fig-FORTH FOR ALPHA MICRO

ASSEMBLY SOURCE LISTING

RELEASE 1

WITH COMPILER SECURITY

AND

VARIABLE LENGTH NAMES

SEPT 1980

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MACRO ASSEMBLY LISTING

; **********************************************************************
; uA/FORTH V 3.2 INTRODUCTION SEPTEMBER 1980
; **********************************************************************

THIS MODEL OF FORTH WAS ORIGINALLY DEVELOPED BY THE
FORTH INTEREST GROUP / FORTH IMPLEMENTATION TEAM
P.O. BOX 1105
SAN CARLOS, CA 94070

IMPLEMENTED FOR THE ALPHA-MICRO BY:

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OF uA/FORTH.

THE FORTH INTEREST GROUP / FORTH IMPLEMENTATION TEAM
HAVE ALSO DEVELOPED NEARLY IDENTICAL VERSIONS OF THIS
SYSTEM FOR THE:

PDP-11  9900  8080  6800
6809  6502  PACE  ALPHA-MICRO

THIS VERSION FOR THE ALPHA-MICRO IS BASED ON THE SYSTEM
IMPLEMENTED FOR THE PDP-11 BY JOHN S. JAMES.

FOR MORE INFORMATION, WRITE:

FORTH INTEREST GROUP
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SAN CARLOS, CA 94070

'ALPHA-MICRO' AND 'AMOS' ARE TRADEMARKS OF ALPHA MICROSYSTEMS
'PDP' IS A TRADEMARK OF DIGITAL EQUIPMENT CORPORATION.
MACRO ASSEMBLY LISTING

uA/FORTH HAS
- FULL LENGTH NAMES (UP TO 31 CHARACTERS)
- EXTENSIVE COMPILATE-CHECKS AND ERROR MESSAGES
- A FORTH ASSEMBLER, PERMITTING STRUCTURED, INTERACTIVE
  DEVELOPMENT OF DEVICE HANDLERS, SPEED-CRITICAL
  ROUTINES, AND LINKAGE TO OPERATING SYSTEMS OR TO
  SUBROUTINE PACKAGES WRITTEN IN OTHER LANGUAGES.
- STRING-HANDLING ROUTINES
- A STRING-SEARCH EDITOR
- LINKED VOCABULARIES
- HOOKS FOR MULTI USER/MULTI-TASKING (CURRENTLY SINGLE TASK)
- AND CAN BE CONFIGURED TO RUN IN A 16K BYTE PARTITION
  (THIS INCLUDES BUFFERS AND ROOM FOR SUBSTANTIAL
  ADDITIONAL FORTH PROGRAMMING) ON AN ALPHA-MICRO RUNNING
  AMOS.

IT IS ALIGNED WITH THE 1978 STANDARD OF THE FORTH INTERNATIONAL
STANDARDS TEAM.

RECOMMENDED DOCUMENTATION:
- A FORTH LANGUAGE MANUAL. WE PARTICULARLY RECOMMEND EITHER
  (A) 'USING FORTH', BY FORTH, INC.
  OR
  (B) 'A FORTH PRIMER', BY W. RICHARD STEVENS, KITT
  PEAK NATIONAL OBSERVATORY.
  EITHER IS AVAILABLE THROUGH THE FORTH INTEREST GROUP,
  P.O. BOX 1105, SAN CARLOS, CA 94070.
- PDP-11 FORTH USER'S GUIDE, AVAILABLE FROM
  PROFESSIONAL MANAGEMENT SERVICES OR
  FROM JOHN S. JAMES, BOX 348, BERKELEY, CA 94701
- FORTH REFERENCE CARD FOR THE FORTH IMPLEMENTATION TEAM
  COMMON MODEL, AVAILABLE FROM FIG.
- 'FIG-FORTH INSTALLATION MANUAL', ALSO FROM FIG.
BRINGING UP THE SYSTEM

TO RUN:
- uA/FORTH is distributed with the system in account [170,10]. Log into [170,10] and type 'AFORTH'. uA/FORTH should come up and type 'uA/FORTH V 3.2 '.
- Make a copy of the account. Protect against accidentally erasing the system or the source programs.
- As provided, the file 'FORTH.SCR' contains forth screens 1-128. FORTH.SCR is a contiguous file.
- If you want to re-assemble the system (which most users would never find necessary), you must edit and macro 'AFORTH.MAC'.
- Advanced users may note that this system is designed to allow the memory layout—number and location of disk buffers, location of the stack, etc.—to be changed dynamically, without reassembly.
- Test that it is up by trying some arithmetic or definitions, e.g., 88 88 *.
  : SQUARE DUP * ; (Note that the '.' means print)
  25 SQUARE .
  Or type 'VLIST' for a list of all the forth operations in the dictionary.
- Test the disk by typing
  1 LIST
  which should list the screen which loads the editor, assembler, and string routines.
- Incidentally, 'FORTH.SCR' is the system's 'virtual memory' file, used for disk I/O. The rest of the system (this program alone) can run independently, even if 'FORTH.SCR' is not available.

The system as supplied reserves 10000 bytes for your forth programming and stack. This is enough for substantial projects. (Note that the editor, assembler, and string package, if loaded, use more than 6k of this.) To change this memory size, change the '10000.' which is in the lines following the label 'XDP:', near the end of this program. Incidentally, very few jobs (e.g., recursion) will ever use more than 100 words of this space for the stack; the rest of the space is available for a string stack (if used) or for your programs—and forth object code is considerably more compact than assembly.

The forth contiguous file 'FORTH.SCR' is used for storing source programs (or data). This file has 128 1-K screens (1-128), i.e., 256 disk blocks. Screens 4 and 5 are used by the system for storing error and warning messages. Screens 6-32 contain a text editor, assembler, string package, and miscellaneous examples. The text editor, string package, and the miscellaneous examples are in the public domain, while the assembler is copyright. Users may want to save their source programs and data in the blank screens.

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VARIATIONS FROM F.I.G. MODEL

FIRST' AND 'LIMIT' HAVE BEEN MADE USER VARIABLES, NOT CONSTANTS. THEREFORE WHEN THEY ARE USED, 'FIRST @' AND 'LIMIT @' ARE REQUIRED.

"TERMINAL" IS TRIGGERED BY CNTL-C.

'EXPECT' OPERATES UNDER CONTROL OF AMOS. THIS PROVIDES FAMILIAR TYPING CONVENTIONS AND AVOIDS SWAPPING DELAYS. NOTE THAT 'KEY' WILL ACCEPT ALL CONTROL CHARACTERS. APPLICATIONS REQUIRING THAT 'EXPECT' ACCEPT CONTROL CHARACTERS SHOULD FIRST LOAD THE 'EXPECT' PROVIDED ON SCREEN 33 OF FORTH.SCR.

IMPLEMENTATION NOTES

CODE ROUTINES CAN USE REGISTERS 0, 1, AND 2 WITHOUT RESTORING THEM.

IMPLEMENTATION FOR THE ALPHA-MICRO RUNNING UNDER AMOS REQUIRES THAT CODE BE RELOCATABLE. uA/FORTH ACHIEVES THIS REQUIREMENT BY A BOOT-UP CODE OVERLAYED IN THE DICTIONARY SPACE. THIS CODE RELOCATES THE CFA, LFA, DOCOLON PARAMETERS, VOCABULARY STRUCTURE, AND START-UP TABLE ADDRESSES. AS ALL ADDRESSES ARE RELOCATED, THE RELOCATION BECOMES TRANSPARENT TO FIG-FORTH APPLICATION PROGRAMS FROM OTHER SOURCES AND COMPUTERS.

uA/FORTH CAN BE LOADED INTO USER MEMORY. WHEN FIRST RUN ALL APPROPRIATE ADDRESSES ARE RELOCATED. THE USER CAN EXIT TO MONITOR AND RETURN TO uA/FORTH WITHOUT LOSING THE DICTIONARY ENTRIES. WHEN uA/FORTH IS RERUN, THE RELOCATION CODE IS BYPASSED AND A WARM START ("ABORT") FOLLOWS. SAVING OF RELOCATED CODE ONTO DISK SHOULD BE DONE ONLY WITH UNDERSTANDING AND IS NOT RECOMMENDED AS SUCH CODE CAN BE RERUN AGAIN ONLY AT THE MEMORY BASE AT WHICH IT WAS FIRST RELOCATED. (USUALLY ONLY UNDER THE SAME SYSTEM.INI AND WITHIN THE SAME JOB.) IF SUCH A RELOCATED CODE IS RELOADED AND RUN AT A DIFFERENT MEMORY BASE uA/FORTH WILL RESPOND 'INVALID MEMORY BASE' AND RETURN TO MONITOR.

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SET UP REGISTERS AND MACROS.

COPY DSK0:SYS.MAC[7,7]

W=R2 ; TEMPORARY USED BY 'NEXT' MACRO (THE INNER INTERPRETER)
U=R3 ; POINTER TO THE USER AREA
IP=R4 ; FORTH INSTRUCTION COUNTER
S=R5 ; FORTH STACK POINTER
RP=SP ; FORTH RETURN-STACK POINTER

