Software Reference Manual ALP

Central Data Corporation

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The ALP

The ALP (Assembler Language Package) is made up of three different programs. The package contains all the programs a user would need to write and debug assembly language programs for 2650 systems. The program starts at address H2000 and ends at approximatelly H4A00. It requires buffer space outside of this area for its editing and assembly functions. The buffer space can be changed by the user to fit their system or programming needs. More about buffer space can be found in the Text Editor chapter.

How to use the ALP

To start using the ALP package load in the program from tape using the supervisor program. Then execute at address H2000. This puts you into the editor program. You can use this program to create tape files of your 2650 source code. Completed source code files are converted to binary (object code) by the assembler program. The assembler is run by typing 'R' as a command in the editor. Commands to the assembler for handling the object code are in the source of the program. Using the 'G' command (Go to the debugger) in the editor, the user enters debug mode. In this mode many options are available for debugging object code. More detailed information on each program is in its chapter.

1. Text Editor

The Central Data text editor allows a user to create and change source code (ASCII) files for use with an assembler, interpreter, or any other application of this type. The user's file (otherwise called the text or the source code) is read into a RAM buffer where the user can inspect it and make changes to it.

The editor takes full advantage of the system's features. The video display is always used to display the lines of text in the immediate area of last editing which frees the user from the task of trying to remember where he is in the file. The cassette interface is used to store files and also allows editing of files which are larger than the amount of RAM that you have available for the editing buffers. The supervisor program is used by the editor for its serial input and output routines.

Basic Information

The editor takes up roughly 2K of RAM starting at address H2000. This space includes all of the working RAM locations that the editor needs. The editor requires two buffers to operate: the edit buffer and the insert buffer. The edit buffer is where the source code is held while editing. The insert buffer is where all changes to the edit buffer are made. After an editing operation is finished (i.e. an insert), the insert buffer is merged into the edit buffer to form the new source code.

There are two restrictions concerning the buffers:

1. The edit buffer must be before the insert buffer in RAM, and there can be no space between the two buffers.

2. The buffers must be multiples of 256 bytes long, and their starting and ending addresses must also be multiples of 256 bytes.

Examples of incorrect formatting of the buffers are:

Text Buffer Start	Insert Buffer Start	Reason Why Wrong
H5000	H4A00	The edit buffer must start at a lower addres than the insert buffer.
H4A00	H5010	Buffers must start in multiples of 256 bytes.

If the text buffer were to start at H4A00 and the insert buffer at H4E00 this would work fine. Note that this means that the edit buffer has 1024 bytes of space (H4A00 to H4E00). You can't tell how big the insert buffer is since its ending address is not known. You must, therefore, also specify an address (256 byte multiple) for the first byte after the insert buffer. This byte's address will be called the end of RAM location from here on. If this address was H5000 in this case, the length of the insert buffer would be 512 bytes. Thus far, in our example of correct buffer addressing, we have the following:

Text Buffer Start	Insert Buffer Start	End Of RAM
H4A00	H4E00	H5000

The user defines where the buffers start and end by altering three RAM locations (using the supervisor) before executing the editor. Because of the 256-byte-multiple address restriction, it can be seen that the low byte of each address is H00. For this reason, you need only specify the high byte of the address for the edit buffer, insert buffer, and the end of RAM location. You alter locations H2003 through H2006 to give this information to the editor and then jump to the editor (address H2000). In our example, location H2003 would be changed to H4A, while H2004 would be changed to H4E, and H2006 would be changed to H50. Address H2005 is changed to allocate an assembler buffer, and this is explained later.

The buffers have no size restrictions so they can span from any one address to any other as long as the end address is greater than the start address.

After the three bytes have been set up for the editor (using the alter command) and the editor has been jumped to (by the execute command) using the supervisor, you are able to edit your source code using one of the 21 editor commands which are described later.

Display Format

While you are inspecting the source code of your file, the editor displays a header line and up to 15 lines of text. The header line tells you how many completely empty blocks (256 bytes per block) you have left in the edit buffer and displays the command you have entered. The bottom 15 lines of the display are used for the text. These lines are numbered from 1 to 15 as they progress down the page. Note that a line can be up to 256 characters long and that the line numbers are not actually part of the text. The line numbers are simply displayed on the screen to allow you to reference each individual line easily.

In the edit buffer, the end of a line is indicated by a ASCII carraige return code (HOD). The end of file is sensed to be the first character in the buffer with bit 7 set to one. Note that the ASCII characters are all encoded using bits 0 through 6, so bit 7 is free for this use.

Commands

There are 21 commands which the editor accepts. All commands are typed in through the keyboard. and all except four are executed after the press of the carraige return key. The four commands that do not require a carraige return are position moving commands which are used so frequently that they are allowed to take only one keypress. They are explained in detail in the section called 'Moving Around in the File' as well as in the Command Reference Section. The other 17 commands require a carraige return for their execution. These other commands also allow you to type in up to sixteen additional characters which tell the routines exactly what should be done. The backspace key is active during command entering so that mistakes can be easily corrected. Pressing control-P causes the last command entered to be executed again.

Depending on the command, the additional characters may be alphabetic, numeric, or not used. If a number is required (such as in the Forward command) it can be of any size, although the maximum number sent to the routine will be 255. For example, if the command typed was F3000 (move forward 3000 lines), the user would only be moved ahead 255 lines. More details about the Forward command are presented later. Also, if a command requiring a number is entered with no extra characters (just the command and then a carraige return), a number of one will automatically be used. This feature was added due to frequent changes the user will make to the 1st line of text.

The specific command explanations tell you what you should enter after the command (a number, a word, or nothing).

User Defined Commands

You can cause the editor to jump to your own routines by utilizing any of the unused command letters. All that you need to do is change the correct locations in the command address table. Refer to the program listing to find out which two memory locations to change for your command.

Moving Around in the File

Since the display can show only 15 lines at a time and the file can be much larger than this, there are commands which allow you to move around in the file (display different areas of the file).

Four of these commands are executed immediately when the command key is pressed. These four commands are: go to end of file (+), go to beginning of file (-), go forward 15 lines (space), and go backward 15 lines (/). The only exception to this immediate action is when another command is entered, erased (by back-spaces) and then one of the four immediate action commands is entered. The four commands then will require a carriage return to execute them.

The other moving commands are: forward x lines (Fx), backward x lines (Bx), and search for an ASCII string 'xxxx' (Xxxxx). The detailed explanations for all seven of the moving commands are given in the command reference section.

Inserting New Lines

To enter new lines of text, use the Insert (I) command, This command should be followed by a number which signifies which line on the screen the text should be inserted after.

After the command, number, and carriage return have been entered, the screen is cleared and you are in INSERT MODE. In this mode you simply type in your new text pressing carraige return at the end of each line. Backspace is active to the beginning of your current line. Note that while in insert mode the characters you type in are being put in the insert buffer, and they are held there until ETX is pressed. Pressing ETX (control-C) when you are done inserting will put the lines just typed into the edit buffer after the line number originally typed with the command.

If you insert too much text (either the insert buffer is

full or it can be seen that the text to be inserted will fill the edit buffer), insert mode is automatically ended and the lines are inserted.

Modifying a String

To modify one ASCII string to another there are two commands available. Using the preset modify strings (P) command you can tell the editor what the original string is and what the new string should be. With the modify (M) command, you tell the editor to look for the original ASCII string on a specified line and, if the string is found, to change it to the new string.

The sequence of steps for a modify is:

1) Type "P" for the preset modify command.

2) Type old string you would like to modify.

3) Hit carraige return. The top line of the display ~~will~~ change to:

   MODIFY STRING "old string just typed " TO

4) Type in the new string.

5) Hit carriage return.
   At this point, the two strings have been entered and are stored in a special set of RAM locations.

To continue modifying lines containing the same old string to the new one:

6) Type "M" for the modify command.

7) Type the line number where the old string can be found.

8) Hit carriage return.
   If the old string is found in that line, it is changed to the new string.
   If the old string is not found, an error message of NOT FOUND is displayed.

You can continue to modify the old string throughout your program using the "M" command.

Saving and Appending Lines

If you have a number of lines of code that repeat themselves

throughout a program, rather than having to retype the lines at each point in the program you can hold the lines in the insert buffer and place them as you wish in the program.

To hold lines in the insert buffer, bring the first line to be held to the top of the screen (using the forward and backward commands) and type "Hx" to hold the top x lines. After the carriage return is pressed, the command is executed. If you try to hold more lines than will fit in the insert buffer, the editor will give you an error message saying TOO MUCH.

To insert these lines. use the append (A) command. This command is in the form of "Ax" with x being the line number after which the held lines should be inserted. If there is no room in the text buffer for all of the lines, the command is aborted and you are given an error message of TOO MUCH.

Deleting Lines

To delete selected lines, bring the first line to be deleted to the top of the screen. Then use the delete (D) command followed by a line number to delete that number of lines from the text buffer (starting from the top line on the screen).

Changing Lines

If you have a line in the text buffer which is wrong, you can change it (without having to retype the whole thing). To change a line, type "Cx", with x being the line number. The screen is then cleared and the line selected is displayed. At this time several keys are active:

1) Copy character (control-U): causes one character from the old line to be copied to the new line. The new line is written just below the old one as the characters are copied.

2) Copy word (control-Y): does continued character copies until the first occurance of a space or comma.

3) Delete old character (control-O): causes one character of the old line to be deleted. In other words one or more characters from the old line can be skipped from being copied.

4) Erase (control-H): just erases one character from the new line.

5) Erase word (control-N): erases characters until it comes to a space or a comma.

6) Copy to end of line (control-P): causes all of the remaining characters of the old line to be copied to the new line.

7) Any printable (non-control) character will be added to the new line.

8) Carriage return ends the change of this line. After this key is pressed, the next line in the text buffer is displayed and you are allowed to change it.

If you press ETX (control-C) right after a new line appears, the editor returns to the normal page showing all of the corrected lines.

Storing your Text

The editor allows you to store and retrieve your programs using cassette tape. You can name your text with labels of up to eight characters long and therefore have the system keep track of the various programs on a tape.

To store the edit buffer on cassette tape, turn the tape recorder to record and type "Sxxxx" with xxxx being the name (up to 8 characters). After carriage return is pressed, the editor starts sending the name and the text to the tape recorder. It finishes when the end of file is reached (any byte in the edit buffer with bit 7 set) and will simply prompt for a new command.

To load that file back just as it was before storing it, first move to the beginning of the file (using the "-" command). Then type "Lxxxx" followed by a carriage return and play the tape recorder. The editor will read everything on the tape and will load the data contained in blocks with the name xxxx. After the end of file byte is read in, the routine terminates.

You should note that the load routine starts loading at the current line position (it starts loading over the top line on the screen). Thus you can merge two files by loading one in as was explained earlier, moving to the end of that file, and loading the second file. Once it is loaded it will appear after the first file in the text buffer.

Also, the full name need not be typed in for the load routine. The routine only checks the tape against the letters typed in with the command, and no others. For instance, if you have a file named STARTREK on tape, you can load it back by typing any of the following as the command:

LSTARTREK	will load only startrek
L	will load any file
LSTAR	will load any file whose name's first four letters are STAR

Note that the last two methods have the possibility of loading the wrong program--the second one loading anything and the third one loading anything which starts with STAR (i.e. STARWAR OR STAR).

Jumping out of the Editor

Use the command 'E' to return to the supervisor program. Type the command 'R' to jump to the assembler, and 'G' to go to the debugger.

2. Editor Command Reference

The following abbreviations are used in this section:

l--a line number
n--a number of lines
a--an ASCII string (up to 16 characters)

Also, note that all commands (except the ones with immediate action) must be terminated with a carriage return.

Command: APPEND

Format: A1

Description: This command places what is in the insert buffer immediately after the line listed in the command. The data in the insert buffer may be the result of a HOLD, INSERT, CHANGE, or MODIFY command.

Errors: If the text in the insert buffer is too large to fit in the edit buffer, you are given an error saying TOO MUCH.

Example:

If the insert buffer had the following lines in it:

```
NOW IS THE TIME
FOR ALL GOOD MEN
TO COME TO THE AID
```

And the screen looked like:

```
                BLOCKS LEFT:  04     COMMAND:
 1  THIS IS LINE ONE
 2  THIS IS LINE TWO
 3  THIS IS LINE THREE
```

And the command "A2" was executed, the insert buffer would remain the same and the screen would change to:

```
                BLOCKS LEFT:  04     COMMAND:
 1  THIS IS LINE ONE
 2  THIS IS LINE TWO
 3  NOW IS THE TIME
 4  FOR ALL GOOD MEN
 5  TO COME TO THE AID
 6  THIS IS LINE THREE
```

Command: BACKWARD

Format: Bn

Description: This command causes the editor to start displaying n lines before the top line on the screen.

Example:

If the screen had displayed the 10th-13th lines of a program as shown below:

```
                    BLOCKS LEFT:  04    COMMAND:
1  THIS IS LINE 10
2  THIS IS LINE 11
3  THIS IS LINE 12
4  THIS IS LINE 13
```

And the command "B3" was executed, the first line displayed is number 7 and the display would change to:

```
                    BLOCKS LEFT:  04    COMMAND:
1  THIS IS LINE 7
2  THIS IS LINE 8
3  THIS IS LINE 9
4  THIS IS LINE 10
5  THIS IS LINE 11
6  THIS IS LINE 12
7  THIS IS LINE 13
```

Command: CHANGE

Format: C1

Description: This command allows you to change a line of text. After entering this command, the screen is cleared and the line selected is displayed on the top of the screen. You can then type control-U to copy a character of the old line to the new one, control-Y to copy a word from the old line to the new one, control-O to skip a character of the old line from being copied, control-H (erase) to delete a character from the new line, control-N to erase a word from the new line, control-P to copy all of the remaining characters from the old line to the new line, or any printable (non-control) character to just be added to the new line. After the new line is as you want it, press carriage return. The next line of the text buffer is then displayed and you can change it. Pressing ETX (control-C) at this point returns you to the command entry page with the corrections entered into the text buffer.

Example:

If you have the line NOW IA THE TIME ready to change (you have just entered the "C" command), the following keypresses will correct the mistake:

KEY	New line so far
control-Y	NOW
control-U	NOW (there is a space after NOW)
control-U	NOW I
control-O	NOW I (the A was deleted)
S	NOW IS
control-P	NOW IS THE TIME

Pressing carriage-return and ETX now will return you to the normal editor display page with the changes in effect.

Command: DELETE

Format: Dn

Description: This command deletes n lines from the text buffer starting with the top line on the screen.

Example:

If the screen had lines 6-10 of the text buffer displayed as is shown below:

```
                    BLOCKS LEFT:  04        COMMAND:
   1  LINE 6
   2  LINE 7
   3  LINE 8
   4  LINE 9
   5  LINE 10
```

And the command "D2" was executed, text lines 6&7 would be deleted and the screen would look like:

```
                    BLOCKS LEFT: 04         COMMAND;
   1  LINE 5
   2  LINE 8
   3  LINE 9
   4  LINE 10
```

Command: EXIT

Format: E

Description: This command exits the user back to location 0 (normally back into the supervisor program).

Command: FORWARD

Format: Fn

Description: This command causes the editor to start displaying n lines after the present line.

Example:

If the screen had the 10th-16th lines of the text buffer displayed as below:

```
                    BLOCKS LEFT:  04        COMMAND:
    1  LINE 10
    2  LINE 11
    3  LINE 12
    4  LINE 13
    5  LINE 14
    6  LINE 15
    7  LINE 16
```

And the command "F5" was executed, the first text line now displayed is line 15 and the screen will look as below:

```
                    BLOCKS LEFT:  04        COMMAND:
    1  LINE 15
    2  LINE 16
```

Command: GO TO THE DEBUGGER

Format: G

Description: This command jumps the user into debugger mode. This allows the user to execute all debugger options.

Command: HOLD

Format: Hn

Description: Copies n lines of the text buffer into the insert buffer starting with the first line displayed on the screen.

Errors: If you try to hold too may lines, you will get an error message of TOO MUCH.

Example:

If the display looked as it does below:

```
                    BLOCKS LEFT:  02        COMMAND:
     1  LINE 1
     2  LINE 2
     3  LINE 3
     4  LINE 4
     5  LINE 5
     6  LINE 6
        ____ _
```

And the command "H3" was executed, the screen will remain the same and the insert buffer will be changed to

```
LINE 1
LINE 2
LINE 3
```

Command: INSERT

Format: Il

Description: This command allows the insertion of new text. The new text is typed in after the command and is ended by a ETX (control-C) key. Then the text is inserted after the line number specified in the command.

Errors: If you try to type in too much text (either too much for the insert buffer to hold or too much to be able to put back into the edit buffer), the insert is automatically ended just as if you had pressed ETX.

Example:

If the screen looked as it does below:

```
                    BLOCKS LEFT:  04        COMMAND:
   1  LINE 1
   2  LINE 2
   3  LINE 3
   4  LINE 4
   5  LINE 5
```

And the command "I2" was executed, the screen would be erased and you would be allowed to type in new text. If you typed in the following lines (each line followed by a carriage return):

```
NOW IS THE TIME
FOR ALL GOOD MEN
TO COME TO THE AID
```

And pressed ETX, the 3 new lines would be inserted after line 2 of the text buffer, and the screen would change to:

```
                    BLOCKS LEFT:  04        COMMAND:
   1  LINE 2
   2  NOW IS THE TIME
   3  FOR ALL GOOD MEN
   4  TO COME TO THE AID
   5  LINE 3
   6  LINE 4
   7  LINE 5
```

Command: LOAD

Format: Lx

Description: Loads a file from cassette tape into the text buffer. The name, x, can be up to 8 characters, and any file which has at least the letters specified in the command will be loaded. A simple "L" command (one with no file name) will load any file. Loading ceases when a byte is read in with the end of file bit set.

The file is loaded starting at the first character position on the screen. Any lines before the ones displayed will not be changed during the load.

Errors: If you run out of text buffer space before a load is complete, you will get an error saying TOO MUCH. If upon loading, a cassette error occurs, you are given a SUMCHECK ERROR message and you must reload.

Command: MODIFY

Format: M1

Description: This command uses the old and new ASCII strings entered with the "P" command. First, the line number specified in the command is searched for the old string. If it is found, that old ASCII string is replaced with the new string.

Errors: If the old string is not found in the line, you are given an error of NOT FOUND.

Example:

If the text buffer had the following lines displayed:

```
                    BLOCKS LEFT:  04        COMMAND:
      1  NOW IS THE TIME
      2  FOR ALL GOOD MEN
      3  TO COME TO THE AID
```

And you wanted to change the word "come" in line 3 to "go", you would first enter the two strings using the P command and then do a "M3" command. The text would be changed, and the screen would change to:

```
                    BLOCKS LEFT:  04        COMMAND:
      1  FOR ALL GOOD MEN
      2  TO GO TO THE AID
```

Command: NORMAL MODE

Format: N

Description: this command turns the upper case mode OFF.

Command: PRESET MODIFY STRINGS

Format: Pa

Description: To allow entry of two ASCII strings for later use with the Modify command. The string to be looked for and replaced (the old string) with the modify is typed in with this command followed by a carriage return. After that, the top line of the screen will change to:

MODIFY STRING "old string just typed" TO

at which time you should type in the string which is to replace the old one (the new string) followed by a carriage return.

Command: RUN

Format: R

Description: This command jumps to the assembler and automatically starts its execution.

Command: STORE

Format: Sx

Description: This command stores the text buffer onto cassette tape. A name (x) is also stored on the tape, and that specific name can be referenced during a LOAD command.

Command: UPPERCASE MODE

Format: U

Description: this command bumps all characters displayed on the screen to upper case. It does not affect what is stored in the text buffer, only what you see. Upper case mode is off when you enter the editor.

Command: X-SEARCH

Format: Xa

Description: This command searches for the ASCII string starting at the 2nd line displayed on the screen. If the string is found, the line with the string is brought to the top of the screen.

Errors: If the string is not found, you are given the error message of NOT FOUND.

Example:

If the screen looked as it is pictured below:

```
                    BLOCKS LEFT:  04        COMMAND:
    1  THIS IS LINE ONE
    2  THIS IS LINE TWO
    3  THIS IS LINE THREE
    4  THIS IS LINE FOUR
    5  THIS IS LINE FIVE
```

And the command "XTHREE" is entered, the screen would start displaying at line 3 and would look as follows:

```
                    BLOCKS LEFT:  04        COMMAND:
    1  THIS IS LINE THREE
    2  THIS IS LINE FOUR
    3  THIS IS LINE FIVE
```

Command: GO TO BEGINNING--IMMEDIATE ACTION

Format: -

Description: Starts displaying lines at the first line of the file.

Command: GO TO END--IMMEDIATE ACTION

Format: +

Description: Starts displaying lines beginning at the last line in the file. You should note that after this command is executed, the screen will contain only one line of text (the last line of the text buffer).

Command: FORWARD 15 LINES--IMMEDIATE ACTION

Format: space

Description: This command functions exactly the same way as the command "F15".

Command: BACKWARD 15 LINES--IMMEDIATE ACTION

Format: /

Description: This command functions in exactly the same way as the command "B15".

3. 2650 Assembler

The Central Data Assembler allows a user to change the 2650 instruction mnemonics into machine executable binary. It takes the source code created by the text editor and makes two passes through it creating the binary tape, output listing, and binary blocks in storage. The assembler uses routines in the text editor and the supervisor program to allow its small size.

Basic Information

The assembler takes up roughlly 4K of RAM starting right after the editor. This 4K includes all space required for the assembler's working RAM area (small buffers, pointers, and general storage locations).

Like the editor, the assembler needs a text buffer to hold the text that it is operating on. Unlike the editor, it needs a symbol table and a output binary storage area (OBST) and does not need the insert buffer. For this reason, the space normally allocated for the editor's insert buffer is, when assembling, divided between the assembler's symbol table and OBST.

The symbol table starts at the same place that the insert buffer would start, and the OBST starts at an address between where the symbol table starts and where RAM ends. As in the editor, you tell the program where you want the buffer to start by altering a RAM location to correspond to the high byte of the start address of the buffer. This RAM location is at address H2005.

For example, if the following allocations were previously made for the editor:

Address	Function	Value
H2003	Text buffer start	H4A
H2004	Insert buffer start	H5B
H2006	End of RAM	H60

and you wished to split the insert buffer's space into two equal pieces for the assembler's use, you would alter location H2005 to a H5D. In this case, the text buffer

starts at H4A00, the symbol table at H5B00, and the binary storage block at H5D00. The last position of RAM is H5FFF.

The allocation would now be:

Address	Function	Value
H2003	Text buffer start	H4A
H2004	Symbol table start	H5B
H2005	Binary Storage Blk.	H5D
H2006	End of RAM	H60

At this time it may be valuable to explain the structure of the symbol table and storage blocks you will be allocating space for.

A symbol is some combination of up to 6 characters where the first character is alphabetic. These 6 ASCII characters each fill one byte of RAM. It should be noted that 6 bytes are always allotted for the symbol name even though the name may consist of fewer characters. Following the 6 bytes in which the name is stored, two bytes of RAM are allotted for the address or data which the symbol refers to. Thus, eight bytes of RAM must be available for each symbol used. In our example above, 512 bytes of memory were provided for the symbol table which would enable us to store up to 64 labels or variables in our program. Of course, we could provide room for more or fewer symbols by changing the number of bytes allotted for the symbol table.

The other block of memory entitled the Binary Storage Block will be used to store the binary code for your program if the pseudo-op TAPE is used. If this option is not used, a Binary Storage Block must still be declared; however, the value stored at address 2006H can be set to the same value as END OF RAM at address 2005H. This will effectively provide no storage locations for Binary Storage. If, on the other hand, you do wish to use the TAPE pseudo-op, you need not provide room in the BSB to store your entire program's binary coding. The coding can be dumped to tape in groups the length of which is determined by the amount of BSB area that you allot. If you plan to use the TAPE pseudo-op, it is best to allocate at least 512 bytes to the BSB. For further details on this see the section entitled "How to Assemble a Program" found in this manual.

Assembler Operation

The source code of your program consists of statements. Each of the statements must be in the following format:

Line positions	Description
1-6	Label
8-11	Opcode
13-14	Register or Condition
18	Indirect Field
19-26	Operand, Index Code

The label is a symbolic name which is given a value equal to the address where the instruction is. The opcode is either one of the 2650's mnemonics or a pseudo-operation. See the Signetics 2650 Manual for detailed information about the 2650's instructions and the Pseudo-Operation Reference Section of this manual for information about the pseudo-ops. If a register or a condition is required for a 2650 instruction, it goes in positions 13-14. If the instruction is to use indirect addressing, an asterisk (*) should go into position 18.

The operand is from 1-6 characters long and can be followed by a comma and an index code if you use indexed addressing for the instruction. The operand itself can be either a hex number, a label which is defined elsewhere in the program, a dollar sign ($) which will make the operand equal to the address of the first byte of this instruction, or an ASCII character in single quote marks (i.e. 'A') which returns the hex value of that ASCII character. Also, an operand can consist of any of the above listed items used in an arithmetic expression using addition or subtraction, Some examples of valid operands are:

```
'A'
100A-START+$
$-2
START-END+1
```

Finially, if position 18 of a source statement contains an up arrow then the value returned is the high byte of the evaluated operand. If there is no up-arrow, then it returns the low byte of the operand (for instructions which need only 1 byte of data). Comments can fill the remainder of the line.

An example of a program is:

```
START  LODI,3     FF
LOOP   STRA,3     DATAX
       SUBI,3     1
       TMI,3      40
       BCTR,0     LOOP
       HALT
*
```

```
DATAX   RES       1
        END
```

The following lines are generalized examples for indexed and indirect instructions:

```
R0      EQU       0
R3      EQU       3
START   LODA,R0   *POINT
        STRA,R3    DSTRT,I  R3 USED AS INDEX REGISTER
        STRA,R3    BSTRT,+  R3 USED AS INDEX REG,
                            AUTO INCREMENT
        STRA,R3    ASTRT,-  R3 USED AS INDEX REG,
                            AUTO DECREMENT
        STRA,R0    CSTRT    NO INDEXED OR INDIRECT
        STRA,R3   *FSTRT,I  R3 USED AS INDEX REG,
                            ALSO INDIRECT
```

If any errors are discovered while assembling the program, an error message is printed above the line with the error. On the event of an error, display mode is automatically switched on ~~so~~ that the user can see the line with the error. The error messages that are printed are all self-explanatory.

Assembly Options

Using various pseudo-operations you can have the assembler include certain normally skipped functions. The operation PRNT will cause a listing to be made. The op-code DISP will cause the program listing to be displayed on the screen as it is assembled. The SYMB option allows the assembler to create a symbol table file which will hold the symbol names used in the programs along with their values. This file is used by the debugger program to allow symbolic referencing of locations.

How to Assemble a Program

To assemble a program, first type the program in using the editor. Note that pressing TAB (control-I) while inserting or changing will move the cursor to the next tab stop--either position 8, 19, or 28. When the source code has been completely entered, including an END statement, leave the editor and then execute the assembler.

The screen will clear, and the message PASS 1 will appear on the top line. This means that the assembler is running through the source code and making a table of all of the labels and their values. When this is finished, the message PASS 2 will appear. This is the time when the assembler actually creates the binary. If you have the BLKS option

on, the bytes are put in memory as they are assembled. If the TAPE option is on, the bytes and their addresses are put into the binary storage block until it is full. When the OBST is full or at the end of the assembly, you will get the message BINARY OUTPUT. At that time you should put a tape in your recorder and turn it to record. Then hit any key on the keyboard and the assembler will start dumping out the data. In long programs, you may have to dump to tape several times. The tape can be loaded back using the supervisor program's LOAD routine.

If the source code for your program will not all fit into the text buffer at one time, you can still assemble it. Simply have on tape the whole program in several sections. Then, before running the assembler, load the first section into memory (using the editor). Then run the assembler with the name of the tape blocks typed after "R" in the command. Everything will be the same except when the assembler comes to the end of the section of text. At this point (in either pass 1 or 2) you will get a message DATA INPUT. This is your signal to turn your tape recorder to play and hit any key on the keyboard. The assembler then loads in another section of source code. When it comes to an END statement, it knows that it is the last section of the program.

When pass 2 starts, it will immediately ask for data input. This means that the assembler wants to go through the whole program again so you must rewind the tape recorder and play in the first section of the program.

When the whole program has been assembled, you will get the message xx ERRORS (where xx is the number of errors that were found in the program). You can then press any key to return to the editor. Note that any time while the assembler is running you can press escape to return to the editor.

If you wish your program to be listed, use the PRNT operation and write a small program to drive your printer. This program should check the printer's status and, if it is ready, should send it the character which is in register 0. This routine can be put anywhere in memory, with the address of the routine stored at H200B and H200C.

4. Pseudo-Operation Reference

The following pages detail the assembler's pseudo-operation commands. When the format of a statement is given, fields typed in upper case are required while any fields typed in lower case are optional.

Operation: DEFINE ADDRESS CONSTANT

Format: label ACON <expression> [,<expression>...]

Description: This opcode tells the assembler to allocate two bytes. The expression will be stored in these two bytes, the higher order bits in the first byte and the low order bits in the second byte. If a label is present, it will be assigned the address of the first byte allocated. The expression listed cannot be a space or comma enclosed in quotes.

Operation: GENERATE AN ASCII LITERAL

Format: label ALIT 'ASCII string'

Description: This command generates a string of bytes in memory which corresponds to the ASCII string in the operand field. The string must be enclosed in delimiter characters, which can be of your choosing. The first character of the operand field is taken to be the delimiter character. In the above example single quote marks (') are used. Note that the string can extend into the comment field but cannot go past the 80th character of the line.

Operation: LOAD BINARY AS ASSEMBLED

Format: BLKS ON or OFF

Description: This operation instructs the assembler to start or stop storing the data into storage as it is assembled. You must be careful not to overwrite the alp, or its buffers when using this option. If you want your program to run in the same locations as the alp, you must use the TAPE option. That way nothing is written into storage until the assembly is complete and you load the tape back.

Operation: CONVERT ALL ASCII LITERALS TO UPPER CASE

Format: BUMP ON or OFF

Description: normally the assembler will generate ASCII literals exactlly like they are shown (upper or lower case). If the BUMP ON operation is given, then all ASCII literals will be converted to upper case before being stored. You can switch back to normal mode by using the BUMP OFF operation.

Operation: DEFINE MEMORY DATA

Format: label DATA <expression> [,<expression>...]

Description: This operation takes the byte of data given by the expression and puts it into one byte of storage. If a label is specified, it will be equated to the address of the data byte. The expression listed cannot be a space or comma enclosed in quotes.

Operation: DISPLAY PROGRAM LISTING ON SCREEN

Format: DISP ON or OFF

Description: This command will start or stop (depending on the operand) displaying the program listing on the screen in pass 2. The format for the display is the same as the format for output listings to a printer (see the PRNT operation). When the screen is full of data, the assembler waits for a keypress before continuing. If this keypress is a control-X, display mode is terminated. Display mode is automatically started if an error is detected in pass 2.

Operation: END OF ASSEMBLY

Format: END

Description: The end of the source must be indicated with this operation at the end of any program.

Operation: EQUATE A SYMBOL'S EQUIVALENCE

Format: LABEL EQU EXPRESSION

Description: The label is made equivalent to the expression. From that point on, you can use the label as an operand, register, or condition just as if it were the expression.

Operation: SET PROGRAM COUNTER

Format: label ORG EXPRESSION

Description: The program counter is set to the expression. Normally used to start your program at an address other than 0 (the default value). If a label is present, it is equated to the expression.

Operation: PRINT LISTING OF PROGRAM

Format: PRNT ON or OFF

Description: The assembler will start or stop (depending on the operation) sending the source lines out to the printer during pass 2. In addition, this option will print line numbers, the address of each byte and the assembled data. The format for this is as follows:

Print Positions	Description
1-4	Line number
7-10	Address
12-13	Byte 1 of the data
15-16	Byte 2 of the data
18-19	Byte 3 of the data
20-22	Byte 4 of the data
23-103	Source line

Note that only the first 80 characters of the line are listed on the printer.

Operation: RESERVE MEMORY

Format: label RES EXPRESSION

Description: The number of bytes of memory specified are reserved starting at the present program counter. The number of bytes allocated is given by the expression, and if the label is present, it is given equivalence to the address of the first byte reserved.

Operation: CREATE BINARY TAPE

Format: TAPE ON

Description: This pseudo-op instructs the assembler to put the binary of the program into the OBST. When the OBST is filled. it is dumped out to cassette tape for later loading by the supervisor program. This must be used as the first line of your program for reliable operation.

5. Debugger Program

The debugger program is designed to be used as an aid in locating and correcting errors in machine language programs. While executing a program on the 2650, there are times the programmer may wish to know what values exist in the microprocessor's registers or flags. An incorrect assumption regarding the value of one of these could send a program off into never never land without the slightest evidence of how it got there. These values are usually not readily obtainable because the registers and flags are internal to the 2650 CPU. The debugger program, however, solves this problem by emulating the instructions of the 2650. All registers, flags, and return stack addresses are stored in RAM where they can be inspected or changed at any time through use of the commands explained later.

Pre-Execution Requirements

The debugger program resides in approximately 4K of memory. Since the debugger is located after the editor/assembler, both programs are present at the same time. Remember, however, that the debugger program can only operate on assembled programs. To enter the debugger program, you should use the 'G' command in the editor.

Running a Program with the Debugger

Upon entering the debugger program, all RAM locations used for registers, stack return addresses, the program counter, and breakpoint addresses are left at their previous value (which is zero if you just loaded the program). Also, upon first entry, all I/O modes are initialized to REALTIME. A further discussion of I/O modes can be found in the section titled "I/O Modes". The programmer will find himself in command entry mode where a miriad of powerful options are available. All commands are listed with detailed descriptions of proper formating and explanations of execution in the next chapter. At this point an attempt will be made to show how the debugger program might be implemented and to explain some of the convenient features of this program.

Set Program Counter (PC)

It is necessary to set the value of the program counter to the first address of the program to be debugged before initiating program emulation. The program counter is incremented during emulation just as it would be if the 2650 were executing the program. Because the program counter is now external to the 2650 chip, however, new possibilities are open. At any time during trace, step, or simulate mode, pressing the control-X key one or two times will return the user to command entry mode. At this point the programmer can inspect or change RAM locations to find out in detail the operations of the program. Since the program counter residing in RAM is not changed while using most commands, a command could be entered to restart emulation. The program would start exactly where it left off. No external stack return addresses, register values, breakpoints, etc. would be changed. The real flexibility offered here is that during program emulation you can stop program flow, inspect or change registers or selected areas of RAM, and then pick up program flow again with all other states unaltered. The imagination of the user provides the only limitation to the ways in which this feature can be used.

Emulation Modes

There are essentially three different emulation modes in which to run programs: simulate, trace, and single-step. Trace and single-step modes can be thought of as subsets of the simulate mode in that their object codes are interpreted by the same process. Each of the three modes has its own specific command and each performs a different function. A broad description of their different functions follows while a detailed description of each command's format and function can be found in the next chapter.

Simulate (SI): This mode begins emulating the 2650's instructions from the address currently held in the RAM program counter or the optional starting address specified by the user as part of the command. No instructions are displayed on the screen, but I/O options may be specified which allow the user to monitor I/O operations. Normal simulation will allow the program to be emulated until an I/O operation is to be performed. If that I/O operation is programmed for REALTIME or preset mode, the debugger will execute it with no operator message. If it is programmed for SIMULATED or ASCII mode, the appropriate messages will be printed and responses required. All I/O options are available for use during this mode. (These are discussed further in another section of the manual). At any time during simulation in this mode, the program can be stopped by typing a control-X. The debugger program will then automatically switch over to step mode.

Trace (TR): The user enters a number with this command which indicates how many instructions should be emulated in trace mode. The debugger then begins with the address in the RAM program counter and prints on the display each instruction as it is emulated along with the present contents of all registers. As an option, a different starting address can be entered as part of the trace command. When the specified number of instructions have been completed, the debugger automatically switches to step mode.

Step (ST): Again, the user should enter a number with this command to indicate how many instructions should be emulated before single step mode is entered. In this mode, register contents are not displayed during emulation prior to single step. If no number is entered, a default value of 0 is assumed. Once single-step mode is active, the instruction at the address found in the RAM program counter will be displayed. As in trace mode, the PC value can be optionally entered as part of the step command. The contents of all registers and the value of the condition code prior to emulation are also displayed on the same line. The debugger program will not emulate the displayed instruction until the user hits the space bar. Once the space bar is hit, that instruction is emulated and the next instruction is displayed with the register values resulting from the last instruction.

I/O Modes

Most programs require input or output operations sometime during execution. The I/O may be to or from a printer, disk drive, tape drive, keyboard or other peripheral according to the user's needs. When emulating the user program, it may be desirable or even necessary to specify an alternate method of I/O. For instance, a series of write operations to a disk drive would not work while the program was being emulated. This is because the disk moves at a rapid, constant speed which the 2650 microprocessor just barely keeps up with under normal execution. During emulation the user program runs considerably slower and cannot possibly keep up with the speed of the disk head. The first write might be placed near the correct disk area; but, the second write might place data in a totally different section. Sequential writing could crash the disk by storing bits of data throughout the entire track. In fact, only slow speed peripheral devices which use handshaking signals in microprocessor interaction should be accessed in REALTIME mode during program emulation. Data transfer to and from speed sensitive peripherals can sometimes be avoided through use of one or more of the other I/O modes offered.

Four different I/O modes are made available: REALTIME, SIMULATED, ASCII and PRESET. REALTIME and SIMULATED modes can be specified for each I/O port individually or for all ports at once. ASCII mode is available only for output operations while PRESET mode is available only for input operations. Again, the modes can be specified for all ports or for each port individually. If ports are to be specified individually, 258 different ports are capable of being accessed for both input and output, 256 extended ports, 1 data port, and 1 control port. For extended I/O ports, the hexadecimal value of the actual port number, 00 through FF, should be used in the command. The data and control ports are recognized by the hexadecimal values 100 and 101, respectivley, being entered for the command. When an I/O command is entered affecting all ports, each port is initialized to the specified mode. The desirability of each mode depends upon the specific application.

REALTIME: This mode transfers I/O through normal chanels. I/O takes place as it would during program execution except that, because the 2650 is being emulated, the process occurs much more slowly. Obviously, this mode would create the disk drive problem mentioned above.

SIMULATED: This mode does not transfer data through normal I/O channels. Instead, all data inputs are requested from the keyboard after display prompting and all data outputs are designated through the display screen. The actual port is never accessed so, in the example given above, the data would be displayed on the screen without disturbing the information stored on the disk. This mode can be used successfully as a means of intercepting and displaying an output.

Unfortunately, it is not as helpful in simulating a disk read. In all probability, the number of keypresses required as input from the keyboard would render this mode impractical. As a means of input, this mode is useful only when small amounts of data need to be brought into the system.

ASCII: This is an output mode which is very similar to the simulated output mode listed above. The only difference is that the output value is displayed as an ASCII character instead of in hexadecimal form. If there is no ASCII character corresponding to the value, then the hexadecimal form is displayed.

PRESET: This input mode allows the user to store one input value for any or all ports. When an input is expected by your program, the preset value is returned to the program instead of actually reading the port. Only one hexadecimal

value can be associated with each port at one time. Although this may seem to place severe limitations on the useful applications of the mode, there are some interesting ways in which the option can be used. During data output to some handshaking peripheral device, the simulation process will output data and then enter a loop in your program to test for a ready condition which would return from the peripheral device. If the input port were preset to give the ready condition, then the debugger program would read the input, fall through the ready test loop in your program and continue emulation. Hopefully, this example suggests other ways in which preset mode might be used.

The problem with disk drive input still has to solved. There just isn't anyway to get data off a disk using the emulator. The only way to get data off these devices is full speed 2650 microprocessor execution. That doesn't mean the debugger can't be used with your program--there is a way around the problem.

Execution (EX) and Breakpoint (BR)

The debugger allows use of an execute command which loads all the registers from RAM into the 2650 chip. The 2650 microprocessor is then given control to execute, beginning at the address specified during command entry. If an address is not specified in the command, execution begins at the address specified in the RAM program counter. During execution none of the specified I/O modes are active. Of course, at some point you will have to indicate that the 2650 should return processing responsibility back to the debugger program. This can be done by setting up a breakpoint prior to execution. Setting up a breakpoint is a convenient way to return to step mode without interrupting program flow. When the breakpoint is reached, internal register values are stored back out to RAM; the breakpoint just hit is cleared; and, step mode emulation begins.

