



PERMANENT
MEMORANDUM

M -1117
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SUBJECT TC-FRAP (Type Controlled - FRAP)
TO PDP Distribution List

ABSTRACT A provision for preparing symbolic programs via the on-line typewriter. A read-in mode tape will be punched by the FRAP assembler by giving a command from the typewriter after a symbolic program has been completed. Errors may be corrected while typing the symbolic program by typing a set chain of commands. Errors can be corrected before or after a first pass through the FRAP assembler.

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APPROVED BY

AREA: All memory except 3000 - 4000

START: 6201 or 1201

OPERATING INSTRUCTIONS:

Complete control of the FRAP assembler is maintained by the typewriter with the exceptions that origin statements may be set by the test word switches provided Sense Switch 1 is on.

To begin, read in TC-FRAP. When the tape has finished reading in, press "b" on the typewriter. The computer will type a carriage return and wait for symbolic type-in. While typing a symbolic program, one must follow the rules mentioned in the FRAP memo. Should a mistake be made during type-in, it may be corrected by first typing "3 spaces, a back space" and then a "carriage return". The computer then types out all symbols within the first statement of the operators program. The operator now has the option of typing a "carriage return" or "C". Typing a carriage return allows the computer to type out the second line of symbols, another carriage return the third line, etc. Typing a "C" puts the operator back in control of symbolic type-in. Normally, after typing a "C" the next character typed is a carriage return. Once a "C" has been typed all statements beyond that point will be destroyed.

Upon completing type-in of the program, type "3 spaces, back space" and then "F". This puts the operator into a Main Control loop of the FRAP assembler.

MAIN CONTROL:

1. Press T, for a complete type-out of the operators symbolic program. This can only be done before a second pass in FRAP.
2. Press E, should an error be found upon completion of typing in a program of first pass. This gives the operator the option of either typing a carriage return or pressing C. If a C is pressed, the same procedure must be followed as mentioned previously. If a carriage return is typed, the operator may scan through to the end of his program by typing consecutive carriage returns. The computer recognizes the end (not the statement "end") of the operators program and transfers him to the control loop for symbolic entry.

Additional statements to the existing program may be entered at this time or the operator can type 3 spaces, a back space, and an F which puts him back in the Main Control loop.

3. Pressing L, has the same features as Sense Switch 2 mentioned in the FRAP memo.
4. Pressing B, has the same features as Sense Switch 3 mentioned in the FRAP memo.
5. Pressing S, has the same features as Sense Switch 6 mentioned in the FRAP memo.
6. To initiate "0" or "first" pass through the FRAP assembler, type a "1". All L's, B's, and/or S's are destroyed upon completion of the "0" or "first" pass in the FRAP assembler.
7. Type in all the options desired (L, B, or S) then type a "2" to initiate the second pass. Upon completion of the second pass, the symbolic program previously typed in is destroyed.
8. Typing C, clears the operators program out of the table area. C clears the table only when pressed in the Main Control loop, otherwise, it is used for clearing out errors beyond a given point in a program.
9. By pressing X, the operator leaves the type control loop for FRAP and enters into a new type control called TYC.

TYC, STARTING ADDRESS 1201

1. Pressing W, "Where are we" tells the operator what register TYC is presently looking at, which may be from octal register 1 - 7777.
2. Typing T, will give an octal type out of the contents of whatever register the TYC program is presently looking at.
3. Pressing I, indexes the present address by one.
4. Pressing A, followed by an address makes TYC look at that address but no type-out will occur.

5. Typing F, followed by an address and six octal numbers means "starting at that address typed, find a number identical to the six octal numbers typed after the address". TYC will then scan the memory for a word identical to those six octal numbers and if a word or group of words are found then each address is typed out along with its contents.
6. Typing E, followed by six octal numbers means execute the following instruction, the instruction being the six numbers.
7. After a register has been found and the contents typed out, it may be desired to change the contents of this register. Typing a C and then six octal numbers allows the operator to change the contents of the register.
8. Typing Q, clears the contents of memory from registers 4000 - 5000.
9. Pressing R, puts the operator back to the Main Control program for FRAP assembly.

NOTES:

Due to a change in the keyboard, the following corrections are made. An upper case "x" (times sign) lower case is the same as an upper case "¢" lower case. A "=" (equal sign) is used instead of a minus sign, "-". A "-" is used instead of an ampersand, &. An upper case "'" lower case takes the place of upper case * lower case.

Register 1464 is used in conjunction with the TYC program. This register is normally octal 7777, but to find six octal numbers, one must change it to 777777.

Memory location 3000 - 5000 may be used without destroying the FRAP assembler or type control programs. Locations 4000 - 5000 are used for table area by the Type Control FRAP. There is enough room in table area to type in 1500 characters.

TYC was provided for the programmer for debugging purposes. After the operator has read a program into memory and wishes to correct contents of registers, he may do so by the use of TYC.

Type Control FRAP was originally intended for use with the DEC Data-Phone. A programmer in California can type-in a symbolic program and have it assembled in Maynard by the PDP-1 Computer. During the assembly of the program, the programmer receives an octal and symbolic listing back in California. After the assembly has completed, an operator standing by the PDP-1 reads in the FRAP tape produced by the computer via the California typewriter. From that point on the programmer in California takes command of the computer provided the controlling program is sophisticated enough.

The TC-FRAP has proven very useful for debugging large symbolic programs. By making small symbolic corrections, the programmer has references in symbology rather than a list of octal numbers stating corrections. When a program has been set aside for any large length of time, the octal corrections have a tendency to loose their meaning where symbolic corrections can always be written to retain self definition.

EXAMPLES:

After starting at register 6201, type:

```
b                                     ,computer types carriage return
,enter in symbolic program
,example program
org 3000
start      lac a
           add b
           dap c (mistake)           ,type 3 spaces back space &
                                     ,carriage return

org 3000                                     ,computer types this
                                     ,type another carriage return
start      lac a                           ,computer type this
           add b c                         ,type carriage return
                                     ,computer types this
           dac c                           ,type c to correct next state-
                                     ,ment
           hlt                             ,operator types this

a          2
b          2
c          0
end                                     ,all programs must be terminated
                                     ,with an "end" statement
                                     ,type 3 spaces back space
f                                     ,f puts operator in Main Control
```

If one wished to type in additional statements at this time or after a first pass, it is possible by typing "e". The computer types out statements while the programmer types carriage returns. Before the end statement is reached, the operator must type c to make the program changes. FRAP will not recognize any statements after an end statement.

Example

```
org 3000
start    lac a
         -----
         -----
         -----
         -----
         -----
         -----
c        oc
org 3500
begin    jmp load
cow      400
barn     0
load     lac cow
         dac barn
         jmp start
jmp start end f
```

} this part of program not to
be changed

,operator types c and carriage return
,new program is entered

,type 3 spaces back space and f

After typing f, the programmer is in control of the nine features of Main Control.