MACRO DEFINITIONS

THE 'HEAD' MACRO CREATES A FORTH DICTIONARY HEADER. ITS ARGUMENTS ARE:
(1) LENGTH BYTE--THE LENGTH OF THE NAME BEING DEFINED. THE SIGN BIT
OF THE LENGTH BYTE MUST BE SET, SO THAT THE SYSTEM WILL RECOGNIZE
THE END OF A VARIABLE-LENGTH NAME FIELD; THEREFORE, THE LENGTH BYTE
IS GIVEN AS 200 OCTAL PLUS THE LENGTH. IF THE OPERATION IS
IMMEDIATE, THE BIT NEXT TO THE SIGN BIT IS ALSO SET, SO THE LENGTH
BYTE IS GIVEN AS 300 OCTAL PLUS THE LENGTH.
(2) NAME--THE NAME OF THE OPERATION BEING DEFINED, LESS THE LAST CHARACTER
IF THE NAME IS AN ODD LENGTH.
(3) LCHAR--THE ASCII VALUE OF THE LAST CHARACTER OF THE NAME, WITH THE
SIGN BIT SET. THE NAME FIELD MUST HAVE AN EVEN LENGTH (INCLUDING
THE LENGTH BYTE), SO IF THE NUMBER OF CHARACTERS IN THE NAME IS
EVEN, 'LCHAR' WILL BE GIVEN AS 240 (200 PLUS CODE FOR A SPACE).
(4) LABEL--THE ASSEMBLY-LANGUAGE LABEL ASSOCIATED WITH THE 'CODE FIELD'
OF THIS DICTIONARY HEADER. THESE LABELS ARE USED IN THE PRECOMPILED-
FORTH SECTION OF THE SYSTEM. WHEN POSSIBLE, THE FORTH OPERATION
NAME ITSELF IS USED AT THE ASSEMBLY LABEL; OTHERWISE AN ABBREVIATION
IS USED. BY CONVENTION, THESE NAMES ARE LIMITED TO FIVE CHARACTERS,
FOR CONSISTENCY AMONG VARIOUS ASSEMBLERS FOR DIFFERENT MICROPROCESSORS.
(THE FORTH IMPLEMENTATION TEAM USES THE SAME LABELS IN ALL OF ITS
VERSIONS).
(5) CODE--POINTER TO THE MACHINE-LANGUAGE "CODE ROUTINE" ASSOCIATED
WITH THIS OPERATION TYPE OR DATA TYPE. E.G., FOR ANY COLON DEFINITION,
THIS ARGUMENT IS 'DOCOL', THE LABEL OF A FOUR-INSTRUCTION ASSEMBLY
ROUTINE WHICH USES THE RETURN STACK TO HANDLE THE NESTED EXECUTION
OF ANOTHER LEVEL OF FORTH OPERATIONS. FOR ANY CONSTANT, THIS CODE
ROUTINE IS 'DOCON', AND SIMILARLY FOR ALL OTHER DATA TYPES.
THE CODE ARGUMENT MAY BE OMITTED. IN THAT CASE, THE 'HEAD'
MACRO LEAVES THE CODE FIELD POINTING TWO BYTES BEYOND ITSELF, WHERE
MACHINE-LANGUAGE CODE MUST BEGIN--AND THE OPERATION SO DEFINED IS
CALLED A "PRIMITIVE". THE "NUCLEUS SECTION" OF THIS VERSION OF
FORTH CONTAINS ABOUT 45 PRIMITIVES, FROM WHICH THE WHOLE SYSTEM
IS BUILT; IN EFFECT, THESE PRIMITIVES DEFINE THE VIRTUAL FORTH
MACHINE. (A FEW OPERATIONS IN THE "PRECOMPILED FORTH" SECTION
OF THE SYSTEM HAVE BEEN REPLACED WITH PRIMITIVES, TO OPTIMIZE
EXECUTION SPEED. AND WHEN A FORTH ASSEMBLER IS ADDED TO THIS
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MACRO ASSEMBLY LISTING

SYSTEM, USERS WILL BE ABLE TO DEFINE THEIR OWN PRIMITIVES DIRECTLY IN FORTH, IMMEDIATELY READY FOR EXECUTION.)

MACRO PARAMETERS DO NOT PASS CHARACTERS ',' AND '<'. THE NEXT FOUR ARGUMENTS PASS THIS INFORMATION.

(6) IF DEFINED, THE LAST CHARACTER IS '<'.
(7) IF DEFINED, THE FIRST CHARACTER IS '<'.
(8) IF DEFINED, THE FIRST CHARACTER IS ';'.
(9) IF DEFINED, THE FIRST TWO CHARACTERS ARE '('.

THE 'HEAD' MACRO CREATES A FORTH HEADER CONSISTING OF LENGTH BYTE--SIGN BIT SET NAME OF THE OPERATION--VARIABLE LENGTH--SIGN BIT SET ON LAST CHAR. LINK FIELD, WHICH POINTS TO THE BEGINNING OF THE PREVIOUS DICTIONARY HEADER (USED AT Compile TIME) CODE POINTER.

LINK=0 ; LAST LINK FIELD IS 0, INDICATING END OF THE DICTIONARY.
LINK2=.

DEFINE HEAD LENGTH,NAME,LCHAR,LABEL,CODE,LT1,LT2,LT3,LT4

LINK=LINK2 LABEL: IF NB,CODE WORD CODE IFF WORD .+2 ENDC ENDM

THE 'NEXT' MACRO TRANSFERS CONTROL FROM ONE FORTH OPERATON TO THE 'CODE ROUTINE' OF THE NEXT. NOTICE THAT ONLY TWO INSTRUCTION EXECUTIONS ARE REQUIRED TO TRANSFER CONTROL FROM USEFUL OPERATIONS OF ONE FORTH PRIMITIVE TO THOSE OF THE NEXT.

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DEFINE NEXT
MOV (LP)+, W
JMP @(W)+
ENDM

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START-UP TABLE

; AT STARTUP, MOST OF THESE VALUES ARE MOVED INTO THE USER AREA
; (LOCATED AFTER XDP:); THEY ARE NORMALLY ACCESSED THERE. THE VALUES
; HERE ARE NOT USUALLY CHANGED, BUT THEY MAY BE CHANGED, E.G., TO
; CONTROL WHAT HAPPENS AT COLD START.

ORIGIN: JMP RETLOC
; GOTO RELOCATION CODE, REPLACE THIS JUMP
; WITH NULLS FOR WARM START FROM MONITOR.

; IN OTHER SYSTEMS THIS IS JUMP TO COLD (JMP CENT)
JMP WENT
; WARM START ENTRY ADDRESS

; NOTE--COLD START WIPES OUT ANY NEW DICTIONARY DEFINITIONS, AND
; THEN DOES A WARM START. WARM START CLEANS UP STACKS, TERMINAL
; BUFFER, ETC.

; MEMORY LOCATION

WORD 1600  ; CPU
WORD 21   ; REVISION
WORD TASK-10 ; POINTER TO LATEST WORD DEFINED
WORD 177  ; DEL CHARACTER
WORD XUP  ; POINTER TO USER AREA

; NOTE--THE USER AREA IS A HOOK IN THIS SYSTEM TO ALLOW MULTITASKING
; TO BE ADDED LATER.

WORD XSO  ; POINTER TO BEGINNING OF THE STACK
WORD XOR  ; POINTER TO BEGINNING OF RETURN STACK
WORD XTB  ; POINTER TO TERMINAL INPUT BUFFER
WORD 37   ; MAXIMUM NAME-FIELD WIDTH, NORMALLY 31
WORD 0    ; WARNING MODE; 0=ERROR #, 1=DISK MESSAGE

; NOTE--WARNING MODE INITIALIZED TO ZERO, IN CASE DISK ISN'T UP.

WORD XDP  ; FENCE TO PROTECT AGAINST ACCIDENTAL
; 'FORGET' OF THE SYSTEM.
WORD XDP  ; POINTER TO NEXT AVAILABLE DICTIONARY
; LOCATION (RETURNED BY 'HERE').

WORD XXVOC ; POINTER TO INITIAL VOCABULARY LINK
WORD DSKBUF ; INITIALIZE 'FIRST'
WORD ENDBUF ; INITIALIZE 'LIMIT'
WORD 0    ; AVAILABLE
WORD 0    ; AVAILABLE
## NUCLEUS

The nucleus contains the primitives from which the system is built.

### MACRO ASSEMBLY LISTING

<table>
<thead>
<tr>
<th>Address</th>
<th>Code</th>
<th>Description</th>
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<td>4389</td>
<td>504F 5259</td>
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<tr>
<td>0038</td>
<td>0046</td>
<td>000D</td>
</tr>
<tr>
<td>003C</td>
<td>0046</td>
<td>4309 504F</td>
</tr>
<tr>
<td>0062</td>
<td>0046</td>
<td>0909 4C41</td>
</tr>
<tr>
<td>007C</td>
<td>0046</td>
<td>4B54 2045</td>
</tr>
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<td>00BA</td>
<td>0046</td>
<td>4B54 2045</td>
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<td>73DA</td>
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<td>4558 5543</td>
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<td>0136</td>
<td>73DA</td>
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<td>4286</td>
<td>4152 434E</td>
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<tr>
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<td>3087</td>
<td>5242 4841</td>
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<td>93B6</td>
<td>0002</td>
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<td>0178</td>
<td>8003</td>
<td></td>
</tr>
</tbody>
</table>

The nucleus contains the primitives from which the system is built.

- **HEAD 211, COPYRIGHT, 324, COPYRIGHT**
- **TYPESCR**
- **TYPESCR <COPYRIGHT 1980 ROBERT BERKEY>**
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- **TYPESCR <THE SOFTWARE, PROGRAMS, AND DOCUMENTS CONTAINED HERIN ARE>**
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- **TYPESCR <LIABILITY LIMITED TO PURCHASE PRICE.>**

THE NUCLEUS CONTAINS THE PRIMITIVES FROM WHICH THE SYSTEM IS BUILT.

- **HEAD 203, LI, 324, LIT**
  - USED ONLY BY COMPILER. PUSH FOLLOWING LITERAL ONTO STACK.
  - **MOV (IP)+, - (S)**
  - NEXT

- **HEAD 207, EXECUT, 305, EXEC**
  - EXECUTE FORTH WORD WHOSE CODE ADDRESS IS ON STACK
  - **MOV (S)+, W**
  - **JMP @(W)+**

- **HEAD 206, BRANCH, 240, BRANCH**
  - USED ONLY BY COMPILER. FORTH BRANCH TO ADDRESS WHICH FOLLOWS.
  - **ADD (IP), IP**
  - NEXT

- **HEAD 207, 0BRANC, 310, 2BRANC**
  - USED ONLY BY COMPILER. FORTH BRANCH IF TOP OF STACK
  - IS ZERO (FALSE).
  - **TST (S)+**
  - **BNE A3$**
  - **ADD (IP), IP**
  - NEXT
  - **A3$: ADDI 2, IP**
  - NEXT

- **HEAD 206, (LOOP), 240, XLOOP**
  - USED ONLY BY COMPILER. INCREMENT LOOF INDEX BY 1, BRANCH
  - IF INDEX BELOW LIMIT.
  - **INC (RP)**
  - **CMP (RP), 2 (RP)**
  - **BPL B2$**

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B1$: ADD (IP),IP

B2$: ADDI 4,RP ;TERMINATE LOOP

NEXT

B2$: ADDI 4,RP

ADDI 2,IP

NEXT

HEAD 207, (+LOOP, 251, XPLOO)

; ***** (+LOOP)

; USED ONLY BY COMPILER. INCREMENT LOOP INDEX BY TOP OF STACK,

; MAYBE BRANCH.

r

0188 2887 4C2B 4F4F

HEAD 207, (+LOOP, 251, XPLOO)

; ***** (+LOOP)

; USED ONLY BY COMPILER. INCREMENT LOOP INDEX BY TOP OF STACK,

; MAYBE BRANCH.