Returning to our disk input problem, how can these features be used? Let's assume that the disk drive input routine occurs between two areas where the programmer would like to use the emulator to aid in debugging. The commands used to dubug this program could be entered in this way:

Command Entered	Comments
ST 15F,5C00	15F hex instructions are emulated in simulate mode after which single-step mode is entered.
Space bar	The current instruction is emulated and the next instruction is dis-

	played along with the registers.
Space bar	the space bar has been hit to advance one more instruction. The programmer now decides to prepare for execution.
Escape key	the display shows the command entry message (DEBUG>).
BR 1,5E20	the 1st breakpoint address is set where 2650 execution will stop and single-step mode will begin.
EX	execution begins at the address where we stopped single-step mode. The program will run at normal operating speeds and no specified I/O modes in the debugger program are active.
Breakpoint 1 reached at 5E20	(displayed by the debugger) the breakpoint address 5E20 has been reached, the breakpoint is cleared, and the program is now in single-step mode.
Space bar	you can now continue to step through your program by hitting the space bar for each instruction,

This procedure could have been done other ways, but the point has been made; the transition between emulation and execution is fairly simple.

A potential problem exists which the programmer should be made aware of; executing breakpoints destroy the return address stack. However, if you are simulating and reach a breakpoint, your stack will be saved. Care should be exercised while executing into subroutines since when the debugger returns at a breakpoint the return address stack is invalid for the section of code that was executed. In general, although there are exceptions, when you set a breakpoint inside of a subroutine and then subsequently execute or simulate after the breakpoint, don't expect the subroutine to return properly.

6. Debugger Command Reference

Command Summary

INSPECT AND EDIT
CH {<reg number>, <data byte>}...change register values
CO <start addr>,<compare addr>,<end addr>...compare memory
DI <memory addr>...display memory
DS...display stack
ED...return to the editor program
IN <start addr>, <end addr>, <data>...initialize memory
PA <start addr>...display page
PC <addr>...set program counter
RE...print out registers
RU...run the assembler program

I/O MODES -
AA...all outputs ASCII
AP...all inputs preset
AR...all I/O realtime
AS...all I/O simulated
IP <port number>, <data>...input preset
IR <port number>...input realtime
IS <port number>...input simulated
OA <port number>...output ASCII
OS <port number>...output simulated
OR <port number>...output realtime

EMULATION MODES
SI [<addr>]...simulate mode
ST <number of steps> [,<start addr>]...step mode
TR <number of steps> [,<start addr>]...trace mode

MISC COMMANDS
BR <number>, (addr>...set breakpoint
CL <number>...clear breakpoint
EX [<addr>]...execute

All values in angle brackets (<>) are parameters to be entered by the user in hexadecimal. Any paramaters contained within braces ({}) can be repeated one or more times. Any items in square brackets ([]) are optional.

COMMAND: CH change register values

FORMAT: CH {<register number>, <data byte>}

The value of a specified register being changed corresponds to the register number you need to specify as follows:

Specified register number	Actual register
0	R0
1	R1,bank 0
2	R2,bank 0
3	R3,bank 0
4	R1,bank 1
5	R2,bank 1
6	R3,bank 1
7	PSL
8	PSU

The data byte must be typed in as a hexidecimal number. Multiple registers can be changed for each command entry by continuing to type pairs of numbers which correspond to the registers and the data.

The new values stored in the specified registers will be displayed as indicated under the 'RE' command after the command is executed.

COMMAND: CO compare memory blocks

FORMAT: CO <1st blk start addr>,<2nd blk start addr>,
<2nd blk end addr>

The <start addr> is the first address of a block of data. The <compare address> is the first address of a second block of data. Each consecutive byte of data in the second block is compared to each corresponding consecutive byte of data in the first block beginning with the first addresses as listed. The <end addr> is the address of the last byte of data in the second block which is to be compared. When the data in any two corresponding address do not match, an error message is given of the following form: <1st block addr> = <data>, <2nd block addr> = <data>.

COMMAND: DI display memory

FORMAT: DI <memory addr>

16 consecutive data bytes located in memory starting with the address specified in the command are displayed in one line across the screen. At the far right of the screen on the same line will appear the sequential ASCII representations of the listed hexadecimal values when possible. If there is no ASCII character corresponding to the hexadecimal value, a period is used to fill that place in the sequence.

Once the display command has been entered, it becomes possible not only to inspect that memory, but to edit it also. On entry to the command. the cursor is positioned to the left of the first data byte displayed. By typing a "J" to move left or an "L" to move right, the cursor can be positioned at any byte in the line. Typing a "K" will slide the cursor all the way back to the left-most position, To change a hexadecimal value stored in memory which appears somewhere along this line, the cursor must be moved to the blank space at the immediate left of the data to be altered. If two hexadecimal digits are then typed in, the data stored in that memory location will be changed to the new value.

Once all desired change to the displayed data have been made, the escape key must be pressed to return to command entry mode. If you hit carraige return while in display mode, the next 16 bytes will be displayed and you will be allowed to edit them.

COMMAND: DS display stack

FORMAT: DS

The return address stack is displayed on the screen in the following format:

STACK = <return addr 1>,<return addr 2>...<return addr 8>

The return address stack stores addresses on a Last In, First Out basis with <RETURN ADDR 1> being the address most recently added.

Command: ED edit

Format: ED

This command returns the user back to the editor.

COMMAND: IN initialize memory

FORMAT: IN <starting addr>,<ending addr>,<data>

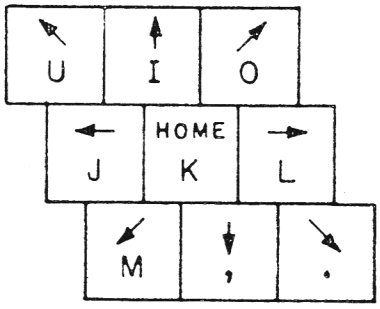
All memory locations between the starting address and the ending address (inclusive) are loaded with the data. All parameters in the command are entered as hexadecimal numbers.

COMMAND: PA display page

FORMAT: PA <start addr>

Beginning with the start address, the contents of 256 memory locations are displayed filling the entire screen. To the far right of each line, ASCII characters appear sequentially corresponding to the hexadecimal digits already appearing on that line. If an ASCII character does not exist for a particular value, that place is held with a period in order to maintain the sequence.

Once this command has been entered, the programmer has the option to change any data bytes on the screen. A cursor is located at the upper-left hand corner and can be moved to any space of the display through the use of the following keys:



(K returns the cursor to the upper-left hand corner of the screen.)

In order to change the data stored in a displayed memory location, move the cursor to the blank space at the immediate left of the hexadecimal value currently in memory. Then type in the new two digit hexadecimal number. The new value will appear reflecting the new data which is stored at that location.

To inspect or edit the next page of memory, press the return key. When you have finally completed making changes, you can return to command entry mode by pressing the escape key.

COMMAND: PC set program counter

FORMAT: PC <addr>

The RAM program counter is set to the specified address. This command allows you to choose which address to begin program emulation at.

COMMAND: RE print out registers

FORMAT: RE

The values stored in the CPU's registers are displayed on the screen. The format, which is the same in trace and step emulation modes, follows:

ADDR B1 B2 B3 R0=hd, R1=hd, R2=hd, R3=hd, R4=hd, R5=hd, R6=hd, PSL=hd, PSU=hd, CC=d

where

ADDR is the current value of the PC
B1, B2, B3 are the data bytes for the current instruction
R means register
R1, R2, R3 are registers 1, 2 & 3 in bank 0
R4, R5, R6 are registers 1, 2 & 3 in bank 1
PSL is the lower program status word
PSU is the upper program status word
CC is the condition code
hd is the hexadecimal data stored in the register
d is the value of the condition code

COMMAND: RU run the assembler

FORMAT: RU

This command jumps to the assembler and automatically starts its execution. After the assembler program is done, it returns the user back to the editor.

COMMAND: AA all outputs ASCII

FORMAT: AA

All output data will be simulated on the display screen in ASCII. The data will appear on the screen as follows;

OUTPUT PORT <port number> = <data value in ASCII>

The data shown is the ASCII character which would have been sent to the specified port if the program had been executed. If there is no ASCII representation for the byte, the hex value is printed on the screen.

COMMAND: AP all inputs preset

FORMAT: AP <data byte>

All input ports are set to return the value of the data byte specified in the command. This value should be entered in hexadecimal form.

COMMAND: AR all I/O realtime

FORMAT: AR

All I/O ports are accessed as specified by the user's program. Data transfer occurs as it would during execution except that it takes place much more slowly.

COMMAND: AS all I/O simulated

FORMAT: AS

All I/O port accesses are simulated. When a read instruction has been initiated, a prompting message will appear on the display as follows:

INPUT PORT <port number> =

The emulation process does not continue until a hexadecimal value followed by a carriage return is entered through the keyboard. The one byte of hexadecimal data typed in is used by the debugger program as if it had been input through the actual input port. When a write instruction is reached, the following message appears on the display screen:

OUTPUT PORT <port number> = <data value>

The port number is displayed in hexadecimal and is the number of the port the data would have been sent to if the program had been executing. The data output is now only designated on the screen (and is not actually sent to the port).

COMMAND: IP input preset

FORMAT: IP <port number>,<data value>

This command sets the hexadecimal value which has been typed in to be the incoming data from the specified port.

COMMAND: IR input realtime

FORMAT: IR <port number>

The specified port is set to realtime mode. Only one port can be specified per command entry. When realtime mode is specified, the actual port is accessed, however, at a much slower speed than it would during 2650 microprocessor execution.

COMMAND: IS input simulated

FORMAT: IS <port number>

This command is used to set an individual port to simulated mode. The debugger program prompts for data input instead of accessing the port specified by the input instruction in binary code. A detailed description of the display prompt can be found under the command AS, all inputs simulated.

COMMAND: OA output ASCII

FORMAT: OA <port number>

Any output to the specified port will be simulated on the display screen where it is shown in ASCII form. Only one port can be set per command entry. A detailed description of the display screen output is given under the command AA, all output ASCII.

COMMAND: OS output simulated

FORMAT: OS <port number>

The indicated port is not accessed for a write instruction. Instead, the data is displayed on the screen. A further description can be found under the command AS, all I/O in simulated mode.

COMMAND: OR output realtime

FORMAT: OR <port number>

The specified port will be sent output data as if the binary code were being executed except that data transfer will occur much more slowly.

COMMAND: SI simulate program mode

FORMAT: SI [<start addr>]

This command initiates program simulation beginning with the address stored in the program counter external to the 2650. The optional start address will reinitialize the program counter before simulation to the address chosen by the user. Pressing CONTROL-X is one way out of this simulation mode and into step mode. An alternate means of exiting this mode is by reaching a breakpoint address which also switches to step mode. Thus, the level at which the programmer chooses to monitor the program flow is completely flexible at any time. For this advantage, the user must give up microprocessor execution speed.

COMMAND: ST step simulation mode

FORMAT: ST <number of instructions>[,<start addr>]

The number of instructions specified in this command will be simulated beginning with the instruction at the address stored in the RAM program counter. After this number of instructions have been simulated, you are put into step mode. Once step mode begins each instruction is displayed on the screen with all current register values. The instruction is not executed until the space bar is hit. With this, the instruction is simulated, the registers are updated with their new values and the next instruction is displayed on the screen. The format of the display is shown under the command called "RE". As an option, you can specify as the second parameter of the command a new value to be assigned to the RAM program counter prior to emulating.

COMMAND: TR trace mode

FORMAT: TR <number of instructions>

The trace command simulates the specified number of instructions, displaying the instruction and register values on the screen automatically. (The format for the display is described in the description of the command "RE".) Upon completion of the trace, the debugger program jumps immediately into step mode and waits for the space bar to be hit. If the number of instructions to be traced exceeds sixteen, then the display scrolls up with the newest instruction appearing on the bottom line. As an option, you can specify as the second parameter of the command a new value to be assigned to the RAM program counter prior to emulating.

COMMAND: BR breakpoint

FORMAT: BR <breakpoint number>,<address>

A breakpoint can be set which will cause a transfer to step mode from either execute or simulate mode. Concurrently, four different breakpoint addresses can be set. Each breapoint address should be assigned a number from one to four which will be used by the debugger program at a later time to identify the breakpoint address which has been reached. The message indicating a breakpoint will appear as follows:

BREAKPOINT X REACHED AT AAAA

Where X is the breakpoint number and AAAA is the address of the breakpoint.

COMMAND: CL clear breakpoint

FORMAT: CL <breakpoint number>

This command is used to clear a breakpoint if the address was never reached and the breakpoint is no longer desired. Since four different breakpoints are possible, it is important that the correct breakpoint number be specified.

If you try to clear a breakpoint which has not been reached (and subsequently cleared) the following message will appear:

BREAKPOINT <#> CLEARED

If the breakpoint has been reached (or cleared previously), no message will be displayed when the command is executed.

COMMAND: EX execute

FORMAT: EX [<address>]

Control returns to the CPU and execution begins at the address designated in the command. Since this is normal execution, only setting a breakpoint can return you to simulate mode without affecting program flow. Execution is essential during I/O accesses to or from speed sensitive peripherals such as cassette tapes or disk drives. Naturally, no I/O modes in the debugger program are available when the user program is being executed. If execution is begun inside a subroutine, do not expect the return from the calling routine to be executed correctly. The return address stack is invalid.

7. ALP Program Listing

On the following pages are the program listings for the ALP program.

FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

0001  0000              *
0002  0000                    EXEC       2000
0003  2000                    ORG        2000
0004  2000           R0       EQU        0
0005  2000           R1       EQU        1
0006  2002           R2       EQU        2
0007  2000           R3       EQU        3
0008  2002           *
0009  2002           *
0010  2002           *
0011  2000           EQ       EQU        0
0012  2000           GT       EQU        1
0013  2002           LT       EQU        2
0014  2000           UN       EQU        3
0015  2022           NE       EQU        80
0016  2020           LE       EQU        81
0017  2000           GE       EQU        82
0018  2000           Z        EQU        0
0019  2000           N        EQU        2
0020  2000           *
0021  2000           *
0022  2000           *
0023  2000           CRY      EQU        1         PSL
0024  2000           COM      EQU        2
0025  2000           OVF      EQU        4
0026  2000           WC       EQU        8
0027  2020           RS       EQU        10
0028  2020           IDC      EQU        20
0029  2000           COND     EQU        C0
0030  2002           SP       EQU        7         PSU
0031  2020           II       EQU        20
0032  2002           FLAG     EQU        40
0033  2000           SENSF    EQU        80
0034  2000           *
0035  2000           *
0036  2000           *
0037  2000           ESC      EQU        1B
0038  2000           BS       EQU        8
0039  2002           CR       EQU        D
0040  2000           CRCD     EQU        D
0041  2000           CCOPY    EQU        10
0042  2000           CTRLX    EQU        18
0043  2000           ETX      EQU        3
0044  2020           CTRLO    EQU        F
0045  2000           CTRLP    EQU        10
0046  2000           CTRLN    EQU        E
0047  2000           CTRLY    EQU        19
0048  2000           CTRLU    EQU        15
0049  2000           HT       EQU        9
0050  2000           *
0051  2000           *
0052  2000           LF       EQU        0A
0053  2000           FORMF    EQU        0C
0054  2000           *
0055  2000           SERO     EQU        024F
```


FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

0056  2000           SERI     EQU        02E9
0057  2000           DELAY    EQU        0278
0058  2002           *
0059  2000 1F 20 30            BCTA,UN    EDITOR
0060  2003 4A          BSTART  DATA       4A
0061  2004 50          IBST    DATA       50
0062  2005 5C          OBST    DATA       5C
0063  2006 60          ENIRAM  DATA       60
0064  2007 07          TABS    DATA       7
0065  2008 12                  DATA       12
0066  2009 1B                  DATA       1B
0067  200A             *
0068  200A 1F E0 46    DPRINT  BCTA,UN    *6046     OUR PRINTER DRIVER ROUTINE
0069  200D             *
0070  200D 00 00 00 00 MBUF    RES        10
0071  2011 00 00 00 00
0072  2015 00 00 00 00
0073  2019 00 00 00 00
0074  201D 00          CCMS    RES        1
0075  201E 00 00 00 00 NAME    RES        10
0076  2022 00 00 00 00
0077  2026 00 00 00 00
0078  202A 00 00 00 00
0079  202E 00          TMPS    RES        1
0080  202F 00          TEMP    RES        1
0081  2030             *
0082  2030           EBC      EQU        83
0083  2030           *
0084  2030           *
0085  2030           *
0086  2030 04 02       EDITOR  LODI,R0    02
0087  2032 93                  LPSL
0088  2033 76 40               PPSU       40
0089  2035 20                  EORZ,R0
0090  2036 CC 0A 15            STRA,R0    OBPTR+1
0091  2039 CC 01 18            STRA,R0    ULC
0092  203C 3F 21 92            BSTA,UN    ERASE
0093  203F 0C 00 05            LODA,R0    CBST
0094  2042 CC 0A 14            STRA,R0    OBPTR
0095  2045 3F 22 59            BSTA,UN    BEGIN
0096  2048             *
0097  2048 3F 21 3E    FBDN    BSTA,UN    DISP
0098  204B 06 10       COMD    LODI,R2    10
0099  204D 05 2F               LODI,R1    2F
0100  204F 3F 44 4C            BSTA,UN    SETCUR
0101  2052 3F 45 45            BSTA,UN    CLFCR
0102  2055 06 10               LODI,R2    10
0103  2057 05 80               LODI,R1    80
0104  2059 3F 44 4C            BSTA,UN    SETCUR
0105  205C 05 0C               LODI,R1    0C
0106  205E 3F 46 CA            BSTA,UN    PRING
0107  2061 3F 21 FE            BSTA,UN    FINDND
0108  2064 0F 00 04            LODA,R3    IBST
0109  2067 AF 2A 02            SUBA,R3    DUMA
0110  206A A7 01               SUBI,R3    01
```

FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

0111  2060 3F 22 71           BSTA,UN     DECOUT
0112  2063 06 13              LODI,R2     13
0113  2065 05 20              LODI,R1     20
0114  2067 3F 22 44           BSTA,UN     SETCUR
0115  206A 05 1D              LODI,R1     1D
0116  206C 3F 22 CA           BSTA,UN     PRING
0117  206F 70           RL1   REDD,R0
0118  2070 1A FC              BCTR,LT     RL1
0119  2072 3F 21 26           BSTA,UN     CLC
0120  2075 04 00              LODI,R0     COMS
0121  2077 05 00              LODI,R1     COMS
0122  2079 05 11              LODI,R2     11
0123  207B 3F 46 67           BSTA,UN     ARROW
0124  207E 90 20 4B           BCFA,EQ     COMD
0125  2081 00 00 1D           LODA,R0     COMS
0126  2084 3F 47 8C           BSTA,UN     LTOU
0127  2087 3F 21 26           BSTA,UN     CLC
0128  208A 00                 EORZ,R0
0129  208B C1                 STRZ,R1
0130  208C 07 FF              LODI,R3     FF
0131  208E 0F 20 1E     NI    LODA,R3     NAME,+
0132  2091 18 26              BCTR,EQ     CK0
0133  2093 E7 10              COMI,R3     10
0134  2095 9A 2C              BCFR,LT     EADD
0135  2097 E4 30              COMI,R0     '0'
0136  2099 1A 26              BCTR,LT     DS
0137  209B E4 39              COMI,R0     '9'
0138  209D 19 22              BCTR,GT     DS
0139  209F 01                 LODZ,R1
0140  20A0 06 09              LODI,R2     09
0141  20A2 81           ONE   ADDZ,R1
0142  20A3 B3 01              TPSL        CRY
0143  20A5 18 0E              BCTR,EQ     D255
0144  20A7 FA 79              BDFR,R2     ONE
0145  20A9 01                 STRZ,R1
0146  20AA 0F 60 1E           LODA,R3     NAME,I
0147  20AD A4 30              SUBI,R0     '0'
0148  20AF 81                 ADDZ,R1
0149  20B0 C1                 STRZ,R1
0150  20B1 B5 01              TPSL        CRY
0151  20B3 98 59              BCFR,EQ     NI
0152  20B5 05 FF        D255  LODI,R1     FF
0153  20B7 1E 0A              BCTR,GN     EADD
0154  20B9 E7 00        CK0   COMI,R3     00
0155  20BB 98 06              BCFR,EQ     EADD
0156  20BD 05 01              LODI,R1     01
0157  20BF 1E 02              BCTR,UN     EADD
0158  20C1 05 02        DS    LODI,R1     02
0159  20C3 20 22 1D     EADD  LODA,R0     COMS
0160  20C6 3F 47 8C           BSTA,UN     LTOU
0161  20C9 03                 SUBI,R3     'A'
0162  20CA A7 41              COMI,R3     19
0163  20CC F7 19              BCTA,GT     COMD
0164  20CE 1D 20 4B           BRN ,R3
0165  20D1 D3
```


FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

0166  20D2 67 80              IORI,R3     80
0167  20D4 0F 01              STRR,R3     $+3
0168  20D6 1B 00              RCTR,UN     COMTBL
0169  20D8 25 26       COMTBL ACON        ISAVE     A=APPEND BUFFER AFTER LINE X
0170  20DA 22 01              ACON        BACK      B=BACK X LINES
0171  20DC 26 24              ACON        CHANGE    C=CHANGE LINES
0172  20DE 23 D5              ACON        DELT      D=DELETE X LINES FROM TOP
0173  20E0 00 83 <<00         DATA        00,83     E=EXIT TO SUP.
0174  20E2 22 07              ACON        FORWD     F=FORWARD X LINES
0175  20E4 36 55              ACON        BUG       G=GO TO DEBUGER
0176  20E6 24 E5              ACON        SAVE      H=HOLD X LINES IN INSERT BUFFER
0177  20E8 22 9E              ACON        INST      I=INSERT LINES AFTER LINE X
0178  20EA 36 5B              ACON        DEBUG     J=JUMP TO DEBUG AND CLEAR IT
0179  20EC 22 4B              ACON        COMD      K
0180  20EE 27 1F              ACON        LOADI     L=LOAD X LINES FROM DISK
0181  20F0 25 8B              ACON        MODIFY    M=MODIFY STRING IN LINE X
0182  20F2 21 19              ACON        ULCASE    N=NORMAL LOWERCASE MODE
0183  20F4 20 4B              ACON        COMD      O
0184  20F6 25 63              ACON        PMOD      P=PRESET MODIFY PATTERNS
0185  20F8 22 4B              ACON        COMD      Q = [illegible]
0186  20FA 2E 69              ACON        ASM       R=RUN ASM
0187  20FC 26 00              ACON        TAPEO     S=STORE X LINES TO DISK
0188  20FE 20 4B              ACON        COMD      T
0189  2100 21 1F              ACON        UPONLY    U=GO INTO UPPER CASE ONLY MODE
0190  2102 20 4B              ACON        COMD      V [illegible]
0191  2104 20 4B              ACON        COMD      W [illegible]
0192  2106 24 CD              ACON        SEARCH    X=SEARCH FOR ASCII STRING X
0193  2108 20 4B              ACON        COMD      Y
0194  210A 20 4B              ACON        COMD      Z [illegible]
0195  210C                 *
0196  210C 02           ULC   RES         1
0197  210D                 *
0198  210D 20           ULCASE IOPZ,R0
0199  210E 0B 7C               STRR,R0     ULC
0200  2110 1F 22 4B            BCTA,UN     COMD
0201  2113                 *
0202  2113 04 FF        UPONLY LODI,R0     FF
0203  2115 0B 75               STRR,R0     ULC
0204  2117 1F 22 4B            BCTA,UN     COMD
0205  211A                 *
0206  211A                 *
0207  211A E4 2B        CLC   COMI,R0     2B
0208  211C 1C 21 E6            BCTA,EQ     ENDF
0209  211F E4 2D              COMI,R0     2D
0210  2121 1C 22 53            BCTA,EQ     BIGN
0211  2124 E4 20              COMI,R0     ' '
0212  2126 1C 22 05            BCTA,EQ     EX15
0213  2129 E4 2F              COMI,R0     '/'
0214  212B 1C 21 FF            BCTA,EQ     EX15
0215  212E 17                  RETC,UN
0216  212F                 *
0217  212F 45 0B        CURIT ACON        CURSOR+1
0218  2131 03           LINEX RES         1
0219  2132                 *
0220  2132 3F 22 64     DISP  BSTA,UN     MTDA
```

FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL   OPCODE     OPERAND    COMMENTS

0271  2141 C1                  STRZ,R1
0272  2142 20                  EORZ,R0
0273  2143 CC 81 3B            STRA,R0    *CURIT
0274  2146 CC 0A 03            STRA,R0    DUMA+1
0275  2149 C8 72               STRR,R0    LINEX
0276  214B 3F 45 45    LINENO  BSTA,UN    OLFCR
0277  214E 0C 81 3B            LODA,R0    *CURIT
0278  2151 44 0F               ANDI,R0    F
0279  2153 14                  RETC,EQ
0280  2154 0D EA 02            LODA,R1    *DUMA,I
0281  2157 1E 21 9D            BCTA,LT    CLREND
0282  215A 08 61               LODR,R0    LINEX
0283  215C 84 01               ADDI,R0    1
0284  215E C8 ED               STRR,R0    LINEX
0285  2160 C3                  STRZ,R3
0286  2161 E4 09               COMI,R0    9
0287  2163 19 05               BCTR,GT    TWOCH
0288  2165 3F 45 8B            BSTA,UN    WRTBL
0289  2168 1B 07               BCTR,UN    WR2ND
0290  216A 04 31       TWOCH   LODI,R0    '1'
0291  216C 3F 45 8D            BSTA,UN    WRT
0292  216F A7 0A               SUBI,R3    A
0293  2171 67 30       WR2ND   IORI,R3    '0'
0294  2173 03                  LODZ,R3
0295  2174 3F 45 6D            BSTA,UN    WRT
0296  2177 3F 45 8B            BSTA,UN    WRTBL
0297  217A 0D EA 02    NXTC    LODA,R1    *DUMA,I
0298  217D 1A 1E               BCTR,LT    CLREND
0299  217F C3                  STRZ,R3
0300  2180 D9 05               BIRR,R1    NA1
0301  2182 3F 21 D9            BSTA,UN    A1DA
0302  2185 9A 1E               BCFR,LT    CLREND
0303  2187 E7 0D       NA1     COMI,R3    CR
0304  2189 1C 21 4B            BCTA,EQ    LINENO
0305  218C 03                  LODZ,R3
0306  218D 3F 45 8D            BSTA,UN    WRT
0307  2190 1B 68               BCTR,UN    NXTC
0308  2192 20          ERASE   EORZ,R0
0309  2193 CC 81 3B            STRA,R0    *CURIT
0310  2196 3F 21 9D            BSTA,UN    CLREND
0311  2199 3F 45 45            BSTA,UN D  OLFCR
0312  219C 17                  RETC,UN
0313  219D 0C 81 3B    CLREND  LODA,R0    *CURIT
0314  21A0 F4 0F               TMI ,R0    F
0315  21A2 14                  RETC,EQ
0316  21A3 3F 45 45            BSTA,UN D  OLFCR
0317  21A6 1B 75               BCTR,UN    CLREND
0318  21A8 00          FTEMP   RES        1
0319  21A9 3F 22 64    FWDX    BSTA,UN    MTDA
0320  21AC C2          FWDX2   STRZ,R2
0321  21AD 01                  LODZ,R1
0322  21AE 14                  RETC,EQ
0323  21AF 20                  EORZ,R0
0324  21B0 CC 0A 03            STRA,R0    DUMA+1
0325  21B3 0E EA 02    NXTCHR  LODA,R2    *DUMA,I
```


FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL   OPCODE     OPERAND    COMMENTS

0326  21B6 1A 1D               BCTR,LT    ENDFW
0327  21B8 C8 6E               STRR,R0    FTEMP
0328  21BA DA 11               BIRR,R2    CRCK
0329  21BC 3F 21 D9            BSTA,UN    A1DA
0330  21BF 1A 00               BCTR,LT    CRCK
0331  21C1 3F 23 73            BSTA,UN    S1DA
0332  21C4 06 FF               LODI,R2    FF
0333  21C6 04 63               LODI,R0    EBC
0334  21C8 CE EA 02            STRA,R2    *DUMA,I
0335  21CB 1B 08               BCTR,UN    ENDFW
0336  21CD 08 69       CRCK    LODR,R0    FTEMP
0337  21CF E4 0D               COMI,R0    CR
0338  21D1 98 60               BCFR,EQ    NXTCHR
0339  21D3 F9 EE               BDRR,R1    NXTCHR
0340  21D5 CE 0A 03    ENDFW   STRA,R2    DUMA+1
0341  21D8 17                  RETC,UN
0342  21D9 04 01       A1DA    LODI,R0    1
0343  21DB 8C 0A 02            ADDA,R0    DUMA
0344  21DE CC 0A 02            STRA,R0    DUMA
0345  21E1 EC 00 04            COMA,R0    IBST
0346  21E4 17                  RETC,UN
0347  21E5                     *
0348  21E5                     *
0349  21E5 3B 07       ENDF    BSTR,UN    FINDND
0350  21E7 3F 22 3F            BSTA,UN    MTCA
0351  21EA 05 01               LODI,R1    1
0352  21EC 1B 13               BCTR,UN    BACK
0353  21EE 3F 22 64    FINDND  BSTA,UN    MTDA
0354  21F1 05 FF       FNDND2  LODI,R1    FF
0355  21F3 3F 21 AC            BSTA,UN    FWDX2
0356  21F6 0C 8A 02            LODA,R0    *DUMA
0357  21F9 16                  RETC,LT
0358  21FA 0C 0A 03            LODA,R2    DUMA+1
0359  21FD 1E 72               BCTR,UN    FNDND2
0360  21FF 05 0F       BK15    LODI,R1    F
0361  2201 3B 0C       BACK    BSTR,UN    BACKX
0362  2203 1B 05               BCTR,UN    FWBKD
0363  2205 05 0F       FW15    LODI,R1    F
0364  2207 3F 21 A9    FOFWD   BSTA,UN    FWDX
0365  220A 3B 33       FWBKD   BSTR,UN    MTCA
0366  220C 1F 22 48            BCTA,UN    FBDN
0367  220F 3F 22 64    BACKX   BSTA,UN    MTDA
0368  2212 02                  STRZ,R2
0369  2213 20                  EORZ,R0
0370  2214 CC 0A 03            STRA,R0    DUMA+1
0371  2217 65 01               ADDI,R1    1
0372  2219 1B 03               BCTR,UN    CHEK
0373  221B 0E CA 02    SUBL    LODA,R2    *DUMA,-
0374  221E C3          CHEK    STRZ,R3
0375  221F E6 00               COMI,R2    0
0376  2221 98 08               BCFR,EQ    NOSU
0377  2223 3F 23 73            BSTA,UN    S1DA
0378  2226 EC 00 03            COMA,R0    BSTART
0379  2229 1A 28               BCTR,LT    BEGN
0380  222B E7 0D       NOSU    COMI,R3    CR
```

* FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND    COMMENTS

0331  222D 98 6C             BCFR,EQ     SUBL
0332  222F F9 6A             BDFR,R1     SUBL
0333  2231 E6 00             COMI,R2     0
0334  2233 3C 21 D9          BSTA,EQ     A1DA
0335  2236 86 01             ADDI,R2     1
0336  2238 3C 21 D9          BSTA,EQ     A1DA
0337  223B CE 0A 03          STRA,R2     DUMA+1
0338  223E 17                RETC,UN
0339  223F 0C 0A 02    MTCA  LODA,R0     DUMA
0340  2242 CC 0A 00          STRA,R0     CURA
0341  2245 0C 0A 03          LODA,R0     DUMA+1
0342  2248 CC 0A 01          STRA,R0     CURA+1
0343  224B 17                RETC,UN
0344  224C                *
0345  224C                *
0346  224C                *
0347  224C 3B 0B        CREATE BSTR,UN    BEGIN
0348  224E 04 83             LODI,R0     EBC
0349  2250 CC 0A 00          STRA,R0     *CURA
0350  2253                *
0351  2253 3F 22 59     BEGN  BSTA,UN     BEGIN
0352  2256 1F 20 48          BCTA,UN     FBDN
0353  2259 0C 00 03     BEGIN LODA,R0     BSTART
0354  225C CC 0A 00          STRA,R0     CURA
0355  225F 20                EORZ,R0
0356  2260 CC 0A 01          STRA,R0     CURA+1
0357  2263 17                RETC,UN
0358  2264                *
0359  2264 0C 0A 00     MTDA  LODA,R0     CURA
0360  2267 CC 0A 02          STRA,R0     DUMA
0361  226A 0C 0A 01          LODA,R0     CURA+1
0362  226D CC 0A 03          STRA,R0     DUMA+1
0363  2270 17                RETC,UN
0364  2271                *
0365  2271 E7 63        DECOUT COMI,R3    63
0366  2273 99 07             BCFR,GT     NO100
0367  2275 04 31             LODI,R0     '1'
0368  2277 3F 4F 8D          BSTA,UN     WRT
0369  227A A7 64             SUBI,R3     64
0370  227C 06 00        NO100 LODI,R2     0
0371  227E E7 09        SUB10 COMI,R3     9
0372  2280 99 06             BCFR,GT     TENIN
0373  2282 A7 0A             SUBI,R3     A
0374  2284 86 01             ADDI,R2     1
0375  2286 1B 76             BCTR,UN     SUB10
0376  2288 02           TENIN LODZ,R2
0377  2289 64 30             IORI,R0     '0'
0378  228B 3F 45 8D          BSTA,UN     WRT
0379  228E 03                LODZ,R3
0380  228F 64 30             IORI,R0     '0'
0381  2291 3F 45 8D          BSTA,UN     WRT
0382  2294 17                RETC,UN
0383  2295                *
0384  2295                *
0385  2295 3F 21 92     INST  BSTA,UN     ERASE
```


FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND    COMMENTS

0386  2298 3F 23 99          BSTA,UN     IBADD
0387  229B 3F 21 A9          BSTA,UN     FWDX
0388  229E 3F 22 3F          BSTA,UN     MTCA
0389  22A1 3F 21 EE          BSTA,UN     FINDND
0390  22A4 05 00             LODI,R1     00
0391  22A6 3F 47 03     NEXI  BSTA,UN     GETKB
0392  22A9 E4 02             COMI,R0     BS
0393  22AB 1C 23 A4          BCTA,EQ     BACKN
0394  22AE E4 09             COMI,R0     HT
0395  22B0 1C 24 22          BCTA,EQ     TABO
0396  22B3 E4 03             COMI,R0     ETX
0397  22B5 18 05             BCTR,EQ     BYPAS
0398  22B7 3F 26 08          BSTA,UN     CKCTRL
0399  22BA 1A 6A             BCTR,LT     NEXI
0400  22BC CD EA 04     BYPAS STRA,R1     *TMPA,I
0401  22BF E4 03             COMI,R0     ETX
0402  22C1 18 31             BCTR,EQ     ENDI
0403  22C3 E4 0D             COMI,R0     CR
0404  22C5 3C 45 C9          BSTA,EQ     LFCR
0405  22C8 3B 02             BSTR,UN     INSTS
0406  22CA 1B 5A             BCTR,UN     NEXI
0407  22CC                *
0408  22CC 04 01        INSTS LODI,R0     1
0409  22CE 06 02             LODI,R2     2
0410  22D0 3F 24 06          BSTA,UN     ADDANY
0411  22D3 EC 00 04          COMA,R0     IBST
0412  22D6 1A 0A             BCTR,LT     INCR
0413  22D8 3F 23 73          BSTA,UN     S1DA
0414  22DB 04 FE             LODI,R0     FE
0415  22DD CC 0A 03          STRA,R0     DUMA+1
0416  22E0 1B 19             BCTR,UN     ENDINS
0417  22E2 D9 0D        INCR  BIRR,R1     RETCUN
0418  22E4 04 01             LODI,R0     1
0419  22E6 8C 0A 04          ADDA,R0     TMPA
0420  22E9 EC 00 06          COMA,R0     ENDRAM
0421  22EC 9A 04             BCFR,LT     STRTMP
0422  22EE CC 0A 04          STRA,R0     TMPA
0423  22F1 17           RETCUN RETC,UN
0424  22F2 04 01        STRTMP LODI,R0    1
0425  22F4 26 02             LODI,R2     2
0426  22F6 3F 23 B5          BSTA,UN     SUBANY
0427  22F9 05 FF             LODI,R1     FF
0428  22FB 04 03        ENDINS LODI,R0    ETX
0429  22FD CD EA 04          STRA,R1     *TMPA,I
0430  2300                *
0431  2300                *     DUMA HAS THE ADDRESS OF NEW LAST BYTE OF BUFFER
0432  2300                *
0433  2300 0C 0A 02     ENDI  LODA,R0     DUMA
0434  2303 CC 0A 04          STRA,R0     TMPA
0435  2306 0F 0A 03          LODA,R3     DUMA+1
0436  2309 3F 21 EE          BSTA,UN     FINDND
0437  230C 3F 23 7C          BSTA,UN     SDCA
0438  230F 0D 0A 03          LODA,R1     DUMA+1
0439  2312 20                EORZ,R0
0440  2313 CC 0A 03          STRA,R0     DUMA-1
```

FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

0441  2316 CC 0A 05       DOWN   STRA,R0    TMPA+1
0442  2319 01 EA 02              LODA,R1    *DUMA,I
0443  231C CF EA 04              STRA,R3    *TMPA,I
0444  231F 04 01                 LODI,R0    1
0445  2321 06 06                 LODI,R2    6
0446  2323 3F 23 B5              BSTA,UN    SUBANY
0447  2326 98 05                 BCFR,EQ    NOCK
0448  2328 DC 0A 07              LODA,R0    BSA1+1
0449  232B 18 1E                 BCTR,EQ    INSTDN
0450  232D                  *
0451  232D A5 01            NOCK   SUBI,R1    1
0452  232F E5 FF                   COMI,R1    FF
0453  2331 98 08                   BCFR,EQ    NS1DA
0454  2333 3F 23 73                BSTA,UN    S1DA
0455  2336 EC 00 03                COMA,R0    BSTAPT
0456  2339 1A 10                   BCTR,LT    INSTDN
0457  233B A7 01            NS1DA  SUBI,R3    01
0458  233D E7 FF                   COMI,R3    FF
0459  233F 98 58                   BCFR,EQ    DOWN
0460  2341 0C 0A 04                LODA,R0    TMPA
0461  2344 A4 01                   SUBI,R0    01
0462  2346 CC 0A 04                STRA,R0    TMPA
0463  2349 1B 4E                   BCTR,UN    DOWN
0464  234B                  *
0465  234B 3F 23 99         INSTDN BSTA,UN    IBADD
0466  234E 3F 22 64                BSTA,UN    MTDA
0467  2351 C1                      STRZ,R1
0468  2352 20                      EORZ,R0
0469  2353 CC 0A 03                STRA,R0    DUMA+1
0470  2356 07 FF                   LODI,R3    FF
0471  2358 0F AA 04         INSERT LODA,R3    *TMPA,+
0472  235B E4 03                   COMI,R0    ETX
0473  235D 18 0F                   BCTR,EQ    INSTE
0474  235F CD EA 02                STRA,R1    *DUMA,I
0475  2362 E7 FF                   COMI,R3    FF
0476  2364 30 23 CC                BSTA,EQ    A1TA
0477  2367 D9 6F                   BIER,R1    INSERT
0478  2369 3F 21 D9                BSTA,UN    A1DA
0479  236C 1A 6A                   BCTR,LT    INSERT
0480  236E 05 01            INSTE  LODI,R1    1
0481  2370 1F 22 01                BCTA,UN    BACK
0482  2373                  *
0483  2373 0C 0A 02         S1DA   LODA,R0    DUMA
0484  2376 A4 01                   SUBI,R0    1
0485  2378 CC 0A 02                STRA,R0    DUMA
0486  237B 17                      RETC,UN
0487  237C                  *
0488  237C 0C 0A 03         SDCA   LODA,R0    DUMA+1
0489  237F AC 0A 01                SUBA,R0    CURA+1
0490  2382 CC 0A 07                STRA,R0    BSA1+1
0491  2385 77 08                   PPSL       WC
0492  2387 0C 0A 02                LODA,R0    DUMA
0493  238A AC 0A 00                SUBA,R0    CURA
0494  238D CC 0A 06                STRA,R0    BSA1
0495  2390 75 08                   CPSL       WC
```


FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

0496  2392 04 01                 LODI,R0    1
0497  2394 06 06                 LODI,R2    6
0498  2396 1F 24 06              BCTA,UN    ADDANY
0499  2399                  *
0500  2399 0C 00 04         IBADD  LODA,R0    IBST
0501  239C CC 0A 04                STRA,R0    TMPA
0502  239F 20                      EORZ,R0
0503  23A0 CC 0A 05                STRA,R0    TMPA+1
0504  23A3 17                      RETC,UN
0505  23A4                  *
0506  23A4 3F 45 18         BACKN  BSTA,UN    BACK1
0507  23A7 1E 22 A6                BCTA,LT    NEXI
0508  23AA 04 01                   LODI,R0    1
0509  23AC 06 02                   LODI,R2    2
0510  23AE 3F 23 B5                BSTA,UN    SUBANY
0511  23B1 1F 22 A6                BCTA,UN    NEXI
0512  23B4                  *
0513  23B4                  *
0514  23B4 00               STORE  PES        1
0515  23B5 CB 7I            SUBANY STRP,R0    STORE
0516  23B7 0F 6A 01                LODA,R2    CURA+1,I
0517  23BA AE 78                   SUBR,R0    STORE
0518  23BC CF 6A 01                STRA,R2    CURA+1,I
0519  23BF 77 08                   PPSL       WC
0520  23C1 0F 6A 00                LODA,R2    CURA,I
0521  23C4 A4 00                   SUBI,R0    0
0522  23C6 CE 6A 00                STRA,R2    CURA,I
0523  23C9 75 08                   CPSL       WC
0524  23CB 17                      RETC,UN
0525  23CC                  *
0526  23CC 04 01            A1TA   LODI,R0    1
0527  23CE 8C 0A 04                ADDA,R0    TMPA
0528  23D1 CC 0A 04                STRA,R0    TMPA
0529  23D4 17                      RETC,UN
0530  23D5                  *
0531  23D5 3F 21 A9         DELT   BSTA,UN    FWDX
0532  23D8 3B 05                   BSTR,UN    SHIF
0533  23DA 05 01                   LODI,R1    1
0534  23DC 1F 22 01                BCTA,UN    BACK
0535  23DF                  *
0536  23DF 0F 0A 02         SHIF   LODA,R3    CURA
0537  23E2 CF 0A 04                STRA,R3    TMPA
0538  23E5 0F 0A 01                LODA,R3    CURA+1
0539  23E8 0D 0A 03                LODA,R1    DUMA+1
0540  23EB 20                      EORZ,R0
0541  23EC CC 0A 05                STRA,R0    TMPA+1
0542  23EF CC 0A 03                STRA,R0    DUMA+1
0543  23F2 0D EA 02         UP     LODA,R1    *DUMA,I
0544  23F5 CF EA 04                STRA,R3    *TMPA,I
0545  23F8 16                      RETC,LT
0546  23F9 87 01                   ADDI,R3    1
0547  23FB 3C 23 CC                BSTA,EQ    A1TA
0548  23FE D9 72                   BIER,R1    UP
0549  2400 3F 21 D9                BSTA,UN    A1DA
0550  2403 1A 6I                   BCTR,LT    UP
```

