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COMPUTER DIGEST

AND

USER'S BULLETIN

VOLUME I - ISSUE I

JANUARY 1975

EDITOR: N. WADSWORTH

ASSISTANT EDITOR: R. FINDLEY

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GREETINGS!

SCELBI COMPUTER CONSULTING IS PLEASED TO BE BRINGING YOU THIS FIRST ISSUE OF "THE SCELBI COMPUTER DIGEST & USER'S BULLETIN." MANY OF OUR SCELBI-8H USERS HAVE BEEN ASKING FOR THIS TYPE OF PUBLICATION FOR SOME TIME. WE THANK YOU FOR YOUR PATIENCE.

THIS FIRST EDITION CONTAINS INFORMATION AND FEATURE ARTICLES PREPARED BY THE STAFF AT SCELBI. IN THE FUTURE WE PLAN TO EXPAND THE SIZE AND SCOPE OF THIS PUBLICATION AS USERS JOIN IN TO HELP MAKE IT AN INFORMATION EXCHANGE JOURNAL. WE ARE ASKING OUR USERS TO SUBMIT ARTICLES ON PROJECTS THEY HAVE DEVELOPED, ROUTINES AND PROGRAMS, OPERATING TIPS ETC. THAT THEY ARE WILLING TO SHARE WITH OUR READERS. THOSE INTERESTED IN SPECIFIC APPLICATION AREAS MAY SUBMIT THEIR NAMES AND ADDRESSES FOR PUBLICATION IF DESIRED SO THAT USERS WITH COMMON INTEREST MAY CONTACT ONE ANOTHER.

WE SHOULD LIKE TO POINT OUT THAT WE HAVE USERS AT MANY LEVELS OF SOPHISTICATION. RANGING FROM THOSE THAT USE THE SCELBI-8H PURELY FOR HOBBY AND PLEASURE ACTIVITIES ON UP TO THOSE USING THE COMPUTER FOR SERIOUS RESEARCH IN MEDICINE OR FOR CONTROLLING INDUSTRIAL PROCESSES. IN THE PAST YEAR WE HAVE RECEIVED INFORMAL REPORTS ON OUR SCELBI-8H BEING USED BY AMATEUR RADIO OPERATORS TO AUTOMATICALLY SEND MORSE CODE MESSAGES, ITS APPLICATION IN GATHERING SCIENTIFIC DATA ON CANCER RESEARCH, PROJECTS INVOLVING INTERFACING IT TO CALCULATOR "CHIPS" AND OTHER DEVICES, PLANS TO USE IT FOR TRACKING SATELLITES, ITS USE AS A NUMERICAL MACHINE CONTROLLER ETC. WE HOPE THE PEOPLE WORKING ON THESE TYPES OF PROJECTS WILL BE ABLE TO CONTRIBUTE INFORMATION THAT COULD HELP OTHERS WORKING TOWARDS SIMILAR GOALS. ARTICLES AIMED AT BEGINNERS, AS WELL AS EXPERTS, OR THOSE IN BETWEEN, ARE DESIRED SO THAT WE MAY PUBLISH A GOOD "MIX."

IF YOU DO NOT HAVE SOMETHING TO SUBMIT, AT LEAST FEEL FREE TO DROP US A LINE AND LET US KNOW WHAT KIND OF MATERIAL YOU ARE INTERESTED IN SEEING SO THAT WE CAN SELECT TIMELY AND RELEVANT MATERIAL FOR YOU!

WELCOME ABOARD READERS!

NAT WADSWORTH
EDITOR

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WAYS TO UTILIZE AN EDITOR PROGRAM

SOME NEW-COMERS TO UTILIZING A COMPUTER MAY NOT BE FAMILIAR WITH THE POWERFUL FUNCTIONS AN "EDITOR" PROGRAM CAN PERFORM FOR THE USER. THE PURPOSE OF THIS ARTICLE IS TO EXPLAIN WHAT AN "EDITOR" PROGRAM IS AND TO ILLUSTRATE SOME OF ITS COMMON USES.