0194 134E

ADD (S), (RP)

0196 0A95

TST (S)+

0198 0506

BLE C1$ ;POSITIVE INCREMENT

019A 93B6 0002

CMP (RP)+,2(RP)

019E 8009

BPL C2$ ;NEGATIVE INCREMENT

01A0 1304

ADD (IP),IP

01A2 B502 73DA

NEXT

01A6 9D8E 0002

C1$: CMP 2(RP), (RP)

01AA 8003

BPL C2$

01AC 1304

ADD (IP),IP

01AE B502 73DA

NEXT

C2$: ADDI 4,RP ;TERMINATE LOOP

01B2 0983

01B4 0901

01B6 B502 73DA

NEXT

C2$: ADDI 4,RP

01BA 2884 4F44 A029

HEAD 204,(DO),240,XDO

; ***** (DO)

01C4 BD66 0002

MOV 2(S), -(RP) ;PUT LIMIT ON RETURN STACK

01C8 B366

MOV (S), -(RP) ;PUT INDEX ON RETURN STACK

01CA 0943

ADDI 4,S

01CC B502 73DA

NEXT

01D0 C981 01BA 01D6

; RETURN CURRENT LOOP INDEX TO STACK.

; ***** I

01D6 B3A5

MOV (RP), -(S)

01DA B502 73DA

NEXT

01DC 4485 4749 D449

HEAD 205, DIGI, 324, DIGIT

; ***** DIGIT

01E6 25F5 0030 0002

01EC 9D57 0002 0009

01F2 0707

01F4 25F5 0007 0002

01FA 9D57 0002 000A

0200 050A

0202 0A85 0002

0206 0507

0208 9D4D 0002

020C 0404

020E B5CD 0001

0212 B502 73DA

NEXT

0216 0941

D2$: ADD 2,S

uA/FORTH [170,10]

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CLR (S); ERROR -- RETURN '0' FLAG

NEXT

HEAD 206, (FIND), 240, PFIND

; USED BY COMPILER. FIND A WORD IN THE DICTIONARY.
; (STRING-ADDRESS NFA => PFA LENGTH TRUE (OR FALSE)).
; STRING-ADDRESS IS ADDRESS OF THE LENGTH BYTE OF THE
; STRING BEING SOUGHT. NFA IS NAME-FIELD ADDRESS OF
; WORD IN DICTIONARY WHERE SEARCH BEGINS. PFA IS
; PARAMETER-FIELD ADDRESS OF THE DICTIONARY ENTRY
; WHICH IS FOUND. IF WORD NOT FOUND, ONLY ONE RESULT
; (0, FALSE) IS RETURNED.

SETUP -- GET ARCS, PRESERVE NEEDED REGISTERS

MOV (S)+, RO ; DICTIONARY ADDRESS
MOV (S)+, R1 ; STRING ADDRESS
MOV R5, -(RP) ; PRESERVE REGISTERS
MOV R3, -(RP)
CLR -(RP) ; SPACE TO STORE LENGTH BYTE

PREPARE R2 FOR FAST COMPARE

MOV (R1), R2
BIC #100200, R2

FCOMP:

; FAST TEST TO ELIMINATE MOST WORDS
; COMPARE FIRST WORD TO SPECIALY PREPARED R2
; THEN INCREMENT TO FIND END OF NAME.
FAST: MOV (R0), R3
BIC #100300, R3
CMP R2, R3
BEQ NOFAST ; NO FAST ELIMINATION POSSIBLE
XMATCH: TST (R0) ; NO MATCH THIS TIME
BPL XMATCH

NOFAST: MOV (RO), RP ; SAVE LENGTH BYTE
MOV R1, R5
BR NOFST1

 ; NOW DO THE MAIN LOOP TO CHECK FOR MATCH
MLOOP: TST (R5)+
MOI (R5), R4
MOV (R0), R3
BIC #100000, R3
CMP R3, R4
BNE XMATCH

NOFST1: BIT #100000, (R0)+
BEQ MLOOP

; IF GET HERE, FOUND IT.
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026C B582      MOV (RP)+,R2 ; POP AND SAVE LENGTH BYTE
026E B583      MOV (RP)+,R3 ; RESTORE REGISTERS
0270 B584      MOV (RP)+,R4
0272 B585      MOV (RP)+,R5
0274 0B03      ADDI 4,R0
0276 B025      MOV R0,-(S)
0278 45C2 FF00  BIC #177400,R2 ; R2 CONTAINS LENGTH BYTE
027C B0A5      MOV R2,-(S)
027E B585 0001  MOV #1,-(S)
0282 B502 73DA  NEXT
0286 0A96      FAI L E D: TST (RP)+ ; POP LENGTH BYTE
0288 B583      MOV (RP)+,R3 ; RESTORE REGISTERS
028A B584      MOV (RP)+,R4
028C B585      MOV (RP)+,R5
028E 0B65      CLR -(S) ; REPLACE LENGTH BYTE WITH ; FAILURE FLAG.
0290 B502 73DA  NEXT ; WE ARE DONE--FAILURE TO FIND
0294 4587 434E 4F4C
| HEAD 207,ENCLOS,305,ENCL | **** ENCLO SE
| ; USED BY COMPIL ER. BREAK NEXT WORD OUT OF INPUT BUFFER. |
| ; (START-ADDRESS DELIMITER == ADDRESS OFFSET END NEXT-CHARACTER) |
02A0 B340      MOV (S),R0 ; DELIMITER
02A2 B841 0002  MOV 2(S),R1 ; STARTING ADDRESS
02A6 0953      SUBI 4,S ; MAKE SPACE FOR RESULTS
02A8 C440
02AA 03FE      ENC1: CMPB (R1)+,R0 ; MAKE SPACE FOR
02AC 0850      EQ ; SKIP OVER LEADING DELIMITERS
02AE B075 0004  MOV R1,4(S)
02B2 8A89      ENC2: TSTB (R1); TEST FOR NULL
02B4 030F      BEQ ENC4 ; NOT NULL, SO FIND END OF TOKEN
02B6 C440
02BA 02FC      CMPB (R1)+,R0
02BB 0C4E      BNE ENC2
02BC 0850      MOV R1,E(S)
02BE B075 0002  SUBI 1,R1
02C2 8D41 0006  ENC3: MOV R1,2(S) ; FINISH UP AND RETURN
02C6 2D4D 0006  MOV 6(S),R1
02C8 2075 0002  SUB R1,(S)
02CC 2075 0004  SUB R1,2(S)
02D0 B502 73DA  NEXT
02D4 B04D      ENC4: MOV R1,(S) ; HANDLE NULL CASE
02D6 9075 0004  CMP R1,4(S)
02DA 02F1      BNE ENC3
02DC 0840      ADDI 1,R1
02DE 01EF      BR ENC3

; ; THE NEXT 4 HEADERS POINT TO INSTALLATION-DEPENDENT TERMINAL I/O ; ROUTINES.

02F0 4584 494D A054  HEAD 204,EMIT,240,EMIT,PEMIT ; **** EMIT

FORTH INTEREST GROUP POB 1105 SAN CARLOS, CA 94070
<table>
<thead>
<tr>
<th>Offset</th>
<th>Assembly Code</th>
<th>Description</th>
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<tr>
<td>02EA</td>
<td>4B83 D945 02E0</td>
<td>HEAD 203,KE,331,KEY,PKEY</td>
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<tr>
<td>02F2</td>
<td>3F89 4554 4D52</td>
<td>HEAD 211,?TERMINA,314,QTERM,PQTER</td>
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<td>4382 A052 02F2</td>
<td>HEAD 202,CR,240,CR,PCR</td>
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<tr>
<td>0308</td>
<td>4385 4F4D 556</td>
<td>MOVE BYTES IN MEMORY. (FROM N =&gt;)</td>
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<td>0312</td>
<td>B540</td>
<td>MOV (S)+,R0</td>
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<td>0314</td>
<td>0305</td>
<td>BEQ G1S; NO MOVE</td>
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<td>B541</td>
<td>MOV (S)+,R1</td>
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<td>0318</td>
<td>B542</td>
<td>MOV (S)+,R2</td>
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<td>0E91</td>
<td>MBBU R2,R1</td>
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<tr>
<td>0322</td>
<td>B502 73DA</td>
<td>G1S: ADDI 4, S; REMOVE ADDRESSES</td>
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<td>5582 A02A 0308</td>
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<td>71F7 0004</td>
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<td>MOV 4(S),R0</td>
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<td>DIV R0,(S)+</td>
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<td>MOV R1,2(S)</td>
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<td>0370 4F82 A052 0362</td>
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<td>0378 554D</td>
<td>BIS (S) +, (S)</td>
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<td>037E 5883 D24F 0370</td>
<td>HEAD 203, XOR, 322, XOR</td>
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<td>0386 654D</td>
<td>XOR (S) +, (S)</td>
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<td>MOV S, -(S)</td>
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<td>MOV 6(U), S</td>
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<td>03AA 5283 A150 039A</td>
<td>HEAD 203, RP, 241, RPSTO</td>
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<td>03B2 BDC6 FCS5</td>
<td>MOV ORIGIN+24, RP</td>
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<td>MOV (S) +, -(RP)</td>
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<td>MOV (RP) +, -(S)</td>
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<td>03F6 D281 03E8 03FC</td>
<td>HEAD 201, 322, R</td>
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<td>03FC B3A5</td>
<td>MOV (RP) +, -(S)</td>
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<td>03FE B502 73DA</td>
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<td>0402 3082 A03D 03F6</td>
<td>HEAD 202, 0=, 240, ZEQU</td>
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<td>040A 0A8D</td>
<td>TST (S)</td>
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<td>040C 0303</td>
<td>BEQ 1S</td>
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<td>040E 0B4D</td>
<td>CLR (S)</td>
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<td>0410 B502 73DA</td>
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<td>0414 B5CD 0001</td>
<td>I1$: MOV #1, (S)</td>
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<td>041A B502 73DA</td>
<td>NEXT</td>
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<td>041C 3082 A03C 0402</td>
<td>HEAD 202, 0, 240, ZLESS,</td>
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<tr>
<td>0424 0A8D</td>
<td>TST (S)</td>
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<tr>
<td>0426 8103</td>
<td>BMI 1S</td>
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<tr>
<td>0428 0B4D</td>
<td>CLR (S)</td>
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<tr>
<td>042E B5CD 0001</td>
<td>J1$: MOV #1, (S)</td>
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</table>

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MACRO ASSEMBLY LISTING

NEXT

HEAD 201, 253, PLUS
ADD (S)+, (S)

; ***** +

HEAD 202, D+, 240, DPLUS
; ***** D+

ADD 2(S), 6(S)
ADD LOW
ADC 4(S)
ADDI (S), 4(S)
ADDI 4, 5

ADDI 4, S

HEAD 205, MINU, 323, MINUS
; ***** MINUS

NEG (S)

NEG 2(S)
NEG 2(S)
SBC (S)
NEG (S)

; ***** DMINUS

HEAD 206, DMINUS, 240, DMINU
; CHANGE SIGN OF DOUBLE INTEGER WORD ON STACK.

