = 3754
MGCLG   = 3350
MGCR1   = 3114
NCHAN   = 3045
NET     = 0045
ONEI    = 3103
OPER    = 3240
OPER1   = 3156
OPER2   = 3157
OPER3   = 3160
OPER4   = 3161
OPER5   = 3163
OPER6   = 3162
P200    = 3606
PINST1  = 3442
PNT0    = 3037
POINT1  = 3145
PRA     = 3522
PRB     = 3405
PRB1    = 3421
PUTV    = 3441
PUTVP   = 3120
RCHAR   = 3633
RD      = 3571
REA     = 3536
READ    = 3701
RED     = 0041
RES     = 0066
RETRNP  = 3677
REWT    = 3535
RINST   = 3636
RINSTP  = 3750
RITE    = 0063
```

```
SFLAG   = 3113
SFLAGP  = 3756
SGRP    = 3453
SGRPP   = 3700
SLOOP   = 3457
STB     = 3531
STEND   = 3257
STERM   = 3454
STORE   = 3030
STR     = 0054
STTW    = 3116
SUM     = 3607
SUMP    = 3755
TABL1   = 3757
TO      = 3765
TOB     = 3426
TOT     = 0050
TOT0    = 2775
TWOI    = 3104
WCHAR   = 3660
WINST   = 3667
WNORM   = 3622
WRA     = 3610
WRITE   = 3727
WRT     = 3671
X101    = 3000
X102    = 3256
X103    = 3050
X104    = 3215
X105    = 3277
X106    = 3424
X107    = 3031
X108    = 3534
X109    = 3226
X110    = 3311
X111    = 3326
X112    = 3333
X113    = 3207
X114    = 3164
X115    = 3166
X116    = 3263
X117    = 3413
X118    = 3407
X119    = 3041
X120    = 3341
X121    = 3354
X122    = 3317
X126    = 3516
X130    = 3371
X131    = 3440
```

```
X132     = 3710
X133     = 3742
X137     = 3323
X138     = 3352
X139     = 3321
X203     = 3616
X204     = 3542
X205     = 3600
X206     = 3573
ER 0000
```