AN "EDITOR" PROGRAM IS ESSENTIALLY WHAT ITS TITLE DENOTES. IT IS A PROGRAM THAT FACILITATES THE "EDITING" OF TEXT. THE PROGRAM CONSIST ESSENTIALLY OF AN OPERATING OR COMMAND PORTION, AND A "TEXT BUFFER" PORTION. THE TEXT BUFFER IS SIMPLY AN AREA SET ASIDE IN MEMORY THAT IS USED TO HOLD, AND ALLOW THE MANIPULATION OF, WHATEVER INFORMATION THE OPERATOR DESIRES TO PLACE IN THERE. IT EFFECTIVELY SERVES AS A SHEET OF PAPER ON WHICH THE OPERATOR MAY WRITE, ALTER, OR ERASE INFORMATION VIA A KEYBOARD INSTEAD OF WITH A PENCIL. THE COMMAND PART OF THE PROGRAM IS USED TO DIRECT WHAT OPERATIONS ARE TO TAKE PLACE IN THE TEXT BUFFER. TYPICAL EDITOR COMMANDS MIGHT INCLUDE: KILL (ERASE THE ENTIRE TEXT BUFFER). DELETE (ELIMINATE PORTIONS OF THE TEXT BUFFER). APPEND (ADD INFORMATION TO THE BUFFER). INSERT (PLACE INFORMATION AT SPECIFIC POINT(S) IN THE BUFFER). AND, LIST OR DISPLAY (PRINT OUT OR OTHERWISE DISPLAY THE CONTENTS OF THE TEXT BUFFER).

INFORMATION IN THE TEXT BUFFER IS TYPICALLY KEPT TRACK OF BY ASSIGNING A "LINE NUMBER" TO EACH LINE OF TEXT THAT IS PLACED IN THE BUFFER. A USER CAN THEN REFER TO ANY PORTION OF THE BUFFER BY DESIGNATING THE LINE NUMBER THAT IT IS DESIRED TO MANIPULATE. FOR INSTANCE, IF THERE ARE 10 LINES OF TEXT IN THE BUFFER, AND THE OPERATOR DISCOVERS THAT THERE IS AN ERROR IN THE TEXT ON LINE 8, THEN THE OPERATOR CAN SIMPLY GIVE THE COMMAND "8,D" AND DELETE THAT LINE FROM THE TEXT BUFFER. OR, SHOULD IT BE BENEFICIAL TO ADD SOME INFORMATION IN BETWEEN LINES, THEN THE USER CAN FOR INSTANCE GIVE THE COMMAND "8,I" AND PROCEED TO INSERT ONE OR MORE LINES OF TEXT IMMEDIATELY BEFORE LINE NUMBER 8. THE OPERATING PORTION OF THE EDITOR PROGRAM AUTOMATICALLY KEEPS TRACK OF THE NUMBER OF LINES IN THE BUFFER AND CAN RE-ASSIGN LINE NUMBERS AS REQUIRED. FOR INSTANCE, IF LINE 8 WAS DELETED FROM THE TEXT BUFFER, THEN THE PROGRAM WOULD MOVE THE NEXT LINE IN THE BUFFER "UP" TO BECOME LINE NUMBER 8. OR, IF A LINE WAS INSERTED, THE PROGRAM WOULD ASSIGN THE CORRECT LINE NUMBER FOR THE POINT AT WHICH IT WAS INSERTED AND CHANGE THE REMAINING LINES IN THE BUFFER TO COMPENSATE FOR THE INSERTED LINE. IN THIS MANNER THE PROGRAM CAN KEEP THE TEXT BUFFER ORGANIZED IN A FORM THAT IS CONVENIENT FOR THE USER TO WORK WITH.

AN EDITOR PROGRAM GENERALLY OPERATES IN TWO MODES. THE "COMMAND" MODE AND THE "TEXT" MODE. THE "COMMAND" MODE ALLOWS THE USER TO GENERATE COMMANDS THAT MANIPULATE INFORMATION IN THE TEXT BUFFER. THE "TEXT" MODE ALLOWS INFORMATION FROM THE INPUT DEVICE TO BE DIRECTLY PLACED INTO THE TEXT BUFFER. CERTAIN COMMANDS, SUCH AS "APPEND" OR "INSERT" CAUSE THE PROGRAM TO SWITCH MODES AUTOMATICALLY FROM THE "COMMAND" TO THE "TEXT" MODE SO THAT INFORMATION IMMEDIATELY FOLLOWING THE COMMAND IS CONSIDERED AS "TEXT" TO BE PLACED IN THE TEXT BUFFER. THUS A SEQUENCE SUCH AS :

8,I
THIS IS A TEST

WOULD RESULT IN "THIS IS A TEST" BEING PLACED AS LINE NUMBER 8 IN THE TEXT BUFFER. NATURALLY, WHEN THE PROGRAM IS IN THE TEXT MODE, THERE MUST BE SOME METHOD OF RETURNING TO THE COMMAND MODE WHEN THE USER HAS PLACED THE DESIRED INFORMATION INTO THE BUFFER. THIS IS GENERALLY ACCOMPLISHED BY ASSIGNING A SPECIAL "NON-PRINTING" CHARACTER AS A SIG-