NEG (S)
NEG 2(S)
SBC (S)
NEG (S)

; ***** OVER

MOV 2(S), -(S)

; ***** DROP

ADDI 2, S

; ***** SWAP

MOV 2(S), R1
MOV (S)+, (S)
MOV R1, -(S)

; ***** SWAP

HEAD 204, SWAP, 240, SWAP

; ***** SWAP

MOV 2(S), R1
MOV (S)+, (S)
MOV R1, -(S)

; ***** SWAP

HEAD 203, DU, 320, DUP

; ***** DUP

MOV (S), -(S)

; ***** DUP

HEAD 202, +!, 240, PSTOR

; ***** +!

ADD NUMBER SECOND ON STACK TO ADDRESS ON TOP.
ADD 2(S), @ (S+)
ADDI 2, S

; ***** TOGGLE

HEAD 205, TOGGLE, 240, TOGGL
; ( BYTE-ADDRESS BIT-PATTERN == ) EXCLUSIVE-OR INTO MEMORY BYTE.

MOV 2(S), R1
XOR (S)+, R1
<table>
<thead>
<tr>
<th>Address</th>
<th>Instruction</th>
<th>Description</th>
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<tbody>
<tr>
<td>04F0</td>
<td>DJD</td>
<td>MOV B1, 73DA</td>
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<td>04F2</td>
<td>B502</td>
<td>NEXT</td>
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<td>04F6</td>
<td>C081</td>
<td>04DE 04FC</td>
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<td>04FC</td>
<td>B765</td>
<td>MOV @S+/-S</td>
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<td>0502</td>
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<td>B04D</td>
<td>MOV R1,R1</td>
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<td>0538</td>
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</table>
PRE-COMPILED FORTH SECTION

NOTE--A FEW OF THE FOLLOWING OPERATIONS HAVE BEEN
CONVERTED TO CODE FOR SPEED. HOWEVER, THE WORD ORDER
IN THE DICTIONARY HAS NOT BEEN CHANGED.

HEAD 301, ,272, COLON, DOCOL
WORD QEXEC, SCSP, CURR, AT, CONT, STORE, CREAT, RBRAC, PSCOD
DOCOL: MOV IP, -(RP)

HEAD 301, ,273, SEMI, DOCOL
WORD QCSP, COMP, SEMIS, SMUDG, LBRAC, SEMIS

HEAD 210, CONSTANT, 240, CON, DOCOL
WORD CREAT, SMUDG, COMMA, PSCOD
DOCON: MOV (W), -(S)

HEAD 210, VARIABLE, 240, VAR, DOCOL
WORD CON, PSCOD
DOVAR: MOV W, -(S)

HEAD 204, USER, 240, USER, DOCOL
CREATE A NEW USER VARIABLE. ( N => ).

HEAD 201, ,260, ZERO, DOCON
WORD 0

HEAD 201, ,261, ONE, DOCON
WORD 1

HEAD 201, ,262, TWO, DOCON
WORD 2

HEAD 201, ,263, THREE, DOCON
WORD 3

CONSTANTS

HEAD 201, ,260, ZERO, DOCON
WORD 0

HEAD 201, ,261, ONE, DOCON
WORD 1

HEAD 201, ,262, TWO, DOCON
WORD 2

HEAD 201, ,263, THREE, DOCON
WORD 3

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MACRO ASSEMBLY LISTING

HEAD 202, BL, 240, BL, DUSE
; BLANK
WORD 40

HEAD 203, C/, 314, CL, DUSE
; # OF CHARACTERS PER LINE
WORD 100

; 'FIRST' AND 'LIMIT' MOVED TO USER AREA

HEAD 205, B/BU, 306, BBUF, DUSE
; BYTES PER DISK-BLOCK BUFFER.
WORD 1024

HEAD 205, B/SC, 322, BSCR, DUSE
; DISK BLOCKS PER FORTH SCREEN.
WORD 1

HEAD 207, +ORIGI, 316, PORIG, DOCOL
; RETURNS ADDRESS, GIVEN OFFSET FROM ORIGIN.
WORD ORIGI, AT, PLUS, SEMIS

USER VARIABLES

HEAD 202, S0, 240, SZERO, DOUSE
; STACK ORIGIN.
WORD 6

HEAD 202, R0, 240, RZERO, DOUSE
; RETURN STACK ORIGIN.
WORD 10

HEAD 203, TI, 302, TIB, DOUSE
; TERMINAL INPUT BUFFER.
WORD 12

HEAD 205, WIDT, 310, WIDTH, DOUSE
; MAXIMUM NAME LENGTH (DEFAULT, 31 CHARACTERS).
WORD 14

HEAD 207, WARNIN, 307, WARN, DOUSE
; WARNING MODE (DEFAULT, GIVE MESSAGE NUMBER AT ERROR)
; OR WARNING CONDITION, DON'T GO TO DISK FOR MESSAGE.
WORD 16

HEAD 205, FENC, 305, FENCE, DOUSE
; PREVENTS 'FORGET' BELOW THIS 'FENCE' SETTING.
WORD 20

HEAD 202, DP, 240, DP, DOUSE
; DICTIONARY POINTER TO NEXT AVAILABLE SPACE.
WORD 22

HEAD 210, VOC-LINK, 240, VOC, DOUSE
; FORTH INTEREST GROUP POB 1105 SAN CARLOS, CA 94070
<table>
<thead>
<tr>
<th>Word</th>
<th>Head</th>
<th>Vocabulary Link</th>
<th>Address of Beginning of Disk Buffer.</th>
<th>Address just beyond end of Disk Buffers.</th>
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MACRO ASSEMBLY LISTING

HEAD 203, CS, 320, CSP, DOUSE
; USED BY COMPILER TO HOLD CURRENT STACK POSITION,
; FOR ERROR CHECKING.
WORD 64

HEAD 202, R#, 240, RNUM, DOUSE
; ***** R#

HEAD 203, HL, 304, HLD, DOUSE
; ***** HLD

POINTS TO LAST CHARACTER HELD IN 'PAD'
WORD 70

HEAD 203, US, 305, USE, DOUSE
; ***** USE

HEAD 204, PREV, 240, PREV, DOUSE
; ***** PREV

HEAD 206, ORIGIN, 240, ORIGI, DOUSE
; ***** ORIGIN

END OF USER AREA

HEAD 202, 1+, 240, ONEP
; ***** 1+
INC (S)

HEAD 202, 2+, 240, TWOP
; ***** 2+
IW2 (S)

HEAD 204, HERE, 240, HERE, DOCOL
; ***** HERE
WORD DP, AT, SEMIS

HEAD 205, ALLO, 324, ALLOT, DOCOL
; ***** ALLOT
WORD DP, PSTOR, SEMIS

HEAD 201, 254, COMMA, DOCOL
; ***** ,
WORD HERE, STORE, TWO, ALLOT, SEMIS

THIS SYSTEM DOES NOT USE 'C,'

HEAD 201, 255, SUB
; ***** -
SUB (S)+, (S)

HEAD 201, 275, EQUAL
; ***** =
CMP (S)+, (S)

BEQ K1S
CLR (S)
BR K2S

END OF USER AREA
MACRO ASSEMBLY LISTING

```
07B4 B5CD 0001  K1$: MOV  $1, (S)
07B8 B502 73DA  K2$: NEXT
07BC BC81 07A5 07C2
07C2 9D55 0002
07C6 0502
07C9 0B4D
07CA 0102
07CC B5CD 0001  L1$: MOV  $1, (S)
07D0 B502 73DA  L2$: NEXT
07D4 BE81 07BC 07DA
07DA 9D55 0002
07DE 0602
07E0 0B4D
07E2 0102
07E4 B5CD 0001  M1$: MOV  $1, (S)
07E8 B502 73DA  M2$: NEXT
07EC 5283 D44F 07D4
07F4 B340
07F6 B44D 0004
07FA BD75 0002 0004
0800 B035 0002
0804 B502 73DA
0808 5385 4150 C543
0812 0120 0020 02E8
081A 2D84 5544 A050
0824 0A8D
0826 0301
0828 B365
082A B502 73DA
082E 5488 4152 4556
083C 04B0
083E 04E8 043A 0120
0850 04B0 04A0 03C0
0856 4C86 5441 5345
0862 06DC 04FA 04FA
```

---

```
FA/FAUTHD [170,10]
086A 4C83 C146 0856
0872 0120 0004 079E
087A 4383 C146 086A
0882 05CC 079E 03C0
```

---

```
FORTH INTEREST GROUP POB 1105 SAN CARLOS, CA 94070
```
THE NEXT 7 OPERATIONS ARE USED BY THE COMPILER, FOR
COMPILE-TIME SYNTAX-ERROR CHECKS.

ALTER LATEST WORD NAME (SO THAT DICTIONARY SEARCH
WON'T FIND A PARTIALLY-COMPLETE ENTRY.