FILE 'AIP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

0551  2405 17                 RETC,UN
0552  2406                 *
0553  2406 8F 6A 01    ADDANY ADDA,R2     CURA+1,I
0554  2409 CF 6A 01            STRA,R2    CURA+1,I
0555  240C 77 08               CPSL       WC
0556  240E 28                  PORZ,R0
0557  240F 8F 6A 00            ADDA,R2    CURA,I
0558  2412 CF 6A 00            STRA,R2    CURA,I
0559  2415 7F 08               CPSL       WC
0560  2417 17                  RETC,UN
0561  2418                 *
0562  2418                 *
0563  2418 07 0F       NOTFON LODI,R3    0F
0564  241A 1F 45 01            BCTA,UN    ERROR
0565  241D 07 0D       TMF     LODI,R3    0D
0566  241F 1F 45 01            BCTA,UN    ERROR
0567  2422                 *
0568  2422 3F 24 38    TABO    BSTA,UN    TABSUB
0569  2425 1C 22 A6            BCTA,EQ    NEXI
0570  2428 04 20       TL3     LODI,R0
0571  242A CF EA 24            STRA,R1    *TMPA,I
0572  242D 3F 45 BD            BSTA,UN    WRT
0573  2430 3F 22 CC            BSTA,UN    INSTS
0574  2433 FE 73               BIRR,R3    TL3
0575  2435 1F 22 A6            BCTA,UN    NEXI
0576  2438                 *
0577  2438 07 FF       TABSUB LODI,R3    FF
0578  243A 00 0A 04            LODA,R0    TMPA
0579  243D CC 0A 05            STRA,R0    BSA1
0580  2440 CD 0A 07            STRA,R1    BSA1+1
0581  2443 87 01       TL1     ADDI,R3    1
0582  2445 04 01               LODI,R0    1
0583  2447 06 06               LODI,R2    6
0584  2449 3F 23 B5            BSTA,UN    SUBANY
0585  244C EC 00 04            COMA,R0    IBST
0586  244F 1A 07               BCTR,LT    CRFND
0587  2451 00 8A 06            LODA,R2    *BSA1
0588  2454 E4 0D               COMI,R0    CR
0589  2456 9B 6B               BCFR,EQ    TL1
0590  2458 06 FF       CRFND   LODI,R2    FF
0591  245A 0E 20 07    TL2     LODA,R2    TABS,+
0592  245D E6 03               COMI,R2    03
0593  245F 14                  RETC,EQ
0594  2460 E3                  COMZ,R3
0595  2461 99 77               BCFR,GT    TL2
0596  2463 A3                  SUBZ,R3
0597  2464 C3                  STRZ,R3
0598  2465 17                  RETC,UN
0599  2466                 *
0600  2466 3F 22 64    S2      BSTA,UN    MTDA
0601  2469 01                  STRZ,R1
0602  246A 20                  PORZ,R0
0603  246B CC 0A 03            STRA,R0    DUMA+1
0604  246E CC 04 C4            STRA,R0    SSTAT
0605  2471 00 0A 02            LODA,R0    DUMA
```


FILE 'AIP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

0606  2474 CC 0A 04            STRA,R0    TMPA
0607  2477 CD 0A 05            STRA,R1    TMPA+1
0608  247A 06 FF       REDO    LODI,R2    FF
0609  247C 0E 20 1F    SI2     LODA,R2    NAME,+
0610  247F 18 33               BCTR,EQ    FOUND
0611  2481 3F 47 BC            BSTA,UN    LTOU
0612  2484 E6 10               COMI,R2    10
0613  2486 18 2C               BCTR,EQ    FOUND
0614  2488 C3                  STRZ,R3
0615  2489 0D EA 02            LODA,R1    *DUMA,I
0616  248C 1E 24 C5            BCTA,LT    NF
0617  248F 3F 47 BC            BSTA,UN    LTOU
0618  2492 CC 00 2E            STRA,R0    TMPS
0619  2495 D9 05               BIRR,R1    NOAD
0620  2497 3F 21 D9            BSTA,UN    A1DA
0621  249A 9A 29               BCFR,LT    NF
0622  249C 00 00 2E    NOAD    LODA,R0    TMPS
0623  249F E3                  COMZ,R3
0624  24A0 18 5A               BCTR,EQ    SL2
0625  24A2 04 01               LODI,R0    1
0626  24A4 06 04               LODI,R2    4
0627  24A6 3F 24 06            BSTA,UN    ADDANY
0628  24A9 00 0A 04            LODA,R0    TMPA
0629  24AC CC 0A 02            STRA,R0    DUMA
0630  24AF 01 0A 05            LODA,R1    TMPA+1
0631  24B2 1B 46               BCTR,UN    REDO
0632  24B4 CD 0A 03    FOUND   STRA,R1    DUMA+1
0633  24B7 CE 00 2F            STRA,R2    TEMP
0634  24BA 02                  LODZ,R2
0635  24BB 06 02               LODI,R2    02
0636  24BD 3F 23 B5            BSTA,UN    SUBANY
0637  24C0 0E 00 2F            LODA,R2    TEMP
0638  24C3 17                  RETC,UN
0639  24C4                 *
0640  24C4 00          SSTAT   RES        1
0641  24C5 04 FF       NF      LODI,R0    FF
0642  24C7 C8 7B               STBR,R0    SSTAT
0643  24C9 3F 22 64            BSTA,UN    MTDA
0644  24CC 17                   EIC,UN
0645  24CD                 *
0646  24CD 05 21       SEARCH  LODI,R1    01
0647  24CF 3F 21 A9            BSTA,UN    FWIX
0648  24D2 3F 22 3F            BSTA,UN    MTCA
0649  24D5 3F 24 66            BSTA,UN    S2
0650  24D8 08 6A               LODR,R0    SSTAT
0651  24DA 1E 24 18            BCTA,LT    NOTFON
0652  24DD 3F 22 3F            BSTA,UN    MTCA
0653  24E0 05 00               LODI,R1    00
0654  24E2 1F 22 01            BCTA,UN    BACK
0655  24E5                 *
0656  24E5 3F 23 99    SAVE    BSTA,UN    IBADD
0657  24E8 3F 21 A9            BSTA,UN    FWDX
0658  24EB 3F 23 7C            BSTA,UN    SDCA
0659  24EE 3F 22 64            BSTA,UN    MTDA
0660  24F1 01                  STRZ,R1
```

FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

0661  24F2 20                 BCFR,R0
0662  24F3 CC 0A 03           STRA,R0     DUMA+1
0663  24F6 CB                 STRZ,R3
0664  24F7 0D EA 02    SL     LODA,R1     *DUMA,I
0665  24FA CF EA 04           STRA,R3     *TMPA,I
0666  24FD D9 05              BIRR,R1     CKR3
0667  24FF 3F 21 D9           BSTA,UN     A1DA
0668  2502 9A 1A              BCFR,LT     SL3
0669  2504 D3 08       CKR3   BIRR,R3     SLCK
0670  2506 3F 23 CC           BSTA,UN     A1TA
0671  2509 FC 22 06           COMA,R2     ENDRAM
0672  250C 1A 00              BCTR,LT     SLCK
0673  250E 04 01       SLCK   LODI,R0     1
0674  2510 06 06              LODI,R2     6
0675  2512 3F 23 B5           BSTA,UN     SUBANY
0676  2515 98 60              BCFR,EQ     SI
0677  2517 00 0A 07           LODA,R0     BSA1+1
0678  251A E4 01              COMI,R0     1
0679  251C 98 59              BCFR,EQ     SI
0680  251E 04 03       SI3    LODI,R0     ETX
0681  2520 CF EA 04           STRA,R3     *TMPA,I
0682  2523 1F 20 4B           BCTA,UN     COMD
0683  2526             *
0684  2526 3F 21 A9    ISAVE  BSTA,UN     FWDX
0685  2529 3F 22 3F           BSTA,UN     MTCA
0686  252C 3F 21 EE           BSTA,UN     FINDND
0687  252F 3F 23 99           BSTA,UN     IBADD
0688  2532 05 00              LODI,R1     0
0689  2534 04 03       ISL2   LODI,R0     ETX
0690  2536 ED EA 04    ISL    COMA,R1     *TMPA,I
0691  2539 18 0D              BCTE,EQ     IFOUND
0692  253B D9 79              BIRR,R1     ISL
0693  253D 3F 23 CC           BSTA,UN     A1TA
0694  2540 FC 00 06           COMA,R0     ENDRAM
0695  2543 9E 20 48           BCFA,LT     FBDN
0696  2546 1B 6C              BCTR,UN     ISL2
0697  2548 00 0A 04    IFOUND LODA,R0     TMPA
0698  254B AC 00 24           SUBA,R0     IBST
0699  254E 8C 0A 02           ADDA,R0     DUMA
0700  2551 CC 0A 02           STRA,R0     DUMA
0701  2554 01                 LODZ,R1
0702  2555 06 02              LODI,R2     02
0703  2557 3F 24 06           BSTA,UN     ADDANY
0704  255A EC 00 04           COMA,R0     IBST
0705  255D 9E 24 1D           BCFA,LT     TME
0706  2560 1F 23 00           BCTA,UN     ENDI
0707  2563             *
0708  2563 06 15       PMOD   LODI,R2     15
0709  2565 05 0F              LODI,R1     0F
0710  2567 3F 44 4C           BSTA,UN     SETCUR
0711  256A 3F 45 45           BSTA,UN     CLPCR
0712  256D 05 FF              LODI,R1     FF
0713  256F 0D 20 1E    NXTNM  LODA,R1     NAME,+
0714  2572 CD 77 EF           STRA,R1     MNAME,I
0715  2575 E5 0F              COMI,R1     F
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FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

0716  2577 98 76              BCFR,EQ     NXTNM
0717  2579 05 0F       WRTM   LODI,R1     0F
0718  257B 3F 46 CA           BSTA,UN     PRING
0719  257E 05 0D              LODI,R1     MBUF
0720  2580 04 20              LODI,R0     ^MBUF
0721  2582 06 10              LODI,R2     10
0722  2584 3F 46 67           BSTA,UN     ARROW
0723  2587 1F 20 4B           BCTA,UN     COMD
0724  258A             *
0725  258A 00          MTEMP  RES         1
0726  258B 01          MODIFY LODZ,R1
0727  258C 1C 20 4B           BCTA,EQ     COMD
0728  258F A5 01              SUBI,R1     1
0729  2591 3F 21 A9           BSTA,UN     FWDX
0730  2594 3F 22 3F           BSTA,UN     MTCA
0731  2597 05 FF              LODI,R1     FF
0732  2599 06 10              LODI,R2     10
0733  259B 0D 37 EF    XFER   LODA,R1     MNAME,+
0734  259E CD 60 1E           STRA,R1     NAME,I
0735  25A1 FA 78              BDRR,R2     XFER
0736  25A3 05 01              LODI,R1     1
0737  25A5 3F 21 A9           BSTA,UN     FWDX
0738  25A8 00 8A 02           LODA,R0     *DUMA
0739  25AB C8 5D              STRR,R0     MTEMP
0740  25AD 04 83              LODI,R0     EBC
0741  25AF CC 8A 02           STRA,R0     *DUMA
0742  25B2 3F 24 66           BSTA,UN     S2
0743  25B5 CE 00 2E           STRA,R2     TMPS
0744  25B8 3F 22 3F           BSTA,UN     MTCA
0745  25BB 05 01              LODI,R1     1
0746  25BD 3F 21 A9           BSTA,UN     FWDX
0747  25C0 08 48              LODR,R0     MTEMP
0748  25C2 CC 8A 02           STRA,R0     *DUMA
0749  25C5 00 04 C4           LODA,R2     SSTAT
0750  25C8 1E 24 18           BCTA,LT     NOTFCN
0751  25CB 3F 22 64           BSTA,UN     MTDA
0752  25CE 00 00 2E           LODA,R0     TMPS
0753  25D1 06 02              LODI,R2     2
0754  25D3 3F 24 06           BSTA,UN     ADDANY
0755  25D6 3F 23 DF           BSTA,UN     SHIF
0756  25D9 3F 23 99           BSTA,UN     IBADD
0757  25DC 05 FF              LODI,R1     FF
0758  25DE 0D 22 0D    ML1    LODA,R1     MBUF,+
0759  25E1 18 09              BCTR,EQ     ENDM
0760  25E3 CD 1A 04           STRA,R1     *TMPA,I
0761  25E6 E5 0F              COMI,R1     0F
0762  25E8 98 74              BCFR,EQ     ML1
0763  25EA 05 10              LODI,R1     10
0764  25EC 04 03       ENDM   LODI,R0     ETX
0765  25EE CD 1A 04           STRA,R1     *TMPA,I
0766  25F1 CD 00 2E           STRA,R1     TMPS
0767  25F4 3F 21 EE           BSTA,UN     FINDND
0768  25F7 00 00 2E           LODA,R0     TMPS
0769  25FA 06 02              LODI,R2     2
0770  25FC 3F 24 06           BSTA,UN     ADDANY
```

FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

0771  25FF ED 00 04           COMA,R0     IBST
0772  2602 9E 24 1D           BCFA,LT     TMI
0773  2605 1F 23 00           BCTA,UN     INDI
0774  2608                *
0775  2608 E4 0D        CKCTRL COMI,R0     CR
0776  260A 98 05               BCFR,EQ     CKLP12
0777  260C 75 80               CPSL        80
0778  260E 77 40               PPSL        40
0779  2610 17                  RETC,UN
0780  2611 24 FF        CKLP12 IORI,R0     FF
0781  2613 77 10               PPSL        RS
0782  2615 C1                  STRZ,R1
0783  2616 24 FF               IORI,R0     FF
0784  2618 F5 E0               TMI ,R1     E0
0785  261A 98 05               BCFR,EQ     NOCTCK
0786  261C 77 80               PPSL        80
0787  261E 75 50               CPSL        50
0788  2620 17                  RETC,UN
0789  2621 75 D0        NOCTCK CPSL        D0
0790  2623 17                  RETC,UN
0791  2624                *
0792  2624 01           CHANGE LODZ,R1
0793  2625 1C 20 4B            BCTA,EQ     COMD
0794  2628 3F 23 99            BSTA,UN     IBADD     TMPA=IBST
0795  262B A5 01               SUBI,R1     1
0796  262D 3F 21 A9            BSTA,UN     FWDX
0797  2630 3F 22 CF            BSTA,UN     MTCA      CURA=ADDRESS OF BYTE TO CHANGE
0798  2633 3F 21 92            BSTA,UN     ERASE
0799  2636 3F 21 FE            BSTA,UN     FINDND    DUMA=END OF BUFFER
0800  2639 0C 0A 00            LODA,R0     CURA      CHGA=ADDRESS OF BYTE TO CHANGE
0801  263C CC 0A 09            STRA,R0     CHGA
0802  263F 0C 0A 01            LODA,R0     CURA+1
0803  2642 CC 0A 09            STRA,R0     CHGA+1
0804  2645 05 00               LODI,R1     00
0805  2647 3F 45 C9    DISPL   BSTA,UN     LFCR
0806  264A 0C 81 3E            LODA,R0     *CURIT
0807  264D F4 0F               TMI ,R0     F
0808  264F 3C 21 92            BSTA,EQ     ERASE
0809  2652 0E 0A 08            LODA,R2     CHGA
0810  2655 CE 0A 0E            STRA,R2     BSA1
0811  2658 0F 0A 09            LODA,R3     CHGA+1
0812  265B 0C 8A 08    DISPLP  LODA,R0     *CHGA
0813  265E 1E 27 D8            BCTA,LT     ENDCHG    EOF
0814  2661 E4 0D               COMI,R0     CR
0815  2663 18 12               BCTR,EQ     ELFND
0816  2665 3F 45 8D            BSTA,UN     WRT
0817  2668 84 01               LODI,R2     1         BUMP CHGA
0818  266A 26 08               LODI,R2     8
0819  266C 3F 24 06            BSTA,UN     ADDANY
0820  266F ED 00 04            COMA,R0     IBST
0821  2672 1A 67               BCTR,LT     DISPLP
0822  2674 1F 27 D8            BCTA,UN     ENDCHG
0823  2677 CF 0A 09    ELFNT   STRA,R3     CHGA+1
0824  267A 0C 0A 06            LODA,R0     BSA1
0825  267D CC 0A 08            STRA,R0     CHGA
```


FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

0826  2680 3F 45 C9            BSTA,UN     LFCR
0827  2683 3F 47 03    CHGL    BSTA,UN     GETKB
0828  2686 E4 08               COMI,R0     BS
0829  2688 98 05               BCFR,EQ     NOCHBS
0830  268A 3F 27 E0            BSTA,UN     CHBACK
0831  268D 1B 74               BCTR,UN     CHGL
0832  268F E4 09        NOCHBS COMI,R0     HT        TAB
0833  2691 98 15               BCFR,EQ     NCET
0834  2693 3F 24 38            BSTA,UN     TABSUB
0835  2696 1B 6B               BCTR,EQ     CHGL
0836  2698 CF 0A 06    TABL3   STRA,R3     BSA1
0837  269B 07 22               LODI,R3     ' '
0838  269D 3F 27 A0            BSTA,UN     STRTMS
0839  26A0 0F 0A 06            LODA,R3     BSA1
0840  26A3 FE 73               BDRR,R3     TABL3
0841  26A5 1F 26 83            BCTA,UN     CHGL
0842  26A8 E4 15        NOHT    COMI,R0     CTRLU
0843  26AA 98 0A               BCFR,EQ     NOCOPY
0844  26AC 3F 27 89            BSTA,UN     LOADD
0845  26AF 1B 52               BCTR,EQ     CHGL
0846  26B1 3F 27 A0            BSTA,UN     STRTMS
0847  26B4 1B 4D               BCTR,UN     CHGL
0848  26B6 E4 19        NOCOPY COMI,R0     CTRLY
0849  26B8 98 26               BCFR,EQ     NOCWD
0850  26BA 3F 27 89    CWD1    BSTA,UN     LOADD
0851  26BD 18 44               BCTR,EQ     CHGL
0852  26BF E7 20               COMI,R3     ' '
0853  26C1 98 18               BCFR,EQ     CWD3
0854  26C3 3F 27 A0            BSTA,UN     STRTMS
0855  26C6 1B 72               BCTR,UN     CWD1
0856  26C8 0F 8A 08    CWD2    LODA,R3     *CHGA
0857  26CB E7 20               COMI,R3     ' '
0858  26CD 1C 26 83            BCTA,EQ     CHGL
0859  26D0 E7 20               COMI,R3     ' '
0860  26D2 1C 26 83            BCTA,EQ     CHGL
0861  26D5 3F 27 89            BSTA,UN     LOADD
0862  26D8 1C 26 83            BCTA,EQ     CHGL
0863  26DB 3F 27 A0    CWD3    BSTA,UN     STRTMS
0864  26DF 1B 68               BCTR,UN     CWD2
0865  26E0 E4 0Z        NOCWD   COMI,R0     CTRLW
0866  26E2 98 35               BCFR,EQ     NOERWD
0867  26E4 CD 0A 0B            STRA,R1     CHGST+1
0868  26E7 0C 0A 04            LODA,R0     TMPA
0869  26EA CC 0A 0A            STRA,R0     CHGST
0870  26ED 06 0A        ERWD1   LODI,R2     A
0871  26EF 04 01               LODI,R0     1
0872  26F1 3F 23 B5            BSTA,UN     SUBANY
0873  26F4 0C 8A 0A            LODA,R0     *CHGST
0874  26F7 E4 20               COMI,R0     ' '
0875  26F9 98 19               BCFR,EQ     ERWD3
0876  26FB 3F 27 E0            BSTA,UN     CHBACK
0877  26FE 1B 6D               BCTR,UN     ERWD1
0878  2700 06 0A        ERWD2   LODI,R2     A
0879  2702 04 01               LODI,R0     1
0880  2704 3F 23 B5            BSTA,UN     SUBANY
```

FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

0881  2707 00 0A 02          LODA,R0   *CHGST
0882  270A E4 20              COMI,R0
0883  270C 1C 26 83           BCTA,EQ   CHGL
0884  270F E4 2C              COMI,R0
0885  2711 1C 26 83           BCTA,EQ   CHGL
0886  2714 3F 27 F0    ERWD3  BSTA,UN   CHBACK
0887  2717 1B 67              BCTR,UN   ERWD2
0888  2719 E4 10        NOERWD COMI,R0   CTRLP     COPY TO END OF LINE
0889  271B 98 03              BCFR,EQ   NOCEOL
0890  271D 3F 27 89    CCPYLP BSTA,UN   LOADD
0891  2720 1C 26 83           BCTA,EQ   CHGL
0892  2723 3F 27 A0           BSTA,UN   STRTMS
0893  2726 1B 75              BCTR,UN   CCPYLP
0894  2728 E4 0F        NOCEOL COMI,R0   CTRLO
0895  272A 98 05              BCFR,EQ   NOD1SC
0896  272C 3F 27 89           BSTA,UN   LOADD
0897  272F 1F 26 83           BCTA,UN   CEGL
0898  2732 C3          NOD1SC STRZ,R3
0899  2733 E4 03              COMI,R0   ETX
0900  2735 1F 26              BCTR,EQ   BYPASS
0901  2737 3F 26 08           BSTA,UN   CKCTRL
0902  273A 1F 26 83           BCTA,LT   CHGL
0903  273D 3F 27 A4    BYPASS BSTA,UN   STRT2
0904  2747 03                 LOD2,R3
0905  2741 E4 01              COMI,R0   CR
0906  2743 18 0F              BCTR,EQ   ENDCHL
0907  2745 E4 03              COMI,R0   ETX
0908  2747 90 26 83           BCFA,EQ   CHGL
0909  274A 04 01              LODI,R0   1
0910  274C 06 02              LODI,R2   2
0911  274E 3F 23 B5           BSTA,UN   SUBANY   GET RID OF ETX BEING IN PICTURE
0912  2751 1F 27 FF           BCTA,UN   ENDCB
0913  2754 3F 27 69    ENDCHL BSTA,UN   ENDCHL
0914  2757 98 7B              BCFR,EQ   A1SC
0915  2759 3F 27 EF           BSTA,UN   DISPL
0916  275C 1F 26 47           BCTA,UN
0917  275F             *
0918  275F 00 0A 02    ENDCB  LODA,R0   DUMA
0919  2762 CC 0A 06           STRA,R0   BSA1
0920  2765 00 0A 03           LODA,R0   DUMA+1
0921  2768 CC 0A 07           STRA,R0   BSA1+1
0922  276B 00 0A 08           LODA,R0   CHGA
0923  276E CC 0A 02           STRA,R0   DUMA
0924  2771 00 0A 09           LODA,R0   CHGA+1
0925  2774 CC 0A 03           STRA,R0   DUMA+1
0926  2777 3F 23 DF           BSTA,UN   SHIF
0927  277A 00 0A 06           LODA,R0   BSA1
0928  277D CC 0A 02           STRA,R0   DUMA
0929  2780 00 0A 07           LODA,R0   BSA1+1
0930  2783 CC 0A 03           STRA,R0   DUMA+1
0931  2786 1F 23 00           BCTA,UN   ENDI
0932  2789             *
0933  2789 0F 8A 08    LOADD  LODA,R3   *CHGA
0934  278C E7 0D              COMI,R3   CR
0935  278E 14                 RETC,EQ
```


FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

0936  278F 04 01        A1SC   LODI,R0   1         DECR DUMA
0937  2791 06 02               LODI,R2   2
0938  2793 3F 23 B5           BSTA,UN   SUBANY
0939  2796 04 01               LODI,R0   1         BUMP CHGA
0940  2798 06 08               LODI,R2   8
0941  279A 3F 24 06           BSTA,UN   ADDANY
0942  279D 04 80              LODI,R0   80
0943  279F 17                 RETC,UN
0944  27A0             *
0945  27A0 03          STRTMS LODZ,R3
0946  27A1 3F 45 8D           BSTA,UN   WRT
0947  27A4 03          STRT2  LODZ,R3
0948  27A5 CD EA 04           STRA,R1   *TMPA,I
0949  27A8 04 01              LODI,R0   1         BUMP DUMA
0950  27AA 06 02              LODI,R2   2
0951  27AC 3F 24 06           BSTA,UN   ADDANY
0952  27AF EC 00 04           COMA,R2   IBST
0953  27B2 1A 0E              BCTR,LT   A1R1
0954  27B4 3F 23 73           BSTA,UN   SIDA
0955  27B7 04 FE              LODI,R0   FE
0956  27B9 CC 0A 03           STRA,R0   DUMA+1
0957  27BC 1F 27 D8           BCTA,UN   ENDCBG
0958  27BF D9 0D       A1R1   BIFR,R1   RETCN
0959  27C1 04 01              LODI,R0   1
0960  27C3 8C 0A 04           ADDA,R2   TMPA
0961  27C6 EC 00 06           COMA,R2   ENDRAM
0962  27C9 9A 04              BCFR,LT   ABRUPT
0963  27CB CC 0A 04           STRA,R2   TMPA
0964  27CE 17          RETCN  RETC,UN
0965  27CF 04 01       ABRUPT LODI,R0   1
0966  27D1 06 02              LODI,R2   2
0967  27D3 3F 23 B5           BSTA,UN   SUBANY
0968  27D6 05 FF              LODI,R1   FF
0969  27D8 34 03       ENDCHG LODI,R0   ETX
0970  27DA CD EA 04           STRA,R1   *TMPA,I
0971  27DD 1F 27 5F           BCTA,UN   ENDCH
0972  27E0             *
0973  27E0 3F 45 18    CHBACK BSTA,UN   BACK1
0974  27E3 16                 RETC,LT
0975  27E4 04 01              LODI,R0   1
0976  27E6 06 02              LODI,R2   2
0977  27E8 3F 23 B5           BSTA,UN   SUBANY
0978  27EB 17                 RETC,UN
0979  27EC             *
0980  27EC 00 00 00    LOADLS RES       3
0981  27EF             *
0982  27EF 3F 2E 0A    LCADI  BSTA,UN   ACK
0983  27F2 3F 2D 9F           BSTA,UN   LOADA
0984  27F5 90 27 FB           BCFA,EQ   SCERR
0985  27F8 1F 20 46           BCTA,UN   FBIN
0986  27FB             *
0987  27FB 07 10       SCERR  LODI,R3   10
0988  27FD 1F 45 01           BCTA,UN   ERROR
0989  2800             *
0990  2800 3F 2E 0A    TAPEC  BSTA,UN   ACK
```

STORE TO TAPE

L PRINT OF

FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-7

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

0991  2803 00 00 03           LODA,R0     BSTART
0992  2806 CC 0A 02           STRA,R0     DUMA
0993  2809 20                 EORZ,R0
0994  280A 08 57        TAPEOT STPR,R0     *SUMK
0995  280C CC 0A 03           STRA,R0     DUMA
0996  280F 07 3E              LODI,R3     ;;
0997  2811 3F 02 4F           BSTA,UN     SERO
0998  2814 06 FF              LOTI,R1     FF
0999  2816 0D 20 1E     NAMO  LODA,R1     NAME,+
1000  2819 03                 STRZ,R3
1001  281A 3F 02 4F           BSTA,UN     SERO
1002  281D F5 07              COMI,R1     07
1003  281F 98 75              BCFR,EQ     NAMO
1004  2821 0E A0              IOTF,R3     *SUMK
1005  2823 3F 02 4F           BSTA,UN     SERO
1006  2826 05 00              LODI,R1     00
1007  2828 09 99              STPR,R1     *SUMK
1008  282A 0D EA 02     BYTEO LODA,R1     *DUMA,I
1009  282D 03                 STRZ,R3
1010  282E 1A 15              BCTR,LT     ENDO
1011  2830 3F 02 4F           BSTA,UN     SERO
1012  2833 D9 75              BIBR,R1     BYTEO
1013  2835 2B 5C              LODR,R3     *SUMK
1014  2837 3F 02 4F           BSTA,UN     SERO
1015  283A 3F 21 D9           BSTA,UN     AIDA
1016  283D 9E 20 48           BCFA,LT     FBDN
1017  2840 1F 28 09           BCTA,UN     TAPEOT
1018  2843                 *
1019  2843 17 F9        SUMK  ACON        17F9
1020  2845                 *
1021  2845 3F 02 4F     ENDO  BSTA,UN     SERO
1022  2848 03 F9        ENDT  LODR,R3     *SUMK
1023  284A 3F 02 4F           BSTA,UN     SERO
1024  284D 1F 20 48           BCTA,UN     FBDN
1025  2850                 *
1026  2850 4C 4C 4C 4C OPCD1  ALIT        'LLLLSSSAAAASSSSDAAAAIIIIEEEECCCCRRBBBBBBBBBZ'
1027  2854 53 53 53 41
1028  2858 41 41 41 53
1029  285C 53 53 53 44
1030  2860 41 41 41 41
1031  2864 49 49 49 49
1032  2868 45 45 45 45
1033  286C 43 43 43 43
1034  2870 52 52 42 42
1035  2874 42 42 42 42
1036  2878 42 42 42 42
1037  287C 5A
1038  287D 42 42 42 42        ALIT        'BBBBBBBZBRRWRWRWRENTLLSSCCPPTTOEDAREAPBBDT'
1039  2881 42 42 42 5A
1040  2885 42 52 52 57
1041  2889 52 57 52 57
1042  288D 52 48 4E 54
1043  2891 4C 4C 53 53
1044  2895 43 43 50 50
1045  2899 54 54 4F 45
```


FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

1046  289D 44 41 52 45
1047  28A1 41 50 42 42
1048  28A5 44 54
1049  28A7 4F 4F 4F 4F OPCD2  ALIT        'OOOOTTTDDDDUUUUANNNNCOOOOOOOOOOORRCCCCRRIIDDP'
1050  28AB 54 54 54 44
1051  28AF 44 44 44 55
1052  28B3 55 55 55 41
1053  28B7 4E 4E 4E 4E
1054  28BB 4F 4F 4F 4F
1055  28BF 4F 4F 4F 4F
1056  28C3 4F 4F 4F 4F
1057  28C7 52 52 43 43
1058  28CB 43 43 52 52
1059  28CF 49 49 44 44
1060  28D3 42
1061  28D4 50 53 53 53        ALIT        'ISSSSSSBSEERRRRRFACMPPPPPPPPPPROACENLRLUIA'
1062  28D8 53 53 53 42
1063  28DC 53 45 45 52
1064  28E0 45 52 45 52
1065  28E4 45 41 4F 4D
1066  28E8 50 50 50 50
1067  28EC 50 50 50 50
1068  28F0 50 50 52 51
1069  28F4 41 43 45 4E
1070  28F8 4C 52 4C 55
1071  28FC 49 41
1072  28FE 44 44 44 44 OPCD3  ALIT        'DDDDRRRDDDDBPPBRDDDDRRRRRRRRMMMMPLTTFFNNRRRRR'
1073  2902 52 52 52 44
1074  2906 44 44 44 42
1075  290A 42 42 42 52
1076  290E 44 44 44 44
1077  2912 52 52 52 52
1078  2916 52 52 52 52
1079  291A 4D 4D 4D 4D
1080  291E 52 4C 54 54
1081  2922 46 46 4E 4E
1082  2926 52 52 52 52
1083  292A 52
1084  292B 41 54 54 46        ALIT        'ATTFFNNSXTTTDTDTDLPISSSSSSSSSSGUTOSDINKMSP'
1085  292F 46 4E 4E 53
1086  2933 58 54 54 54
1087  2937 44 54 44 54
1088  293B 44 4C 50 49
1089  293F 53 53 53 53
1090  2943 53 53 53 53
1091  2947 53 53 47 55
1092  294B 54 4F 53 44
1093  294F 49 4E 45 4D
1094  2953 53 50
1095  2955 5A 49 52 41 OPCD4  ALIT        'ZIRAZRAZIRAZIRA ZIRAZIRAZIPAZIRA  RARARARARAR'
1096  2959 5A 52 41 5A
1097  295D 49 52 41 5A
1098  2961 45 52 41 20
1099  2965 5A 49 52 41
1100  2969 5A 49 52 41
```

FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

1101  29ED 5A 49 52 41
1102  29F1 5A 49 52 41
1103  29F5 20 22 52 41
1104  29F9 52 41 52 41
1105  29FD 52 41 52 41
1106  2981 52
1107  2982 20 52 41 52          ALIT      ' RARARARACEDDCCEET  ULULULULUL  AN  TTSPPE'
1108  2986 41 52 41 52
1109  298A 41 43 45 44
1110  298E 44 43 43 45
1111  2992 45 54 20 20
1112  2996 55 4C 55 4C
1113  299A 55 4C 55 4C
1114  299E 55 4C 20 20
1115  29A2 41 4E 20 20
1116  29A6 54 54 53 50
1117  29AA 50 45
1118  29AC 00 04 08 0C 0C0 OPCD5  DATA      00,04,08,0C,C0,C8,CC,80,84,88,8C,A0,A4,A8,AC
1119  29B2 C8 CE CC 80
1120  29B4 84 88 8C A0
1121  29B8 A4 A8 AC
1122  29BB 94 40 44 48          DATA      94,40,44,48,4C,60,64,68,6C,20,24,28,2C,E0,E4
1123  29BF 4C 60 64 68
1124  29C3 6C 20 24 28
1125  29C7 2C E0 F4
1126  29CA E8 EC 50 D0          DATA      E8,EC,50,D0,18,1C,98,9C,58,5C,D8,DC,F8,FC,9B
1127  29CE 1B 1C 98 9C
1128  29D2 58 5C D8 DC
1129  29D6 F8 FC 9B
1130  29D9 9F 38 3C B8          DATA      9F,38,3C,B8,BC,78,7C,BB,BF,14,34,F0,72,B0,30
1131  29DD BC 78 7C BB
1132  29E1 BF 14 34 F0
1133  29E5 72 B0 30
1134  29EB D4 54 40 C0          DATA      D4,54,40,C0,F4,92,93,12,13,74,75,76,77,B4,B5
1135  29EC F4 92 93 12
1136  29F0 13 74 75 76
1137  29F4 77 B4 B5
1138  29F7              *
1139  29F7              *
1140  29F7 00           PASS    RES       1
1141  29F8 00 00        LTBL    RES       2
1142  29FA 00           OUTOFF  RES       1
1143  29FB 00           DISPON  RES       1
1144  29FC 00           BPEC    RES       1
1145  29FD 00           COMAST  RES       1
1146  29FE 00           RETR    RES       1
1147  29FF 00           SPTR    RES       1
1148  2A00 00 00        CURA    RES       2
1149  2A02 00           DUMA    RES       1
1150  2A03 00           DUM2    RES       1
1151  2A04 00           TMPA    RES       1
1152  2A05 00           TEMP2   RES       1
1153  2A06 00 00        BSA1    RES       2
1154  2A08 00 00        CHGA    RES       2
1155  2A0A 00 00        CHGST   RES       2
```


FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

1156  2A0C 00 00        PAGE    RES       2
1157  2A0E 00           BUMPON  RES       1
1158  2A0F 00           DISPLN  RES       1
1159  2A10 00           BLKSON  RES       1
1160  2A11 00           TAPECN  RES       1
1161  2A12 00 00        SECH    RES       2
1162  2A14 00 00        OBPTR   RES       2
1163  2A16 00 00        LINE    RES       2
1164  2A18 00 00 00 00  TITBUF  RES       51
1165  2A1C 00 00 00 00
1166  2A20 00 00 00 00
1167  2A24 00 00 00 00
1168  2A28 00 00 00 00
1169  2A2C 00 00 00 00
1170  2A30 00 00 00 00
1171  2A34 00 00 00 00
1172  2A38 00 00 00 00
1173  2A3C 00 00 00 00
1174  2A40 00 00 00 00
1175  2A44 00 00 00 00
1176  2A48 00 00 00 00
1177  2A4C 00 00 00 00
1178  2A50 00 00 00 00
1179  2A54 00 00 00 00
1180  2A58 00 00 00 00
1181  2A5C 00 00 00 00
1182  2A60 00 00 00 00
1183  2A64 00 00 00 00
1184  2A68 00
1185  2A69              BYTSTG  RES       100
1186  2B69              ORGP    EQU       4B
1187  2B69              EQUP    EQU       4C
1188  2B69              DATAP   EQU       4D
1189  2B69              ACONP   EQU       4E
1190  2B69              RESP    EQU       4F
1191  2B69              ENDP    EQU       50
1192  2B69              ALITP   EQU       51
1193  2B69              PRNTP   EQU       52
1194  2B69              BLKSP   EQU       53
1195  2B69              BUMPP   EQU       54
1196  2B69              DISPP   EQU       55
1197  2B69              TAPEP   EQU       56
1198  2B69              TOPCOM  EQU       56
1199  2B69              *
1200  2B69              *
1201  2B69 3F 21 92     ASM     BSTA,UN   ERASE
1202  2B6C 20           PASS1   EORZ,R0
1203  2B6D CC 09 F7             STRA,R0   PASS
1204  2B70 CC 0D 7C             STRA,R0   BLKSIN
1205  2B73 CC 19 80             STRA,R0   PC
1206  2B76 CC 19 81             STRA,R0   PC+1
1207  2B79 CC 09 F9             STRA,R0   LTBL+1
1208  2B7C CC 0A 68             STRA,R0   TITBUF+50
1209  2B7F CC 0F 14             STRA,R0   ERRS
1210  2B82 3F 22 59             BSTA,UN   BEGIN
```

FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

1211  2B85 0C 00 04          LODA,R0    IBST
1212  2B88 CC 09 F8          STRA,R0    LTBL
1213  2B8B 04 FF             LODI,R0    FF
1214  2B8D CC 0A 0E          STRA,R0    BUMPON
1215  2B90 CC 09 FF          STRA,R0    SPTR
1216  2B93 CC 09 FE          STRA,R0    BPTR
1217  2B96 CC 0E 5F          STRA,R0    ERRPTP
1218  2B99 CC 89 F8          STRA,R0    *LTBL
1219  2B9C 05 11             LODI,R1    11
1220  2B9E 3F 46 C7          BSTA,UN    PSTRNG
1221  2BA1 3F 22 59          BSTA,UN    BEGIN
1222  2BA4 3F 2D 21  LOOP    BSTA,UN    NEXT
1223  2BA7 0C 0A 18          LODA,R0    TXTBUF
1224  2BAA E4 2A             COMI,R0    '*'
1225  2BAC 18 76             BCTR,EQ    LOOP
1226  2BAE 3F 2E 15          BSTA,UN    FIND
1227  2BB1 E5 56             COMI,R1    TOPCOM
1228  2BB3 19 6F             BCTR,GT    LOOP
1229  2BB5 E5 60             COMI,R1    ENTP
1230  2BB7 1C 00 73          BCTA,EQ    PASS2
1231  2BBA E5 4B             COMI,R1    ORGP
1232  2BBC 3C 2D 0F          BSTA,EQ    ORG
1233  2BBF 0C 0A 18          LODA,R0    TXTBUF
1234  2BC2 E4 20             COMI,R0    ' '
1235  2BC4 1C 2C 0E          BCTA,EQ    NOLB
1236  2BC7 04 FF             LODI,R0    FF
1237  2BC9 CC 0F F4          STRA,R0    TMPS2
1238  2BCC 04 06             LODI,R0    06
1239  2BCE CC 0F F3          STRA,R0    B2POS
1240  2BD1 3F 32 16          BSTA,UN    TBL2
1241  2BD4 3C 2C A4          BSTA,EQ    ERRMT
1242  2BD7 07 FF             LODI,R3    FF
1243  2BD9 0E 09 FF          LODA,R2    SPTR
1244  2BDC 05 06             LODI,R1    06
1245  2BDE 0F 2A 18  NXTL    LODA,R3    TXTBUF,+
1246  2BE1 CE A9 F8          STRA,R2    *LTBL,+
1247  2BE4 F9 78             BDRR,R1    NXTL
1248  2BE6 0C 19 80          LODA,R0    PC
1249  2BE9 CE A9 F8          STRA,R2    *LTBL,+
1250  2BEC 0C 19 81          LODA,R0    PC+1
1251  2BEF CE A9 F8          STRA,R2    *LTBL,+
1252  2BF2 E6 FF             COMI,R2    FF
1253  2BF4 98 10             BCFR,EQ    ENDLB
1254  2BF6 3F 2C 98          BSTA,UN    A1LT
1255  2BF9 1A 03             BCTR,LT    ENDLB
1256  2BFB 05 13             LODI,R1    13
1257  2BFD 3F 46 C7          BSTA,UN    PSTRNG
1258  2C00 3F 46 F7          BSTA,UN    PAUSE
1259  2C03 1F 20 30          BCTA,UN    EDITOR
1260  2C06 CE 09 FF  ENDLB   STRA,R2    SPTR
1261  2C09 04 FF             LODI,R0    FF
1262  2C0B CE A9 F8          STRA,R2    *LTBL,+
1263  2C0E 0D 0E 14  NOLB    LODA,R1    OPPOS
1264  2C11 0C 0E 13          LODA,R0    OPCODE    SETUP FOR ADDPC ROUTINE
1265  2C14 E5 4B             COMI,R1    ORGP
```


FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

1266  2C16 1F 2C 8E          BCTA,LT    ADDPC
1267  2C19 E5 4C             COMI,R1    EQUP
1268  2C1B 98 28             BCFR,EQ    EQU1
1269  2C1D 3F 2F 15          BSTA,UN    GETADD
1270  2C20 0E 09 FF          LODA,R2    SPTR
1271  2C23 E6 FF             COMI,R2    FF
1272  2C25 98 08             BCFR,EQ    NOTZ
1273  2C27 0C 09 F8          LODA,R0    LTBL
1274  2C2A A4 01             SUBI,R0    1
1275  2C2C CC 09 F8          STRA,R0    LTBL
1276  2C2F A6 02     NOTZ    SUBI,R2    2
1277  2C31 0C 10 14          LODA,R0    OPER2
1278  2C34 CE A9 F8          STRA,R2    *LTBL,+
1279  2C37 0C 10 15          LODA,R0    OPER3
1280  2C3A CE A9 F8          STRA,R2    *LTBL,+
1281  2C3D E6 FF             COMI,R2    FF
1282  2C3F 3C 2C 98  A1BACK  BSTA,EQ    A1LT
1283  2C42 1F 2B A4          BCTA,UN    LOOP
1284  2C45 E5 4D     EQU1    COMI,R1    DATAP
1285  2C47 98 07             BCFR,EQ    DATA1
1286  2C49 3F 2C B6          BSTA,UN    FINDCM
1287  2C4C 03                LODZ,R3
1288  2C4E 1F 2C 91          BCTA,UN    EASY
1289  2C50 E5 4F     DATA1   COMI,R1    RESP
1290  2C52 98 13             BCFR,EQ    RES1
1291  2C54 3F 2F 15          BSTA,UN    GETADD
1292  2C57 0C 10 14          LODA,R0    OPER2
1293  2C5A 8C 19 80          ADDA,R0    PC
1294  2C5D 44 7F             ANDI,R0    7F
1295  2C5F CC 19 80          STRA,R0    PC
1296  2C62 0C 10 15          LODA,R0    OPER3
1297  2C65 1B 2A             BCTR,UN    EASY
1298  2C67 E5 4F     RES1    COMI,R1    ACONP
1299  2C69 98 07             BCFR,EQ    ACON1
1300  2C6B 3F 2C B6          BSTA,UN    FINDCM
1301  2C6E 03                LODZ,R3
1302  2C6F D0                RRL ,R0
1303  2C70 1B 1F             BCTR,UN    EASY
1304  2C72 E5 51     ACON1   COMI,R1    ALITP
1305  2C74 9C 2B A4          BCFA,EQ    LOOP
1306  2C77 05 11             LODI,R1    11
1307  2C79 0D 2A 18          LODA,R1    TXTBUF,+
1308  2C7C CC 0C 97          STRA,R0    ALDEL
1309  2C7F 0D 2A 18  NCALE1  LODA,R1    TXTBUF,+
1310  2C82 1A 05             BCTR,EQ    ALFND1
1311  2C84 EC 0C 97          COMA,R0    ALDEL
1312  2C87 98 76             BCFR,EQ    NCALE1
1313  2C89 A5 13     ALFND1  SUBI,R1    13
1314  2C8B 01                LODZ,R1
1315  2C8C 1B 03             BCTR,UN    EASY
1316  2C8E 3F 2C DA  ADDPC   BSTA,UN    ADDLM
1317  2C91 3F 2C F5  EASY    BSTA,UN    APC
1318  2C94 1F 2B A4          BCTA,UN    LOOP
1319  2C97           *
1320  2C97           *
```

FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

1321  2097             *
1322  2097             *
1323  2097 00          A1DFL  RES        1
1324  2098             *
1325  2098 04 01       A1LT   LODI,R0     1
1326  209A 80 09 F8           ADDA,R0    LTBL
1327  209D CC 09 F8           STRA,R0    LTBL
1328  20A0 E0 00 05           COMA,R0    OBST
1329  20A3 17                 RETC,UN
1330  20A4             *
1331  20A4 06 16       ERRMT  LODI,R1    16
1332  20A6 3F 46 C7           BSTA,UN    PSTRNG
1333  20A9 06 FF              LODI,R1    FF
1334  20AB 06 06              LODI,R2    6
1335  20AD 0D 2A 18    ERRMT2 LODA,R1    TXTBUF,+
1336  20B0 3F 45 8D           BSTA,UN    WRT
1337  20B3 FA 78              BIRR,R2    ERRMT2
1338  20B5 17                 RETC,UN
1339  20B6             *
1340  20B6 07 01       FINDCM LODI,R3    1
1341  20B8 06 12              LODI,R1    12
1342  20BA 0I 2A 18    DAT1A  LODA,R1    TXTBUF,+
1343  20BD 14                 RETC,EQ
1344  20BE F4 20              COMI,R0    ' '
1345  20C0 14                 RETC,EQ
1346  20C1 F4 2C              COMI,R0    ','
1347  20C3 98 75              BCFR,EQ    DAT1A
1348  20C5 87 01              ADDI,R3    1
1349  20C7 1B 71              BCTR,UN    DAT1A
1350  20C9             *
1351  20C9 06 13       OFFON  LODI,R1    13
1352  20CB 0D 6A 18           LODA,R1    TXTBUF,I
1353  20CE 3F 47 8C           BSTA,UN    LTOU
1354  20D1 F4 46              COMI,R0    'F'
1355  20D3 18 02              BCTR,EQ    OFFFF
1356  20D5 20                 IORZ,R0
1357  20D6 17                 RETC,UN
1358  20D7 04 FF       OFFFF  LODI,R0    FF
1359  20D9 17                 RETC,UN
1360  20DA             *
1361  20DA 52          ADDLN  RRR ,R0
1362  20DB 52                 RRR ,R0
1363  20DC E4 05              COMI,R0    5
1364  20DE 18 09              BCTR,EQ    SUBLN
1365  20E0 E4 0D              COMI,R0    0D
1366  20E2 18 04              BCTR,EQ    SUBLN
1367  20E4 E4 25              COMI,R0    25
1368  20E6 98 01              BCFR,EQ    NOCL
1369  20E8 20          SUBLN  IORZ,R0
1370  20E9 C3          NOCL   STRZ,R3
1371  20EA 47 07              ANDI,R3    7
1372  20EC CB 0B              STRR,R3    TYPE
1373  20EE 44 03              ANDI,R0    3
1374  20F0 E4 01              COMI,R0    1
1375  20F2 19 02              BCTR,GT    SLRE
```


FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

1376  20F4 84 01              ADDI,R0    1
1377  20F6 C8 02       SLRE   STRR,R0    LENT
1378  20F8 17                 RETC,UN
1379  20F9             *
1380  20F9 00          TYPE   RES        1
1381  20FA 00          LENT   RES        1
1382  20FB             *
1383  20FB 80 19 81    APC    ADDA,R0    PC+1
1384  20FE CC 19 81           STRA,R0    PC+1
1385  2D01 77 08              PPSL       WC
1386  2D03 20                 IORZ,R0
1387  2D04 80 19 80           ADDA,R0    PC
1388  2D07 44 7F              ANDI,R0    7F
1389  2D09 CC 19 80           STRA,R0    PC
1390  2D0C 75 08              CPSL       WC
1391  2D0E 17                 RETC,UN
1392  2D0F             *
1393  2D0F 3F 2F 15    ORG    BSTA,UN    GETADD
1394  2D12 0C 10 14           LODA,R0    OPER2
1395  2D15 CC 19 80           STRA,R0    PC
1396  2D18 0C 10 15           LODA,R0    OPER3
1397  2D1B CC 19 81           STRA,R0    PC+1
1398  2D1E 17                 RETC,UN
1399  2D1F             *
1400  2D1F 00 00       NEXTS  RES        2
1401  2D21             *
1402  2D21 70          NEXT   REDD,R0
1403  2D22 44 7F              ANDI,R0    7F
1404  2D24 E4 1B              COMI,R0    ESC
1405  2D26 1C 20 30           BCTA,EQ    EDITOR
1406  2D29 07 FF              LODI,R3    FF
1407  2D2B 0D 09 FE           LODA,R1    BPTR
1408  2D2E 0D AA 00    NEXT4  LODA,R1    *CURA,+
1409  2D31 0E 0A 0E           LODA,R2    BUMPON
1410  2D34 3C 47 8C           BSTA,EQ    LTOU
1411  2D37 E7 0F              COMI,R3    0F
1412  2D39 3E 47 8C           BSTA,LT    LTOU
1413  2D3C E7 FF              COMI,R3    FF
1414  2D3E 3C 47 8C           BSTA,EQ    LTOU
1415  2D41 CF 2A 18           STRA,R3    TXTBUF,+
1416  2D44 02                 LODZ,R0
1417  2D45 1E 2D 6D           BCTA,LT    NBI
1418  2D48 E5 FF              COMI,R1    FF
1419  2D4A 98 2D              BCFR,EQ    NXTCK
1420  2D4C 0E 0A 00           LODA,R2    CURA
1421  2D4F 86 01              ADDI,R2    01
1422  2D51 EF 00 06           COMA,R2    ENDRAM
1423  2D54 18 17              BCTR,EQ    NBI
1424  2D56 CE 0A 00           STRA,R2    CURA
1425  2D59 E4 0D       NXTCK  COMI,R0    CR
1426  2D5B 18 06              BCTR,EQ    NEXTF
1427  2D5D E7 50              COMI,R3    50
1428  2D5F 1A 4D              BCTR,LT    NEXT4
1429  2D61 07 4F              LODI,R3    4F
1430  2D63 1B 49              BCTR,UN    NEXT4
```

FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND    COMMENTS

     2D65 20          NEXTF  EORZ,R0
     2D66 CF 6A 18           STRA,R3    TXTBUF,I
     2D69 CD 09 FE           STRA,R1    BPTR
     2D6C 17                 RETC,UN
     2D6D             *
     2D6D             *
     2D6D 3F 2D 7D    NBI    BSTA,UN    NEWBLK
     2D70 3F 22 59           BSTA,UN    BEGIN
     2D73 05 FF              LODI,R1    FF
     2D75 CD 09 FE           STRA,R1    BPTR
     2D78 1F 2D 21           BCTA,UN    NEXT
     2D7B             *
     2D7B             *
     2D7B 00          R2STG  RES        1
     2D7C 00          BLKSIN RES        1
     2D7D             *
     2D7D CA 7C       NEWBLK STRR,R2    R2STG
     2D7F 05 1E              LODI,R1    1E
     2D81 3F 46 C7           BSTA,UN    PSTRNG
     2D84 3F 45 F7           BSTA,UN    PAUSE
     2D87 E4 1               COMI,R0    ESC
     2D89 1C 20 30           BCTA,EQ    EDITOR
     2D8C 3F 22 59           BSTA,UN    BEGIN
     2D8F 3F 2D 9F           BSTA,UN    LOADA
     2D92 9C 27 FB           BCFA,EQ    SCERR
     2D95 3F 2E 0A           BSTA,UN    AOK
     2D98 04 01              LODI,R0    01
     2D9A C8 60              STRR,R0    BLKSIN
     2D9C 0A 5D              LODR,R2    R2STG
     2D9E 17                 RETC,UN
     2D9F             *                            TAPE
     2D9F             *     LEES DATA VAN
     2D9F 3F 22 64    LOADA  BSTA,UN    MTDA
     2DA2 20          WAIT   EORZ,R0
     2DA3 CC 88 43            TRA,R0    *SUMK
     2DA6 3F 02 E9           BSTA,UN    SERI
     2DA9 E7 3B              COMI,R3    ';'
     2DAB 98 75              BCFR,EQ    WAIT
     2DAD 05 FF              LODI,R1    FF
     2DAF 3F 02 E9    NAML   BSTA,UN    SERI
     2DB2 0D 20 1E           LODA,R1    NAME,+
     2DB5 18 03              BCTR,EQ    OVERSI
     2DB7 E3                 COMZ,R3
     2DB8 98 68              BCFR,EQ    WAIT
     2DBA E5 07       OVERSI COMI,R1    07
     2DBC 98 71              BCFR,EQ    NAML
     2DBE 3F 02 E9           BSTA,UN    SERI
     2DC1 0C 88 43           LODA,R0    *SUMK
     2DC4 16                 RETC,LT
     2DC5 15                 RETC,GT
     2DC6 CD 0A 03           LODA,R1    DUM2
     2DC9 CC 0A 03           STRA,R0    DUM2
     2DCC CC 00 2E           STRA,R0    TMPS
     2DCF 3F 02 E9    ASCII  BSTA,UN    SERI
     2DD2 03                 LODZ,R3
```


FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND    COMMENTS

     2DD3 CD EA 02           STRA,R1    *DUMA,I
     2DD6 1A 2B              BCTR,LT    ENDING
     2DD8 D9 12              BIRR,R1    LL1
     2DDA 3F 21 D9           BSTA,UN    A1DA
     2DDD 1A 0D              BCTR,LT    LL1
     2DDF 3F 23 73           BSTA,UN    S1DA
     2DE2 05 FF              LODI,R1    FF
     2DE4 04 BC              LODI,R0    FBC
     2DE6 CD EA 02           STRA,R1    *DUMA,I
     2DE9 1F 24 1D           BCTA,UN    TMI
     2DEC 0E 00 2E    LL1    LODA,R2    TMPS
     2DEF 86 01              ADDI,R2    01
     2DF1 CE 00 2E           STRA,R2    TMPS
     2DF4 98 59              BCFR,EQ    ASCII
     2DF6             *
     2DF6 3F 02 E9    ENDTP  BSTA,UN    SERI
     2DF9 CD 0A 03           STRA,R1    DUM2
     2DFC 0F 88 43           LODA,R3    *SUMK
     2DFF 1C 2D A2           BCTA,EQ    WAIT
     2E02 17                 RETC,UN
     2E03             *
     2E03 3F 02 E9    ENDING BSTA,UN    SERI
     2E06 0C 88 43           LODA,R0    *SUMK
     2E09 17                 RETC,UN
     2E0A             *
     2E0A 05 1F       AOK    LODI,R1    1F
     2E0C 3F 46 CA           BSTA,UN    PRING
     2E0F 3F 46 2F           BSTA,UN    ERAS1
     2E12 17                 RETC,UN
     2E13             *
     2E13             *
     2E13 00          OPCODE RES        1
     2E14 00          OPPOS  RES        1
     2E15             *
     2E15 05 FF       FIND   LODI,R1    FF
     2E17 07 06       FIND1  LODI,R3    6
     2E19 0F 2A 18           LODA,R3    TXTBUF,+
     2E1C ED 28 50           COMA,R1    OPCD1,+
     2E1F 98 24              BCFR,EQ    FIND2
     2E21 0F 2A 18           LODA,R3    TXTBUF,+
     2E24 ED 66 A7           COMA,R1    OPCD2,I
     2E27 98 1C              BCFR,EQ    FIND2
     2E29 0F 2A 18           LODA,R3    TXTBUF,+
     2E2C ED 68 FE           COMA,R1    OPCD3,I
     2E2F 98 14              BCFR,EQ    FIND2
     2E31 0D 69 55           LODA,R1    OPCD4,I
     2E34 E4 20              COMI,R0    ' '
     2E36 18 05              BCTR,EQ    FIND3
     2E38 EF 2A 18           COMA,R3    TXTBUF,+
     2E3B 98 08              BCFR,EQ    FIND2
     2E3D 0D 69 AC    FIND3  LODA,R1    OPCD5,I
     2E40 C8 51              STRR,R0    OPCODE
     2E42 C9 50              STRR,R1    OPPOS
     2E44 17                 RETC,UN
     2E45 E5 56       FIND2  COMI,R1    TOPCOM
```

FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

1541  2F47 99 4E              BCFR,GT    FIND1
1542  2F49 C9 45              STRR,R1    OPPOS
1543  2F4B 04 00              LODI,R0    0         OPCODE ERROR
1544  2F4D 1B 19              BCTR,UN    ERRW
1545  2F4F                *
1546  2F4F 04 02        EPRMO LODI,R0    2         OPERAND ERROP
1547  2F51 1B 15              BCTR,UN    ERRW
1548  2F53 04 03        ERRMR LODI,R0    3         REGISTER ERROR
1549  2F55 1B 11              BCTR,UN    ERRW
1550  2F57 04 04        ERRMD LODI,R0    4         DISPLACEMENT ERROR
1551  2F59 1B 0D              BCTR,UN    ERRW
1552  2F5B 04 05        ERRMP LODI,R0    5         PAGING ERROR
1553  2F5D 1B 09              BCTR,UN    ERRW
1554  2F5F                *
1555  2F5F 00           ERRPTR RES       1
1556  2F60 00 00 00 00  ERRSTK RES       8
1557  2F64 00 00 00 00
1558  2F68                *
1559  2F68 0A 75        ERRW   LODR,R2    ERRPTR
1560  2F6A E6 07               COMI,R2    7
1561  2F6C 14                  RETC,EQ
1562  2F6D CF 2E 60            STRA,R2    ERRSTK,+
1563  2F70 CA 6D               STRR,R2    ERRPTR
1564  2F72 0C 0F 14            LODA,R0    ERRS
1565  2F75 84 67               ADDI,R0    67
1566  2F77 94                  DAR ,R0
1567  2F78 CC 0F 14            STRA,R0    ERRS
1568  2F7B 0C 09 F7            LODA,R0    PASS
1569  2F7E 14                  RETC,EQ
1570  2F7F 20                  EORZ,R0
1571  2F80 CC 09 FB            STRA,R0    DISPON
1572  2F83 17                  RETC,UN
1573  2F84                *
1574  2F84 0E 0F 5F     ERRP   LODA,R2    ERRPTR
1575  2F87 16                  RETC,LT
1576  2F88 0E 6E 60            LODA,R2    ERRSTK,I
1577  2F8B A6 01               SUBI,R2    1
1578  2F8D CE 2E 5F            STRA,R2    ERRPTR
1579  2F90 C2                  STRZ,R2
1580  2F91 3F 32 46            BSTA,UN    PLN
1581  2F94 05 4E               LODI,R1    PMSG4-PRTBUF
1582  2F96 3F 36 4B            BSTA,UN    BLKPRT
1583  2F99 05 00               LODI,R1    0
1584  2F9B 07 FF               LODI,R3    FF
1585  2F9D 01           ERRW4  LOIZ,R1
1586  2F9E E2                  COMZ,R2
1587  2F9F 18 04               BCTR,EQ    ERRW2
1588  2FA1 0F 38 4D     ERRW3  LODA,R3    MSG16,+
1589  2FA4 9A 7B               BCFR,LT    ERRW3
1590  2FA6 65 01               ADDI,R1    1
1591  2FA8 1B 73               BCTR,UN    ERRW4
1592  2FAA 0F 38 4D     ERRW2  LODA,R3    MSG16,+
1593  2FAD 1A 05               BCTR,LT    ERRW5
1594  2FAF 3F 3F 72            BSTA,UN    PRNT
1595  2FB2 1B 76               BCTR,UN    ERRW2
```


FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

1596  2FB4 0F 52        ERRW5  LODI,R1    PMSG6-PRTBUF
1597  2FB6 3F 36 4B            BSTA,UN    BLKPRT
1598  2FB9 0C 13 F2            LODA,R0    PLINE
1599  2FBC 84 01               ADDI,R0    1
1600  2FBE CC 13 F2            STRA,R0    PLINE
1601  2FC1 E4 36               COMI,R2    36
1602  2FC3 3D 35 B9            BSTA,GT    HEADIN
1603  2FC6 1F 2E 84            BCTA,UN    ERRP
1624  2FC9                *
1605  2FC9                *
1606  2FC9 0C 09 FA     CHKPR  LODA,R0    CUTOFF
1607  2FCC 14                  RETC,EQ
1608  2FCD 0C 09 FB            LODA,R0    DISPON
1609  2FD0 17                  RETC,UN
1610  2FD1                *
1611  2FD1                *
1612  2FD1 4F 50 43 4F  EMSG2  ALIT       'OPCODE'
1613  2FD5 44 45
1614  2FD7 FF                  DATA       FF
1615  2FD8 4C 41 42 45         ALIT       'LABEL USED TWICE'
1616  2FDC 4C 20 55 53
1617  2FE0 45 44 20 54
1618  2FE4 57 49 43 45
1619  2FE8 FF                  DATA       FF
1620  2FE9 4F 50 4F 52         ALIT       'OPERAND'
1621  2FED 41 4E 44
1622  2FF0 FF                  DATA       FF
1623  2FF1 52 45 47 49         ALIT       'REGISTER FIELD'
1624  2FF5 53 54 45 52
1625  2FF9 20 46 49 45
1626  2FFD 4C 44
1627  2FFF FF                  DATA       FF
1628  3000 44 49 53 50         ALIT       'DISPLACEMENT'
1629  3004 4C 41 43 45
1630  3008 4D 45 4E 54
1631  300C FF                  DATA       FF
1632  300D 50 41 47 49         ALIT       'PAGING'
1633  3011 4E 47
1634  3013 FF                  DATA       FF
1635  3014                *
1636  3014 00           ERRS   RES        1
1637  3015                *
1638  3015 0E 11        GETADD LODI,R1    11
1639  3017 CD 0F F4     GETAD2 STRA,R1    TMPS2
1640  301A 20                  EORZ,R0
1641  301B CC 0F E3            STRA,R0    OPSTG
1642  301E CC 10 14            STRA,R0    OPER2
1643  3021 CC 10 15            STRA,R0    OPER3
1644  3024 3F 2F 80     ADL2A  BSTA,UN    EVAL
1645  3027 0C 0F 8B            LODA,R0    OPSTG
1646  302A 1C 2F 4D            BCTA,EQ    ADDADD
1647  302D E4 2B               COMI,R0    2B
1648  302F 18 10               BCTR,EQ    ADDADD
1649  3031 E4 2D               COMI,R0    2D
1650  3033 9B 2E               BCFR,EQ    SUBADD
```

FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

1651  2F35 0C 10 15          LODA,R0     OPER3
1652  2F38 AC 10 13          SUBA,R0     OPER1
1653  2F3B CC 10 15          STRA,R0     OPER3
1654  2F3E 0C 10 14          LODA,R0     OPER2
1655  2F41 77 08             PPSL        WC
1656  2F43 AC 10 12          SUBA,R0     OPER0
1657  2F46 CC 10 14          STRA,R0     OPER2
1658  2F49 75 08             CPSL        WC
1659  2F4B 18 16             BCTR,UN     SUBADD
1660  2F4D 0C 10 15    ADDADD LODA,R0     OPER3
1661  2F50 8C 10 13          ADDA,R0     OPER1
1662  2F53 CC 10 15          STRA,R0     OPER3
1663  2F56 77 08             PPSL        WC
1664  2F58 0C 10 14          LODA,R0     OPER2
1665  2F5B 8C 10 12          ADDA,R0     OPER0
1666  2F5E CC 10 14          STRA,R0     OPER2
1667  2F61 75 08             CPSL        WC
1668  2F63 0D 2F F3    SUBADD LODA,R1     R2POS
1669  2F66 CD 0F F4          STRA,R1     TMPS2
1670  2F69 0D 6A 18          LODA,R1     TXTBUF,I
1671  2F6C 18 0D             BCTR,EQ     CKHIG
1672  2F6E F4 2C             COMI,R0     ','
1673  2F70 18 09             BCTR,EQ     CKHIG
1674  2F72 F4 20             COMI,R0     ' '
1675  2F74 18 05             BCTR,EQ     CKHIG
1676  2F76 06 13             STRR,R0     OPSTG
1677  2F78 1F 2F 24          BCTA,UN     ADL2A
1678  2F7B 0E 11       CKHIG LODI,R1     11
1679  2F7D 0D 6A 18          LODA,R1     TXTBUF,I
1680  2F80 F4 5E             COMI,R0     '^'
1681  2F82 15                RETC,GT
1682  2F83 16                RETC,LT
1683  2F84 0C 10 14          LODA,R0     OPER2
1684  2F87 CC 10 15          STRA,R0     OPER3
1685  2F8A 17                RETC,UN
1686  2F8B                   *
1687  2F8B 00          OPSTG  RES         1
1688  2F8C                   *
1689  2F8C 0D 0F F4    EVAL  LODA,R1     TMPS2
1690  2F8F 0D 2A 18    LU    LODA,R1     TXTBUF,+
1691  2F92 18 10             BCTR,EQ     STRR2
1692  2F94 F4 20             COMI,R0     ' '
1693  2F96 18 0C             BCTR,EQ     STRR2
1694  2F98 F4 2D             COMI,R0     2D
1695  2F9A 18 08             BCTR,EQ     STRR2
1696  2F9C F4 2E             COMI,R0     2E
1697  2F9E 18 04             BCTR,EQ     STRR2
1698  2FA0 F4 2C             COMI,R0     ','
1699  2FA2 98 65             BCFR,EQ     LU
1700  2FA4 CD 0F F3    STRR2 STRA,R1     R2POS
1701  2FA7 0D 0F F4          LODA,R1     TMPS2
1702  2FAA 0D 2A 18          LODA,R1     TXTBUF,+
1703  2FAD F4 24             COMI,R0     '$'
1704  2FAF 98 0D             BCFR,EQ     CKASCI
1705  2FB1 0C 19 80          LODA,R0     PC
```


FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

1706  2FB4 CC 10 12          STRA,R0     OPER0
1707  2FB7 0C 19 81          LODA,R0     PC+1
1708  2FBA CC 10 13          STRA,R0     OPER1
1709  2FBD 17                RETC,UN
1710  2FBE 20          CKASCI EORZ,R0
1711  2FBF CC 10 12          STRA,R0     OPER0
1712  2FC2 CC 10 13          STRA,R0     OPER1
1713  2FC5 0D 6A 18          LODA,R1     TXTBUF,I
1714  2FC8 F4 27             COMI,R0     '''
1715  2FCA 98 0C             BCFR,EQ     LOOKUP
1716  2FCC 0D 2A 18          LODA,R1     TXTBUF,+
1717  2FCF CC 10 13          STRA,R0     OPER1
1718  2FD2 85 02             ADDI,R1     2
1719  2FD4 CD 0F F3          STRA,R1     R2POS
1720  2FD7 17                RETC,UN
1721  2FD8 3F 32 16    LOOKUP BSTA,UN     TBL2
1722  2FDB 14                RETC,EQ
1723  2FDC 09 15             LODR,R1     TMPS2
1724  2FDE 0D 2A 18    BYTE2 LODA,R1     TXTBUF,+
1725  2FE1 3F 47 8C          BSTA,UN     LTCU
1726  2FE4 F9 0D             COMR,R1     R2POS
1727  2FE6 14                RETC,EQ
1728  2FE7 07 10             LODI,R3     10
1729  2FE9 EF 56 AC    BL2   COMA,R3     HXTBL,-
1730  2FEC 18 07             BCTR,EQ     HEXMAT
1731  2FEE 5B 79             BRNR,R3     BL2
1732  2FF0 1F 2E 4F          BCTA,UN     ERRMO
1733  2FF3                   *
1734  2FF3 00          R2POS RES         1
1735  2FF4 00          TMPS2 RES         1
1736  2FF5                   *
1737  2FF5 CE 7D       HEXMAT STRR,R3     TMPS2
1738  2FF7 06 19             LODR,R0     OPER0
1739  2FF9 0E 18             LODR,R3     OPER1
1740  2FFB 77 08             PPSL        WC
1741  2FFD D3                RRL ,R3
1742  2FFE D2                RRL ,R2
1743  2FFF D3                RRL ,R3
1744  3000 D0                RRL ,R0
1745  3001 D3                RRL ,R3
1746  3002 D2                RRL ,R2
1747  3003 D3                RRL ,R3
1748  3004 D2                RRL ,R2
1749  3005 75 08             CPSL        WC
1750  3007 47 F0             ANDI,R3     F0
1751  3009 6F 69             IORR,R3     TMPS2
1752  300B CB 06             STRR,R3     OPER1
1753  300D C8 03             STRR,R0     OPER0
1754  300F 1F 2F DE          BCTA,UN     BYTE2
1755  3012                   *
1756  3012 00          OPER0 RES         1
1757  3013 00          OPER1 RES         1
1758  3014 00          OPER2 RES         1
1759  3015 00          OPER3 RES         1
1760  3016                   *
```

FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

1761  3016 3F 23 99     TBL2   BSTA,UN    IBADD
1762  3019 07 FF               LODI,R3    FF
1763  301B 03 57        TBL2A  LODR,R1    TMPS2
1764  301D 0F AA 04     TBL3   LODA,R3    *TMPA,+
1765  3020 1E                  FETC,LT
1766  3021 A7 01               SUBI,R3    1
1767  3023 0D 2A 1B            LODA,R1    TXTBUF,+
1768  3026 3F 47 BC            BSTA,UN    LTOU
1769  3029 E1 0F F3            COMA,R1    R2POS
1770  302C 18 10               BCTR,EQ    STPOP
1771  302E EF AA 04            COMA,R3    *TMPA,+
1772  3031 18 6A               BCTR,EQ    TBL3
1773  3033 47 F8        TBL4   ANDI,R3    F8
1774  3035 67 07               ADDI,R3    7
1775  3037 E7 FF               COMI,R3    FF
1776  3039 3C 23 CC            BSTA,EQ    A1TA
1777  303C 1B 5D               BCTR,UN    TBL2A
1778  303E 03           STPOP  LODZ,R3
1779  303F 44 07               ANDI,R0    7
1780  3041 E4 05               COMI,R0    5
1781  3043 9A 09               BCFR,LT    ADDIN
1782  3045 0F AA 04            LODA,R3    *TMPA,+
1783  3048 E4 20               COMI,R0
1784  304A 98 67               BCFR,EQ    TBL4
1785  304C 1B 70               BCTR,UN    STROP
1786  304E 0F AA 04     ADDIN  LODA,R3    *TMPA,+
1787  3051 CC 10 12            STRA,R0    OPER0
1788  3054 0F AA 04            LODA,R3    *TMPA,+
1789  3057 CC 10 13            STRA,R0    OPER1
1790  305A 20                  EORZ,R0
1791  305B 17                  RETC,UN
1792  305C                *
1793  305C 04 01        CCK2   LODI,R0    1
1794  305E 80 09 FD            ADDA,R0    COMAST
1795  3061 CC 09 FD            STRA,R0    COMAST
1796  3064 2D 0F F3            LODA,R1    R2POS
1797  3067 0D 6A 1B            LODA,R1    TXTBUF,I
1798  306A E4 2C               COMI,R0    ','
1799  306C 16                  RETC,LT
1800  306D 15                  RETC,GT
1801  306E 3F 2F 17            BSTA,UN    GFTAD2
1802  3071 20                  EORZ,R0
1803  3072 17                   ETC,UN
1804  3073                *
1805  3073                *
1806  3073                *
1807  3073                *
1808  3073 04 FF        PASS2  LODI,R0    FF
1809  3075 CC 09 F7            STRA,R0    PASS
1810  3078 20           PASS2A EORZ,R0
1811  3079 CC 0A 0F            STRA,R0    DISPLN
1812  307C CC 19 80            STRA,R0    PC
1813  307F CC 19 81            STRA,R0    PC+1
1814  3082 CC 0A 16            STRA,R0    LINE
1815  3085 CC 0A 17            STRA,R0    LINE+1
```


FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

1816  3088 CC 0A 15            STRA,R0    OBPTR+1
1817  308B CC 0A 0C            STRA,R0    PAGE
1818  308E CC 0A 0D            STRA,R0    PAGE+1
1819  3091 CC 09 FC            STRA,R0    BPPC      SETUP FOR HEXOS
1820  3094 04 FF               LODI,R0    FF
1821  3096 CC 09 FA            STRA,R0    OUTOFF
1822  3099 CC 09 FB            STRA,R0    DISPON
1823  309C CC 09 FE            STRA,R0    BPTR
1824  309F 0C 02 05            LODA,R0    OBST
1825  30A2 CC 0A 14            STRA,R0    OBPTR
1826  30A5 04 FF               LODI,R0    FF
1827  30A7 CC 0A 11            STRA,R0    TAPEON
1828  30AA CC 0A 10            STRA,R0    BLKSON
1829  30AD 04 02               LODI,R0    2
1830  30AF CC 13 F1            STRA,R0    HEXOST
1831  30B2 3F 34 20            BSTA,UN    HEXOS
1832  30B5 05 12               LODI,R1    12        'PASS 2'
1833  30B7 3F 46 C7            BSTA,UN    PSTRNG
1834  30BA 3F 46 3C            BSTA,UN    EROLD
1835  30BD 3F 22 59            BSTA,UN    BEGIN
1836  30C0 0C 0D 7C            LODA,R0    BLKSIN
1837  30C3 BC 2D 7D            BSFA,EQ    NEWBLK
1838  30C6 20           P2NXT  EORZ,R0
1839  30C7 CC 0A FD            STRA,R0    COMAST
1840  30CA CC 0A FC            STRA,R0    BPPC
1841  30CD CC 12 2C            STRA,R0    RESBUF+2
1842  30D0 04 FF               LODI,R0    FF
1843  30D2 CC 13 F2            STRA,R0    BYTSP
1844  30D5 CC 0F 9F            STRA,R0    ERRPTR
1845  30D8 3F 2D 21            BSTA,UN    NEXT
1846  30DB 0C 0A 1B            LODA,R0    TXTBUF
1847  30DE E4 2A               COMI,R0    '*'
1848  30E0 1C 33 78            BCTA,EQ    NEXTLZ
1849  30E3 3F 2E 15            BSTA,UN    FIND
1850  30E6 E5 56               COMI,R1    TOPCOM
1851  30E8 1D 33 78            BCTA,GT    NEXTLZ
1852  30EB E5 40               COMI,R1    EQUP
1853  30ED 1C 33 78            BCTA,EQ    NEXTLZ
1854  30F0 E5 5C               COMI,R1    ENDP
1855  30F2 1C 35 15            BCTA,EQ    P2END
1856  30F5 E5 53               COMI,R1    BLKSP
1857  30F7 98 09               BCFR,EQ    BLKS2
1858  30F9 3F 20 C9            BSTA,UN    OFFON
1859  30FC CC 0A 10            STRA,R0    BLKSON
1860  30FF 1F 30 C6            BCTA,UN    P2NXT
1861  3102 E5 58        BLKS2  COMI,R1    TAPEP
1862  3104 98 09               BCFR,EQ    TAPE2
1863  3106 3F 20 C9            BSTA,UN    OFFON
1864  3109 CC 0A 11     TAPEP  STRA,R0    TAPEON
1865  310C 1F 30 C6            BCTA,UN    P2NXT
1866  310F E5 55        TAPE2  COMI,R1    DISPP
1867  3111 98 15               BCFR,EQ    BUMP2
1868  3113 3F 20 C9            BSTA,UN    OFFON
1869  3116 CC 09 FB            STRA,R0    DISPON
1870  3119 1F 30 C6            BCTA,LT    P2NXT
```

FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

1871  3110 3F 45 C9          BSTA,UN     LFCR
1872  3113 0C 09 FA          LODA,R0     OUTOFF
1873  3116 3E 35 B9          BSTA,LT     HEADIN
1874  3119 1F 30 C6          BCTA,UN     P2NXT
1875  311C E5 54       BUMP2 COMI,R1     BUMPP
1876  311E 98 09             BCFR,EQ     P1SP2
1877  3120 3F 20 C9          BSTA,UN     OFFON
1878  3123 CC 0A 0E          STRA,R0     BUMPON
1879  3126 1F 30 C6          BCTA,UN     P2NXT
1880  3129 E5 4E       DISP2 COMI,R1     ORGP
1881  312B 98 09             BCFR,EQ     ORG2
1882  312D 3F 20 0F          BSTA,UN     ORG
1883  3130 3F 34 20          BSTA,UN     HEXOS
1884  3133 1F 33 78          BCTA,UN     NEXTLZ
1885  3136 E5 52       ORG2  COMI,R1     PRNTP
1886  3138 98 1E             BCFR,EQ     PRNT2
1887  313A 3F 20 C9          BSTA,UN     OFFON
1888  313D CC 09 FA          STRA,R0     OUTOFF
1889  3140 18 08             BCTR,EQ     PRNT1
1890  3142 04 F0             LODI,R0     F0
1891  3144 3F 20 0A          BSTA,UN     DPRINT
1892  3147 1F 30 C6          BCTA,UN     P2NXT
1893  314A 04 F8       PRNT1 LODI,R0     F8
1894  314C 3F 20 0A          BSTA,UN     DPRINT
1895  314F 0C 09 FB          LODA,R0     DISPON
1896  3152 3F 35 B9          BSTA,UN     HEADIN
1897  3155 1F 30 C6          BCTA,UN     P2NXT
1898  3158 E5 4B       PRNT2 COMI,R1     ORGP
1899  315A 1E 32 7F          BCTA,LT     P2
1900  315D E5 51             COMI,R1     ALITP
1901  315F 98 23             BCFR,EQ     ALIT2
1902  3161 05 11             LODI,R1     11
1903  3163 0D 2A 18          LODA,R1     TXTBUF,+
1904  3166 CC 0C 97          STRA,R0     ALDEL
1905  3169 0D 2A 18    NOALI2 LODA,R1    TXTBUF,+
1906  316C 18 10             BCTR,EQ     ALDN2
1907  316E FC 0C 97          COMA,R0     ALDEL
1908  3171 18 0E             BCTR,EQ     ALDN2
1909  3173 C1 0F F3          STRA,R1     R2POS
1910  3176 3F 33 F3          BSTA,UN     HEXOUT
1911  3179 01 0F F3          LODA,R1     R2POS
1912  317C 1F 6B             BCTR,UN     NOALI2
1913  317E A5 13       ALDN2 SUBI,R1     13
1914  3180 C1                LODZ,R1
1915  3181 1F 33 79          BCTA,UN     NEXTL
1916  3184 3F 2F 15    ALIT2 BSTA,UN     GETAID
1917  3187 0D 0E 14          LODA,R1     OPPOS
1918  318A E5 4D             COMI,R1     DATAP
1919  318C 98 11             BCFR,EQ     DAT2
1920  318E 0C 10 15    DAT2A LODA,R0     OPER3
1921  3191 3F 33 F3          BSTA,UN     HEXOUT
1922  3194 3F 30 5C          BSTA,UN     CCK2
1923  3197 18 75             BCTR,EQ     DAT2A
1924  3199 0C 09 FD          LODA,R0     COMAST
1925  319C 1F 33 79          BCTA,UN     NEXTL
```


FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

1926  319F E5 4E       DAT2  COMI,R1     ACONP
1927  31A1 98 18             BCFR,EQ     ACON2
1928  31A3 0C 10 14    ACON2A LODA,R0    OPER2
1929  31A6 3F 33 F3          BSTA,UN     HEXOUT
1930  31A9 0C 10 15          LODA,R0     OPER3
1931  31AC 3F 33 F3          BSTA,UN     HEXOUT
1932  31AF 3F 30 5C          BSTA,UN     CCK2
1933  31B2 18 6F             BCTR,EQ     ACON2A
1934  31B4 0C 09 FD          LODA,R0     COMAST
1935  31B7 D0                RRL ,R0
1936  31B8 1F 33 79          BCTA,UN     NEXTL
1937  31BB E5 4F       ACON2 COMI,R1     RESP
1938  31BD 9C 32 16          BCFA,EQ     ADDP2
1939  31C0 0C 10 14          LODA,R0     OPER2
1940  31C3 18 2D             BCTR,EQ     RES4
1941  31C5 0C 19 80          LODA,R0     PC
1942  31C8 CC 12 1E          STRA,R0     RESBUF
1943  31CB 0C 19 81          LODA,R0     PC+1
1944  31CE CC 12 1F          STRA,R0     RESBUF+1
1945  31D1 04 FF             LODI,R0     FF
1946  31D3 CC 12 20          STRA,R0     RESBUF+2
1947  31D6 0C 10 15          LODA,R0     OPER3
1948  31D9 8C 19 81          ADDA,R0     PC+1
1949  31DC CC 19 81          STRA,R0     PC+1
1950  31DF 77 08             PPSL        WC
1951  31E1 0C 10 14          LODA,R0     OPER2
1952  31E4 8C 19 80          ADDA,R0     PC
1953  31E7 CC 19 80          STRA,R0     PC
1954  31EA 75 08             CPSL        WC
1955  31ED 3F 34 20          BSTA,UN     HEXOS
1956  31F0 1F 33 79          BCTA,UN     NEXTL
1957  31F3 01 10 15    RES4  LODA,R1     OPER3
1958  31F6 1C 33 79          BCTA,EQ     NEXTL
1959  31F9 CD 12 1D    RES3  STRA,R1     RESSTG
1960  31FC 20                EORZ,R0
1961  31FD 3F 33 F3          BSTA,UN     HEXOUT
1962  3200 01 12 1D          LODA,R1     RESSTG
1963  3203 F9 74             BDRR,R1     RES3
1964  3205 0C 10 15          LODA,R0     OPER3
1965  3208 1F 33 79          BCTA,UN     NEXTL
1966  320B 0C 0C FA    ADDP2 LODA,R0     LENT
1967  320E 1F 33 79          BCTA,UN     NEXTL
1968  3211                   *
1969  3211                   *
1970  3211 00          P1STO RES         1
1971  3212 00          RESSTG RES        1
1972  3213 02 00 00    RESBUF RES        3
1973  3216                   *
1974  3216 3F 32 4E    PRTLN BSTA,UN     PLN
1975  3219 08 7A             LODR,R0     RESBUF+2
1976  321B 18 0F             BCTR,EQ     PRNT3
1977  321D 0C 12 1E          LODA,R0     RESBUF
1978  3220 3F 35 56          BSTA,UN     PRINT
1979  3223 0C 12 1F          LODA,R0     RESBUF+1
1980  3226 3F 35 56          BSTA,UN     PRINT
```

FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

1981  3024 1F 35 6E          BCTA,UN     PRBL
1982  3027 20 19 80    PRNT3 LODA,R2     PC
1983  302A 3F 35 58          BSTA,UN     PRINT
1984  302D 20 19 81          LODA,R2     PC+1
1985  3030 3F 35 58          BSTA,UN     PRINT
1986  3033 1F 35 6E          BCTA,UN     PRBL
1987  3036                 *
1988  3036 20 0A 17    PLN   LODA,R0     LINE+1
1989  3039 84 67             ADDI,R0     67
1990  303B 94                DAR ,R0
1991  303C CC 0A 17          STRA,R2     LINE+1
1992  303F 77 08             PPSL        WC
1993  3041 04 66             LODI,R0     66
1994  3043 60 0A 16          ADDA,R2     LINE
1995  3046 94                DAR ,R2
1996  3047 CC 0A 16          STRA,R0     LINE
1997  304A 75 08             CPSL        WC
1998  304C 3F 35 58          BSTA,UN     PRINT
1999  304F 20 0A 17          LODA,R2     LINE+1
2000  3052 3F 35 58          BSTA,UN     PRINT
2001  3055 3F 35 6E          BSTA,UN     PRBL
2002  3058 1F 35 6E          BCTA,UN     PRBL
2003  305B                 *
2004  305B CD 0F F4    CC    STRA,R1     TMPS2
2005  305E 85 03             ADDI,R1     3
2006  3070 CD 0F F3          STRA,R1     R2POS
2007  3073 3F 30 16          BSTA,UN     TBL2
2008  3076 3E 2E 53          BSTA,LT     ERRMR
2009  3079 20 12 13          LODA,R2     OPER1
2010  307C 1B 24             BCTR,UN     SPEC1
2011  307E                 *
2012  307E 05 0A       P2    LODI,R1     A
2013  3080 0D 6A 18          LODA,R1     TXTBUF,I
2014  3083 E4 2C             COMI,R0     ','
2015  3085 18 04             BCTR,EQ     P2A
2016  3087 05 0C             LODI,R1     C
2017  3089 1E 02             BCTR,UN     P2B
2018  308B 05 0B       P2A   LODI,R1     B
2019  308D 07 0C       P2B   LODI,R3     0C
2020  308F 0D 6A 18          LODA,R1     TXTBUF,I
2021  3092 AF 01             SUBI,R1     1
2022  3094 F4 20             COMI,R0     ' '
2023  3096 18 08             BCTR,EQ     SPEQ0
2024  3098 F4 30             COMI,R0     '0'
2025  309A 1A 4F             BCTR,LT     CC
2026  309C F4 33             COMI,R0     '3'
2027  309F 19 4B             BCTR,GT     CC
2028  30A0 44 03       SPEQ0 ANDI,R0     3
2029  30A2 60 0E 13    SPEC1 IOPA,R0     OPCODE
2030  30A5 3F 33 F3          BSTA,UN     HEXOUT
2031  30A8 20 0E 13          LODA,R0     OPCODE
2032  30AB 3F 20 DA          BSTA,UN     ADDLN
2033  30AE 00 20 F9          IODA,R0     TYPE
2034  30B1 44 03             ANDI,R0     3
2035  30B3 1C 32 16          BCTA,EQ     ADDP2
```


FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

2036  30B6 E4 01             COMI,R0     1
2037  30B8 98 0C             BCFR,EQ     ADDR
2038  30BA 3F 2F 15          BSTA,UN     GETADD
2039  30BD 00 10 15          LODA,R0     OPER3
2040  30C0 3F 33 F3          BSTA,UN     HEXOUT
2041  30C3 1F 32 16          BCTA,UN     ADDP2
2042  30C6 3F 2F 15    ADDR  BSTA,UN     GETADD
2043  30C9 00 00 F9          LODA,R0     TYPE
2044  30CC F4 03             TMI ,R0     3
2045  30CE 1C 33 22          BCTA,EQ     ABSBR
2046  30D1 04 02             LODI,R0     2
2047  30D3 3F 35 A7          BSTA,UN     APCTA
2048  30D6 00 0E 13          LODA,R0     OPCODE
2049  30D9 F4 BB             COMI,R0     BB
2050  30DB 18 04             BCTR,EQ     ZERORL
2051  30DD F4 9B             COMI,R0     9B
2052  30DF 98 07             BCFR,EQ     NOZERO
2053  30E1 20          ZERORL EORZ,R0
2054  30E2 CC 0A 04          STRA,R0     TMPA
2055  30E5 CC 0A 05          STRA,R0     TMPA+1
2056  30E8 00 10 14    NOZERO LODA,R0     OPER2
2057  30EB 20 0A 04          EORA,R0     TMPA
2058  30EE 44 60             ANDI,R0     60
2059  30F0 BC 2E 52          BSFA,EQ     ERRMP
2060  30F3 01 10 15          LODA,R1     OPER3
2061  30F6 A5 0A 05          SUBA,R1     TMPA+1
2062  30F9 77 08             PPSL        WC
2063  30FB 00 10 14          LODA,R0     OPER2
2064  30FE A0 0A 04          SUBA,R0     TMPA
2065  3101 75 08             CPSL        WC
2066  3103 18 05             BCTR,EQ     TB2
2067  3105 F4 FF             TMI ,R0     FF
2068  3107 BC 2E 57          BSFA,EQ     ERRMD
2069  310A 01          TB2   LODZ,R1
2070  310B F4 C0             TMI ,R0     C0
2071  310D 18 08             BCTR,EQ     TTZ
2072  310F 24 FF             EORI,R0     FF
2073  3111 F4 C0             TMI ,R0     C0
2074  3113 BC 2E 57          BSFA,EQ     ERRMD
2075  3116 01                LODZ,R1
2076  3117 03          TTZ   STRZ,R3
2077  3118 3F 35 07          BSTA,UN     INDIR
2078  311B 03                LODZ,R3
2079  311C 3F 33 F3          BSTA,UN     HEXOUT
2080  311F 1F 32 16          BCTA,UN     ADDP2
2081  3122 0F 10 14    ABSBR LODA,R3     OPER2
2082  3125 3F 35 07          BSTA,UN     INDIR
2083  3128 00 00 F9          LODA,R0     TYPE
2084  312B F4 03             COMI,R0     3
2085  312D 18 07             BCTR,EQ     ABS
2086  312F 03                LODZ,R3
2087  3130 3F 33 F3          BSTA,UN     HEXOUT
2088  3133 1F 33 6E          BCTA,UN     BYTBT
2089  3136 03          ABS   LODZ,R3
2090  3137 20 19 80          EORA,R0     PC
```

FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

2091  333A 44 60              ANDI,R0     60
2092  333C BC 2E 5B           BSFA,EQ     ERRMP
2093  333F 47 9F              ANDI,R3     9F
2094  3341 0C 0F F3           LODA,R1     R2POS
2095  3344 0D 6A 18           LODA,R1     TXTBUF,I
2096  3347 18 21              BCTR,EQ     NOIND
2097  3349 E4 2C              COMI,R0     ','
2098  334B 98 1D              BCFR,EQ     NOIND
2099  334D 0D 2A 1B           LODA,R1     TXTBUF,+
2100  3350 3F 47 8C           BSTA,UN     LTOU
2101  3353 E4 2B              COMI,R0     2B
2102  3355 98 04              BCFR,EQ     NOPLUS
2103  3357 67 20              IORI,R3     20
2104  3359 1B 0F              BCTR,UN     NOIND
2105  335B E4 2D        NOPLUS COMI,R0     2D
2106  335D 98 04              BCFR,EQ     NOMINU
2107  335F 67 40              IORI,R3     40
2108  3361 1B 07              BCTR,UN     NOIND
2109  3363 E4 49        NOMINU COMI,R0     'I'
2110  3365 BC 2E 4F           BSFA,EQ     ERRMO
2111  3368 67 60              IORI,R3     60
2112  336A 03           NOIND  LODZ,R3
2113  336B 3F 33 F3           BSTA,UN     HEXOUT
2114  336E 0C 10 15     BYTPT  LODA,R0     OPER3
2115  3371 3F 33 F3           BSTA,UN     HEXOUT
2116  3374 1F 32 16           BCTA,UN     ADDP2
2117  3377                    *
2118  3377 00           NEXTLS RES         1
2119  3378                    *
2120  3378 20           NEXTLZ EORZ,R0
2121  3379 08 7C        NEXTL  STBR,R0     NEXTLS
2122  337B 04 0D               LODI,R0     CR
2123  337D 3F 35 70            BSTA,UN     PRNT
2124  3380 04 0A               LODI,R0     LF
2125  3382 3F 35 70            BSTA,UN     PRNT
2126  3385 3F 2E C9            BSTA,UN     CHKPR
2127  3388 9C 33 E6            BCFA,EQ     NEXTL4
2128  338B 3F 2E E4            BSTA,UN     ERRP
2129  338E 3F 32 21            BSTA,UN     PRTLN
2130  3391 06 FF               LODI,R2     FF
2131  3393 3F 34 F1            BSTA,UN     PRTDB
2132  3396 0F 09 FC            LODA,R3     BPPC
2133  3399 E7 03        BL3    COMI,R3     3
2134  339B 19 0B               BCTR,GT     PRTLM
2135  339D 3F 35 6E            BSTA,UN     PRBL
2136  33A0 3F 35 6E            BSTA,UN     PRBL
2137  33A3 3F 35 6E            BSTA,UN     PRBL
2138  33A6 DB 71               BIRR,R3     BL3
2139  33A8 06 FF        PRTLM  LODI,R1     FF
2140  33AA 0C 2A 18     PRTNX  LODA,R1     TXTBUF,+
2141  33AD 18 05               BCTR,EQ     GOON2
2142  33AF 3F 35 70            BSTA,UN     PRNT
2143  33B2 1F 7E               BCTR,UN     PRTNX
2144  33B4 05 03        GOON2  LODI,R2     3
2145  33B6 0C 13 F0     GOON   LODA,R0     PLINE
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FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

2146  33B9 84 21               ADDI,R0     1
2147  33BB CC 13 F0            STRA,R0     PLINE
2148  33BE E4 36               COMI,R0     36
2149  33C0 3D 35 B9            BSTA,GT     HEADIN
2150  33C3 0C 09 FC            LODA,R0     BPPC
2151  33C6 E4 05               COMI,R0     5
2152  33C8 1A 1F               BCTR,LT     NEXTL6
2153  33CA A4 04               SUBI,R0     4
2154  33CC CC 09 FC            STRA,R0     BPPC
2155  33CF 04 04               LODI,R0     4
2156  33D1 3F 2C FB            BSTA,UN     APC
2157  33D4 04 0D               LODI,R0     CR
2158  33D6 3F 35 70            BSTA,UN     PRNT
2159  33D9 04 0A               LODI,R0     LF
2160  33DB 3F 35 70            BSTA,UN     PRNT
2161  33DE 3F 32 21            BSTA,UN     PRTLN
2162  33E1 3F 34 F1            BSTA,UN     PRTDB
2163  33E4 1B 50               BCTR,UN     GOON
2164  33E6 0C 13 77     NEXTL4 LODA,R0     NEXTLS
2165  33E9 3F 2C FB     NEXTL6 BSTA,UN     APC
2166  33EC 1F 30 C6            BCTA,UN     P2NXT
2167  33EF                    *
2168  33EF 02           BLKSO  RES         1
2169  33F0 02           PLINE  RES         1
2170  33F1 00           HEXOST RES         1
2171  33F2 00           BYTSP  RES         1
2172  33F3                    *
2173  33F3                    *
2174  33F3                    *
2175  33F3                    *
2176  33F3 0F 0A 10     HEXOUT LODA,R3     BLKSON
2177  33F6 98 0B               BCFR,EQ     NODIRL
2178  33F8 C1                  STRZ,R1
2179  33F9 0C 09 FC            LODA,R0     BPPC
2180  33FC 3F 34 C6            BSTA,UN     APCDA
2181  33FF 01                  LODZ,R1
2182  3400 CC 6A 02            STRA,R0     *DUMA
2183  3403 0E 13 F1     NODIRL LODA,R2     HEXOST
2184  3406 CE AA 14            STRA,R2     *OBPTR,+
2185  3409 CE 13 F1            STRA,R2     HEXOST
2186  340C 0D 13 F2            LODA,R1     BYTSP
2187  340F CD 2A 69            STRA,R1     BYTSTG,+
2188  3412 CD 13 F2            STRA,R1     BYTSP
2189  3415 0D 09 FC            LODA,R1     BPPC
2190  3418 85 01               ADDI,R1     01
2191  341A CD 09 FC            STRA,R1     BPPC
2192  341D E6 FF               COMI,R2     FF
2193  341F 16                  RETC,LT
2194  3420                    *
2195  3422 0E 0A 11     HEXOS  LODA,R2     TAPEON
2196  3423 16                  RETC,LT
2197  3424 0E 13 F1            LODA,R2     HEXOST
2198  3427 E6 02               COMI,R2     2
2199  3429 1C 34 AB            BCTA,EQ     HEXO3
2200  342C 02                  LODZ,R2
```

FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

LINE	ADDR	B1	B2	B3	B4	LABEL	OPCODE	OPERAND	COMMENTS
2201	342D	A4	03				SUBI,R0	3	
2202	342F	98	02				BCFR,EQ	HEXOS1	
2203	3431	04	01				LODI,R0	01	
2204	3433	05	02			HEXOS1	LODI,R1	2	
2205	3435	CD	EA	14			STRA,R1	*OBPTR,I	
2206	3438	00	0A	14		HEXOS2	LODA,R0	OBPTR	
2207	343B	84	01				ADDI,R0	1	
2208	343D	CC	0A	14			STRA,R0	OBPTR	
2209	3440	FC	00	06			COMA,R0	ENDRAM	
2210	3443	1B	34	AB			BCTA,LT	HEXO3	
2211	3446	05	1C			BINOT	LODI,R1	1C	'BINARY OUTPUT'
2212	3448	3F	46	C7			BSTA,UN	PSTRNG	
2213	344B	3F	46	F7			BSTA,UN	PAUSE	
2214	344E	E4	1B				COMI,R0	ESC	
2215	3450	1C	20	30			BCTA,EQ	EDITOR	
2216	3453	3F	34	E6			BSTA,UN	BINADD	
2217	3456	20				NBO	EORZ,R0		
2218	3457	CC	00	43			STRA,R0	*SUMK	
2219	345A	07	3A				LODI,R3	':'	← DUMP ONTO TAPE
2220	345C	3F	02	4F			BSTA,UN	SERO	
2221	345F	25	FF				LODI,R1	-1	
2222	3461	0D	AA	14		HEADO	LODA,R1	*OBPTR,+	
2223	3464	C3					STRZ,R3		
2224	3465	3F	02	4F			BSTA,UN	SERO	
2225	3468	E5	02				COMI,R1	02	
2226	346A	98	75				BCFR,EQ	HEADO	
2227	346C	0F	88	43			LODA,R3	*SUMK	
2228	346F	3F	02	4F			BSTA,UN	SERO	
2229	3472	3F	02	78			BSTA,UN	DELAY	
2230	3475	CC	00	43			STRA,R0	*SUMK	
2231	3478	0D	EA	14			LODA,R1	*OBPTR,I	
2232	347B	84	03				ADDI,R0	03	
2233	347D	CC	00	2E			STRA,R0	TMPS	
2234	3480	2D	AA	14		BITSO	LODA,R1	*OBPTR,+	
2235	3483	C3					STRZ,R3		
2236	3484	3F	02	4F			BSTA,UN	SERO	
2237	3487	ED	00	2E			COMA,R1	TMPS	
2238	348A	98	74				BCFR,EQ	BITSO	
2239	348C	0F	88	43			LODA,R3	*SUMK	
2240	348F	3F	02	4F			BSTA,UN	SERO	
2241	3492	00	00	2E			LODA,R0	TMPS	
2242	3495	E4	03				COMI,R0	03	
2243	3497	18	0E				BCTR,EQ	BITS2	
2244	3499	3F	34	DA			BSTA,UN	A1HT	
2245	349C	1E	34	56			BCTA,LT	NBO	
2246	349F	3F	34	E6		BITS2	BSTA,UN	BINADD	
2247	34A2	3F	2E	0A			BSTA,UN	ACK	
2248	34A5	00	00	05			LODA,R0	OBST	
2249	34A8	CC	0A	14			STRA,R0	OBPTR	
2250	34AB	00	05	FC		HEXO3	LODA,R0	BPPC	
2251	34AE	3F	35	A7			BSTA,UN	APCTA	
2252	34B1	06	FF				LODI,R2	FF	
2253	34B3	00	0A	04			LODA,R2	TMPA	
2254	34B6	CE	AA	14			STRA,R2	*OBPTR,+	
2255	34B9	00	0A	05			LODA,R0	TMPA+1	

FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

LINE	ADDR	B1	B2	B3	B4	LABEL	OPCODE	OPERAND	COMMENTS
2256	34BC	CE	AA	14			STRA,R2	*OBPTR,+	
2257	34BF	20					EORZ,R0		
2258	34C0	CE	AA	14			STRA,R2	*OBPTR,+	
2259	34C3	CE	13	F1			STRA,R2	HEXOST	
2260	34C6	17					RETC,UN		
2261	34C7	17							
2262	34C8					*			
2263	34C8	8C	19	81		APCDA	ADDA,R0	PC+1	
2264	34CB	CC	0A	03			STRA,R0	DUM2	
2265	34CE	77	08				PPSL	WC	
2266	34D0	20					EORZ,R0		
2267	34D1	8C	19	80			ADDA,R0	PC	
2268	34D4	CC	0A	02			STRA,R0	DUMA	
2269	34D7	75	08				CPSL	WC	
2270	34D9	17					RETC,UN		
2271	34DA					*			
2272	34DA					*			
2273	34DA	00	0A	14		A1HT	LODA,R0	OBPTR	
2274	34DD	84	01				ADDI,R0	01	
2275	34DF	CC	0A	14			STRA,R0	OBPTR	
2276	34E2	FC	00	06			COMA,R0	ENDRAM	
2277	34E5	17					RETC,UN		
2278	34E6					*			
2279	34E6					*			
2280	34E6	00	00	05		BINADD	LODA,R0	OBST	
2281	34E9	CC	0A	14			STRA,R0	OBPTR	
2282	34EC	22					EORZ,R0		
2283	34ED	CC	0A	15			STRA,R0	OBPTR+1	
2284	34F0	17					RETC,UN		
2285	34F1					*			
2286	34F1					*			
2287	34F1	2D	09	FC		PRTDB	LODA,R1	BPPC	
2288	34F4	14					RETC,EQ		
2289	34F5	E5	04				COMI,R1	4	
2290	34F7	1A	02				BCTR,LT	NEXTL3	
2291	34F9	05	04				LODI,R1	4	
2292	34FB	0E	2A	69		NEXTL3	LODA,R2	BYTSTG,+	
2293	34FE	3F	35	56			BSTA,UN	PRINT	
2294	3501	3F	35	6E			BSTA,UN	PRBL	
2295	3504	F9	75				BIRR,R1	NEXTL3	
2296	3506	17					RETC,UN		
2297	3507					*			
2298	3507	47	7F			INDIR	ANDI,R3	7F	
2299	3509	05	11				LODI,R1	11	
2300	350B	0C	6A	18			LODA,R1	TXTBUF,I	
2301	350E	E4	2A				COMI,R0	'*'	
2302	3510	16					RETC,LT		
2303	3511	15					RETC,GT		
2304	3512	67	80				IOPI,R3	80	
2305	3514	17					RETC,UN		
2306	3515					*			
2307	3515	3F	45	C9		P2END	BSTA,UN	LFCR	
2308	3518	0C	0A	11			LODA,R0	TAPEON	
2309	351B	9C	35	3F			BCFA,EQ	P2E2	
2310	351E	0C	13	F1			LODA,R0	HEXOST	

FILE 'AIP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

2311  3521 A4 03              SUBI,R0     03
2312  3523 98 22              BCFR,EQ     P2D1
2313  3525 04 01              LODI,R2     01
2314  3527 06 02        P2D1  LODI,R3     02
2315  3529 CB BA 14           STRA,R2     *OPPTR,I
2316  352C 3F 34 DA           BSTA,UN     AIRT
2317  352F 9A 08              BCFR,LT     NOZFR
2318  3531 06 03              LODI,R2     03
2319  3533 20                 EOR2,R0
2320  3534 CB CA 14     ZERLP STRA,R2     *OPPTR,-
2321  3537 9A FB              BRNR,R2     ZERLP
2322  3539 3F 34 46     NOZFR BSTA,UN     BINCT
2323  353C 3F 45 C9           BSTA,UN     LFCR
2324  353F C0 0F 14     P2D2  LODA,R0     ERRS
2325  3542 3F 47 4F           BSTA,UN     EXOT
2326  3545 05 14              LODI,R1     14
2327  3547 3F 46 CA           BSTA,UN     PRING
2328  354A 04 F0              LODI,R0     F0
2329  354C 0D 09 FA           LODA,R1     OUTOFF
2330  354F 30 20 2A           BSTA,EQ     DPRINT
2331  3552 3F 46 F7           BSTA,UN     PAUSE
2332  3555 1F 20 30           BCTA,UN     EDITOR
2333  3558                    *
2334  3558 C3           PRINT STRZ,R3
2335  3559 52                 RRR ,R0
2336  355A 52                 RRR ,R0
2337  355B 52                 RRR ,R0
2338  355C 52                 RRR ,R0
2339  355D 44 0F              ANDI,R0     0F
2340  355F C0 76 AC           LODA,R0     EXTBL,I
2341  3562 3F 35 70           BSTA,UN     PRNT
2342  3565 47 0F              ANDI,R3     0F
2343  3567 0F 76 AC           LODA,R3     EXTBL,I
2344  356A 3F 35 70           BSTA,UN     PRNT
2345  356D 17                 RETC,UN
2346  356E                    *
2347  356E 04 20        PRBL  LODI,R0     ' '
2348  3570 77 10        PRNT  PPSL        RS
2349  3572 0D 09 FA           LODA,R1     OUTOFF
2350  3575 98 05              BCFR,EQ     CKDISP
2351  3577 3F 22 0A           BSTA,UN     DPRINT
2352  357A 77 10              PPSL        RS
2353  357C 0D 09 FB     CKDISP LODA,R1    DISPON
2354  357F 1A 2D              BCTR,LT     PRTRTN
2355  3581 44 7F              ANDI,R0     7F
2356  3583 E4 0D              COMI,R0     CR
2357  3585 98 24              BCFR,EQ     DISP3
2358  3587 3F 28              BSTA,UN     LFCRST
2359  3589 1B 03              BCTR,UN     PRTRTN
2360  358B 3F 45 8D     DISP3 BSTA,UN     WRT
2361  358E 75 10        PRTRTN CPSL       RS
2362  3590 17                   RETC,UN
2363  3591                    *
2364  3591 3F 45 C9     LFCRST BSTA,UN    LFCR
2365  3594 0D 0A 0F           LODA,R0     DISPLN
```


FILE 'AIP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

2366  3597 84 01              ADDI,R0     1
2367  3599 CC 0A 0F           STRA,R0     DISPLN
2368  359C E4 0F              COMI,R0     F
2369  359E 16                 RETC,LT
2370  359F 20                 EOR2,R0
2371  35A0 CC 0A 0F           STRA,R0     DISPLN
2372  35A3 3F 46 F7           BSTA,UN     PAUSE
2373  35A6 17                 RETC,UN
2374  35A7                    *
2375  35A7 80 19 81     APCTA ADDA,R0     PC+1
2376  35AA CC 0A 05           STRA,R0     TMPA+1
2377  35AD 77 08              PPSL        WC
2378  35AF 20                 EOR2,R0
2379  35B0 80 19 80           ADDA,R0     PC
2380  35B3 CC 0A 04           STRA,R0     TMPA
2381  35B6 75 08              CPSL        WC
2382  35B8 17                 RETC,UN
2383  35B9                    *
2384  35B9                    *
2385  35B9                    *
2386  35B9 05 00        HEADIN LODI,R1    00
2387  35BB CD 13 F0           STRA,R1     PLINE
2388  35BE 3F 36 4B           BSTA,UN     BLKPRT
2389  35C1 C0 0A 0D           LODA,R0     PAGE+1
2390  35C4 84 67              ADDI,R0     67
2391  35C6 54                 DAR ,R0
2392  35C7 CC 0A 0D           STRA,R0     PAGE+1
2393  35CA 77 08              PPSL        WC
2394  35CC C0 0A 0C           LODA,R0     PAGE
2395  35CF 84 66              ADDI,R0     66
2396  35D1 54                 DAR ,R0
2397  35D2 CC 0A 2C            TRA,R2     PAGE
2398  35D5 75 08              CPSL        WC
2399  35D7 3F 35 58           BSTA,UN     PPINT
2400  35DA 20 0A 0D           LODA,R0     PAGE+1
2401  35DC 3F 35 58           BSTA,UN     PRINT
2402  35DF 04 0A              LODI,R0     LF
2403  35E1 3F 35 70           BSTA,UN     PPNT
2404  35E4 04 2D              LODI,R0     CR
2405  35E7 3F 35 70           BSTA,UN     PRNT
2406  35EA 17                 RETC,UN
2407  35EB                    *
2408  35EB                    *
2409  35EB 2D 0A 2A 0A PRTBUF DATA        FORMF,LF,LF,LF,CR
2410  35EF 0D
2411  35F0 4C 49 4E 45        ALIT        'LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND'
2412  35F4 20 20 41 44
2413  35F8 44 52 22 42
2414  35FC 31 20 42 32
2415  3600 20 42 33 20
2416  3604 42 34 22 4C
2417  3608 41 42 45 42
2418  360C 20 22 4F 52
2419  3610 43 4F 44 45
2420  3614 20 22 20 20
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LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

2421  3618 20 4F 50 45
2422  3610 52 41 4E 44
2423  3602 20 22 20 43        ALIT        '  COMMENTS       PAGE '
2424  3624 4F 4D 4D 45
2425  3626 4E 54 53 20
2426  3620 20 20 20 20
2427  3630 20 22 20 50
2428  3634 41 47 45 20
2429  3635 FF                 DATA        FF
2430  3639 0A 2A 2A 20 PMSG4  ALIT.       '*** '
2431  363D FF                 DATA        FF
2432  363E 20 45 52 52 PMSG5  ALIT        ' ERROR ***'
2433  3642 4F 52 20 2A
2434  3646 2A 2A
2435  3648 0A 0D FF           DATA        LF,CR,FF
2436  364B                  *
2437  364D 0D 76 EB     BLKPRT LODA,R1    PRTBUF,I
2438  364E 16                  RETC,LT
2439  364F 0F 3E 70            BSTA,UN    PRNT
2440  3652 19 77               BIRR,R1    BLKPRT
2441  3654 17                  RETC,UN
2442  3655                  *
2443  3655 0F 21 92     BUG    BSTA,UN    ERASE
2444  3658 1F 42 90            BCTA,UN    DCOMD
2445  365B 0F 21 92     DEBUG  BSTA,UN    ERASE
2446  365E 1F 41 4C            BCTA,UN    AR
2447  3661                  *
2448  3661                  ************************** LIST OF TABLES **********************************
2449  3661                  *
2450  3661                  *
2451  3661 70           TAB1   DATA        IN2ERO-JADD1
2452  3662 5E                  DATA        INIM-JADD1
2453  3663 65                  DATA        INREL-JADD1
2454  3664 20                  DATA        INABS-JADD1
2455  3665 1E           TAB2   DATA        OT2ERO-JADD2
2456  3666 03                  DATA        OUT1M-JADD2
2457  3667 02                  DATA        OUTREL-JADD2
2458  3668 00                  DATA        OUTABS-JADD2
2459  3669 60           TAB3   DATA        EX1-JADD3
2460  366A 64                  DATA        EX0-JADD3
2461  366B 02                  DATA        GREL-JADD3
2462  366C 43                  DATA        GABS-JADD3
2463  366D                  *
2464  366D 00           TABEX0 DATA        RETC-JEX0
2465  366E 05                  DATA        RETE-JEX0
2466  366F 5E                  DATA        REDE-JEX0
2467  3670 12                  DATA        CPS-JEX0       (PPS)
2468  3671 F7                  DATA        DAR-JEX0
2469  3672 34                  DATA        TPS-JEX0
2470  3673 92                  DATA        WRTE-JEX0
2471  3674 42                  DATA        TMI-JEX0
2472  3675                  *
2473  3675 10           TABEX1 DATA        SPS-JEX1
2474  3676 30                  DATA        REDC-JEX1
2475  3677 00                  DATA        RRR-JEX1
```



```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

2476  3678 36                 DATA        REDD-JEX1
2477  3679 20                 DATA        LPS-JEX1
2478  367A 7E                 DATA        WRTC-JEX1
2479  367B 00                 DATA        RRL-JEX1
2480  367C 81                 DATA        WRTD-JEX1
2481  367D                  *
2482  367D 00           REDETB DATA        REDEX-REDEX
2483  367E 05                  DATA        REDE1-REDEX
2484  367F 0E                  DATA        REDE1-REDEX
2485  3680 19                  DATA        REDB-REDEX
2486  3681                  *
2487  3681 00           REDTAB DATA        RED0-RED0
2488  3682 04                  DATA        RED1-RED0
2489  3683 04                  DATA        RED1-RED0
2490  3684 11                  DATA        RED2-RED0
2491  3685                  *
2492  3685 00           WRTETB DATA        WRTEX-WRTEX
2493  3686 0F                  DATA        WRTE1-WRTEX
2494  3687 06                  DATA        WRTE6-WRTEX
2495  3688 06                  DATA        WRTE6-WRTEX
2496  3689                  *
2497  3689 00           WRTTB  DATA        WRT1-WRT1
2498  368A 05                  DATA        WRT5-WRT1
2499  368B 17                  DATA        WRT4-WRT1
2500  368C 17                  DATA        WRT4-WRT1
2501  368D                  *
2502  368D 72           MODTAB DATA        DCOMD-OUT
2503  368E 73                  DATA        S1-OUT
2504  368F 43                  DATA        ST-OUT
2505  3690 1F                  DATA        TR-OUT
2506  3691 62                  DATA        SS-OUT
2507  3692                  *
2508  3692 10           INVAL  DATA        10             INVALID OPCODES
2509  3693 11                  DATA        11
2510  3694 90                  DATA        90
2511  3695 91                  DATA        91
2512  3696 B6                  DATA        B6
2513  3697 B7                  DATA        B7
2514  3698 C4                  DATA        C4
2515  3699 C5                  DATA        C5
2516  369A C6                  DATA        C6
2517  369B C7                  DATA        C7
2518  369C                  *
2519  369C                  *
2520  369C 4A 4C 55 49 KEYTAB ALIT        'JLUIOM..'
2521  36A0 4F 4D 2C 2E
2522  36A4 FF           KEY0   DATA        FF
2523  36A5 01                  DATA        01
2524  36A6 EF                  DATA        EF
2525  36A7 F0                  DATA        F0
2526  36A8 F1                  DATA        F1
2527  36A9 0F                  DATA        0F
2528  36AA 10                  DATA        10
2529  36AB 11                  DATA        11
2530  36AC                  *
```

FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

2631  36AC 30 31 32 33 HXTBL  ALIT       '0123456789ABCDEF'
2632  36B0 34 35 36 37
2633  36B4 38 39 41 42
2634  36B8 43 44 45 46
2635  36BC                *
2636  36BC 00             ADRTAB DATA      00
2637  36BD 01                    DATA      01
2638  36BE 01                    DATA      01
2639  36BF 02                    DATA      02
2640  36C0                *
2641  36C0                *
2642  36C0 43 48         COMTB2 ALIT      'CH'
2643  36C2 41 66                ACON      CH
2644  36C4 43 4F                ALIT      'CO'
2645  36C6 40 00                ACON      CO
2646  36C8 44 49                ALIT      'DI'
2647  36CA 43 68                ACON      DDIS
2648  36CC 44 53                ALIT      'DS'
2649  36CE 3F 76                ACON      DSBUG
2650  36D0 49 4E                ALIT      'IN'
2651  36D2 42 98                ACON      IN
2652  36D4 50 41                ALIT      'PA'
2653  36D6 43 59                ACON      DPAGE
2654  36D8 50 43                ALIT      'PC'
2655  36DA 43 41                ACON      PCIT
2656  36DC 52 45                ALIT      'RE'
2657  36DE 41 94                ACON      RE
2658  36E0 41 41                ALIT      'AA'
2659  36E2 41 46                ACON      AA
2660  36E4 41 50                ALIT      'AP'
2661  36E6 41 34                ACON      AP
2662  36E8 41 52                ALIT      'AR'
2663  36EA 41 4C                ACON      AR
2664  36EC 41 53                ALIT      'AS'
2665  36EE 41 02                ACON      AS
2666  36F0 49 50                ALIT      'IP'
2667  36F2 42 0D                ACON      IP
2668  36F4 49 52                ALIT      'IR'
2669  36F6 40 D5                ACON      IRIT
2670  36F8 49 53                ALIT      'IS'
2671  36FA 42 D6                ACON      IS
2672  36FC 4F 41                ALIT      'OA'
2673  36FE 42 59                ACON      OA
2674  3700 4F 53                ALIT      'OS'
2675  3702 42 FE                ACON      OS
2676  3704 4F 52                ALIT      'OR'
2677  3706 40 B1                ACON      OR
2678  3708 53 49                ALIT      'SI'
2679  370A 43 0F                ACON      CSI
2680  370C 53 54                ALIT      'ST'
2681  370E 43 17                ACON      CST
2682  3710 54 52                ALIT      'TR'
2683  3712 43 49                ACON      CTR
2684  3714 42 52                ALIT      'BR'
2685  3716 3F 69                ACON      BR
```


FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

2686  3718 43 4C                ALIT      'CL'
2687  371A 3F 43                ACON      CLIT
2688  371C 45 58                ALIT      'EX'
2689  371E 3F D1                ACON      EX
2690  3720 52 55                ALIT      'RU'
2691  3722 23 6C                ACON      PASS1
2692  3724 45 44                ALIT      'ED'
2693  3726 20 30                ACON      EDITOR
2694  3728 FF                    DATA      FF
2695  3729                *
2696  3729                *
2697  3729                *
2698  3729                *
2699  3729 49 4E 50 55 MSG0   ALIT       'INPUT PORT '
2700  372D 54 20 50 4F
2701  3731 52 54 20
2702  3734 FF                    DATA      FF
2703  3735 4F 55 54 50 MSG1   ALIT       'OUTPUT PORT '
2704  3739 55 54 20 50
2705  373D 4F 52 54 20
2706  3741 FF                    DATA      FF
2707  3742 42 52 45 41 MSG2   ALIT       'BREAK POINT '
2708  3746 4B 20 50 4F
2709  374A 49 4E 54 20
2710  374E FF                    DATA      FF
2711  374F 20 43 4C 45 MSG3   ALIT       ' CLEARED'
2712  3753 41 52 45 44
2713  3757 FF                    DATA      FF
2714  3758 53 54 41 43 MSG4   ALIT       'STACK= '
2715  375C 4B 3D 20
2716  375F FF                    DATA      FF
2717  3760 20 49 4E 56 MSG5   ALIT       ' INVALID COMMAND'
2718  3764 41 4C 49 44
2719  3768 20 43 4F 4D
2720  376C 4D 41 4E 44
2721  3770 FF                    DATA      FF
2722  3771 44 45 42 55 MSG6   ALIT       'DEBUG> '
2723  3775 47 3E 20
2724  3778 FF                    DATA      FF
2725  3779 50 52 4F 47 MSG7   ALIT       'PROGRAM HALTED'
2726  377D 52 41 4D 20
2727  3781 48 41 4C 54
2728  3785 45 44
2729  3787 FF                    DATA      FF
2730  3788 20 52 45 41 MSG8   ALIT       ' REACHED AT '
2731  378C 43 48 45 44
2732  3790 20 41 54 20
2733  3794 FF                    DATA      FF
2734  3795 49 4E 56 41 MSG9   ALIT       'INVALID OPCODE'
2735  3799 4C 49 44 20
2736  379D 4F 50 43 4F
2737  37A1 44 45
2738  37A3 FF                    DATA      FF
2739  37A4 20 43 43 3D MSGA   ALIT       ' CC='
2740  37A8 FF                    DATA      FF
```

FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

2641  37A9 20 20 49 4E MSGB   ALIT       '  INVALID HEX VALUE'
2642  37AD 56 41 4C 49
2643  37B1 44 20 48 45
2644  37B5 58 20 56 41
2645  37B9 4C 55 45
2646  37BC FF                 DATA       FF
2647  37BD 42 4C 4F 43 MSGC   ALIT       'BLOCKS  LEFT:  '
2648  37C1 4B 53 20 20
2649  37C5 4C 45 46 54
2650  37C9 3A 20 20
2651  37CC FF                 DATA       FF
2652  37CD 54 4F 4F 20 MSGD   ALIT       'TOO MUCH'
2653  37D1 4D 55 43 48
2654  37D5 FF                 DATA       FF
2655  37D6 4E 4F 54 20 MSGE   ALIT       'NOT FOUND'
2656  37DA 46 4F 55 4E
2657  37DE 44
2658  37DF FF                 DATA       FF
2659  37E0 4D 4F 44 49 MSGF   ALIT       =MODIFY STRING '=
2660  37E4 46 59 20 53
2661  37E8 54 52 49 4E
2662  37EC 47 20 27
2663  37EF 00 00 00 00 MNAME  RES        10
2664  37F3 00 00 00 00
2665  37F7 00 00 00 00
2666  37FB 00 00 00 00
2667  37FF 27 20 54 4F        ALIT       =' TO '=
2668  3803 20 27
2669  3805 FF                 DATA       FF
2670  3806 53 55 4D 43 MSG10  ALIT       'SUMCHECK ERROR'
2671  380A 48 45 43 4B
2672  380E 20 45 52 52
2673  3812 4F 52
2674  3814 FF                 DATA       FF
2675  3815 50 41 53 53 MSG11  ALIT       'PASS 1'
2676  3819 20 31
2677  381B FF                 DATA       FF
2678  381C 50 41 53 53 MSG12  ALIT       'PASS 2'
2679  3820 20 32
2680  3822 FF                 DATA       FF
2681  3823 53 59 4D 42 MSG13  ALIT       'SYMBOL OVERFLOW'
2682  3827 4F 4C 20 4F
2683  382B 56 45 52 46
2684  382F 4C 4F 57
2685  3832 FF                 DATA       FF
2686  3833 20 45 52 52 MSG14  ALIT       ' ERRORS'
2687  3837 4F 52 53
2688  383A FF                 DATA       FF
2689  383B 44 55 50 4C MSG15  ALIT       'DUPLICATE LABLE: '
2690  383F 49 43 41 54
2691  3843 45 20 4C 41
2692  3847 42 4C 45 3A
2693  384B 20
2694  384C FF                 DATA       FF
2695  384D 4F 50 43 4F MSG16  ALIT       'OPCODE'
```


FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

2696  3851 44 45
2697  3853 FF                 DATA       FF
2698  3854 4C 41 42 4C MSG17  ALIT       'LABLE USED TWICE'
2699  3858 45 20 55 53
2700  385C 45 44 20 54
2701  3860 57 49 43 45
2702  3864 FF                 DATA       FF
2703  3865 4F 50 45 52 MSG18  ALIT       'OPERAND'
2704  3869 41 4E 44
2705  386C FF                 DATA       FF
2706  386D 52 45 47 49 MSG19  ALIT       'REGISTER FIELD'
2707  3871 53 54 45 52
2708  3875 20 46 49 45
2709  3879 4C 44
2710  387B FF                 DATA       FF
2711  387C 44 49 53 50 MSG1A  ALIT       'DISPLACEMENT'
2712  3880 4C 41 43 45
2713  3884 4D 45 4E 54
2714  3888 FF                 DATA       FF
2715  3889 50 41 47 45 MSG1B  ALIT       'PAGEING'
2716  388D 49 4E 47
2717  3892 FF                 DATA       FF
2718  3891 42 49 4F 41 MSG1C  ALIT       'BINARY  OUTPUT'
2719  3895 52 59 20 20
2720  3899 4F 55 54 50
2721  389D 55 54
2722  389F FF                 DATA       FF
2723  38A0 43 4F 4D 4D MSG1D  ALIT       'COMMAND:  '
2724  38A4 41 4E 44 3A
2725  38A8 20 20
2726  38AA FF                 DATA       FF
2727  38AB 44 41 54 41 MSG1E  ALIT       'DATA INPUT'
2728  38AF 20 49 4E 50
2729  38B3 55 54
2730  38B5 FF                 DATA       FF
2731  38B6 20 4F 4B    MSG1F  ALIT       ' OK'
2732  38B9 FF                 DATA       FF
2733  38BA                   ********** SIMULATOR **********
2734  38BA                   *
2735  38BA 05 09       INER   LODI,R1    9
2736  38BC 3F 46 C7            BSTA,UN   PSTRNG        "INVALID OPCODE"
2737  38BF 1F 20 4B            BCTA,UN   COMD
2738  38C2                   *
2739  38C2 00          IR     RES        1
2740  38C3                   *
2741  38C3 0C 99 80    GETOP  LODA,R0   *PC
2742  38C6 3F 3A 98            BSTA,UN    PCINC
2743  38C9 C8 77               STBR,R0    IR
2744  38CB 07 0A               LODI,R3    0A
2745  38CD 1F 56 92    VALID  COMA,R3    INVAL,-       CHECK FOR VALID OPCODE
2746  38D2 18 68               BCTR,EQ    INER
2747  38D2 5B 79               BRNR,R3    VALID
2748  38D4 01                  STRZ,R1
2749  38D5 C2                  STBI,R2
2750  38D6 44 03               ANDI,R0    03
```

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE    OPERAND   COMMENTS

2751  3808 CC 1A 7E          STRA,R0    REGIND    STORE REGISTER BITS (BITS 1 AND 0)
2752  380B 51                RRR ,R1
2753  380C 51                RRR ,R1
2754  380D 01                LODZ,R1
2755  380E 44 03             ANDI,R0    03
2756  3810 C3                STRZ,R3
2757  3811 CC 19 7F          STRA,R0    ADRMD     STORE ADDRESS MODE BITS (BITS 2 AND 3)
2758  3814 51                RRR ,R1
2759  3815 51                RRR ,R1
2760  3816 01                LODZ,R1
2761  3817 48 0E             ANDI,R1    0E
2762  3819 44 01             ANDI,R0    01
2763  381B 60 39 45          BCFA,EQ    BRANCH    BRANCH IF BRANCH BIT SET IN INSTRUCTION
2764  381E E6 C0       NONB  COMI,R2    C0        TEST FOR NOP
2765  3820 1C 42 13          BCTA,EQ    NOP
2766  3823 E6 40             COMI,R2    40        TEST FOR HALT
2767  3825 1C 3B 9B          BCTA,EQ    HALT
2768  3826 0F 76 61          LODA,R3    TAB1,I    SET UP REGISTERS
2769  3829 C3                STRZ,R3
2770  382C FF 3A 21          BSXA       JADD1
2771  382F 0F 18 C2          LODA,R3    IR        SET UP OPCODE
2772  3832 47 F0             ANDI,R3    F0
2773  3834 67 01             IORI,R3    01
2774  3836 C8 3A       NON0  STRR,R0    CTMP
2775  3838 C9 39             STRR,R1    CTMP+1
2776  383A CB 08             STRR,R3    CODE
2777  383C 0C 1F 06          LODA,R0    SPSL
2778  383F 93                LPSL
2779  3840 29 31             LODR,R1    CTMP+1
2780  3842 0A 2E             LODR,R2    CTMP
2781  3844 00          CODE  RES        1         EXECUTE OPCODE
2782  3845 C9 2C             STRR,R1    CTMP+1
2783  3847 C8 29             STRR,R0    CTMP
2784  3849 13                SPSL
2785  384A C8 28             STRR,R0    CTMP+2
2786  384C 04 02             LODI,R0    02
2787  384E 93                LPSL
2788  384F 0C 18 C2          LODA,R0    IR
2789  3852 44 FC             ANDI,R0    FC
2790  3854 F4 C6             COMI,R0    C8
2791  3856 18 09             BCTR,EQ    NONB0     BRANCH IF STORE RELATIVE
2792  3858 E4 CC             COMI,R0    CC
2793  385A 18 05             BCTR,EQ    NONB0     BRANCH IF STORE ABS.
2794  385C 0B 16             LODR,R3    CTMP+2
2795  385E CF 1F 06          STRA,R3    SPSL      STORE OUT THE CC.
2796  3861 0F 19 7F    NONB0 LODA,R3    ADRMD     STORE ALL REG.
2797  3864 0F 76 65          LODA,R3    TAB2,I
2798  3867 C3                STRZ,R3
2799  3868 08 08             LODR,R0    CTMP
2800  386A 09 07             LODR,R1    CTMP+1
2801  386C BF 3A 00          BSXA       JADD2
2802  386F 1F 42 13          BCTA,UN    OUT
2803  3872                   *
2804  3872 0C 00 00    CTMP  RES        3
2805  3875                   *
```



```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE    OPERAND   COMMENTS

2806  3875                   *
2807  3875 0F 76 69    BRANCH LODA,R3    TAB3,I     GET MAR SET UP USING ADDRESS MODE
2808  3878 C3                STRZ,R3
2809  3879 BF 3B 27          BSXA       JADD3
2810  387C 0E 18 C2          LODA,R2    IR
2811  387F 0D 1F 06          LODA,R1    SPSL
2812  3882 0C 1A 7E          LODA,R0    REGIND
2813  3885 F6 40             TMI,R2     40
2814  3887 1C 39 D7          BCTA,EQ    BREG      BRANCH IF IR=REG. BRANCH
2815  388A F4 03             TMI,R0     03
2816  388C 1C 39 84          BCTA,EQ    BRUN      BRANCH IF UN
2817  388F 52                RRR ,R0              TEST CONDITION OF BRANCH
2818  3890 50                RRR ,R0
2819  3891 21                IORZ,R1
2820  3892 C1                STRZ,R1
2821  3893 D1                RRL ,R1
2822  3894 61                IORZ,R1
2823  3895 22                IORZ,R2
2824  3896 1F 42 13          BCTA,LT    OUT       OUT IF NO BRANCH
2825  3899 3F 3B 0E    JUMP0 BSTA,UN    INDRT     SEE IF INDIRECT
2826  389C 0F 18 C2    JUMP  LODA,R3    IR
2827  389F F7 20             TMI,R3     20        TEST FOR SUBROUTINE
2828  38A1 3C 3A B6          BSTA,EQ    PUSH
2829  38A4 08 0C       JUMP1 LODR,R0    MAR
2830  38A6 09 0B             LODR,R1    MAR+1
2831  38A8 CF 26             STRR,R0    PC        SET PC TO NEW ADDRESS
2832  38AA C9 25             STRR,R1    PC+1
2833  38AC 1F 42 13          BCTA,UN    OUT
2834  38AF                   *
2835  38AF 02          ADRMD RES        1
2836  38B0 00 00       PC    RES        2
2837  38B2 00 00       MAR   RES        2
2838  38B4                   *
2839  38B4 22          BRUN  LODZ,R2
2840  38B5 9A 62             RORR,LT    JUMP0     IF (B??? ,UN) THEN BRANCH
2841  38B7 08 76             LODR,R0    ADRMD
2842  38B9 F4 22             COMI,R0    22
2843  38BB 18 17             BCTR,EQ    ZB?R      BRANCH USING (ZB?R)
2844  38BD                   *                    IF NOT BRANCH USING (B?XA)
2845  38BD 3F 3B 0E          BSTA,UN    INDRT
2846  38C0 3F 3A 6D          BSTA,UN    LREG
2847  38C3 C1                STRZ,R1
2848  38C4 20                IORZ,R0
2849  38C5 88 6C             ADDR,R1    MAR+1
2850  38C7 C9 6A             STRR,R1    MAR+1
2851  38C9 77 08             RPSL       WC
2852  38CB 8E 9E             ADDR,R2    MAR
2853  38CD C6 63             STRR,R2    MAR
2854  38CF 75 28             CPSL       WC
2855  38A1 1F 39 6C          BCTA,UN    JUMP
2856  38A4 09 5B       ZB?R  LODR,R1    PC+1
2857  38A6 08 58             LODR,R0    PC
2858  38A8 C8 2E             STRR,R0    PCSAV
2859  38AA C9 2A             STRR,R1    PCSAV+1
2860  38AC A5 01             SUBI,R1    01
```

FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

2861  39AE 77 08            PPSL       WC
2862  39B0 A6 03            SUBI,R2    03
2863  39B2 75 08            CPSL       WC
2864  39B4 CE 41            STRR,R0    PC
2865  39B6 C9 49            STRR,R1    PC+1
2866  39B8 0A C5            LODR,R2    *PC
2867  39BA 3F 3A 98         BSTA,UN    PCINC
2868  39BD 20               EORZ,R0
2869  39BE CC 19 80         STRA,R0    PC
2870  39C1 CC 19 81         STRA,R0    PC+1
2871  39C4 02               LODZ,R2
2872  39C5 3F 3B 2D         BSTA,UN    GREL0
2873  39C8 0E 0E            LODR,R0    PCSAV
2874  39CA CC 19 82         STRA,R0    PC
2875  39CD 0E 07            LODR,R0    PCSAV+1
2876  39CF CC 19 81         STRA,R0    PC+1
2877  39D2 1F 39 69         BCTA,UN    JUMP0
2878  39D5                *
2879  39D5 00 00          PCSAV  RES       2
2880  39D7                *
2881  39D7                *
2882  39D7 3F 3A 6D       BREG   BSTA,UN    LREG
2883  39DA F6 80                 TMI ,R2    80
2884  39DC 18 07                 BCTR,EQ    BREG0          BRANCH IF INC. OR DEC. REG.
2885  39DE 00                    LODZ,R0
2886  39DF 1C 42 13              BCTA,EQ    OUT
2887  39E2 1F 39 69              BCTA,UN    JUMP0          JUMP IF REG NOT ZERO
2888  39E5 F6 20          BREG0  TMI ,R2    20
2889  39E7 18 02                 BCTR,EQ    BREG1
2890  39E9 84 02                 ADDI,R0    02
2891  39EB A4 01          BREG1  SUBI,R0    01
2892  39ED 3F 3A 03              BSTA,UN    SREG
2893  39F0 00                    LODZ,R0
2894  39F1 1C 42 13              BCTA,EQ    OUT            IF ZERO, NO JUMP
2895  39F4 3F 3B 2E              BSTA,UN    INDIRT         DO THE JUMP
2896  39F7 0C 19 82              LODA,R0    MAR
2897  39FA 0D 19 83              LODA,R1    MAR+1
2898  39FD 1F 39 74              BCTA,UN    JUMP1
2899  3A00                *
2900  3A00                JADD2  EQU        $
2901  3A00                *
2902  3A00                *
2903  3A00                OUTABS EQU        $
2904  3A00 CD 99 82       OUTREL STRA,R1    *MAR
2905  3A03                CUTIM  EQU        $
2906  3A03 0F 1A 7E       SREG   LODA,R3    REGIND
2907  3A06 18 09                 BCTR,EQ    REG1
2908  3A08 0E 1F 06              LODA,R2    SPSL
2909  3A0B 46 12          —      ANDI,R2    10
2910  3A0D 18 02                 BCTR,EQ    REG1
2911  3A0F 87 03                 ADDI,R3    03
2912  3A11 CF 7E FF       REG1   STRA,R3    CPUREG,I
2913  3A14 17                    RETC,UN
2914  3A15                *
2915  3A15                *
```


FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

2916  3A15 C8 09          OTZERO STRR,R0    ZTEM
2917  3A17 01                    LODZ,R1
2918  3A18 3B 69                 BSTR,UN    SREG
2919  3A1A 08 04                 LODR,R0    ZTEM
2920  3A1C CC 1E FF              STRA,R0    CPUREG
2921  3A1F 17                    RETC,UN
2922  3A20                *
2923  3A20 00             ZTEM   RES        1
2924  3A21                *
2925  3A21                *
2926  3A21                JADD1  EQU        $
2927  3A21                *
2928  3A21                *.
2929  3A21                *
2930  3A21 3F 3B 6A       INABS  BSTA,UN    GABS
2931  3A24 0C 19 80              LODA,R0    PC
2932  3A27 44 60                 ANDI,R0    60
2933  3A29 2D 19 82              LODA,R1    MAR
2934  3A2C 45 1F                 ANDI,R1    1F
2935  3A2E 61                    IORZ,R1
2936  3A2F CC 19 82              STRA,R0    MAR
2937  3A32 3F 3E 0E              BSTA,UN    INDIRT
2938  3A35 0C 0A 0C              LODA,R0    PAGE
2939  3A38 1B 30                 BCTR,FQ    INABS0
2940  3A3A 06 00                 LODI,R2    00
2941  3A3C E4 60                 COMI,R0    60
2942  3A3E 18 07                 BCTR,EQ    LDABS0         BRANCH IF INDEX-ONLY
2943  3A40 D0                    RRL ,R0
2944  3A41 1A 02                 BCTF,LT    LDABS1         BRANCH IF AUTO-DECREMENT
2945  3A43 86 02                 ADDI,R2    02
2946  3A45 A6 01          LDABS1 SUBI,R2    01
2947  3A47 3F 3A 6D       LDABS0 BSTA,UN    LREG
2948  3A4A 82                    ADDZ,R2
2949  3A4B 3F 3A 03              BSTA,UN    SREG
2950  3A4E 8C 19 83              ADDA,R0    MAR+1
2951  3A51 CC 19 83              STRA,R0    MAR+1
2952  3A54 77 08                 PPSL       WC
2953  3A56 20                    IORZ,R0
2954  3A57 8C 19 82              ADDA,R0    MAR
2955  3A5A 75 08                 CPSL       WC
2956  3A5C 0D 19 82              LODA,R1    MAR
2957  3A5F 44 1F                 ANDI,R0    1F
2958  3A61 45 60                 ANDI,R1    60
2959  3A63 61                    IORZ,R1
2960  3A64 CC 19 82              STRA,R0    MAR
2961  3A67 20                    IORZ,R0
2962  3A68 C8 14                 STRR,R0    REGIND         SINCE INDIXED, R0 WILL BE USED
2963  3A6A 0D 99 82       INABS0 LODA,R1    *MAR
2964  3A6D 0E 0F          LREG   LODR,R3    REGIND
2965  3A6F 18 09                 BCTR,EQ    REG0
2966  3A71 0C 1F 06              LODA,R0    SPSL
2967  3A74 44 10                 ANDI,R0    10
2968  3A76 18 02                 BCTR,EQ    REG0
2969  3A78 87 03                 ADDI,R3    03
2970  3A7A 0F 7E FF       REG0   LODA,R3    CPUREG,I
```

'FILE 'ALF' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

2971  3A7D 17                 RETC,UN
2972  3A7E                *
2973  3A7E 00             REGIND RES        1
2974  3A7F                *
2975  3A7F 0D 99 80       INIM   LODA,R1   *PC
2976  3A82 3B 14                 BSTR,UN    PCINC
2977  3A84 1B 67                 BCTR,UN    LREG
2978  3A86                *
2979  3A86 3F 3B 27       INREL  BSTA,UN    GREL
2980  3A89 3F 3B 0E              BSTA,UN    INDIRT
2981  3A8C 0D 99 82              LODA,R1   *MAR
2982  3A8F 1B 5C                 BCTR,UN    LREG
2983  3A91                *
2984  3A91 3B FA          INZERO BSTR,UN    LREG
2985  3A93 C1                    STRZ,R1
2986  3A94 0C 1F FF              LODA,R0    CPUREG
2987  3A97 17                    RETC,UN
2988  3A98                *
2989  3A98 77 10          PCINC  PPSL       RS
2990  3A9A C3                    STRZ,R3
2991  3A9B 20                    EORZ,R0
2992  3A9C 05 01                 LODI,R1    01
2993  3A9E 0E 19 80              LODA,R2    PC
2994  3AA1 8D 19 81              ADDA,R1    PC+1
2995  3AA4 77 08                 PPSL       WC
2996  3AA6 82                    ADDZ,R2
2997  3AA7 44 1F                 ANDI,R0    1F
2998  3AA9 46 60                 ANDI,R2    60
2999  3AAB 60                    IORZ,R2
3000  3AAC CC 19 80              STRA,R2    PC
3001  3AAF CD 19 81              STRA,R1    PC+1
3002  3AB2 03                    LODZ,R3
3003  3AB3 75 18                 CPSL       WC+PS
3004  3AB5 17                    RETC,UN
3005  3AB6                *
3006  3AB6 77 10          PUSH   PPSL       RS
3007  3AB8 C3                    STRZ,R3
3008  3AB9 0C 1F 07              LODA,R0    SPSU
3009  3ABC C2                    STRZ,R2
3010  3ABD 66 01                 ADDI,R2    01
3011  3ABF 46 07                 ANDI,R2    07
3012  3AC1 44 F8                 ANDI,R0    F8
3013  3AC3 62                    IORZ,R2
3014  3AC4 CC 1F 07              STRA,R0    SPSU
3015  3AC7 D2                    RRL ,R2
3016  3AC8 0C 19 80              LODA,R0    PC
3017  3ACB CE 7A D8              STRA,R2    STACK,I
3018  3ACE 0C 19 81              LODA,R0    PC+1
3019  3AD1 CE 7A D9              STRA,R2    STACK+1,I
3020  3AD4 03                    LODZ,R3
3021  3AD5 75 10                 CPSL       RS
3022  3AD7 17                    RETC,UN
3023  3AD8                *
3024  3AD8 00 00 00 00 STACK  RES       10
3025  3ADC 00 00 00 00
```


FILE 'ALF' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

3026  3AE0 00 00 00 00
3027  3AE4 00 00 00 00
3028  3AE8                *
3029  3AE8 77 10          POP    PPSL       RS
3030  3AEA C2                    STRZ,R3
3031  3AEB 0C 1F 07              LODA,R0    SPSU
3032  3AEE C2                    STRZ,R2
3033  3AEF C1                    STRZ,R1
3034  3AF0 A5 01                 SUBI,R1    01
3035  3AF2 45 07                 ANDI,R1    07
3036  3AF4 44 F8                 ANDI,R0    F8
3037  3AF6 61                    IORZ,R1
3038  3AF7 CC 1F 07              STRA,R0    SPSU
3039  3AFA 46 07                 ANDI,R2    07
3040  3AFC D2                    RRL ,R2
3041  3AFD 01 7A D8              LODA,R2    STACK,I
3042  3B00 CC 19 80              STRA,R0    PC
3043  3B03 0E 7A D9              LODA,R2    STACK+1,I
3044  3B06 CC 19 81              STRA,R0    PC+1
3045  3B09 03                    LODZ,R3
3046  3B0A 75 10                 CPSL       RS
3047  3B0C 17                    RETC,UN
3048  3B0D                *
3049  3B0D 00             INDIR2 RES        1
3050  3B0E                *
3051  3B0E 08 7D          INDIRT LODR,R0    INDIR0
3052  3B10 14                    RETC,EQ
3053  3B11 77 10                 PPSL       RS
3054  3B13 07 02                 LODI,R3    02
3055  3B15 0D 99 82              LODA,R1   *MAR
3056  3B18 0F 99 82              LODA,R3   *MAR,-
3057  3B1B CC 19 83              STRA,R0    MAR+1
3058  3B1E CD 19 82              STRA,R1    MAR
3059  3B21 75 10                 CPSL       RS
3060  3B23 20                    EORZ,R0
3061  3B24 CB 67                 STRR,R2    INDIR0
3062  3B26 17                    RETC,UN
3063  3B27                *
3064  3B27                JADDS  EQU        $
3065  3B27                *
3066  3B27 0C 99 80       GREL   LODA,R0   *PC
3067  3B2A 3F 3A 98              BSTA,UN    PCINC
3068  3B2D C1             GPEL2  STRZ,R1
3069  3B2E 44 80                 ANDI,R0    80
3070  3B30 CC 1B 0D              STRA,R0    INDIB0
3071  3B33 01                    LODZ,R1
3072  3B34 F4 40                 TMI,R0     40
3073  3B36 18 10                 BCTR,EQ    RELM
3074  3B38 45 3F                 ANDI,R1    3F
3075  3B3A 62                    IORZ,R0
3076  3B3B 8D 19 81              ADDA,R1    PC+1
3077  3B3E CD 19 83              STRA,R1    MAR+1
3078  3B41 77 08                 PPSL       WC
3079  3B43 8C 19 80              ADDA,R0    PC
3080  3B46 1B 14                 BCTR,UN    REL
```

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

3081  3B4B 20 19 81    RELM   LODA,R0    PC+1
3082  3B4F 25 FF             EORI,R1    FF
3083  3B51 45 3F             ANDI,R1    3F
3084  3B54 85 01             ADDI,R1    01
3085  3B51 A1                STBZ,R1
3086  3B52 CC 19 83          STRA,R0    MAR+1
3087  3B55 27 08             PPSL       WC
3088  3B57 0C 19 80          LODA,R0    PC
3089  3B5A A4 00             SUBI,R0    00
3090  3B5C 44 1F       REL   ANDI,R0    1F
3091  3B5E 0D 19 80          LODA,R1    PC
3092  3B61 45 60             ANDI,R1    60
3093  3B63 61                IORZ,R1
3094  3B64 CC 19 82          STRA,R0    MAR
3095  3B67 75 08             CPSL       WC
3096  3B69 17                RETC,UN
3097  3B6A             *
3098  3B6A 20 99 80    GABS  LODA,R0    *PC
3099  3B6D 3F 3A 98          BSTA,UN    PCINC
3100  3B70 C1                STRZ,R1
3101  3B71 44 60             ANDI,R0    60
3102  3B73 CC 1B 0D          STRA,R0    INDIR0
3103  3B76 01                LODZ,R1
3104  3B77 44 60             ANDI,R0    60
3105  3B79 CC 0A 0C          STRA,R0    PAGE
3106  3B7C 45 7F             ANDI,R1    7F
3107  3B7E CD 19 82          STRA,R1    MAR
3108  3B81 0C 99 80          LODA,R0    *PC
3109  3B84 3F 3A 98          BSTA,UN    PCINC
3110  3B87 CC 19 83          STRA,R0    MAR+1
3111  3B8A 17                RETC,UN
3112  3B8B             *
3113  3B8B 51          EX0   RRR ,R1
3114  3B8C 0D 76 6D          LODA,R1    TABEX0,I
3115  3B8F C3                STRZ,R3
3116  3B90 9F 3B BB          BXA        JEX0
3117  3B93             *
3118  3B93 51          EX1   RRR ,R1
3119  3B94 0D 76 75          LODA,R1    TABEX1,I
3120  3B97 C3                STRZ,R3
3121  3B98 9F 3C B2          BXA        JEX1
3122  3B9B             *
3123  3B9B 05 07       HALT  LODI,R1    7              "PROGRAM HALTED"
3124  3B9D 3F 46 C7          BSTA,UN    PSTRNG
3125  3BA0 1F 42 90          BCTA,UN    DCOMD
3126  3BA3             *
3127  3BA3             *
3128  3BA3 0C 1A 7E    RETC0 LODA,R0    REGIND
3129  3BA6 E4 03             COMI,R0    03
3130  3BA8 18 0D       —     BCTR,EQ    RET
3131  3BAA 50                RRR ,R0
3132  3BAB 50                RRR ,R0
3133  3BAC 0D 1F 06          LODA,R1    SPSL
3134  3BAF 44 C2             ANDI,R0    C2
3135  3BB1 45 C0             ANDI,R1    C0
```



```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

3136  3BB3 E1                COMZ,R1
3137  3BB4 90 42 13          BCFA,EQ    OUT
3138  3BB7 3F 3A 99    RET   BSTA,UN    POP
3139  3BBA 17                RETC,UN
3140  3BBB             *
3141  3BBB             *
3142  3BBB             *
3143  3BBB             *
3144  3BBB             JEX0  ECU        $
3145  3BBB             *
3146  3BBB 3F 66       RETC  BSTR,UN    RETC0
3147  3BBD 1F 42 13          BCTA,UN    OUT
3148  3BC0             *.
3149  3BC0 3F 61       RETE  BSTR,UN    RETC0
3150  3BC2 0C 1F 07          LODA,R0    SPSU
3151  3BC5 44 DF             ANDI,R0    DF
3152  3BC7 CC 1F 07          STRA,R0    SPSU
3153  3BCA 1F 42 13          BCTA,UN    OUT
3154  3BCD             *
3155  3BCD 0C 1E C2    CPS   LODA,R0    IR
3156  3BD0 C3                STBZ,R3
3157  3BD1 47 01             ANDI,R3    01
3158  3BI3 C1                STRZ,R1
3159  3BI4 27 01             EORI,R3    1
3160  3BD6 0F 7F 06          LODA,R3    SPSL,I
3161  3BD9 0E 99 80          LODA,R2    *PC
3162  3BIC 3F 3A 98          BSTA,UN    PCINC
3163  3BIF F5 02             TMI ,R1    02
3164  3BE1 18 05             BCTR,EQ    CPS0
3165  3BE3 26 FF             EORI,R2    FF
3166  3BE5 42                ANIZ,R2
3167  3BE6 1E 01             BCTR,UN    CPS1
3168  3BEB 62          CPS0  IORZ,R2
3169  3BE9 CE 7F 06    CPS1  STRA,R3    SPSL,I
3170  3BEC 1F 42 13          BCTA,UN    OUT
3171  3BEF             *
3172  3BEF             *
3173  3BEF 0I 1E C2    TPS   LODA,R1    IR
3174  3BF2 45 01             ANDI,R1    01
3175  3BF4 25 01             EORI,R1    1
3176  3BF6 0I 7F 06          LODA,R1    SPSL,I
3177  3BF9 1F 03             BCTR,UN    MCC
3178  3BFB             *
3179  3BFB             *
3180  3BFB 3F 3A 6D    TMI   BSTA,UN    LREG
3181  3BFE 0E 99 80    MCC   LODA,R2    *PC
3182  3C01 3F 3A 98          BSTA,UN    PCINC
3183  3C04 42                ANIZ,R2
3184  3C05 20                IORZ,R2
3185  3C06 99 02             BCFR,GT    MASKCC
3186  3C08 04 FF             LODI,R0    FF
3187  3C0A 13          MASKCC SPSL
3188  3C0B 0D 1F 0E          LODA,R1    SPSL
3189  3C0E 44 C0             ANDI,R0    C0
3190  3C10 45 3F             ANDI,R1    3F
```

FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

3191  3012 61               IORZ,R1
3192  3013 CC 1F 06         STRA,R2    SPSL
3193  3016 1F 42 13         BCTA,UN    OUT
3194  3019            *
3195  3019            *
3196  3019 01 99 80   REDE   LODA,R1   *FC
3197  301C 3F 3A 99         BSTA,UN    PCINC
3198  301F 22               IORZ,R2
3199  3020 C7 1C 66         STRA,R1    REDEX+1
3200  3023 05 80            LODI,R2    80
3201  3025 3F 3D 82         BSTA,UN    I/O
3202  3028 00 76 7D         LODA,R0    REDETB,I
3203  302B C3               STRZ,R3
3204  302C CF 1D 24         STRA,R3    R3STG
3205  302F BF 3C 65   EREAD  BSXA      REDEX
3206  3032 9A 14            BCTR,EQ    EREDE
3207  3034 C1         REDCC  STRZ,R1
3208  3035 13               SPSL
3209  3036 03 1F 06         LODA,R2    SPSI
3210  3039 44 C0            ANDI,R0    C0
3211  303B 46 3F            ANDI,R2    3F
3212  303D 62               IORZ,R2
3213  303E CC 1F 06         STRA,R2    SPSL
3214  3041 01               LODZ,R1
3215  3042 3F 3A 03         BSTA,UN    SREG
3216  3045 1F 42 13         BCTA,UN    OUT
3217  3048            *
3218  3048 3F 3D 25   EREDE  BSTA,UN    ERR
3219  304B 1F 62            BCTR,UN    EREAD
3220  304D            *
3221  304D 01 99 80   WRTE   LODA,R1   *FC
3222  3050 3F 3A 98         BSTA,UN    PCINC
3223  3053 22               IORZ,R0
3224  3054 C2               STRZ,R2
3225  3055 C7 1C 88         STRA,R1    WRTS1+1
3226  3058 3F 3D 82         BSTA,UN    I/O
3227  305B 00 76 85         LODA,R0    WRTETB,I
3228  305E C3               STRZ,R3
3229  305F BF 3C 84         BSXA       WRTEX
3230  3062 1F 42 13         BCTA,UN    OUT
3231  3065            *
3232  3065            *
3233  3065 04 00      REDEX  REDE,R0    00
3234  3067 75 C0            CPSL       C0
3235  3069 17                 RETC,UN
3236  306A 05 00      REDE1  LODI,R1    0              "INPUT PORT "
3237  306C 3F 46 C7         BSTA,UN    PSTRNG
3238  306F 00 1C 66         LODA,R0    REDEX+1
3239  3072 3F 47 4F         BSTA,UN    HXOT
3240  3075 04 3D      REDA   LODI,R0    '='
3241  3077 3F 45 8D         BSTA,UN    WRT
3242  307A 3F 47 0F         BSTA,UN    HEXIN
3243  307D 17               RETC,UN
3244  307E 00 1D F0   REDB   LODA,R0    PRESET
3245  3081 75 C0            CPSL       C0
```


FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

3246  3083 17               RETC,UN
3247  3084            *
3248  3084            *
3249  3084            *
3250  3084 3F 3A 6D   WRTEX  BSTA,UN    LREG
3251  3087 04 00      WRTS1  WRTE,R0    00
3252  3089 17               RETC,UN
3253  308A            *
3254  308A 3F 3D 72   WRTE5  BSTA,UN    CKREGA
3255  308D 18 04            BCTR,EQ    WRTE1
3256  308F 05 FF            LODI,R1    FF
3257  3091 18 02            BCTR,UN    WRTE0
3258  3093            *
3259  3093 05 00      WRTE1  LODI,R1    00
3260  3095 09 1A      WRTE0  STRR,R1    TFLAG
3261  3097 05 01             LODI,R1    1              "OUTPUT PORT "
3262  3099 3F 46 C7         BSTA,UN    PSTRNG
3263  309C 08 6A            LODR,R0    WRTS1+1
3264  309E 3F 47 4F         BSTA,UN    HXOT
3265  30A1 04 3D      WRTALL LODI,R0    '='
3266  30A3 3F 45 8D         BSTA,UN    WRT
3267  30A6 3F 3A 6D         BSTA,UN    LREG
3268  30A9 0B 06            LODR,R3    TFLAG
3269  30AB 90 45 8D         BCFA,EQ    WRT
3270  30AE 1F 47 4F         BCTA,UN    HXOT
3271  30B1            *
3272  30B1 00         TFLAG  PES        1
3273  30B2            *
3274  30B2            *
3275  30B2            JEX1   EQU        $
3276  30B2            *
3277  30B2            DAR    EQU        $
3278  30B2            RRL    EQU        $
3279  30B2 3F 3A 6D   RRR    BSTA,UN    LREG
3280  30B5 05 01             LODI,R1    01
3281  30B7 CC 19 7F          STRA,R1    ADRMD
3282  30BA CF 18 C2          LODA,R3    IR
3283  30BD 47 FC             ANDI,R3    FC
3284  30BF 1B 39 06          BCTA,UN    NON0
3285  30C2            *
3286  30C2 CD 18 C2   SPS    LODA,R1    IR
3287  30C5 45 01             ANDI,R1    01
3288  30C7 25 01             RORI,R1    1
3289  30C9 CD 7F 06          LODA,R1    SPSL,I
3290  30CC CC 1E FF          STRA,R0    CPUREG
3291  30CF 1F 3C 0A          BCTA,UN    MASKCC
3292  30D2            *
3293  30D2            *
3294  30D2 CD 18 C2   LPS    LODA,R1    IR
3295  30D5 45 01             ANDI,R1    01
3296  30D7 25 01             RORI,R1    1
3297  30D9 CC 1E FF          LODA,R0    CPUREG
3298  30DC CD 7F 06          STRA,R1    SPSL,I
3299  30DF 1F 42 13          BCTA,UN    OUT
3300  30E2            *
```

FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

3301  3CE2                    *
3302  3CE2 06 43        REDC  LODI,R2     'C'
3303  3CE4 05 01              LODI,R1     01
3304  3CE6 1B 04              BCTR,UN     REDIT
3305  3CE8 06 44        REDD  LODI,R2     'D'
3306  3CEA 05 00              LODI,R1     00
3307  3CEC 0C 1A C2     REDIT LODA,R2     IR
3308  3CEF 44 FC              ANDI,R0     FC
3309  3CF1 CB 19              STRR,R0     RED0
3310  3CF3 04 01              LODI,R0     01
3311  3CF5 CA 2C              STRR,R2     HOLD
3312  3CF7 06 00              LODI,R2     00
3313  3CF9 3F 3E 82           BSTA,UN     I/O
3314  3CFC 0C 76 81           LODA,R0     REDTAB,I
3315  3CFF C3                 STRZ,R3
3316  3D00 CB 22              STRR,R0     R3STG
3317  3D02 BF 3D 0C     EREDIT BSXA       RED0
3318  3D05 1C 3C 34           BCTA,EQ     REDCC
3319  3D08 3E 1B              BSTR,UN     ERR
3320  3D0A 1E 7E              BCTR,UN     EREDIT
3321  3D0C                    *
3322  3D0C 70           RED0  REDD,R0
3323  3D0D 75 C0              CPSL        C0
3324  3D0F 17                 RETC,UN
3325  3D10                    *
3326  3D10 05 00        RED1  LODI,R1     0           "INPUT PORT "
3327  3D12 3F 46 C7           BSTA,UN     PSTRNG
3328  3D15 08 2C              LODR,R0     HOLD
3329  3D17 3F 45 8D           BSTA,UN     WRT
3330  3D1A 1F 3C 75           BCTA,UN     RED1
3331  3D1D                    *
3332  3D1D 0C 1D F0     RED2  LODA,R0     PRESET
3333  3D20 75 C0              CPSL        C0
3334  3D22 17                 RETC,UN
3335  3D23                    *
3336  3D23 00           HOLD  RES         1
3337  3D24 00           R3STG RES         1
3338  3D25                    *
3339  3D25 05 0E        ERR   LODI,R1     E
3340  3D27 3F 46 CA           BSTA,UN     PRING
3341  3D2A 0B 78              LODR,R3     R3STG
3342  3D2C 17                 RETC,UN
3343  3D2D                    *
3344  3D2D 06 43        WRTC  LODI,R2     'C'
3345  3D2F 05 01              LODI,R1     01
3346  3D31 1B 04              BCTR,UN     WRTIT
3347  3D33 06 44        WRTD  LODI,R2     'D'
3348  3D35 05 00              LODI,R1     00
3349  3D37 0C 1B C2     WRTIT LODA,R0     IR
3350  3D3A 44 FC              ANDI,R0     FC
3351  3D3C CC 1D 55           STRA,R0     WRT0
3352  3D3F 04 01              LODI,R0     01
3353  3D41 CA 60              STRR,R2     HOLD
3354  3D43 06 00              LODI,R2     00
3355  3D45 3F 3D 82           BSTA,UN     I/O
```

FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78