NAL TO THE COMPUTER WHEN IN THE "TEXT" MODE TO RETURN TO THE COMMAND MODE. A "CONTROL/CHARACTER" COMBINATION IS FREQUENTLY USED FOR THIS PURPOSE. THUS, WHEN THE COMPUTER IS IN THE TEXT MODE, IT CHECKS EACH CHARACTER AS IT IS ENTERED TO SEE IF IT IS THE SPECIAL "CONTROL/CHARACTER." IF IT IS NOT, THE INFORMATION IS PLACED IN THE TEXT BUFFER. HOWEVER, WHEN A "CONTROL/CHARACTER" APPEARS, THE PROGRAM REVERTS BACK TO THE COMMAND MODE.

WHILE THE BULK OF "EDITING" IS DONE BY USING THE COMMANDS AVAILABLE TO MANIPULATE THE INFORMATION IN THE TEXT BUFFER, IT IS OFTEN VALUABLE TO HAVE SOME ADDITIONAL CAPABILITY TO MAKE MINOR ALTERATIONS TO TEXT WHILE ACTUALLY IN THE TEXT MODE. THUS EDITOR PROGRAMS TYPICALLY HAVE THE CAPABILITY OF DELETING INDIVIDUAL CHARACTERS WHILE OPERATING IN THE TEXT MODE BY THE USE OF A SPECIAL KEY SUCH AS THE "ROB OUT" OR - KEY WHERE EACH DEPRESSION OF SUCH A SPECIAL KEY RESULTS IN THE ELIMINATION OF THE PREVIOUSLY ENTERED CHARACTER. THIS FEATURE MAKES IT UNNECESSARY TO RETURN TO THE COMMAND MODE EACH TIME A MINOR "TYPO" OCCURS.

NOW THAT ONE HAS A BRIEF BACKGROUND ON WHAT AN "EDITOR" PROGRAM CAN DO AND HOW IT WORKS, ONE WILL HAVE LITTLE DIFFICULTY DISCERNING WHAT A GREAT TIME SAVER AN EDITOR PROGRAM CAN BE FOR ANYONE THAT HAS TO PREPARE ANY KIND OF TEXT MATERIAL! THE ABILITY TO USE THE COMPUTER TO HELP PREPARE MATERIAL, PARTICULARLY IN REGARDS TO MAKING CORRECTIONS, AND ARRANGING THE LAY-OUT, SAVES A TREMENDOUS AMOUNT OF TIME. IT HAS BEEN CONSERVATIVELY ESTIMATED THAT A PERSON WORKING WITH A COMPUTER CENTERED EDITOR PROGRAM CAN PRODUCE "FINISHED" COPY ABOUT THREE TO FOUR TIMES FASTER THAN A PERSON RESTRICTED TO WORKING WITH AN ORDINARY TYPEWRITER. ALMOST ALL OF THIS INCREASE IN PRODUCTIVITY CAN BE ATTRIBUTED TO THE ABILITY OF THE PROGRAM TO ALLOW THE USER TO MAKE CORRECTIONS, OR INSERT OR DELETE INFORMATION, AND OTHERWISE RE-ARRANGE THE TEXT IN THE TEXT BUFFER BEFORE PRINTING A FINAL COPY. WITHOUT AN EDITOR PROGRAM THIS TYPE OF WORK MUST BE DONE EITHER USING AN ERASER OR BY "CUT AND PASTE" METHODS. THE USE OF AN EDITOR PROGRAM ALSO TAKES THE TEDIIOUSNESS OUT OF PREPARING TEXTUAL MATERIAL AND GIVES THE PREPARER MORE TIME TO BE CREATIVE.