ALTER LATEST WORD NAME (SO THAT DICTIONARY SEARCH
WON'T FIND A PARTIALLY-COMPLETE ENTRY.
MACRO ASSEMBLY LISTING

09C8 0120 000A 06F4 ; WORD LIT,12,BASE,STORE,SEMS
09C9 4F85 5443 CC41 ; HEAD 205,OCTA,314,OCTAL,DOCOL
09CD 0120 0008 06F4 ; HEAD 207,CODE,251,PSCOD,DOCOL,/,LT4
09F2 03EE 0860 08A4 ; USED ONLY BY COMPILER; COMPILED BY 'CODE'.
09FE 3BC5 4F43 C544 ; WORD FROMR,LATES,PPA,CFA,STORE,SEMS
0A08 092C 0964 09F0 ; HEAD 305,COD,305,SEMID,DOCOL,/,LT3
0A14 3C87 5542 4C49 ; CREATE NEW DATA TYPE WITH CODE ROUTINE WRITTEN IN ASSEMBLY.
0A26 4485 454F BE53 ; WORD QCSP,COMP,PSCOD,LBLRAC,SMUDG,SEMS
0A30 03EE 0860 08A4 ; WORD FROMR,LATES,PPA,STORE,SEMS
0A3A B126 ; DODDE: MOV IP,-(RP)
0A3B B4B4 ; MOV (W)+,IP
0A3E B8A5 ; MOV W,-(S)
0A40 B502 73DA ; NEXT
0A44 4385 554F D44E ; HEAD 207,BUILD,323,BUILD,DOCOL,/,LT2
0A58 5484 5059 A045 ; CREATE NEW DATA TYPE WITH CODE ROUTINE IN HIGHER-LEVEL FORTH.
0A5D 0622 0154 0018 ; HEAD 205,DOES,276,DOES,DOCOL
0A70 01D4 0508 02E8 ; ***** DOES>
0A7E 04A0 ; DODDE: MOV IP,-(RP)
0A80 03C0 ; MOV (W)+,IP
0A82 3D86 4543 4C4C ; MOV W,-(S)
0A88 04C4 05C4 0368 ; HEAD 206=CELLS,240,ECELL,DOCOL
0A98 04C4 05BC 01C2 ; ***** =CELLS
0AA6 2089 5254 4941 ; NOTE--NEEDED TO FORCE EVEN ADDRESS.
0AAE 04C4 05BC 01C2 ; WORD DUP,ONE,AND,PLUS,SEMS
0AB6 048E 048E 043A ; HEAD 211,-TRAILIN,307,DTRAI,DOCOL
0AB8 05DE 079E 0154 ; ***** -TRAILING
0AC5 05C4 079E ; WORD OVER,OVER,PLUS,ONE,SUB,CAT
0AC9 0170 PF80 03C0 ; XXW6: WORD BL,SUB,ZBRAN,XXW7-.LEAVE,BRAN,XXWA-.;
0ADD 2882 222E A029 ; XXW7: WORD ONE, SUB
0AEB 03FA 0A4C 04C4 ; WORD XLOOP,XXW6-.SEMS
0AE4 03EE 043A 03E0 ; HEAD 204, (".),240,PDTOT,DOCOL
0AEE 2EC2 A022 0ADD ; ***** (.")

FORTH INTEREST GROUP POB 1105 SAN CARLOS, CA 94070
MACRO ASSEMBLY LISTING

; TYPE ASCII MESSAGE.
; LIT,34.,STATE,AT,ZBRAN,XXL6-.
; COMP,PDTOQ,WORD,HERE,CAT,ONEP,BCELL
; ALLOT,BRN,XXL7-.
; WORD,HERE,COUNT,TYPESEMIS
; XXL6: WORD
; XXL7: WORD

HEAD 206,?ALIGN,240,QLAG,DOCOL ; ***** ?ALIGN

HEAD 206,EXPECTED,240,EXPEC ; ***** EXPECT

READ N CHARACTERS TO MEMORY (AND TERMINATE WITH NULLS).
(Address N =>).

LEAVES INPUT BUFFER INDEX IN R2
RETURNS LINE OF INPUT

MOV (S)+,R0
PUT COUNT IN R0
PUT DEST ADDR IN R1

CTRLC XXK4
CMPB #12,(R2)
IS FIRST CHAR LF?

BEQ XXK3
IF YES FINISH UP

MOVB (R2)+,(R1)+
TEST FOR LF

BEQ XXK 2 QUI T MOVING IF LF FOUND

SOB RO,XXK1

CMPB #15,-1(RL)
TEST FOR CR

BNE XXK 3 REMOVE IT IF FOUND

SUBI 1,R1
AND APPEND NULLS

CLRB (R1)+
NEXT

CLRB (R1)

JOBIDX R0,JOBSTS

BIC #J.CCC,(R0) REMOVE IMPENDING CNTL-C

BR XXK3

HEAD 205,QUER,311,QUERY,DOCOL ; ***** QUERY

WORD TIB,AT,LIT,120,EXPEC,ZERO,IN,STORE,SEMIS

HEAD 301,,200,NULL,DOCOL ; ***** THE NULL

THE NULL OPERATION (ASCII 0) STOPS INTERPRETATION/COMPILATION
AT END OF A TERMINAL INPUT LINE, OR A DISK SCREEN. ALL DISK
BUFFERS MUST TERMINATE WITH NULLS, AND 'EXPECT' PLACES NULLS
AFTER EACH TERMINAL INPUT LINE.

WORD BLK,AT

WORD ZBRAN,XXJ2-,ONE,BLK,PSTOR,ZERO,IN,STORE

WORD BLK,AT,BSCR,MOD,SEQU,ZBRAN,XX1-,QEXEC,FROMR,DROP

WORD BRAN,XXJ4-.

WORD FROMR,DROP

WORD SEMIS

PAGE 024
MACRO ASSEMBLY LISTING

HEAD 204, FILL, 240, FILL, DOCOL
WORD SWAP, TOR, OVER, CSTOR, DUP, ONEP, FROMR
ONE, SUB, CMOVE, SEMIS

HEAD 205, ERAS, 305, ERASE, DOCOL
WORD ZERO, FILL, SEMIS

HEAD 206, BLANKS, 240, BLANK, DOCOL
WORD BL, FILL, SEMIS

HEAD 204, HOLD, 240, HOLD, DOCOL
WORD LIT, -1, HLD, PSTOR, HLD, AT, CSTOR, SEMIS

HEAD 203, PA, 304, PAD, DOCOL
WORD HERE, LIT, 104, PLUS, SEMIS

HEAD 204, WORD, 240, WORD, DOCOL
WORD BLK, AT, ZBRAN, XX1-., BLK, AT, BLOCK, BRAN, XX12-.

HEAD 206, NUMBER, 240, NUMB, DOCOL
WORD ONEP, DUP, TOR, CAT, BASE, AT, DIGIT
XXF3: WORD ZBRAN, XXG4-., SWAP, BASE, AT, USTAR, DROP
WORD ROT, BASE, AT, USTAR, DPLUS
WORD DPLUS, ZBRAN, XXG5-., ONE, DPLUS, PSTOR
DPL, CAT, ZBRAN, XXG5-., ONE, DPLUS, PSTOR
XXF7: WORD DROP, FROMR, ZBRAN, XXFA-., DMINU
XXF6: WORD DROP, FROMR, ZBRAN, XXFA-., DMINU

HEAD 205, -FIN, 304, DFIND, DOCOL
WORD BL, WORD, HERE, COUNT, UPER, HERE, CONT, AT, AT, PFIND
DUP, ZERQ, ZBRAN, XXE3-., DROP, HERE, LATES, PFIND
XXE3: WORD SEMIS

HEAD 205, UPPE, 322, UPPER, DOCOL
WORD OVER, PLUS, SWAP, XDO

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WORD OVER, PLUS, SWAP, XDO

HEAD 206, NUMBER, 240, NUMB, DOCOL
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XXE3: WORD SEMIS

MACRO ASSEMBLY LISTING

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HEAD 206, NUMBER, 240, NUMB, DOCOL
WORD ONEP, DUP, TOR, CAT, BASE, AT, DIGIT
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</table>

**FORTH INTEREST GROUP POB 1105 SAN CARLOS, CA 94070**
MACRO ASSEMBLY LISTING

DF IND

STK TE

LESS

ZBRAN, XXEA-. COMMA, BRAN, XXE6-. CFA, EXEC

HERE, NUMB, DPL, AT, ONEP, ZBRAN, XXF4-, DLITE, BRAN, XXF5-

HERE, VOCL, AT, COMMA, VOCL, STORE

DOVOC: WORD

CONT, AT, CURR, STORE, SEMIS

HEAD 204, QUIT, 240, QUIT, DOCOL

WORD ZERO, BLK, STORE, LBRAC

XXB2: WORD RPSTO, CR, QUERY, INTER, STATE, AT

BYTE 20

ASCII / OK/

EVEN

HEAD 205, ABOR, 324, ABORT, DOCOL

WORD SPSTO, DEC, SPACE

WORD CR, PDOTQ

BYTE 20

ASCII "uA/FORTH V 3.2"