```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

3356  3D48 0C 76 89           LODA,R0     WRTTB,I
3357  3D4B C3                 STRZ,R3
3358  3D4C FF 3D 52           BSXA        WRT1
3359  3D4F 1F 42 13           BCTA,UN     OUT
3360  3D52                    *
3361  3D52 3F 3A 6D     WRT1  BSTA,UN     LREG
3362  3D55 F0           WRT0  WRTD,R0
3363  3D56 17                 RETC,UN
3364  3D57                    *
3365  3D57 05 00        WRT5  LODI,R1     00
3366  3D59 CD 1C B1     WRT3  STRA,R1     TFLAG
3367  3D5C 05 01              LODI,R1     1           "OUTPUT PORT "
3368  3D5E 3F 46 C7           BSTA,UN     PSTRNG
3369  3D61 09 40              LODR,R0     HOLD
3370  3D63 3F 45 8D           BSTA,UN     WRT
3371  3D66 1F 3C A1           BCTA,UN     WRTALL
3372  3D69                    *
3373  3D69 3E 07        WRT4  BSTR,UN     OKREGA
3374  3D6B 18 6A              BCTR,EQ     WRT5
3375  3D6D 05 FF              LODI,R1     FF
3376  3D6F 1F 3D 59           BCTA,UN     WRT3
3377  3D72                    *
3378  3D72 3F 3A 6D     OKREGA BSTA,UN    LREG
3379  3D75 C1                 STRZ,R1
3380  3D76 45 E0              ANDI,R1     E0
3381  3D78 14                 RETC,EQ
3382  3D79 F4 80              TMI ,R0     80
3383  3D7B 17                 RETC,UN
3384  3D7C                    *
3385  3D7C                    *
3386  3D7C 00           TEMPC RES         2
3387  3D7E 00 00        TEMPB RES         2
3388  3D80 00 00        TEMPA RES         2
3389  3D82                    *
3390  3D82                    *
3391  3D82                    *                     INPUT                    OUTPUT
3392  3D82 C9 78        I/O   STRR,R0     TEMPC
3393  3D84 C9 77              STRR,R1     TEMPC+1     R0= HI ADDRESS OF I/O    R0= CODE
3394  3D86 65 DF              ADDI,R1     NBUFF       R1= LOW ADDRESS OF I/O   R3= PRESET DATA
3395  3D88 C9 75              STRR,R1     TEMPB+1     R2= COMAND (SEE BELOW)
3396  3D8A                    *                       R3= PRESET DATA
3397  3D8A 77 08              PPSL        WC
3398  3D8C 64 47              ADDI,R0     NBUFF       7= INPUT                 CODES
3399  3D8E C8 6E              STRR,R0     TEMPB       6= CHANGE                0=R
3400  3D90 09 6B              LODR,R1     TEMPC+1     2= HI CODE BIT           3=P
3401  3D92 08 68              LODR,R0     TEMPC       1= LOW CODE BIT          1=S
3402  3D94 75 01              CPSL        CRY                                  2=A
3403  3D96 50                 PRR ,R0
3404  3D97 51                 PRR ,R1
3405  3D98 52                 PRR ,R2
3406  3D99 75 08              CPSL        WC
3407  3D9B 00                 LODZ,R0
3408  3D9C 9C 42 6B           BCFA,EQ     INCOMD
3409  3D9F F9 81              COMI,R1     81
3410  3DA1 1T 42 6B           BCTA,GT     INCOMD
```

FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

3411  3DA4 85 F1              ADDI,R1     MBUFF
3412  3DA6 77 08              BPSL        WC
3413  3DA8 20                 EORZ,R0
3414  3DA9 84 48              ADDI,R0     ^MBUFF
3415  3DAB 75 08              CPSL        WC
3416  3DAD C8 51              STBR,R0     TEMPA
3417  3DAF C9 50              STBR,R1     TEMPA+1
3418  3DB1 00 CD              LODR,R0     *TEMPA
3419  3DB3 F6 80              TMI ,R2     80              TEST FOR UPPER/LOWER
3420  3DB5 98 04              BCFR,EQ     I/00
3421  3DB7 5A                 RRR ,R2
3422  3DB8 50                 RRR ,R2
3423  3DB9 50                 RRR ,R0
3424  3DBA 52                 RRR ,R2
3425  3DBB F6 40        I/00  TMI,R2      40              TEST FOR IN/OUT
3426  3DBD 98 02              BCFR,EQ     I/01
3427  3DBF 50                 RRR ,R0
3428  3DC0 50                 RRR ,R0
3429  3DC1 F6 20        I/01  TMI,R2      20              TEST FOR CHANGE
3430  3DC3 C8 2C              STBR,R0     I/OTEM
3431  3DC5 95 21              BCFR,EQ     I/04
3432  3DC7 F6 60              TMI ,R2     60
3433  3DC9 98 03              BCFR,EQ     I/05
3434  3DCB CF 9D 7E           STBA,R3     *TEMPB
3435  3DCE C1           I/05  STBZ,R1
3436  3DCF 02                 LODZ,R2
3437  3DD0 45 FC              ANDI,R1     FC
3438  3DD2 44 03              ANDI,R0     03
3439  3DD4 61                 IORZ,R1
3440  3DD5 F6 40              TMI,R2      40
3441  3DD7 98 02              BCFR,EQ     I/02
3442  3DD9 D2                 RRL ,R0
3443  3DDA D2                 RRL ,R0
3444  3DDB F6 80        I/02  TMI,R2      80
3445  3DDD 98 04              BCFR,EQ     I/03
3446  3DDF D2                 RRL ,R0
3447  3DE0 D2                 RRL ,R0
3448  3DE1 D2                 RRL ,R0
3449  3DE2 D2                 RRL ,R0
3450  3DE3 CC 9D 80     I/03  STBA,R0     *TEMPA
3451  3DE6 C8 09              LODR,R0     I/OTEM
3452  3DE8 44 03        I/04  ANDI,R0     03
3453  3DEA CF 9D 7E           LODA,R3     *TEMPB
3454  3DED CE 01              STBR,R3     PRESET
3455  3DEF 17                 RETC,UN
3456  3DF0                    *
3457  3DF0 00           PRESET RES        1
3458  3DF1                    *
3459  3DF1 00           I/OTEM RES        1
3460  3DF2                    *
3461  3DF2 02 00 00 00  BPTAB1 RES        08
3462  3DF6 02 00 00 00
3463  3DFA 00 00 00 00  BPTAB2 RES        10
3464  3DFE 00 00 00 00
3465  3E02 00 00 00 00
```


FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

3466  3E06 00 00 00 00
3467  3E0A 00 00        BPTEMP RES        02
3468  3E0C                    *
3469  3E0C                    ************************** COMMANDS ***************************************
3470  3E0C                    *
3471  3E0C A4 01        CLEAR SUBI,R0     01              R0= BREAK POINT NUMBER
3472  3E0E C8 7A              STBR,R2     BPTEMP
3473  3E10 E4 03              COMI,R0     03
3474  3E12 1D 42 8B           BCTA,GT     INCOMD
3475  3E15 03                 STBZ,R3
3476  3E16 D3                 RRL ,R3
3477  3E17 0F 7D F2           LODA,R3     BPTAB1,I
3478  3E1A CC 1D 80           STBA,R0     TEMPA
3479  3E1D 0F 7D F3           LODA,R3     BPTAB1+1,I
3480  3E20 CC 1D 81           STBA,R0     TEMPA+1
3481  3E23 D3                 RRL ,R3
3482  3E24 06 02              LODI,R2     02
3483  3E26 0F 7D FD           LODA,R3     BPTAB2+3,I
3484  3E29 14                 RETC,EQ
3485  3E2A 0F 7D FC           LODA,R3     BPTAB2+2,I
3486  3E2D CE FD 80           STBA,R2     *TEMPA,I
3487  3E30 0F 7D FE           LODA,R3     BPTAB2+1,I
3488  3E33 CE DD 80           STBA,R2     *TEMPA,-
3489  3E36 0F 7D FA           LODA,R3     BPTAB2,I
3490  3E39 CE DD 80           STBA,R2     *TEMPA,-
3491  3E3C 20                 EORZ,R0
3492  3E3D CF 7D FD            TRA,R3     BPTAB2+3,I
3493  3E40 04 01              LODI,R0     01
3494  3E42 17                 RETC,UN
3495  3E43                    *
3496  3E43                    *
3497  3E43 3F 47 92     CLIT  BSTA,UN     GETNUM    *****COMMAND
3498  3E46 9C 42 8B           BCFA,EQ     INCOMD
3499  3E49 0C                 LODZ,R0
3500  3E4A 9C 42 8B           BCFA,EQ     INCOMD
3501  3E4D 01                 LODZ,R1
3502  3E4E 3F 3E 0C           BSTA,UN     CLEAR
3503  3E51 1C 42 9C           BCTA,EQ     DCOMD
3504  3E54 06 02              LODI,R1     2               "BREAK POINT "
3505  3E56 3F 4E C7           BSTA,UN     PSTRNG
3506  3E59 0C 1E 0A           LODA,R0     BPTEMP
3507  3E5C 84 01              ADDI,R0     01
3508  3E5E 3F 47 4F           BSTA,UN     HEXOT
3509  3E61 05 03              LODI,R1     3               " CLEARED"
3510  3E63 3F 4E CA           BSTA,UN     PRING
3511  3E66 1C 42 9C           BCTA,UN     DCOMD
3512  3E69                    *
3513  3E69                    *
3514  3E69 3F 47 92     BR    BSTA,UN     GETNUM    *****COMMAND
3515  3E6C 9C 42 8B           BCFA,EQ     INCOMD
3516  3E6F 0C                 LODZ,R0
3517  3E70 9C 42 8B           BCFA,EQ     INCOMD
3518  3E73 01                 LODZ,R1
3519  3E74 3F 3E 0C           BSTA,UN     CLEAR
3520  3E77 04 FF              LODI,R0     FF
```

FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND    COMMENTS

3521  3FD6 CF 7D FD           STRA,R3    BPTAB2+3,I
3522  3FD9 CF 1E 0B           STRA,R3    BPTEMP+1
3523  3FDC 3F 47 92           BSTA,UN    GETNUM
3524  3FDF 9C 42 BB           BCFA,EQ    INCOMD
3525  3FE2 0F 1E 0E           LODA,R3    BPTEMP+1
3526  3FE5 CC 1D 80           STRA,R0    TEMPA
3527  3FE8 CD 1D 81           STRA,R1    TEMPA+1
3528  3FEB 0E 1E 0A           LODA,R2    BPTEMP
3529  3FEE D2                 RRL ,R2
3530  3FEF CE 7D F2           STRA,R2    BPTAB1,I
3531  3FF2 01                 LODZ,R1
3532  3FF3 CE 7D F3           STRA,R2    BPTAB1+1,I
3533  3FF6 0C 9D 80           LODA,R0    *TEMPA
3534  3FF9 CF 7D FA           STRA,R3    BPTAB2,I
3535  3FFC 05 00              LODI,R1    00
3536  3FFE 0D BD 80           LODA,R1    *TEMPA,+
3537  4001 CF 3D FA           STRA,R3    BPTAB2,+
3538  4004 0D BD 80           LODA,R1    *TEMPA,+
3539  4007 CF 3D FA           STRA,R3    BPTAB2,+
3540  400A 04 1F              LODI,R0    1F
3541  400C CC 9D 80           STRA,R0    *TEMPA
3542  400F 05 3F              LODI,R1    ^ENTER
3543  4011 04 26              LODI,R0    ENTER
3544  4013 0F 1E 0A           LODA,R2    BPTEMP
3545  4016 12                 RPL ,R2
3546  4017 D2                 RRL ,R2
3547  4018 D2                 RRL ,R2
3548  4019 82                 ADDZ,R2
3549  401A 77 08              PPSL       WC
3550  401C 85 00              ADDI,R1    00
3551  401E 75 08              CPSL       WC
3552  4020 C2                 STRZ,R2
3553  4021 01                 LODZ,R1
3554  4022 07 00              LODI,R3    00
3555  4024 CF BD 80           STRA,R3    *TEMPA,+
3556  4027 02                 LODZ,R2
3557  4028 CF BD 80           STRA,R3    *TEMPA,+
3558  402B 1F 42 90           BCTA,UN    DCOMD
3559  402E                *
3560  402E                *
3561  402E 3F 47 92       EX      BSTA,UN    GETNUM     *****COMMAND
3562  4031 98 06                  BCFR,EQ    EXX0
3563  4033 CC 19 80               STRA,R0    PC
3564  4036 CD 19 81               STRA,R1    PC+1
3565  4039 0C 1F 06       EXX0    LODA,R0    SPSL
3566  403C CC 1E FB               STRA,R0    EXX1+1
3567  403F 0C 1F 07       ------  LODA,R0    SPSU
3568  4042 92                     LPSU
3569  4043 77 10                  PPSL       RS
3570  4045 0C 19          -       LODR,R1    CPUREG+4
3571  4047 0A 18                  LODR,R2    CPUREG+5
3572  4049 0B 17                  LODR,R3    CPUREG+6
3573  404B 75 10                  CPSL       RS
3574  404D 09 0E                  LODR,R1    CPUREG+1
3575  404F 0A 0D                  LODR,R2    CPUREG+2
```


FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND    COMMENTS

3576  4051 0B 0C                LODR,R3    CPUREG+3
3577  4053 08 07                LODR,R0    CPUREG
3578  4055 75 FF                CPSL       FF
3579  4057 77 00          EXX1  PPSL       00
3580  4059 1F 85 80             BCTA,UN    *PC
3581  405C                *
3582  405C                *
3583  405C                *
3584  405C 00 00 00 00 CPUREG RES        7
3585  4063 00 00 00
3586  4066 00           SPSL   RES       1
3587  4067 00           SPSU   RES       1
3588  4068              *
3589  4068 C8 75        SAVEIT STRR,R0    CPUREG
3590  406A 12                  SPSL
3591  406B CC 1F 05            STRA,R0    SPSL
3592  406E 12                  SPSU
3593  406F CC 1F 07            STRA,R0    SPSU
3594  4072 75 10               CPSL       RS
3595  4074 C9 6A               STRR,R1    CPUREG+1
3596  4076 CA 69               STRR,R2    CPUREG+2
3597  4078 CB 68               STRR,R3    CPUREG+3
3598  407A 77 10               PPSL       RS
3599  407C C9 65               STRR,R1    CPUREG+4
3600  407E CA 64               STRR,R2    CPUREG+5
3601  4080 CB 63               STRR,R3    CPUREG+6
3602  4082 04 02               LODI,R0    02
3603  4084 93                  LPSL
3604  4085 17                  RETC,UN
3605  4086              *
3606  4086 3F 3F 03       ENTER  BSTA,UN    SAVEIT
3607  4089 04 01                 LODI,R0    01
3608  408B 1F 3F 43              BCTA,UN    EN0
3609  408E 3F 3F 08              BSTA,UN    SAVEIT
3610  4091 04 02                 LODI,R0    02
3611  4093 1F 3F 43              BCTA,UN    EN0
3612  4096 3F 3F 08              BSTA,UN    SAVEIT
3613  4099 04 03                 LODI,R0    03
3614  409B 1F 3F 43              BCTA,UN    EN0
3615  409E 3F 3F 08              BSTA,UN    SAVEIT
3616  40A1 04 04                 LODI,R0    04
3617  40A3 C8 2F         EN0     STRR,R0    ENSAV
3618  40A5 05 02                 LODI,R1    2              "BREAK POINT "
3619  40A7 3F 46 C7              BSTA,UN    PSTRNG
3620  40AA 08 2B                 LODR,R0    ENSAV
3621  40AC 64 30                 IORI,R0    '0'
3622  40AE 3F 45 8D              BSTA,UN    WRT
3623  40B1 05 08                 LODI,R1    8              " REACHED"
3624  40B3 3F 46 CA              BSTA,UN    PRING
3625  40B6 06 1C                 LODR,R2    ENSAV
3626  40B8 3F 3E 0C              BSTA,UN    CLEAR
3627  40BB 0F 1F 0A              LODA,R3    BPTEMP
3628  40BE D3                    RRL ,R3
3629  40BF 0F 7D F2              LODA,R3    BPTAB1,I
3630  40C2 CC 19 80              STRA,R0    PC
```

FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

3631  3F66 3F 47 4F           BSTA,UN     HXOT
3632  3F69 0F 3D F2           LODA,R3     BPTAB1,*
3633  3F6C CC 1B 01           STRA,R2     PC+1
3634  3F6F 3F 47 4F           BSTA,UN     HXOT
3635  3F71 1F 42 6E           BCTA,UN     CBST
3636  3F74            *
3637  3F74 00         ENSAV   RES         1
3638  3F75            *
3639  3F75            *
3640  3F75 05 04      DSBUG   LODI,R1     4                 "STACK= " *****COMMAND
3641  3F77 3F 45 C7           BSTA,UN     PSTRNG
3642  3F7A 0F 1F 07           LODA,R3     SPSU
3643  3F7D A7 01              SUBI,R3     01
3644  3F7F 47 07              ANDI,R3     07
3645  3F81 D3                 PRL ,R3
3646  3F82 06 08              LODI,R2     08
3647  3F84 3F 45 BB           BSTA,UN     WRTBL
3648  3F87 0F 3A D8   DS0     LODA,R3     STACK,*
3649  3F8A 3F 47 4F           BSTA,UN     HXOT
3650  3F8D 0F 3A D6           LODA,R3     STACK,*
3651  3F90 3F 47 4F           BSTA,UN     HXOT
3652  3F93 B6 01              COMI,R2     01
3653  3F95 1C 42 90           BCTA,EQ     DCOMD
3654  3F98 04 20              LODI,R2     ' '
3655  3F9A 3F 45 BD           BSTA,UN     WRT
3656  3F9D 3F 45 BB           BSTA,UN     WRTBL
3657  3FA0 47 0F              ANDI,R3     0F
3658  3FA2 FA 63              BIRR,R2     DS0
3659  3FA4            *
3660  3FA4 00 99 80   REP0    LODA,R0     *PC
3661  3FA7 17                 RETC,UN
3662  3FA8 0F B9 80   REP1    LODA,R2     *PC,+
3663  3FAB 17                 RETC,UN
3664  4000                    ORG         4000
3665  4000            *
3666  4000 3F 47 92   CO      BSTA,UN     GETNUM    *****COMMAND
3667  4003 9C 42 8B           BCFA,EQ     INCOMD
3668  4006 CC 00 92           STRA,R0     TEMPD
3669  4009 CD 00 93           STRA,R1     TEMPD+1
3670  400C 3F 47 92           BSTA,UN     GETNUM
3671  400F 9C 42 9E           BCFA,EQ     INCOMD
3672  4012 CC 00 94           STRA,R0     TEMPE
3673  4015 CD 00 95           STRA,R1     TEMPE+1
3674  4018 3F 47 92           BSTA,UN     GETNUM
3675  401B 9C 42 8B           BCFA,EQ     INCOMD
3676  401E CC 00 96           STRA,R0     TEMPF
3677  4021 CD 00 97           STRA,R1     TEMPF+1
3678  4024 00 80 92   COOP    LODA,R0     *TEMPD
3679  4027 E0 00 94           COMA,R0     *TEMPE
3680  402A 1C 42 65           BCTA,EQ     COOP0
3681  402D 3F 45 C9           BSTA,UN     LFCR
3682  4030 20 00 92           LODZ,R0     TEMPD
3683  4033 3F 47 4F           BSTA,UN     HXOT
3684  4036 00 00 93           LODA,R0     TEMPD+1
3685  4039 3F 47 4F           BSTA,UN     HXOT
```


FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

3686  403C 04 3D              LODI,R0     '='
3687  403E 3F 45 BD           BSTA,UN     WRT
3688  4041 00 80 92           LODA,R0     *TEMPD
3689  4044 3F 47 4F           BSTA,UN     HXOT
3690  4047 04 20              LODI,R0     ' '
3691  4049 3F 45 BD           BSTA,UN     WRT
3692  404C 3F 45 BB           BSTA,UN     WRTBL
3693  404F 00 00 94           LODA,R0     TEMPE
3694  4052 3F 47 4F           BSTA,UN     HXOT
3695  4055 00 00 95           LODA,R0     TEMPE+1
3696  4058 3F 47 4F           BSTA,UN     HXOT
3697  405B 04 3D              LODI,R0     '='
3698  405D 3F 45 BD           BSTA,UN     WRT
3699  4060 05 B2              LODR,R0     *TEMPE
3700  4062 3F 47 4F           BSTA,UN     HXOT
3701  4065 05 01      COOP0   IOLI,R1     01
3702  4067 20                 IORZ,R0
3703  4068 89 2B              ADDR,R1     TEMPE+1
3704  406A C9 29              STRR,R1     TEMPE+1
3705  406C 77 02              PPSL        WC
3706  406E 88 24              ADDR,R0     TEMPE
3707  4070 C8 22              STRR,R0     TEMPE
3708  4072 75 02              CPSL        WC
3709  4074 E8 20              COMR,R0     TEMPF
3710  4076 1A 08              BCTR,LT     COOP1
3711  4078 1D 42 90           BCTA,GT     DCOMD
3712  407B F9 1A              COMR,R1     TEMPF+1
3713  407D 1D 20 4B           BCTA,GT     COMD - DCOMD
3714  4080 20         COOP1   IORZ,R0
3715  4081 05 01              LODI,R1     01
3716  4083 89 2E              ADDR,R1     TEMPD+1
3717  4085 C9 2C              STRR,R1     TEMPD+1
3718  4087 77 28              PPSL        WC
3719  4089 89 27              ADDR,R0     TEMPD
3720  408B C8 25              STRR,R0     TEMPD
3721  408D 75 09              CPSL        WC
3722  408F 1F 42 24           BCTA,UN     COOP
3723  4092            *
3724  4092 00 00      TEMPD   RES         2
3725  4094 00 00      TEMPE   RES         2
3726  4096 00 00      TEMPF   RES         2
3727  4098            *
3728  4098            *
3729  409E 3F 47 92   IN      BSTA,UN     GETNUM    *****COMMAND
3730  409B 9C 42 8E           BCFA,EQ     INCOMD
3731  409E C6 72              STRR,R2     TEMPD
3732  40A0 C9 71              STRR,R1     TEMPD+1
3733  40A2 3F 47 92           BSTA,UN     GETNUM
3734  40A5 9C 42 8B           BCFA,EQ     INCOMD
3735  40A8 C8 6A              STRR,R2     TEMPE
3736  40AA C9 69              STRR,R1     TEMPE+1
3737  40AC 3F 47 92           BSTA,UN     GETNUM
3738  40AF 9C 42 8B           BCFA,EQ     INCOMD
3739  40B2 02                 LODZ,R0
3740  40B3 9C 42 8B           BCFA,EQ     INCOMD
```

*FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

3741  40E6 C8 1A       IN0    STRR,R1   *TEMPD
3742  40E8 06 01              LODI,R2   01
3743  40EA 20                 EORZ,R0
3744  40EB 8A 56              ADDR,R2   TEMPD+1
3745  40ED CA 54              STRR,E2   TEMPD+1
3746  40EF 77 08              PPSL      WC
3747  40F1 88 4F              ADDR,R0   TEMPD
3748  40F3 C8 4D              STRR,R0   TEMPD
3749  40F5 75 03              CPSL      WC
3750  40F7 E8 4B              COMR,R0   TEMPE
3751  40F9 1A 6B              BCTR,LT   IN0
3752  40FB 1F 42 90           BCTA,GT   DCOMD
3753  40FE E8 45              COMR,R1   TEMPE+1
3754  4100 1A 64              BCTR,LT   IN0
3755  4102 1F 42 90           BCTA,UN   DCOMD
3756  4105              *
3757  4105              *
3758  4105              *
3759  4105 06 C0       IRIT   LODI,R2   C0        *****COMMAND
3760  4107 1B 12              BCTR,UN   INI/O
3761  4109 06 C2       IS     LODI,R2   C2        *****COMMAND
3762  410B 1B 0E              BCTR,UN   INI/O
3763  410D 06 C6       IP     LODI,R2   C6        *****COMMAND
3764  410F 1B 0A              BCTR,UN   INI/O
3765  4111 06 40       OR     LODI,R2   40        *****COMMAND
3766  4113 1E 06              BCTR,UN   INI/O
3767  4115 06 42       OS     LODI,R2   42        *****COMMAND
3768  4117 1B 02              BCTR,UN   INI/O
3769  4119 06 44       OA     LODI,R2   44        *****COMMAND
3770  411B CA 21       INI/O  STRR,R2   INTEMP
3771  411D 3F 47 92           BSTA,UN   GETNUM
3772  4120 9C 42 8B           BCFA,EQ   INCOMD
3773  4123 C8 1A              STRR,R0   INTEMP+1
3774  4125 C9 19              STRR,R1   INTEMP+2
3775  4127 3F 47 92           BSTA,UN   GETNUM
3776  412A 98 04              BCFR,EQ   INI/00
3777  412C 01                 LODZ,R1
3778  412D C3                 STRZ,R3
3779  412E 1B 02              BCTR,UN   INI/01
3780  4130 07 02       INI/00 LODI,R3   02
3781  4132 0A 0A       INI/01 LODR,R2   INTEMP
3782  4134 08 09              LODR,R0   INTEMP+1
3783  4136 09 0B              LODR,R1   INTEMP+2
3784  4138 3F 3D 82           BSTA,UN   I/O
3785  413B 1F 42 90           BCTA,UN   DCOMD
3786  413E              *
3787  413E 02 00 00 00 INTEMP RES       4
3788  4112              *
3789  4112 CB 7D       AINI/O STRR,R3   INTEMP+3
3790  4114 CA 78              STRR,R2   INTEMP
3791  4116 04 01              LODI,R0   01
3792  4118 05 02              LODI,R1   02
3793  411A A5 01       AIN0/O SUBI,R1   01
3794  411C 77 08              PPSL      WC
3795  411E A4 00              SUBI,R0   00
```


FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

3796  4120 75 08              CPSL      WC
3797  4122 16                 RETC,LT
3798  4123 C8 6A              STRR,R0   INTEMP+1
3799  4125 C9 69              STRR,R1   INTEMP+2
3800  4127 0A 65              LODR,R2   INTEMP
3801  4129 0B 66              LODR,R3   INTEMP+3
3802  412B 3F 3D 82           BSTA,UN   I/O
3803  412E 08 5F              LODR,R0   INTEMP+1
3804  4130 09 5E              LODR,R1   INTEMP+2
3805  4132 1B 66              BCTR,UN   AIN2/O
3806  4134              *
3807  4134 3F 47 92    AP     BSTA,UN   GETNUM    *****COMMAND
3808  4137 9C 42 8B           BCFA,EQ   INCOMD
3809  413A 00                 LODZ,R0
3810  413B 9C 42 8B           BCFA,EQ   INCOMD
3811  413E 01                 LODZ,R1
3812  413F C3                 STRZ,R3
3813  4140 04 00              LODI,R0   00
3814  4142 06 C6              LODI,R2   C6
3815  4144 1B 12              BCTR,UN   AIN1
3816  4146 04 44       AA     LODI,R0   44        *****COMMAND
3817  4148 06 00              LODI,R2   00
3818  414A 1B 0A              BCTR,UN   AIN0
3819  414C 04 40       AR     LODI,R0   40        *****COMMAND
3820  414E 06 C0              LODI,R2   C0
3821  4150 1B 04              BCTR,UN   AIN0
3822  4152 04 42       AS     LODI,R0   42        *****COMMAND
3823  4154 06 C2              LODI,R2   C2
3824  4156 07 00       AIN0   LODI,R3   00
3825  4158 C8 0B       AIN1   STRR,R0   AINTEM
3826  415A 3F 41 12           BSTA,UN   AINI/O
3827  415D 0A 06              LODR,R2   AINTEM
3828  415F 3F 41 12           BSTA,UN   AINI/O
3829  4162 1F 42 90           BCTA,UN   DCOMD
3830  4165              *
3831  4165 00          AINTEM RES       1
3832  4166              *
3833  4166 3F 47 92    CH     BSTA,UN   GETNUM    *****COMMAND
3834  4169 98 29              BCFR,EQ   RE
3835  416B 00                 LODZ,R0
3836  416C 9C 42 8B           BCFA,EQ   INCOMD
3837  416F E5 08              COMI,R1   08
3838  4171 1D 42 8E           BCTA,GT   INCOMD
3839  4174 C9 13              STRR,R1   CHTEM
3840  4176 3F 47 92           BSTA,UN   GETNUM
3841  4179 9C 42 8B           BCFA,EQ   INCOMD
3842  417C 02                 LODZ,R2
3843  417D 9C 42 8B           BCFA,EQ   INCOMD
3844  4180 01                 LODZ,R1
3845  4181 CF 06              LODR,R3   CHTEM
3846  4183 CF F1 92           STRA,R3   *ICPU,I
3847  4186 1F 41 66           BCTA,UN   CH
3848  4189              *
3849  4189 00          CHTEM  RES       1
3850  418A              *
```

FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

3851  418A 39 80        IPC     ACON        PC
3852  418C 39 81        IPC2    ACON        PC+1
3853  418E 36 PC        IADRT   ACON        ADSTAB
3854  4190 3E FF        ICPU    ACON        CPUREG
3855  4192 36 8D        IMOD    ACON        MODTAB
3856  4194              *
3857  4194 3F 03        PE      ESTR,UN     RE0       *****COMMAND
3858  4196 1F 42 90             BCTA,UN     DOCMD
3859  4199              *
3860  4199              *
3861  4199 3F 45 C9     RE0     ESTA,UN     LFCP
3862  419C 20 81 8A             LODA,R0     *IPC
3863  419F 3F 47 4F             ESTA,UN     HXOT
3864  41A2 20 81 8C             LODA,R0     *IPC2
3865  41A5 3F 47 4F             ESTA,UN     HXOT
3866  41A8 3F 45 8B             ESTA,UN     WRTBL
3867  41AB 3F 3F A4             ESTA,UN     PEF0          *PC
3868  41AE C3                   STRZ,R3
3869  41AF 53                   PPP ,R3
3870  41B0 53                   RRR ,R3
3871  41B1 47 03                ANDI,R3     03
3872  41B3 44 FC                ANDI,R0     FC
3873  41B5 E4 94                COMI,R0     94
3874  41B7 18 08                BCTR,EQ     RE1
3875  41B9 E4 14                COMI,R0     14
3876  41BB 18 04                BCTR,EQ     RE1
3877  41BD E4 34                COMI,R0     34
3878  41BF 98 02                BCFR,EQ     RE2
3879  41C1 07 02        RE1     LODI,R3     02
3880  41C3 0F E1 8E     RE2     IODA,R3     *IADRT,I
3881  41C6 C3                   STRZ,R3
3882  41C7 06 FF                LODI,R2     FF
3883  41C9 3F 45 8B     RE3     ESTA,UN     WRTBL
3884  41CC 3F 3F A8             ESTA,UN     REP1          R2    *PC,+
3885  41CF 3F 47 4F             ESTA,UN     HXOT
3886  41D2 02                   LODZ,R2
3887  41D3 E3                   COMI,R3
3888  41D4 98 73                BCFR,EQ     RE3
3889  41D6 06 11                LODI,R2     11
3890  41D8 20 05 C8             LODA,R1     CURSOR+1
3891  41DB 45 0F                ANDI,R1     0F
3892  41DD 3F 44 4C             ESTA,UN     SETCUR
3893  41E0 07 FF                LODI,R3     FF
3894  41E2 67 01        RE4     ADDI,R3     01
3895  41E4 3F 45 8B             ESTA,UN     WRTBL
3896  41E7 04 42                LODI,R0     'B'
3897  41E9 3F 45 8D             ESTA,UN     WRT
3898  41EC 03                   LODZ,R3
3899  41ED 64 30                IORI,R0     30
3900  41EF 3F 45 8D             ESTA,UN     WRT
3901  41F2 04 3D                LODI,R0     '='
3902  41F4 3F 45 8D             ESTA,UN     WRT
3903  41F7 0F E1 90             IODA,R2     *ICPU,I
3904  41FA 3F 47 4F             ESTA,UN     HXOT
3905  41FD E7 08                COMI,R3     08
```


FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

3906  41FF 98 61                BCFR,EQ     RE4           " CC= "
3907  4201 05 0A                LODI,R1     A
3908  4203 3F 46 CA             ESTA,UN     PRING
3909  4206 0F 89                IODR,R0     *SSPSL
3910  4208 12                   RRL ,R0
3911  4209 12                   RRL ,R0
3912  420A 44 03                ANDI,R0     03
3913  420C 64 30                IORI,R0     30
3914  420E 1F 45 8D             BCTA,UN     WRT
3915  4211              *
3916  4211 3F 26        SSPSL   ACON        SPSL
3917  4213              *
3918  4213              NOP     EQU         $
3919  4213              *
3920  4213 26 3F        OUT     LODI,R2     ^ENTER
3921  4215 EE 01 8A             COMA,R2     IPC
3922  4218 98 2F                BCFR,EQ     OUT0
3923  421A 07 03                LODI,R3     03
3924  421C 9F B9 80             BXA         *PC
3925  421F 72           OUT0    RRDL,R0                   MODES ARE
3926  4220 44 7F                ANDI,R0     7F            01 - SI
3927  4222 E4 18                COMI,R0     CTRLX         02 - ST
3928  4224 1C 42 6E             BCTA,EQ     CHST          00 - COMD
3929  4227 2A 2A        OUT1    LODR,R2     MODE          03 - TR
3930  4229 2E E1 92             LODA,R2     *IMOD,I       04 - SS
3931  422C C3                   STRZ,R3
3932  422D 9F 42 13             BXA         OUT
3933  4230              *
3934  4230 20 20        TRSTOP  RES         2
3935  4232              *
3936  4232 3F 41 99     TR      ESTA,UN     RE0
3937  4235 09 79                LODR,R2     TRSTOR
3938  4237 08 78                LODR,R1     TRSTOR+1
3939  4239 A5 01                SUBI,R1     01
3940  423B 77 C6                PPSL        WC
3941  423D A4 00                SUBI,R0     00
3942  423F 76 08                CPSL        WC
3943  4241 C8 61        CHMOD0  STRR,R0     TRSTOP
3944  4243 09 6C                STRR,R1     TRSTOR+1
3945  4245 00                   LODZ,R0
3946  4246 90 38 C3             BCTA,FC     GETOP
3947  4249 01                   LODZ,R1
3948  424A 98 38 C3             BCFA,EQ     GETOP
3949  424D 04 04                LODI,R0     04
3950  424F C8 02                STRR,R0     MODE
3951  4251 1F 25                BCTR,UN     SS1
3952  4253              *
3953  4253 02           MODE    RES         1
3954  4254 20 00        STSTOR  RES         2
3955  4256              *
3956  4256 28 70        ST      LODR,R2     STSTOR
3957  4258 29 7B                LODR,R1     STSTOR+1
3958  425A A5 01                SUBI,R1     01
3959  425C 77 08                PPSL        WC
3960  425E A4 00                SUBI,R0     00
```

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LINE  ADDR  B1 B2 B3 B4 LABEL   OPCODE     OPERAND   COMMENTS

3961  4262  75 08           CPSL       WC
3962  4262  CB 70           STRR,R0    STSTOR
3963  4264  C9 6F           STRR,R1    STSTOR+1
3964  4266  00         CHMOD LODZ,R0
3965  4267  90 38 C3        BCFA,EQ    GETOP
3966  426A  01               LODZ,R1
3967  426B  90 38 C3        BCFA,EQ    GETOP
3968  426E  04 04      CHST  LODI,R2    04
3969  4270  CB 61           STRR,R2    MODE
3970  4272  1F 42 27        BCTA,UN    OUT1
3971  4275                *
3972  4275 3F 41 99     SS    BSTA,UN    RE0
3973  4278 3F 46 FC     SS1   BSTA,UN    PAUSEL
3974  427B 3F 46 F7           BSTA,UN    PAUSE
3975  427E F4 18              COMI,R2    CTRLX
3976  4280 18 0E              BCTR,EQ    ICOMD
3977  4282 F4 1B              COMI,R2    ESC
3978  4284 18 0A              BCTR,EQ    DCOMD
3979  4286 1F 38 C3     SI    BCTA,UN    GETOP
3980  4289                *
3981  4289 36 C0        CMDTB ACON       COMTB2
3982  428B               *
3983  428B 05 05        INCOMD LODI,R1   5
3984  428D 3F 46 CA            BSTA,UN    PRING
3985  4290 20           DCOMD  EORZ,R0
3986  4291 CB 40               STRR,R0    MODE
3987  4293 04 02               LODI,R0    02
3988  4295 93                  LPSL
3989  4296 05 06               LODI,R1    6
3990  4298 3F 46 C7            BSTA,UN    PSTRNG
3991  429B 04 42               LODI,R0    COMSTG
3992  429D 05 FF               LODI,R1    COMSTG
3993  429F 06 20               LODI,R2    20
3994  42A1 3F 46 67            BSTA,UN    ARROW
3995  42A4 98 6A               BCFR,EQ    DCOMD
3996  42A6 07 60               LODI,R3    60
3997  42A8 1E 04               BCTR,UN    NOTOK0
3998  42AA 0B 3F        NOTOK  LODR,R3    COMPTR+1
3999  42AC A7 04               SUBI,R3    04
4000  42AE CE 3B        NOTOK0 STRR,R3    COMPTR+1
4001  42B0 1A 59               BCTR,LT    INCOMD
4002  42B2 08 3A               LODR,R0    COMSTG
4003  42B4 3F 47 8C            BSTA,UN    LTOU
4004  42B7 EF E2 89            COMA,R3    *CMDTB.I
4005  42BA 98 6E               BCFR,EQ    NOTOK
4006  42BC 08 31               LODR,R0    COMSTG+1
4007  42BE 3F 47 8C     ------ BSTA,UN    LTOU
4008  42C1 EF A2 89            COMA,R3    *CMDTB,+
4009  42C4 98 64        --     BCFR,EQ    NOTOK
4010  42C6 0F A2 89            LODA,R3    *CMDTB,+
4011  42C9 C8 21               STRR,R0    JTEM
4012  42CB 0F A2 89            LODA,R3    *CMDTB,+
4013  42CE C8 1D               STRR,R0    JTEM+1
4014  42D0 20                  EORZ,R0
4015  42D1 C8 17               STRR,R2    COMPTR
```



```
LINE  ADDR  B1 B2 B3 B4 LABEL   OPCODE     OPERAND   COMMENTS

4016  42D3 3F 47 7B    OKCOMD BSTA,UN    GETCOM
4017  42D6 00                 LODZ,R0
4018  42D7 18 92              BCTR,EQ    *JTEM
4019  42D9 E4 20              COMI,R0    20
4020  42DB 18 8F              BCTR,EQ    *JTEM
4021  42DD 3F 47 65           BSTA,UN    CKNUM
4022  42E0 98 71              BCFR,EQ    CKCOMD
4023  42E2 08 26              LODR,R0    COMPTR
4024  42E4 A4 01              SUBI,R0    01
4025  42E6 C8 22              STRR,R0    COMPTR
4026  42E8 1B 82              BCTR,UN    *JTEM
4027  42EA               *
4028  42EA 00 00        COMPTR RES        2
4029  42EC 00 00        JTEM   RES        2
4030  42EE               *
4031  42EE 00 00 00 00 COMSTG RES        21
4032  42F2 00 00 00 00
4033  42F6 00 00 00 00
4034  42FA 00 00 00 00
4035  42FE 00 00 00 00
4036  4302 00 00 00 00
4037  4306 00 00 00 00
4038  430A 00 00 00 00
4039  430E 00
4040  430F               *
4041  430F               *
4042  430F 04 01        CSI    LODI,R0    01        *****COMMAND
4043  4311 CC 02 53            STRA,R0    MODE
4044  4314 1F 43 32            BCTA,UN    CST0
4045  4317               *
4046  4317 3F 47 92     CST    BSTA,UN    GETNUM    *****COMMAND
4047  431A 9C 42 6E            BCFA,EQ    CHST
4048  431D CC 02 54            STRA,R0    STSTOR
4049  4320 CD 02 55            STRA,R1    STSTOR+1
4050  4323 00                  LODZ,R0
4051  4324 98 07               BCFR,EQ    CST1
4052  4326 01                  LODZ,R1
4053  4327 98 04               BCFR,EQ    CST1
4054  4329 04 04               LODI,R0    04
4055  432B 1B 02               BCTR,UN    CST2
4056  432D 04 02        CST1   LODI,R2    02
4057  432F CC 02 53     CST2   STRA,R2    MODE
4058  4332 3F 47 92     CST0   BSTA,UN    GETNUM
4059  4335 9C 42 13            BCFA,EQ    OUT
4060  4338 CC 61 8A     CPC    STRA,R0    *IPC
4061  433B CD 61 8C            STRA,R1    *IPC2
4062  433E 1F 42 13            BCTA,UN    OUT
4063  4341               *
4064  4341 3F 47 92     PCIT   BSTA,UN    GETNUM    *****COMMAND
4065  4344 9C 42 6E            BCFA,EQ    INCOMD
4066  4347 1B 6F               BCTR,UN    CPC
4067  4349               *
4068  4349 3F 47 92     CTR    BSTA,UN    GETNUM    *****COMMAND
4069  434C 9C 42 6E            BCFA,EQ    CHST
4070  434F CC 02 30            STRA,R2    TRSTOR
```