EVEN

WORD FORTH, DEF, QUIT

WORD SEMIS

; ONLY FOR RELOCATION CODE

; COLD AND WARM STARTS

;
### MACRO ASSEMBLY LISTING

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<thead>
<tr>
<th>Offset</th>
<th>Value</th>
<th>Description</th>
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<tbody>
<tr>
<td>0000</td>
<td>0100</td>
<td>MOV ORIGIN+14,FORTH+6; SET 'FORTH' VOCABULARY FROM STARTUP TABLE</td>
</tr>
<tr>
<td>0002</td>
<td>0102</td>
<td>MOV ORIGIN+20,U; INITIALIZE USER POINTER</td>
</tr>
<tr>
<td>0004</td>
<td>0104</td>
<td>CLR (RO)+</td>
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<tr>
<td>0006</td>
<td>0106</td>
<td>CMP R0,R1</td>
</tr>
<tr>
<td>0008</td>
<td>0108</td>
<td>MOV ORIGIN+42,RO; 'FIRST' -- BEGINNING OF DISK BUFFERS</td>
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<tr>
<td>000A</td>
<td>010A</td>
<td>MOV ORIGIN+44,R0; 'LIMIT' -- JUST BEYOND DISK BUFFERS</td>
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<tr>
<td>000C</td>
<td>010C</td>
<td>CLR 42(U); CLEAR 'OUT'</td>
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<td>000E</td>
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<td>CLR 46(U); CLEAR 'OFFSET'</td>
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<td>MOV ORIGIN+42,72(U); TO 'USE'</td>
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<td>MOV ORIGIN+42,74(U); TO 'PREV'</td>
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<td>MOV ORIGIN+42,RO; 'FIRST' -- BEGINNING OF DISK BUFFERS</td>
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<td>MOV ORIGIN+20,U; INITIALIZE USER POINTER</td>
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<td>0017</td>
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<td>CMP R0,76(U); TO 'ORIGIN'</td>
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<td>ADDI 6,R0</td>
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<td>011D</td>
<td>MOV (R5)+(RO)+</td>
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<td>001F</td>
<td>011F</td>
<td>MOV R5,RO; START MOVING FROM HERE</td>
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<tr>
<td>0021</td>
<td>0121</td>
<td>MOV ORIGIN+20,RO; MOVE TO THE USER AREA</td>
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<td>0123</td>
<td>MOV ORIGIN+24,RO; INITIALIZE THE RETURN-STACK POINTER</td>
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</table>

---

**NOTE:**
- **COLD START ENTRY POINT:**
- **WARM START ENTRY POINT:**
- **EXIT:**
- **START MOVING FROM HERE:**
- **MOVE TO THE USER AREA:**
- **START MOVING FROM HERE:**
- **MOVE TO THE USER AREA:**
- **SET TERMINAL STATUS WORD:**
- **BIT 4 = LOWER CASE INPUT OK:**
- **FETCH INDEX TO TERMINAL LINE TABLE:**
- **JOBGET:**
- **SET TERMINAL STATUS WORD:**
- **BIT 4 = LOWER CASE INPUT OK:**
- **FETCH INDEX TO TERMINAL LINE TABLE:**
- **JOBGET:**

---

**FOR FORTH INTEREST GROUP POB 1105 SAN CARLOS, CA 94070**

---

**FOR FORTH INTEREST GROUP POB 1105 SAN CARLOS, CA 94070**
; MACRO ASSEMBLY LISTING
; NOW SET FORTH'S INSTRUCTION COUNTER, AND GO
; LEA IP, ABORT+2 ; START EXECUTION WITH 'ABORT'

1108 7337 FF18
110C B502 73DA

1110 5384 3E2D A044
111A 0A8D
111C 0D65
111E B502 73DA

1112 4183 D342 1110
112A 04C4 0422 0154
1134 03C0
1136 4484 4241 A053
1140 04C4 0422 0154
114A 03C0
114C 4D83 CE49 1136
1154 048E 048E 07D8
1160 04A0 03C0
1164 4D83 D841 114C
116C 048E 048E 07C0
1178 04A0 03C0
117C 4D82 A02A 1164
1184 BD66 0002
1188 8002
118A 0C75 0002
118E 0A8D
1190 8002
1192 0C4E
1196 71F7 F19C
119A 0A96
119C 8003
119E 0C55
11A0 0C4D
11A2 8DE5
11A4 B502 73DA
11A8 4D82 A02F 117C
11B0 BD66 0002
11B4 0201
11B6 0C8E
11B8 03A6
11BA 8008
11BC 0C35 0002

NOTE—THIS SYSTEM DOESN'T NEED THE OPERATIONS '+' AND 'D+',
BECAUSE 'M*' AND 'M/' ARE DEFINED IN CODE.

; HEAD 203, AB, 323, ABS, DOCOL ; ***** ABS
; WORD DUP, ZLESS, ZBRAN, XXR5\-, MINUS
; XXR5: WORD SEMIS
; HEAD 204, S->D, 240, STOD ; ***** S->D
; TST (S)
; SXT -S (S)
; NEXT
; HEAD 204, DABS, 240, DABS, DOCOL ; ***** DABS
; WORD DUP, ZLESS, ZBRAN, XXR-\-, DMINU
; XXR-: WORD SEMIS
; HEAD 203, MI, 316, MIN, DOCOL ; ***** MIN
; WORD OVER, OVER, GREAT, ZBRAN, XXR7\-, SWAP
; XXR7: WORD DROP, SEMIS
; HEAD 203, MA, 330, MAX, DOCOL ; ***** MAX
; WORD OVER, OVER, LESS, ZBRAN, XXR6\-, SWAP
; XXR6: WORD DROP, SEMIS
; HEAD 202, M*, 240, MSTAR ; ***** M*
; MOV 2(S), -(RP) ; USE RETURN STACK FOR SAVING SIGN
; BPL SS1\$
; NEG 2(S); GET ABSOLUTE VALUE
; SS1$: TST (S)
; BPL SS2$
; NEG (RP); ADJUST SIGN WHICH WAS SAVED
; XXR: NEG (S); GET ABSOLUTE VALUE
; SS2$: JSR PC, UMULT
; TST (RP)+ ; NEGATIVE RESULT?
; BPL SS3$
; NO ; IF GET HERE, NEGATE THE DOUBLE-INTEGER NUMBER ON THE STACK
; NEG (S)+
; NEA (S)
; SBC -(S)
; SS3$: NEXT
; HEAD 202, M/, 240, MSLAS ; ***** M/
; MOV 2(S), -(RP) ; SAVE DIVIDEND SIGN
; BNE S5$
; INC (RP); A SIGN CHANGE
; S5$: MOV (RP), -(RP) ; DUPLICATE IT
; BPL S1$
; NO ; IF GET HERE, TAKE ABSOLUTE VALUE OF DOUBLE-INTEGER DIVIDEND
; COM 2(S)

FOR THE INTEREST GROUP POB 1105 SAN CARLOS, CA 94070
MACRO ASSEMBLY LISTING

PAGE 0

uA/FORTH

[170, 10]

11C0 0C35 0004 COM 4(S)
11C4 0C35 0004 INC 4(S)
11C8 0D35 0002 ADC 2(S)
11CC 0A8D S1$: TST (S) ; IS DIVISOR NEGATIVE?
11CE 8002 BPL S2$ ; IF YES, NEGATE QUOTIENT SIGN
11D0 0C4E NEG (RP) ; AND TAKE ABS. VALUE OF DIVISOR
11D2 0C4D NEG (S)
11D4 71F7 F178 S2$: JSR PC, UDIV
11D8 0A96 TST (RP)+ ; NEGATIVE QUOTIENT?
11DA 8001 BPL S3$ ; NO
11DC 0C4D NEG (S)
11DE 0A96 S3$: TST (RP)+ ; NEGATIVE DIVIDEND?
11E0 8002 BPL S4$ ; NEGATE THE REMAINDER
11E2 0C75 0002 NEG 2(S)
11E6 8502 73DA S4$: NEXT

11BA AA81 11A8 0554 HEAD 201, 252, STAR, DOCOL ; ***** *
11F0 1182 04A0 03C0 WORD MSTAR, DROP, SEMIS
11F6 2F84 4F4D A044 HEAD 204, /MOD, 240, SSMOD, DOCOL ; ***** /MOD
1200 03E0 1118 03EE WORD TOR, STOD, FROMR, MSLAS, SEMIS
120A AF81 11F6 0554 HEAD 201, 257, SLASH, DOCOL ; ***** /
1210 11FE 04B0 04A0 WORD SSMOD, SWAP, DROP, SEMIS
1218 4D83 C44F 120A HEAD 203, MO, 304, MOD, DOCOL ; ***** MOD
1220 11FE 04A0 03C0 WORD SSMOD, DROP, SEMIS
1226 2A85 4D2F C44F HEAD 205, */MO, 304, SSMOD, DOCOL ; ***** */MOD
1230 03E0 1182 03EE WORD TOR, MSTAR, FROMR, MSLAS, SEMIS
123A 2A82 A02P 1226 HEAD 202, */240, SSLA, DOCOL ; ***** */
1242 122E 04B0 04A0 WORD SSMOD, SWAP, DROP, SEMIS
124A 4D85 4D2F C44F HEAD 205, M/MO, 304, SSMOD, DOCOL ; ***** M/MOD
1254 03E0 05BC 03FA WORD TOR, ZERO, R, USLAS, FROMR
125E 04B0 03E0 0346 WORD SWAP, TOR, USLAS, FROMR, SEMIS

; ; ; ; ;

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FORTH INTEREST GROUP POB 1105 SAN CARLOS, CA 94070
MACRO ASSEMBLY LISTING

; ********************* kk * k * kk * k *********************

; 'USE' AND 'PREV' MOVED TO USER AREA

; ********************* kk * k * kk * k *********************

; HEAD 204,+BUF,240,PBUF,DOCOL ; ***** +BUF
; WORD BBUF,LIT,4,PLUS,PLUS,DUP,LIMIT,AT,EQUAL
; HEAD 206,UPDATE,240,UPDAT,DOCOL ; ***** UPDATE
; WORD PREV,AT,AT,LIT,100000,OR,PREV
; WORD AT,STORE,SEMIS
; HEAD 215,EMPTY-BUFFER,323,MTBUF,DOCOL ; ***** EMPTY-BUFFERS
; WORD FIRST,AT,LIMIT,AT,OVER,SUB,ERASE,SEMIS
; HEAD 205,PLUS,310,FLUSH,DOCOL ; ***** FLUSH
; SOME SYSTEMS DEFINE THIS IN THE EDITOR, NOT HERE.
; WORD LIMIT,AT,FIRST,AT,XDO
; WORD AT,LIMIT,AT,OVER,SUB,ERASE,SEMIS
; HEAD 205,BLOC,313,BLOCK,DOCOL ; ***** BLOCK
; WORD OFSET,AT,PLUS,TOR
; WORD PREV,AT,DUP,AT,R,SUB,DUP,PLUS,ZBRAN,XXT4-.
; WORD DUP,R,BUFFE
; WORD DUP,R,ONE,RW,TWO,SUB
; WORD ZBRAN,XXT5-.
; WORD DUMP,STORE
; WORD DUMP,R,ONE,RW,TWO,SUB
; WORD ZBRAN,XXT5-.
; WORD DUMP,STORE
; WORD DUMP,R,BUFFE
; WORD DUMP,R,ONE,RW,TWO,SUB
; WORD ZBRAN,XXT5-.
; WORD DUMP,STORE
; WORD DUMP,R,ONE,RW,TWO,SUB
; WORD ZBRAN,XXT5-.
; WORD DUMP,STORE
; WORD DUMP,R,BUFFE
; WORD DUMP,R,ONE,RW,TWO,SUB
; WORD ZBRAN,XXT5-.
; WORD DUMP,STORE
; WORD DUMP,R,BUFFE
; WORD DUMP,R,ONE,RW,TWO,SUB
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; WORD DUMP,STORE
; WORD DUMP,R,BUFFE
; WORD DUMP,R,ONE,RW,TWO,SUB
; WORD ZBRAN,XXT5-.
; WORD DUMP,STORE
; WORD DUMP,R,BUFFE
; WORD DUMP,R,ONE,RW,TWO,SUB
; WORD ZBRAN,XXT5-.
MACRO ASSEMBLY LISTING

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UA/FORTH [170,10]  WORD TOR, CL, BBUF, SSMOD, FROMR, BSCR
13D0 03E0 05E8 05F4  WORD STAR, PLUS, BLOCK, PLUS, CL, SEMIS
13DC 11EE 043A 136C;
13E8 2E85 494C C54E  ; HEAD 205, , LIN, 305, DLINE, DOCOL
13F2 13CE 0AA4 0A60  ; WORD PLINE, DTRAJ, TYPE, SEMIS

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UA/FORTH [170,10]

FORTH INTEREST GROUP POB 1105 SAN CARLOS, CA 94070
MACRO ASSEMBLY LISTING

; *********************************************************
; MISCELLANEOUS HIGHER LEVEL
; *********************************************************

;*************************************************************
;*************************************************************

148C A7C1 146A 0554  HEAD 301,,247,TICK,DOCOL ; *****
1492 0D42 0408 05BC  WORD DFIND,ZEQU,ZERO,QERR,DROP,LITER,SEMIS

14A0 4686 524F 4547  HEAD 206,FORGET,240,FORGE,DOCOL ; ***** FORGET
14AC 06DC 04FA 06CE  WORD CURR,AT,CONT,AT,SUB,LIT,30,QERR,TICK,DUP
14C0 065B 04FA 07C0  WORD FENCE,AT,LESS,LIT,25,QERR
14CC 04C4 088E 0862  WORD DUP,NPA,DP,STORE,LFA,AT,CONT,AT
14DC 051C 03C0  WORD STORE,SEMIS

14E0 42B4 4341 A04B  HEAD 204,BACK,240,BACK,DOCOL ; ***** BACK
14EA 0772 079E 078E  WORD HERE, SUB, COMMA, SEMIS

14F2 42C5 4745 CE49  HEAD 305,BEGI,316,BEGIN,DOCOL ; ***** BEGIN
14FC 08E8 0772 05C4  WORD QCMP, HERE, ONE, SEMIS
1504 45C5 444E CE49  HEAD 305,ENDI,306,ENDIF,DOCOL ; ***** ENDIF
150E 08E8 05CC 0918  WORD QCMP, TWO, QPAIR, HERE, OVER, SUB, SWAP, STORE, SEMIS
1520 54C4 4543 A04E  HEAD 304,THEN,240,THEN,DOCOL ; ***** THEN
152A 150C 03C0  WORD ENDIF,SEMIS

152E 44C2 A04F 1520  HEAD 302,D0,240,D0,DOCOL ; ***** DO
1536 0964 01C2 0772  WORD COMP, XDO, HERE, LIT, 3, SEMIS
1542 4CC4 4F4F A050  HEAD 304, LOOP, 240, LOOP, DOCOL ; ***** LOOP
154C 0120 0003 0918  WORD LIT, 3, QPAIR, COMP, XLOOP, BACK, SEMIS
155A 2BC5 4F4F D04F  HEAD 305,+LOOP,320, PLOOP, DOCOL ; ***** +LOOP
1564 0120 0003 0918  WORD LIT, 3, QPAIR, COMP, XLOOP, BACK, SEMIS
1572 55C5 544E CC49  HEAD 305, UNTI, 314, UNTIL, DOCOL ; ***** UNTIL
157C 05C4 0918 0964  WORD ONE, QPAIR, COMP, ZBRAN, BACK, SEMIS
1588 45C3 C44E 1572  HEAD 303, EN, 304, END, DOCOL ; ***** END
1590 157A 03C0  WORD UNTIL, SEMIS
1594 41C5 4147 CE49  HEAD 305, AGAI, 316, AGAIN, DOCOL ; ***** AGAIN
159E 05C4 0918 0964  WORD ONE, QPAIR, COMP, ZBRAN, BACK, SEMIS
15AA 52C6 5045 4145  HEAD 306, REPEAT, 240, REPEAT, DOCOL ; ***** REPEAT
15B6 03E0 03E0 159C  WORD TOR, TOR, AGAIN, FROMR, FROMR, TWO, SUB, ENDIF, SEMIS
15C8 49C2 A046 15AA  HEAD 302, IF, 240, IF, DOCOL ; ***** IF
15D0 0964 0154 0772  WORD COMP, ZBRAN, HERE, ZERO, COMMA, TWO, SEMIS

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FORTH INTEREST GROUP PCB 1105 SAN CARLOS, CA 94070
MACRO ASSEMBLY LISTING

HEAD 304, ELSE, 240, ELSE, DOCOL
HEAD 305, WHIL, 305, WHILE, DOCOL
HEAD 206, SPACES, 240, SPACES, DOCOL
HEAD 202, $, 240, BDIGS, DOCOL, LT2
HEAD 204, SIGN, 240, SIGN, DOCOL
HEAD 201, , , 243, DIG, DOCOL
HEAD 202, $S, 240, DIGS, DOCOL
HEAD 203, D, , 322, DDOTR, DOCOL
HEAD 202, D, , 240, DDOTR, DOCOL
HEAD 201, , 256, DOT, DOCOL
HEAD 201, , 277, QUEST, DOCOL
HEAD 202, U, , 240, UDOT, DOCOL
HEAD 201, , 240, DOCOL
HEAD 201, , 256, DOT, DOCOL
HEAD 201, , 277, QUEST, DOCOL
HEAD 202, U, , 240, UDOT, DOCOL
HEAD 201, , 240, DOCOL
HEAD 201, , 256, DOT, DOCOL
HEAD 201, , 277, QUEST, DOCOL
HEAD 202, U, , 240, UDOT, DOCOL
HEAD 304, ELSE, 240, ELSE, DOCOL
HEAD 305, WHIL, 305, WHILE, DOCOL
HEAD 206, SPACES, 240, SPACES, DOCOL
HEAD 202, $, 240, BDIGS, DOCOL, LT2
HEAD 204, SIGN, 240, SIGN, DOCOL
HEAD 201, , , 243, DIG, DOCOL
HEAD 202, $S, 240, DIGS, DOCOL
HEAD 203, D, , 322, DDOTR, DOCOL
HEAD 202, D, , 240, DDOTR, DOCOL
HEAD 201, , 256, DOT, DOCOL
HEAD 201, , 277, QUEST, DOCOL
HEAD 202, U, , 240, UDOT, DOCOL
HEAD 201, , 240, DOCOL
HEAD 201, , 256, DOT, DOCOL
HEAD 201, , 277, QUEST, DOCOL
HEAD 202, U, , 240, UDOT, DOCOL
HEAD 201, , 240, DOCOL
HEAD 201, , 256, DOT, DOCOL
HEAD 201, , 277, QUEST, DOCOL
HEAD 202, U, , 240, UDOT, DOCOL
HEAD 201, , 240, DOCOL
HEAD 201, , 256, DOT, DOCOL
HEAD 201, , 277, QUEST, DOCOL
HEAD 202, U, , 240, UDOT, DOCOL
HEAD 201, , 240, DOCOL
HEAD 201, , 256, DOT, DOCOL
HEAD 201, , 277, QUEST, DOCOL
HEAD 202, U, , 240, UDOT, DOCOL

UTILITY SECTION.

FOR TH INTEREST GROUP  POB 1105  SAN CARLOS, CA 94070
MACRO ASSEMBLY LISTING

HEAD 204, LIST, 240, LIST, DOCOL

( N---. LIST GIVEN SCREEN.)

WORD DEC, CR, DUP, SCR, STORE, PDOTQ

BYTE 6

ASCII /SCR # /

EVEN

WORD DOT, Lit, 20, ZERO, XDO

WORD CR, I, THREE, DOTR, SPACE

WORD I, SCR, AT, DLINE, XLOOP, XXZ1...CR, SEMIS

HEAD 205, INDE, 330, INDEX, DOCOL

LIST FIRST LINE OF A RANGE OF DISK SCREENS.

WORD CR, ONEP, SWAP, XDO

XXZ2:

WORD CR, I, THREE, DOTR, SPACE, ZERO, 1, DLINE

WORD QTERM, ZBRAN, XXZ3...LEAVE

XXZ 3: WORD XLOOP, XXZ 2...SEMIS

HEAD 205, TRIA, 304, TRIAD, DOCOL

LIST DISK SCREENS THREE PER PAGE.