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LINE  ADDR P1 P2 P3 P4 LABEL  OPCODE    OPERAND   COMMENTS

4071  4352 CD 02 31          STRA,R1    TRSTOR+1
4072  4355 04 03             LODI,R0    03
4073  4357 1F 56             BCTR,UN    CST2
4074  4359             *
4075  4359             *
4076  4359 3F 47 92    DPAGE  BSTA,UN    GETNUM    *****COMMAND
4077  435C 90 42 8B          BCFA,EQ    INCOMD
4078  435F 0E 23             STRR,R2    POINT
4079  4361 09 22             STRR,R1    POINT+1
4080  4363 0E 10       DPAGE2 LODI,R2    10
4081  4365 05 00             LODI,R1    00
4082  4367 3F 44 4C          BSTA,UN    SETCUR
4083  436A 20                EORZ,R0
4084  436B 0E 19             STRR,R0    CURSTA
4085  436D 07 FF             LODI,R3    FF
4086  436F 3F 43 B5          BSTA,UN    DISPZ
4087  4372 3F 44 28    DPAGE0 BSTA,UN    CURPLT
4088  4375 3F 44 5F          BSTA,UN    CURED
4089  4378 98 76             BCFR,EQ    DPAGE0
4090  437A 04 01             LODI,R0    01
4091  437C 86 25             ADDR,R0    POINT
4092  437E 44 7F             ANDI,R0    7F
4093  4380 0E 02             STRR,R0    POINT
4094  4382 1F 5F             BCTR,UN    DPAGE2
4095  4384             *
4096  4384 00 20       POINT  RES        2
4097  4386 00 00       CURSTA RES        2
4098  4388             *
4099  4388             *
4100  4388 3F 47 92    DDIS   BSTA,UN    GETNUM    *****COMMAND
4101  438B 90 42 8E          BCFA,EQ    INCOMD
4102  438E 0E 74             STRR,R2    POINT
4103  4390 01 03 85          STRA,R1    POINT+1
4104  4393 20          DDIS2  EORZ,R0
4105  4394 0E 72             STRR,R0    CURSTA
4106  4396 07 7F             LODI,R3    0F
4107  4398 3F 1B             BSTR,UN    DISPZ
4108  439A 3F 44 2B    DDIS0  BSTA,UN    CURPLT
4109  439D 3F 44 5F          BSTA,UN    CURED
4110  43A0 98 76             BCFR,EQ    DDIS0
4111  43A2 05 12             LODI,R1    12
4112  43A4 89 FF             ADDR,R1    POINT+1
4113  43A6 09 5D             STRR,R1    POINT+1
4114  43A8 77 08             PPSL       WC
4115  43AA 20                EORZ,R0
4116  43AB 86 57             ADDR,R2    POINT
4117  43AD 0E 55             STRR,R2    POINT
4118  43AF 75 08             CPSL       WC
4119  43B1 1E 60             BCTR,UN    DDIS2
4120  43B3             *
4121  43B3             *
4122  43B3 00 00       DIST   RES        2
4123  43B5             *
4124  43B6 0F 70       DISPZ  STRR,R3    DIST
4125  43B7 06 FF             LODI,R2    FF
```



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LINE  ADDR P1 P2 P3 P4 LABEL  OPCODE    OPERAND   COMMENTS

4126  43B9 86 01       DIS2   ADDI,R2    01
4127  43BB CA 77             STRR,R2    DIST+1
4128  43BD 3F 45 C9          BSTA,UN    LFCR
4129  43C0 0A 72             LODR,R2    DIST+1
4130  43C2 0F 03 85          LODA,R3    POINT+1
4131  43C5 03                LODZ,R3
4132  43C6 82                ADDZ,R2
4133  43C7 03                STRZ,R3
4134  43C8 77 08             PPSL       WC
4135  43CA 20                EORZ,R0
4136  43CB 80 03 84          ADDA,R2    POINT
4137  43CE 75 08             CPSL       WC
4138  43D0 3F 47 4F          BSTA,UN    HXOT
4139  43D3 03                LODZ,R3
4140  43D4 3F 47 4F          BSTA,UN    HXOT
4141  43D7 3F 45 8B          BSTA,UN    WRTBL
4142  43DA A6 01             SUBI,R2    01
4143  43DC 3F 45 8B    DIS    BSTA,UN    WRTBL
4144  43DF 3F 44 0E          BSTA,UN    R2IP
4145  43E2 01                LODZ,R1
4146  43E3 3F 47 4F          BSTA,UN    HXOT
4147  43E6 F6 0F             TMI ,R2    0F
4148  43E8 98 72             BCFR,EQ    DIS
4149  43EA A6 10             SUBI,R2    10
4150  43EC 25 24             LODI,R1    24
4151  43EF 3F 45 8B    DIS4   BSTA,UN    WRTBL
4152  43F1 F9 7B             BDRR,R1    DIS4
4153  43F3 3F 19       DIS7   BSTR,UN    R2IP
4154  43F5 21                LODZ,R1
4155  43F6 45 F0             ANDI,R1    F0
4156  43F8 18 04             BCTR,EQ    DIS5
4157  43FA F4 80             TMI ,R0    80
4158  43FC 98 22             BCFR,EQ    DIS6
4159  43FE 04 2E       DIS5   LODI,R0    '.'
4160  4400 3F 45 8D    DIS6   BSTA,UN    WRT
4161  4403 F6 0F             TMI ,R2    0F
4162  4405 98 6C             BCFR,EQ    DIS7
4163  4407 1B 03 B3          CTMA,R2    DIST
4164  440A 14                RETC,EQ
4165  440B 1F 43 B9          BCTA,UN    DIS0
4166  440E             *
4167  440E 03          R2IP   STRZ,R3
4168  440F 04 01             LODI,R0    01
4169  4411 60                ADDZ,R2
4170  4412 02                STRZ,R2
4171  4413 80 03 86          ADDA,R0    POINT+1
4172  4416 0E 0F             STRR,R0    PTEMP+1
4173  4418 77 08             PPSL       WC
4174  441A 20                EORZ,R0
4175  441B 80 03 84          ADDA,R0    POINT
4176  441E 75 08             CPSL       WC
4177  4420 0E 04             STRR,R0    PTEMP
4178  4422 29 82             IORR,R1    *PTEMP
4179  4424 03                LODZ,R3
4180  4425 17                RETC,UN
```

FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

4181  4426                 *
4182  4426 00 00           PTEMP  RES        2
4183  4428                 *
4184  4428                 *
4185  4428 0C 23 86        CURPLT LODA,R0    CURSTA
4186  442B C1                     STRZ,R1
4187  442C 0F 03 B3               LODA,R3    DIST
4188  442F 1A 03                  BCTR,LT    CURP0
4189  4431 02 05 C8               LODA,R1    CURSOR+1
4190  4434 45 0F           CURP0  ANDI,R1    0F
4191  4436 44 F0                  ANDI,R0    F0
4192  4438 C3                     STRZ,R3
4193  4439 06 00                  LODI,R2    00
4194  443B 75 01                  CPSL       CRY
4195  443D 77 08                  PPSL       WC
4196  443F D0                     RRL ,R0
4197  4440 D2                     RRL ,R2
4198  4441 83                     ADDZ,R3
4199  4442 86 10                  ADDI,R2    10
4200  4444 84 50                  ADDI,R0    50
4201  4446 86 00                  ADDI,R2    00
4202  4448 75 08                  CPSL       WC
4203  444A 61                     IORZ,R1
4204  444B C1                     STRZ,R1
4205  444C 3F 46 3C        SETCUR BSTA,UN    EROLD
4206  444F CB 05 C7               STRA,R2    CURSCR
4207  4452 CD 05 C8               STRA,R1    CURSOR+1
4208  4455 04 1C                  LODI,R0    1C
4209  4457 CC 05 C7               STRA,R0    *CURSCR
4210  445A 17                     RETC,UN
4211  445B                 *
4212  445B                 *
4213  445B 36 9C           KYTAB  ACON       KEYTAB
4214  445D 36 A4           KY0    ACON       KEY0
4215  445F                 *
4216  445F                 *
4217  445F 3F 46 F7        CURED  BSTA,UN    PAUSE
4218  4462 3F 47 8C               BSTA,UN    LTOU
4219  4465 E4 0D                  COMI,R0    0D
4220  4467 14                     RETC,EQ
4221  4468 E4 1B                  COMI,R0    ESC
4222  446A 1C 44 F1               BCTA,EQ    CUREDX
4223  446D E4 4B                  COMI,R0    'K'
4224  446F 98 07                  BCFR,EQ    CURED0
4225  4471 20                     EORZ,R0
4226  4472 CC 03 B6        ------ STRA,R0    CURSTA
4227  4475 04 01                  LODI,R0    01
4228  4477 17                     RETC,UN
4229  4478 CE 03 B3        CURED0 LODA,R2    DIST
4230  447B 1A 04                  BCTR,LT    CURED1
4231  447D 06 02                  LODI,R2    02
4232  447F 1B 02                  BCTR,UN    CURED1
4233  4481 06 08           CURED1 LODI,R2    08
4234  4483 EE C4 5B        CURED1 COMA,R2    *KYTAB,-
4235  4486 1C 44 D0               BCTA,EQ    CURED4
```


FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

4236  44B9 FA 78                 BRNR,R2    CURED1
4237  44BB 3F 47 6E              BSTA,UN    OKHEX
4238  44BE 98 4F                 BCFR,EQ    CURED
4239  44C0 C3                    STRZ,R3
4240  44C1 3F 45 8B              BSTA,UN    WRTBL
4241  44C4 0C 07 02              LODA,R0    KBBUF
4242  44C7 3F 45 8D              BSTA,UN    WRT
4243  44CA 03                    LODZ,R3
4244  44CB 3F 47 46              BSTA,UN    MHEX          CONVERT ASCII TO HEX
4245  44CE 03                    LODZ,R3
4246  44CF C1                    STRZ,R1
4247  44D2 3F 46 F7        CUPED2 BSTA,UN    PAUSE
4248  44A3 3F 47 8C              BSTA,UN    LTOU
4249  44A6 E4 1B                 COMI,R0    ESC
4250  44A8 1C 44 F1              BCTA,EQ    CUREDX
4251  44AB 3F 47 6E              BSTA,UN    OKHEX
4252  44AE 98 72                 BCFR,EQ    CURED2
4253  44E0 3F 47 46              BSTA,UN    MHEX
4254  44E3 0C 07 02              LODA,R0    KBBUF
4255  44E6 3F 45 8D              BSTA,UN    WRT           WRITE THE SECOND DIGIT
4256  44E9 03                    LODZ,R3
4257  44EA D1                    RRL,R1
4258  44EB D1                    RRL,R1
4259  44EC D1                    RRL,R1
4260  44ED D1                    RRL,R1
4261  44EE 61                    IORZ,R1
4262  44EF 0E 03 86        CURED3 LODA,R2    CURSTA
4263  44F2 52                    RRR ,R2
4264  44F3 52                    RRR ,R2
4265  44F4 52                    RRR ,R2
4266  44F5 52                    RRR ,R2
4267  44F6 A6 01                 SUBI,R2    01
4268  44F8 3F 44 0E              BSTA,UN    P2IP
4269  44FB CC 04 26              STRA,R0    *PTEMP
4270  44FE 06 01                 LODI,R2    01
4271  4500 0C 03 86        CURED4 LODA,R0    CUPSTA        UPDATES CURSRA TO THE NEW ADDRESS
4272  4503 C1                    STRZ,R1
4273  4504 50                    RRR ,R0
4274  4505 50                    RRR ,R0
4275  4506 50                    RRR ,R0
4276  4507 50                    RRR ,R0
4277  4508 0E F4 5D              ADDA,R2    *KY0,I
4278  450B D0                    RRL ,R0
4279  450C D0                    RRL ,R0
4280  450D D0                    RRL ,R0
4281  450E D0                    RRL ,R0
4282  450F CC 03 86              STRA,R0    CURSTA
4283  4512 0F 03 B3              LODA,R3    DIST
4284  4515 16                    RETC,LT
4285  4516 44 F0                 ANDI,R0    F0
4286  4518 45 0F                 ANDI,R1    0F
4287  451A 61                    IORZ,R1
4288  451B CC 03 86              STRA,R0    CURSTA
4289  451E 04 01                 LODI,R0    01
4290  4520 17                    RETC,UN
```

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

4291  44F1                    *
4292  44F1 20 03 E3     CUREDX LODA,R0     DIST
4293  44F4 91 42 90            BCFA,LT     DCOMD
4294  44F7 06 10               LODI,R2     10
4295  44F9 05 4F               LODI,R1     4F
4296  44FB 3F 44 4C            BSTA,UN     SETCUR
4297  44FE 1F 42 90            BCTA,UN     DCOMD
4298  4501                    *
4299  4501 06 13        ERROR  LODI,R2     13
4300  4503 05 00               LODI,R1     00
4301  4505 3F 44 4C            BSTA,UN     SETCUR
4302  4508 03                  LODZ,R3
4303  4509 01                  STRZ,R1
4304  450A 3F 46 CA            BSTA,UN     PRING
4305  450D 04 20               LODI,R0     ' '
4306  450F C0 85 C7            STRA,R0    *CURSOR
4307  4512 3F 46 F7            BSTA,UN     PAUSE
4308  4515 1F 20 46            BCTA,UN     FBDN
4309  4518                    *
4310  4518 3F 46 2F     BACK1  BSTA,UN     ERAS1
4311  451B 16                  RETC,LT
4312  451C 20 05 C8            LODA,R0     CURSOR+1
4313  451F A4 10               SUBI,R0     10
4314  4521 C0 25 C8            STRA,R0     CURSCR+1
4315  4524 77 05               PPSL        WC
4316  4526 20 05 C7            LODA,R0     CURSOR
4317  4529 A4 00               SUBI,R0     0
4318  452B C0 05 C7            STRA,R0     CURSOR
4319  452E 75 08               CPSL        WC
4320  4530 04 10               LODI,R0     10
4321  4532 C0 0F C7            STRA,R0    *CURSCR
4322  4535 A5 01               SUBI,R1     1
4323  4537 E5 FF               COMI,R1     FF
4324  4539 9E 26               BCFR,EQ     NOSUB1
4325  453B 0F B6               LODR,R0    *TMM
4326  453D A4 01               SUBI,R0     1
4327  453F CF F2               STRR,R0    *TMM
4328  4541 02           NOSUB1 BORZ,R0
4329  4542 17                  RETC,UN
4330  4543                    *
4331  4543 2A 24        TMM    ACON        TMPA
4332  4545                    *
4333  4545 07 20        OLFCR  IODI,R3     ' '
4334  4547 CF 85 C7            STRA,R3    *CURSOR
4335  454A 05 25 C8     OLFCR2 LODA,R3     CURSCR+1
4336  454D 47 0F               ANDI,R3     F
4337  454F 67 01               ADDI,R3     1
4338  4551 47 0F               ANDI,R3     F
4339  4553 CF 25 C8            STRA,R3     CURSCR+1
4340  4556 07 10               IODI,R3     10
4341  4558 CF 25 C7            STRA,R3     CURSCR
4342  455B 04 20               LODI,R0     ' '
4343  455D C0 85 C7     L2     STRA,R0    *CURSOR
4344  4560 07 10               IODI,R3     10
4345  4562 6F 05 C8            ADDA,R3     CURSCR+1
```



```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

4346  4565 CF 25 C8            STRA,R3     CURSOR+1
4347  4568 77 05               PPSL        WC
4348  456A 27 02               LODI,R3     2
4349  456C 6F 25 C7            ADDA,R3     CURSOR
4350  456F CF 25 C7            STRA,R3     CURSOR
4351  4572 75 08               CPSL        WC
4352  4574 F7 05               TMI ,R3     5
4353  4576 98 65               BCFR,EQ     L2
4354  4578 25 05 C8            LODA,R3     CURSCR+1
4355  457B CF 85 C8            STRA,R3     CURSOR+1
4356  457E 07 10               LODI,R3     10
4357  4580 CF 25 C7            STRA,R3     CURSCR
4358  4583 27 10               LODI,R3     10
4359  4585 CF 85 C7            STRA,R3    *CURSOR
4360  4588 17                  RETC,UN
4361  4589                    *
4362  4589 21 16        IULC   ACON        ULC
4363  458B                    *
4364  458B 04 20        WRTBL  LODI,R0     ' '
4365  458D 77 10        WRT    PPSL        PS
4366  458F 0D 85 89            LODA,R1    *IULC
4367  4592 3E 47 6C            BSTA,LT     LTOU
4368  4595 C1                  STRZ,R1
4369  4596 25 FF               FOPI,R1     FF
4370  4598 F5 60               TMI ,R1     60
4371  459A 18 09               BCFR,EQ     RETURN
4372  459C F4 60               TMI ,R0     60
4373  459E 18 02               BCTR,EQ     WRTLC
4374  45A0 44 3F               ANDI,R0     3F
4375  45A2 C8 A3        WRTLC  STRR,R0    *CURSOR
4376  45A4 05 10               LODI,R1     10
4377  45A6 69 20               ADDR,R1     CURSOR+1
4378  45A8 C9 1E               STRR,R1     CURSOR+1
4379  45AA 77 08               PPSL        WC
4380  45AC 25 02               LODI,R1     02
4381  45AE 69 17               ADDR,R1     CURSCR
4382  45B0 C9 15               STRR,R1     CURSOR
4383  45B2 F5 05               TMI ,R1     5
4384  45B4 98 0A               BCFR,EQ     WRTCUR
4385  45B6 09 10               LODR,R1     CURSOR+1
4386  45B8 E5 F0               COMI,R1     F0
4387  45BA C9 00               STRR,R1     CURSOR+1
4388  45BC 25 14               LODI,R1     14
4389  45BE C9 07               STRR,R1     CURSOR
4390  45C0 05 10        WRTCUR LODI,R1     10
4391  45C2 C9 83               STRR,R1    *CURSOR
4392  45C4 75 18        RETURN CPSL        RS+WC
4393  45C6 17                  RETC,UN
4394  45C7                    *
4395  45C7 00 00        CURSOR RES         2
4396  45C9                    *
4397  45C9 3F 46 30     LFCR   BSTA,UN     EROLI
4398  45CC 09 7A               LODR,R0     CURSOR+1
4399  45CE F4 2F               TMI ,R0     F
4400  45D0 18 2E               BCTF,EQ     SCROLL
```

FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

4291  44F1                 *
4292  44F1 00 03 B3        CURRDX LODA,R0    DIST
4293  44F4 91 42 90                BCFA,LT    DCOMD
4294  44F7 05 10                   LODI,R2    10
4295  44F9 05 4F                   LODI,R1    4F
4296  44FB 3F 44 4C                BSTA,UN    SETCUR
4297  44FE 1F 42 90                BCTA,UN    DCOMD
4298  4501                 *
4299  4501 06 13           ERROR  LODI,R2    13
4300  4503 05 C0                   LODI,R1    C0
4301  4505 3F 44 4C                BSTA,UN    SETCUR
4302  4508 03                      LODZ,R3
4303  4509 01                      STRZ,R1
4304  450A 3F 46 CA                BSTA,UN    PRING
4305  450D 04 20                   LODI,R0
4306  450F CC 85 C7                STRA,R0   *CURSOR
4307  4512 3F 46 F7                BSTA,UN    PAUSE
4308  4515 13 20 48                BCTA,UN    FBEN
4309  4518                 *
4310  4518 3F 46 2F        BACK1  BSTA,UN    ERAS1
4311  451B 18                      RETC,LT
4312  451C 0C 05 C8                LODA,R0    CURSOR+1
4313  451F A4 10                   SUBI,R0    10
4314  4521 0C 05 C8                STRA,R0    CURSOR+1
4315  4524 77 06                   PPSL       WC
4316  4526 0C 05 C7                LODA,R0    CURSOR
4317  4529 A4 00                   SUBI,R0    0
4318  452B 0C 05 C7                STRA,R0    CURSOR
4319  452E 75 08                   CPSL       WC
4320  4530 04 1C                   LODI,R0    1C
4321  4532 0C 85 C7                STRA,R0   *CURSOR
4322  4535 A5 01                   SUBI,R1    1
4323  4537 E5 FF                   COMI,R1    FF
4324  4539 9E 06                   BCFR,EQ    NOSUB1
4325  453B 06 B6                   LODR,R0   *TMM
4326  453D A4 01                   SUBI,R0    1
4327  453F CE 02                   STRR,R0   *TMM
4328  4541 22              NOSUB1 BORZ,R0
4329  4542 17                      RETC,UN
4330  4543                 *
4331  4543 2A 04           TMM    ACON       TMPA
4332  4545                 *
4333  4545 07 20           OLPCR  LODI,R3     ' '
4334  4547 CF 85 C7                STRA,R3   *CURSOR
4335  454A 05 C8           CLPCR2 LODA,R3    CURSCR+1
4336  454D 47 0F                   ANDI,R3    F
4337  454F 67 01                   ADDI,R3    1
4338  4551 47 0F                   ANDI,R3    F
4339  4553 CF 05 C8                STRA,R3    CURSOR+1
4340  4556 07 10                   LODI,R3    10
4341  4558 CF 05 C7                STRA,R3    CURSCR
4342  455B 04 20                   LODI,R0    ' '
4343  455D CC 85 C7        L2     STRA,R0   *CURSOR
4344  4560 07 10                   LODI,R3    10
4345  4562 87 05 C8                ADDA,R3    CURSCR+1
```


FILE 'ALP' AS ASSEMBLED BY SYSTEM ON 11-03-78

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

4346  4565 CF 05 C8                STRA,R3    CURSOR+1
4347  4568 77 05                   PPSL       WC
4348  456A 07 02                   LODI,R3    2
4349  456C CF 05 C7                ADDA,R3    CURSOR
4350  456F CF 05 C7                STRA,R3    CURSOR
4351  4572 75 08                   CPSL       WC
4352  4574 F7 05                   TMI ,R3    5
4353  4576 98 65                   BCFR,EQ    L2
4354  4578 07 C8                   LODA,R3    CURSCR+1
4355  457B CF 05 C8                STRA,R3    CURSOR+1
4356  457E 07 10                   LODI,R3    10
4357  4580 CF 05 C7                STRA,R3    CURSCR
4358  4583 07 1C                   LODI,R3    1C
4359  4585 CF 85 C7                STRA,R3   *CURSOR
4360  4588 17                      RETC,UN
4361  4589                 *
4362  4589 21 18           IULC   ACON       ULC
4363  458B                 *
4364  458B 04 20           WRTBL  LODI,R0     ' '
4365  458D 77 10           WRT    PPSL       PS
4366  458F 0D 85 89                LODA,R1   *IULC
4367  4592 3F 47 6C                BSTA,LT    LTOU
4368  4595 01                      STRZ,R1
4369  4596 25 FF                   PORI,R1    FF
4370  4598 F5 60                   TMI ,R1    60
4371  459A 1E 29                   BCTR,EQ    RETURN
4372  459C F4 60                   TMI ,R0    60
4373  459E 1E 02                   BCTR,EQ    WRTLC
4374  45A0 44 3F                   ANDI,R0    3F
4375  45A2 CB A3           WRTLC  STPR,R0   *CURSOR
4376  45A4 05 12                   LODI,R1    12
4377  45A6 89 20                   ADDR,R1    CURSCR+1
4378  45A8 09 1E                   STPR,R1    CURSCR+1
4379  45AA 77 06                   PPSL       WC
4380  45AC 05 02                   LODI,R1    02
4381  45AE 89 17                   ADDR,R1    CURSCR
4382  45B0 09 15                   STPR,R1    CURSOR
4383  45B2 F5 05                   TMI ,R1    5
4384  45B4 9E 0A                   BCFR,EQ    WRTCUR
4385  45B6 09 10                   LODR,R1    CURSOR+1
4386  45B8 E5 F0                   IORI,R1    F0
4387  45BA C9 0C                   STPR,R1    CURSOR+1
4388  45BC 05 14                   LODI,R1    14
4389  45BE C9 07                   STPR,R1    CURSOR
4390  45C0 05 1C           WRTCLP LODI,R1    1C
4391  45C2 C9 83                   STPR,R1   *CURSOR
4392  45C4 75 1B           RETURN CPSL       RS+WC
4393  45C6 17                      RETC,UN
4394  45C7                 *
4395  45C7 00 00           CURSOR RES        2
4396  45C9                 *
4397  45C9 3F 46 3C        IPCR   BSTA,UN    IPCLI
4398  45CC 0A 7A                   LODR,R0    CURSOR+1
4399  45CE F4 0F                   TMI ,R0    F
4400  45D0 1E 26                   BCTR,EQ    SCROLL
```

```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

4401  45D2 84 01             ADDI,R0    1
4402  45D4 44 0F             ANDI,R0    F
4403  45D6 CB 70             STR,R0     CURSCR+1
4404  45D8 07 10       CLRLIN LODI,R3    10
4405  45DA CB 6B             STRR,R3    CURSOR
4406  45DC 04 20             LODI,R0    ' '
4407  45DE 06 00             LODI,R2    0
4408  45E0 CE E5 C7    FLL1   STRA,R2    *CURSOR,I
4409  45E3 86 10             ADDI,R2    10
4410  45E5 96 79             BCFR,EQ    FLL1
4411  45E7 87 01             ADDI,R3    1
4412  45E9 CB 5C             STRR,R3    CURSOR
4413  45EB E7 15             COMI,R3    15
4414  45ED 98 71             BCFR,EQ    FLL1
4415  45EF 07 10             LODI,R3    10
4416  45F1 CB 54             STRR,R3    CURSOR
4417  45F3 04 1C             LODI,R0    1C
4418  45F5 CB D0             STR,R0     *CURSOR
4419  45F7 17                RETC,UN
4420  45F8 04 14       SCROLL LODI,R0    14
4421  45FA CB 4E             STRR,R0    CURSCR
4422  45FC 20                EORZ,R0
4423  45FD C8 49             STRR,R0    CURSOR+1
4424  45FF 06 00       SCROL2 LODI,R2    00
4425  4601 07 FF             LODI,R3    FF
4426  4603 0F A5 C7    SCROL1 LODA,R2    *CURSOR,+
4427  4606 26 FF             EORI,R2    FF
4428  4608 F6 0F             TMI ,R2    F
4429  460A 18 1F             BCTR,EQ    SCPOL4
4430  460C CF A5 C7          STRA,R3    *CURSOR,+
4431  460F 26 FF       SCROL5 EORI,R2    FF
4432  4611 E6 FF             COMI,R2    FF
4433  4613 98 EE             BCFR,EQ    SCROL1
4434  4615 0C 05 C7          LODA,R0    CURSCR
4435  4618 A4 01             SUBI,R0    1
4436  461A E4 0F             COMI,R0    F
4437  461C 18 05             BCTR,EQ    SCROL3
4438  461E CC 05 C7          STRA,R0    CURSCR
4439  4621 1B 5              BCTR,UN    SCPOL2
4440  4623 04 0F       SCROL3 LODI,R0    F
4441  4625 CC 05 C8          STRA,R0    CURSOR+1
4442  4628 1F 45 D8          BCTA,UN    CLRLIN
4443  462B B7 01       SCROL4 ADDI,R3    1
4444  462D 1E E0             BCTR,UN    SCROL5
4445  462F             *
4446  462F 0C 05 C7    ERAS1  LODA,R0    CURSCR
4447  4632 E4 10             COMI,R0    10
4448  4634 98 06             BCFR,EQ    ERCLD
4449  4636 0C 05 C8          LODA,R0    CURSOR+1
4450  4639 E4 10             COMI,R0    10
4451  463B 16                RETC,LT
4452  463C 04 20       ERCLD  LODI,R0    ' '
4453  463E CC B5 C7          STRA,R0    *CURSOR
4454  4641 17                RETC,UN
4455  4642             *
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```
LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

4456  4642             *
4457  4642 3F 6B       BACKSP BSTR,UN    ERAS1
4458  4644 0F 05 C8          LODA,R3    CURSCR+1
4459  4647 0C 05 C7          LODA,R0    CURSOR
4460  464A E4 10             COMI,R0    10
4461  464C 98 03             BCFR,EQ    BACKS1
4462  464E E4 12             COMI,R2    12
4463  4650 16                RETC,LT
4464  4651 A7 12       BACKS1 SUBI,R3    10
4465  4653 77 08             PPSL       WC
4466  4655 A4 00             SUBI,R0    0
4467  4657 75 08             CPSL       WC
4468  4659 CF 05 C8          STRA,R3    CURSCR+1
4469  465C CC 05 C7    .     STRA,R0    CURSOR
4470  465F 04 1C             LODI,R0    1C
4471  4661 CC B5 C7          STRA,R0    *CURSOR
4472  4664 17                RETC,UN
4473  4665             *
4474  4665             *
4475  4665 00 00       TMPAR  RES        2
4476  4667             *
4477  4667             *
4478  4667 C8 7C       ARROW  STRR,R0    TMPAR
4479  4669 C9 7B             STRR,R1    TMPAR+1
4480  466B 05 FF             LODI,R1    FF
4481  466D 3F 47 03    INLOOP BSTA,UN    GETKB
4482  4670 E4 1B             COMI,R0    ESC
4483  4672 1C 46 C2          BCTA,EQ    ARROW2
4484  4675 E4 08             COMI,R0    BS
4485  4677 98 0F             BCFR,EQ    NOBS
4486  4679 E5 FF             COMI,R1    FF
4487  467B 18 72             BCTR,EQ    INLOOP
4488  467D 3F 45 42          BSTA,UN    BACKSP
4489  4680 18 6E             BCTR,EQ    INLOOP
4490  4682 A5 01             SUBI,R1    1
4491  4684 86 01             ADDI,R2    1
4492  4686 1B E5             BCTR,UN    INLOOP
4493  4688 E4 15       NOBS   COMI,R0    15
4494  468A 98 14             BCFR,EQ    STRIN
4495  468C E5 FF             COMI,R1    FF
4496  468E 98 5D             BCFR,EQ    INLOOP
4497  4690 0D A6 65    NOBS2  L DA,R1    *TMPAR,+
4498  4693 18 07             BCTR,EQ    STRIN2
4499  4695 3F 45 8D          BSTA,UN    WRT
4500  4698 FA 76             BIRR,R2    NOBS2
4501  469A 1E 07             BCTR,UN    CRWAIT
4502  469C A5 01       STRIN2 SUBI,R1    1
4503  469E 1B 4D             BCTR,UN    INLOOP
4504  46A0 CD A6 65    STRIN  STRA,R1    *TMPAR,+
4505  46A3 E4 0D             COMI,R0    CRCD
4506  46A5 18 11             BCTR,EQ    CLRLAS
4507  46A7 FA 44             BIRR,R2    INLOOP
4508  46A9 72          CRWAIT BIDI,R2
4509  46AA E4 08             COMI,R0    BS
4510  46AC 1C 46 6D          BCTA,EQ    INLOOP
```

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LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE    OPERAND   COMMENTS

4611  46AF F4 0D              COMI,R2    CRCD
4612  46B1 96 76              BCFR,EQ    CR=AIT
4613  46B3 3F 46 FC           BCTA,UN    PAUSEL
4614  46B6 22                 FORZ,R0
4615  46B7 17                 RETC,UN
4616  46B8 02           CLRLAS FORZ,R2
4617  46B9 CD F6 66     CL     STRA,R1    *TMPAR,I
4618  46BC 65 01              ADDI,R1    1
4619  46BE FA 79              BDRR,R2    CL
4620  46C0 02                 FORZ,R0
4621  46C1 17                 RETC,UN
4622  46C2 04 FF        ARPOW2 LODI,R2    FF
4623  46C4 17                 RETC,UN
4624  46C5                  *
4625  46CF 02 00        TMESS  RES        2
4626  46C7                  *
4627  46C7 3F 45 C9     PSTRNG BSTA,UN    LFCR
4628  46CA 04 37        PRING  LODI,R0    'MSG0
4629  46CC 06 2C              LODI,R2    MSG2
4630  46CE CE 75              STRR,R2    TMESS
4631  46D0 CA 74              STRR,R2    TMESS+1
4632  46D2 A6 01        PRING2 SUBI,R1    01
4633  46D4 1A 16              BCTR,LT    PRING2
4634  46D6 06 01        PRING1 LODI,R2    01
4635  46D8 20                 FORZ,R0
4636  46D9 8E 06 C6           ADDA,R2    TMESS+1
4637  46DC CA 68              STRR,R2    TMESS+1
4638  46DE 77 02              PPSL       WC
4639  46E0 8E 63              ADDR,R2    TMESS
4640  46E2 CE 61              STRR,R0    TMESS
4641  46E4 75 08              CPSL       WC
4642  46E6 0E DE              LODR,R0   *TMESS
4643  46E8 1A 68              BCTR,LT    PRING0
4644  46EA 1E 6A              BCTR,UN    PRING1
4645  46EC 07 00        PRING2 LODI,R3    00
4646  46EE 3F A6 C5     PRING3 LODA,R3   *TMESS,-
4647  46F1 16                 RETC,LT
4648  46F2 3F 45 8D           BSTA,UN    WRT
4649  46F5 1E 77              BCTR,UN    PRING3
4650  46F7                  *
4651  46F7                  *
4652  46F7 70           PAUSE  REDD,R0
4653  46F8 1A 7D              BCTR,LT    PAUSE
4654  46FA CB 2E              STRR,R0    KBBUF
4655  46FC 70           PAUSEL REDD,R0
4656  46FD 9A 2F              BCFR,LT    PAUSEL
4657  46FF 0E 01              LODR,R0    KBBUF
4658  4701 17                 RETC,UN
4659  4722                  *
4660  4702 02           KBPUF  RES        1
4661  4723                  *
4662  4703 3F 72        GETKB  BSTR,UN    PAUSE
4663  4725 3F 45 8D           BSTA,UN    WRT
4664  4728 0E 78              LODR,R0    KBPUF
4665  472A 17                 RETC,UN
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LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE    OPERAND   COMMENTS

4666  472B                  *
4667  472B 36 AC        HEXTAB ACON       HXTBL
4668  472D 02 00        HEXSTG RES        2
4669  472F                  *
4670  472F 04 47        HEXIN  LODI,R0    'HEXSTG
4671  4711 05 0D              LODI,R1    HEXSTG
4672  4713 06 02              LODI,R2    2
4673  4715 3F 4F 67           BSTA,UN    ARROW
4674  4718 1F 42 90           BCTA,LT    DOOMD
4675  471B 0C 07 0D           LODA,R0    HEXSTG
4676  471E 3F 47 8C           BSTA,UN    LTOU
4677  4721 3F 47 6E           BSTA,UN    OKHEX
4678  4724 16                 RETC,LT
4679  4725 15                 RETC,GT
4680  4726 3E 1E              BSTR,UN    MHEX
4681  4728 03                 LODZ,R3
4682  4729 01                 STRZ,R1
4683  472A 0C 07 2E           LODA,R0    HEXSTG+1
4684  472D 9E 04              BCFR,EQ    HEXIN2
4685  472F 03                 LODZ,R3
4686  4730 75 C0              CPSL       C0
4687  4732 17                 RETC,UN
4688  4733 3F 47 8C     HEXIN2 BSTA,UN    LTOU
4689  4736 3F 47 6E           BSTA,UN    OKHEX
4690  4739 16                 RETC,LT
4691  473A 15                 RETC,GT
4692  473B 3E 29              BSTR,UN    MHEX
4693  473D D1                 RRL,R1
4694  473E D1                 RRL,R1
4695  473F D1                 RRL,R1
4696  4740 D1                 RRL,R1
4697  4741 01                 LODZ,R1
4698  4742 63                 IORZ,R3
4699  4743 75 C0              CPSL       C0
4700  4745 17                 RETC,UN
4701  4746                  *
4702  4746 07 10        MHEX   LODI,R3    10
4703  4748 CF C7 2B     HEX0   COMA,R3    *HEXTAB,-
4704  474B 14                 RETC,EQ
4705  474C 0B 7A              BRNR,R3    HEX0
4706  474E 17                 RETC,UN
4707  474F                  *
4708  474F C1           HXOT   STRZ,R1
4709  4750 60                 PPSL ,R2
4710  4751 60                 PPSL ,R0
4711  4752 60                 PPSL ,R2
4712  4753 60                 PPSL ,R2
4713  4754 44 0F              ANDI,R0    F
4714  4756 0C E7 0B           LODA,R0    *HEXTAB,I
4715  4759 3F 45 8D           BSTA,UN    WRT
4716  475C 01                 LODZ,R1
4717  475D 44 0F              ANDI,R0    F
4718  475F 0C E7 0E           LODA,R0    *HEXTAB,I
4719  4762 1F 45 8D           BSTA,UN    WRT
4720  4765                  *
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LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

4601  476E F4 30       CKNUM  COMI,R0    '0'
4602  4770 16                 RETC,LT
4603  4771 F4 39              COMI,R0    '9'
4604  4773 15                 RETC,GT
4605  4774 75 C0              CPSL       C0
4606  4776 17                 RETC,UN
4607  4777            *
4608  4777            *
4609  4777            *
4610  4777 3F 47 6E    CKHEX  BSTA,UN    CKNUM
4611  477A 14                 RETC,EQ
4612  477B E4 41              COMI,R0    'A'
4613  477D 15                 RETC,LT
4614  477E F4 46              COMI,R0    'F'
4615  4780 15                 RETC,GT
4616  4781 75 C0              CPSL       C0
4617  4783 17                 RETC,UN
4618  4784            *
4619  4784            *
4620  4784 0F 02 EA    GETCOM LODA,R2    COMPTR
4621  4787 1A 05              BCTR,LT    GETCM2
4622  4789 E6 20              COMI,R2    20
4623  478B 09 02              BCFR,GT    GETCM2
4624  478D 06 20              LODI,R2    20
4625  478F 0E 22 EE    GETCM2 LODA,R2    COMSTG,+
4626  4792 CE 02 EA           STRA,R2    COMPTR
4627  4795 F4 60       LTCU   TMI ,R0    60
4628  4797 16                 RETC,LT
4629  4798 44 5F              ANDI,R0    5F
4630  479A 17                 RETC,UN
4631  479B            *
4632  479B            *
4633  479B 3F 47 7B    GETNUM BSTA,UN    GETCOM
4634  479E F4 20              COMI,R0    ' '
4635  47A0 18 79              BCTR,EQ    GETNUM
4636  47A2 F4 48              COMI,R0    'H'
4637  47A4 18 75              BCTR,EQ    GETNUM
4638  47A6 F4 00              COMI,R0    00
4639  47A8 98 05              BCFR,EQ    GETNM2
4640  47AA 04 FF              LODI,R0    FF
4641  47AC 17                 RETC,UN
4642  47AD            *
4643  47AD            *
4644  47AD 00 00       GETNMS RES        2
4645  47AF            *
4646  47AF            *
4647  47AF 05 00       GETNM2 LODI,R1    0
4648  47B1 07 00              LODI,R3    0
4649  47B3 1F 03              BCTR,UN    GETNM6
4650  47B5 3F 47 7B    GETNM7 BSTA,UN    GETCOM
4651  47B8 3F 47 6E    GETNM6 BSTA,UN    CKHEX
4652  47BB 06 1F              BCFR,EQ    GETNM3
4653  47BD F4 40              COMI,R0    40
4654  47BF 19 04              BCTR,GT    GETNM8
4655  47C1 A4 30              SUBI,R0    '0'
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LINE  ADDR B1 B2 B3 B4 LABEL  OPCODE     OPERAND   COMMENTS

4656  47C3 1F 02              BCTR,UN    GETNM9
4657  47C5 A4 37       GETNM8 SUBI,R0    'A'-A
4658  47C7 47 0F       GETNM9 ANDI,R3    F
4659  47C9 75 01              CPSL       CRY
4660  47CB 77 08              PPSL       WC
4661  47CD D1                 RRL ,R1
4662  47CE D3                 RRL ,R3
4663  47CF D1                 RRL ,R1
4664  47D0 D3                 RRL ,R3
4665  47D1 D1                 RRL ,R1
4666  47D2 D3                 RRL ,R3
4667  47D3 D1                 RRL ,R1
4668  47D4 D3                 RRL ,R3
4669  47D5 81                 ADDI,R1
4670  47D6 C1                 STRZ,R1
4671  47D7 75 08              CPSL       WC
4672  47D9 1F 5A              BCTR,UN    GETNM7
4673  47DB F4 20       GETNM3 COMI,R0    ' '
4674  47DD 98 05              BCFR,EQ    GETNM4
4675  47DF 3F 47 7B           BSTA,UN    GETCOM
4676  47E2 1F 77              BCTR,UN    GETNM3
4677  47E4 03          GETNM4 LODZ,R3
4678  47E5 07 00              LODI,R3    0
4679  47E7 17                 RETC,UN
4680  47E8            *
4681  47E8            *
4682  47E8            NBUFF  RES        102
4683  484A 00 00 00 00 MBUFF RES        8A
4684  484E 00 00 00 00
4685  4852 00 00 00 00
4686  4856 00 00 00 00
4687  485A 00 00 00 00
4688  485E 00 00 00 00
4689  4862 00 00 00 00
4690  4866 00 00 00 00
4691  486A 00 00 00 00
4692  486E 00 00 00 00
4693  4872 00 00 00 00
4694  4876 00 00 00 00
4695  487A 00 00 00 00
4696  487E 00 00 00 00
4697  4882 00 00 00 00
4698  4886 00 00 00 00
4699  488A 00 00 00 00
4700  488E 00 00 00 00
4701  4892 00 00 00 00
4702  4896 00 00 00 00
4703  489A 00 00 00 00
4704  489E 00 00 00 00
4705  48A2 00 00 00 00
4706  48A6 00 00 00 00
4707  48AA 00 00 00 00
4708  48AE 00 00 00 00
4709  48B2 00 00 00 00
4710  48B6 00 00 00 00
4711  48BA 00 00 00 00
4712  48BE 00 00 00 00
4713  48C2 00 00 00 00
4714  48C6 00 00 00 00
4715  48CA 00 00 00 00
4716  48CE 00 00 00 00
4717  48D2 00 00 00 00
4718  48D6 00 00 00 00
4719  48DA 00 00 00 00
4720  48DE 00 00 00 00
4721  48E2 00 00 00 00
4722  48E6 00 00 00 00
4723  48EA 00 00 00 00
4724  48EE 00 00 00 00
4725  48F2 00 00 00 00
4726  48F6 00 00 00 00
4727  48FA 00 00 00 00
4728  48FE 00 00 00 00
4729  4902 00 00 00 00
4730  4906 00 00 00 00

                                  ****LAST ADDRESS USED:  496A****
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