WORD LIT, 200, OUT, STORE, CONT, AT, AT

WORD CR, ZERO, OUT, STORE

WORD LIT, 17, MESS, CR, SEMIS

XXZ4:

WORD CR, I, LIST, XLOOP, XXZ 4..., CR, LIT, 17, MESS, CR, SEMIS

XXZ 5: WORD XXZ6:

WORD XXZ 6:

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FORTH INTEREST GROUP POB 1105 SAN CARLOS, CA 94070
MACRO ASSEMBLY LISTING

; *****************************************************
; INSTALLATION-DEPENDENT SECTION (TERMINAL AND DISK I/O)
; *****************************************************

1818

PENDING:
; INCREMENT 'OUT', UNLESS A CONTROL CHARACTER BEING OUTPUT
CMP (S), #40 ; TEST FOR CONTROL CHARACTER
BLT E1$ ; INCREMENT 'OUT'
E1$:
MOV (S)+, R1
TOUT
NEXT

182A

PKEY:
JOBGET R0, JOBTRM ; GET INDEX TO TERMINAL STATUS WORD,
BIS #3, @R0 ; SET IMAGE MODE, NOECHO
TIN ; GET CHAR IN R1
BIC #3, @R0 ; CLEAR IMAGE MODE, NOECHO
CTRLC F6$ ; BRANCH IF CNTL-C CONDITION
MOV R1, -(S) ; PUT CHAR ON DATA STACK
BR E4$ ; REMOVE IMPENDING CNTL-C

184A

PQTER: CLR -(S) ; HAS CNTL-C BEEN PRESSED?
CTRLC E3$ ; NO
NEXT
E3$:
INC (S) ; CHANGE FALSE VALUE ON STACK TO TRUE
JOBIDX R0, JOBSTS
BIC #J.TCC, (R0) ; REMOVE IMPENDING CNTL-C

1864

PCR: CR LF ; CARRIAGE RETURN AND LINE FEED
NEXT

1876

HEAD 204, NRTS, 240, NRTS ; ***** NRTS
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uA/FORTH

| 1880 | B577 | F7CC |
| 1884 | B540 |       |
| 1886 | B037 | F7C0 |
| 188A | 0B70 | 0100 |
| 188E | 0B65 |       |
| 1890 | 0080 | 0DC0 |
| 1896 | 03D1 |       |
| 1898 | 0C8D |       |
| 189A | B502 | 73DA |

iPAGE FORTH INTEREST GROUP POB 1105 SAN CARLOS, CA 94070
MACRO ASSEMBLY LISTING

HEAD 204, TASK, 240, TASK, DOCOL

WORD SEMIS

***** TASK

PAGE

FORTH INTEREST GROUP POB 1105 SAN CARLOS, CA 94070
MACRO ASSEMBLY LISTING

; ************************************************************
; STACKS AND BUFFERS
; ************************************************************
;
; NOTE--'UP' AND DISK BUFFERS ARE
; INITIALIZED AT COLD START, OR AT FIRST TIME THROUGH.
;
; XDP:
; DICTIONARY STARTS HERE
;
; RELOC:
; OVERLAY RELOCATION CODE AND DICTIONARY SPACE
; REMOVE BRANCH AT ORIGIN SO THAT UA/FORTH
; CAN BE LOADED AND RERUN FROM MONITOR WITHOUT
; LOSING LOADED DICTIONARY ENTRIES
; RUN THROUGH DICTIONARY MAKING CPA AND
; LFA ABSOLUTE
;
1922 0B77 E6DA
1922 0B77 E6D8
1926 0B77 E6D8
192A 7237 FFEE
192E 7277 E6CE
1932 BD03 E6DA
1936 1043
1938 B073 003E
193C B004
193E 0901 ADDI 2,R4
1940 9517 0554 CMP (R4)+,#DOCOL
1944 022B BNE Y2
1946 9317 03C0 CMP (R4),#SEMIS
194A 0327 BEQ Y6
194C 9317 09F0 CMP (R4),#PSCOD
1950 0324 BEQ Y6
1952 9317 0120 CMP (R4),#LIT
1956 031B BEQ Y3
1958 9317 0142 CMP (R4),#BRAN
195C 0318 BEQ Y3
195E 9317 0154 CMP (R4),#ZBRAN
1962 0315 BEQ Y3
1964 9317 0170 CMP (R4),#XLOOP
1968 0312 BEQ Y3
196A 9317 0192 CMP (R4),#XPLOO
196E 030F BEQ Y3
1970 9317 0964 CMP (R4),#COMP
1974 030F BEQ Y7
1976 9317 0AD8 CMP (R4),#PDOTQ
197A 0207 BNE Y5
197C 1054 ADD R1,(R4)+
197E D302 MOVB (R4),R2
1980 0881 ADDI 2,R2
1982 0882 ASR R2
1984 0AC2 ASL R2
1986 1084 ADD R2,R4
1988 01DE BR Y4
198A 1054 Y5: ADD R1,(R4)+
**MACRO ASSEMBLY LISTING**

<table>
<thead>
<tr>
<th>Address</th>
<th>Instruction</th>
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<tbody>
<tr>
<td>198C 0D0</td>
<td>BR Y4</td>
</tr>
<tr>
<td>198E 1054</td>
<td>ADD R1,(R4)+ ; ADD BASE TO PARAMETER</td>
</tr>
<tr>
<td>1990 0901</td>
<td>ADDI 2,R4</td>
</tr>
<tr>
<td>1992 0109</td>
<td>BR Y4</td>
</tr>
<tr>
<td>1994 1054</td>
<td>ADD R1,(R4)+ ; MOVE POINTER PAST CONSTANT</td>
</tr>
<tr>
<td>1996 1054</td>
<td>ADD R1,(R4)+ ; RELOCATE EMBEDDED ADDRESS</td>
</tr>
<tr>
<td>1998 01D6</td>
<td>BR Y4</td>
</tr>
<tr>
<td>199A 104C</td>
<td>ADD R1,(R4) ; END OF PARAMETER RELOCATION LOOP</td>
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<tr>
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<td>199C 1070 0002</td>
<td>BR Y4</td>
</tr>
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<td>19A0 0A88</td>
<td>BR Y4</td>
</tr>
<tr>
<td>19A2 0305</td>
<td>BR Y4</td>
</tr>
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<td>19A4 1048</td>
<td>BR Y4</td>
</tr>
<tr>
<td>19A6 B200</td>
<td>BR Y4</td>
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; BR Y4 |

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<tr>
<td>19A8 0A90</td>
<td>ADD R1,IR41+</td>
</tr>
<tr>
<td>19AA 80FE</td>
<td>MOV (RO),RO</td>
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; RO NOW POINTS TO NFA |

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<tbody>
<tr>
<td>19AC 01C7</td>
<td>ADD R1,ORIGIN+14 ; MAKE ADDRESSES IN BOOT-UP TABLE ABSOLUTE</td>
</tr>
</tbody>
</table>

; BR Y0 |

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<tbody>
<tr>
<td>19AE 73B7 F6C4</td>
<td>LEA R2,FDDB+56 ; PREPARE AFORTH.SCR</td>
</tr>
<tr>
<td>19B2 E5F7 0001 F691</td>
<td>BISB #1,FDDB+1</td>
</tr>
<tr>
<td>19B8 0089 0DD7 F6B8</td>
<td>FSPEC FDDB,SCR</td>
</tr>
<tr>
<td>19C0 0080 0DC0 F6B2</td>
<td>INIT FDDB</td>
</tr>
<tr>
<td>19C6 0080 1DD7 F67C</td>
<td>OPENR FDDB</td>
</tr>
<tr>
<td>19CE 1077 E63A</td>
<td>ADD R1,ORIGIN+14 ; MAKE ADDRESSES IN BOOT-UP TABLE ABSOLUTE</td>
</tr>
<tr>
<td>19D2 1077 E63A</td>
<td>ADD R1,ORIGIN+20</td>
</tr>
<tr>
<td>19D6 1077 E638</td>
<td>ADD R1,ORIGIN+22</td>
</tr>
<tr>
<td>19DA 1077 E636</td>
<td>ADD R1,ORIGIN+24</td>
</tr>
<tr>
<td>19DE 1077 E634</td>
<td>ADD R1,ORIGIN+26</td>
</tr>
<tr>
<td>19E2 1077 E636</td>
<td>ADD R1,ORIGIN+34</td>
</tr>
<tr>
<td>19E6 1077 E634</td>
<td>ADD R1,ORIGIN+36</td>
</tr>
<tr>
<td>19EA 1077 E632</td>
<td>ADD R1,ORIGIN+40</td>
</tr>
<tr>
<td>19EE 1077 E630</td>
<td>ADD R1,ORIGIN+42</td>
</tr>
<tr>
<td>19F2 1077 E628</td>
<td>ADD R1,ORIGIN+44</td>
</tr>
<tr>
<td>19F6 1077 F5CO</td>
<td>ADD R1,FORTH+2 ; FIX VOCABULARY LINK STRUCTURE TO ABSOLUTE ADDR</td>
</tr>
<tr>
<td>19FA 73F7 F692</td>
<td>JMP CENZ</td>
</tr>
<tr>
<td>19FE</td>
<td>BLKB 10000,&lt;.-XDP&gt;</td>
</tr>
<tr>
<td>4032</td>
<td>XSO:</td>
</tr>
<tr>
<td>4032</td>
<td>BLEN 2 ; START OF COMPUTATION STACK</td>
</tr>
<tr>
<td>4032</td>
<td>; IN CASE OF EMPTY STACK</td>
</tr>
<tr>
<td>4036</td>
<td>; DSKBUF:</td>
</tr>
<tr>
<td>4036</td>
<td>; THREE 1K DISK BUFFERS (TWO REQUIRED)</td>
</tr>
<tr>
<td>4036</td>
<td>; INITIALIZE BUFFERS' UPDATE BITS, AND TERMINATING NULLS, TO ZERO.</td>
</tr>
<tr>
<td>4036</td>
<td>; NOTE--THese BUFFERS ARE CLEARED AT COLD START</td>
</tr>
<tr>
<td>4036</td>
<td>; ALSO THE NUMBER OR LOCATION OF BUFFERS CAN BE</td>
</tr>
<tr>
<td>4036</td>
<td>; CHANGED AT RUN TIME.</td>
</tr>
<tr>
<td>4038 0000</td>
<td>WORD 0</td>
</tr>
<tr>
<td>4038</td>
<td>BLKB 1024.</td>
</tr>
</tbody>
</table>

**uA/FORTH** [170,10] | FORTH INTEREST GROUP POB 1105 SAN CARLOS, CA 94070
ENDBUF: ; CAUTION: 'ENDBUF' - 'DSKBUF' MUST BE EXACT MULTIPLE
; OF THE BUFFER LENGTH PLUS 4.

; 'XTIB', 'XRO', AND 'XUP' ARE ONLY USED IN BOOT-UP TABLE;
; THEREFORE THE AREAS DEFINED HERE CAN BE MOVED AT RUN TIME.

XTIB: BLKW 42. ; TERMINAL INPUT BUFFER
        BLKW 50. ; FOR RETURN STACK
XRO=. XUP:  BLKW 100 ; ROOM FOR 100 USER VARIABLES
       END    ORIGIN

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