THUS, AN EDITOR PROGRAM CAN BE A VALUABLE TOOL FOR ANY WRITER. THE MATERIAL YOU ARE CURRENTLY READING WAS PREPARED USING AN EDITOR PROGRAM. ANY BUSINESS MAN CAN PUT AN EDITOR TO GOOD USE JUST DOING SECRETARIAL CHORES. IN FACT, THERE ARE MANY COMPANIES TODAY SELLING FANCY AND EXPENSIVE TYPEWRITER SYSTEMS THAT HAVE "EDITING" CAPABILITIES. ALL THOSE SYSTEMS CONSIST OF IS A TYPEWRITER CONNECTED TO A DEDICATED COMPUTER THAT HAS AN EDITOR PROGRAM IN IT! SAD THING IS, MANY OF THOSE SYSTEMS HAVE THE COMPUTER PORTION BUILT IN SUCH A WAY THAT IT IS THE ONLY THING THE SYSTEM CAN DO - AND MANY OF THE USERS ARE TOTALLY UNAWARE OF THE FACT THAT FOR ABOUT THE SAME PRICE THEY COULD HAVE PURCHASED A MUCH MORE VERSATILE MACHINE (A COMPUTER!), USED IT FOR EDITING PURPOSES WHEN REQUIRED, AND BEEN ABLE TO LOAD DIFFERENT PROGRAMS INTO IT WHEN ITS EDITING CAPABILITIES WERE NOT REQUIRED!

FOR COMPUTER PROGRAMMERS, THE PRIMARY REASON FOR UTILIZING AN EDITOR PROGRAM, IS TO ASSIST IN THE PREPARATION OF "SOURCE LISTINGS" OF COMPUTER PROGRAMS! THE REASON, AGAIN, IS BECAUSE OF THE CAPABILITY OF BEING ABLE TO RAPIDLY MAKE CHANGES IN THE MATERIAL BEING PREPARED. THIS FACTOR BECOMES MULTIPLIED IN THE CASE OF PREPARING PROGRAMS, BECAUSE THE DEVELOPMENT OF A PROGRAM IS A TWO PART PROCESS. FIRST A PROGRAM MUST BE PREPARED IN THE SYMBOLIC MNEMONIC (SOURCE LISTING) FORM, AND THEN THIS MNEMONIC LISTING MUST BE CONVERTED TO THE ACTUAL MACHINE LANGUAGE CODES USED BY THE COMPUTER. ANY MISTAKE(S) IN THE SOURCE LISTING WILL RESULT IN ERRORS IN THE MACHINE CODE. THE ABILITY TO RAPIDLY CORRECT OR ALTER

THE SOURCE LISTING GREATLY EASES THE OVER-ALL TASK OF PROGRAM PREPARATION. IT SAVES A LOT OF PAPER (AND ERASERS!) WHEN ONE IS IN THE PROCESS OF MENTALLY CREATING "ALGORITHMS" AND PUTTING THEM INTO SYMBOLIC (MNE-MONIC) FORM. ONE CAN "THINK" OF DESIRED ROUTINES, ENTER THEM INTO THE TEXT BUFFER IN THE COMPUTER, AND, FROM TIME-TO-TIME, HAVE THE COMPUTER DISPLAY THEM FOR REVIEW. ALTERATIONS, ADDITIONS, OR DELETIONS TO THE DEVELOPING ROUTINE CAN BE EASILY MADE AT WILL UNTIL THE PROGRAMMER FEELS THAT THE ROUTINE IS CORRECT - ALL WITHOUT THE MESS AND FUSS OF PENCIL, PAPER, AND ERASERS! WHEN THE PROGRAMMER IS SATISFIED WITH THE CREATION, THE PRESS OF A BUTTON PRESENTS A NICE "CLEAN" COPY READY FOR THE NEXT STEP - CONVERSION TO THE MACHINE LANGUAGE CODE.

SUPPOSE, FOR EXAMPLE, A PERSON WANTED TO CREATE A SMALL PROGRAM THAT WOULD SET ALL THE WORDS ON A PAGE OF MEMORY TO THE 377 (OCTAL) CON-DITION. USING AN EDITOR THE PROCESS MIGHT GO AS FOLLOWS. (COMMANDS WILL BE UNDERLINED).

```
A
LMI 000
LLI 000
LMI 377
INL
JFZ DOMORE
HLT
```

```
3,D
3,I
DOMORE, LMI 377
```

```
1,I
LDH
LEL
```

```
L
LDH
LEL
LMI 000
LLI 000
DOMORE, LMI 377
INL
JFZ DOMORE
HLT
```

A REVIEW OF THE ABOVE EXAMPLE SHOWS HOW EASILY THE PROGRAM WAS CREATED AND MODIFIED AS THE PROGRAMMER'S THOUGHT PROCESS PROCEEDED. FIRST THE PROGRAMMER SET UP REGISTERS "H" AND "L" TO POINT TO THE AREA IN MEMORY THAT WAS TO BE FILLED WITH THE 377 CODE. AN "LMI 377" IN-STRUCTION WAS USED AND THEN AN "INL" INSTRUCTION USED TO ADVANCE THE MEMORY POINTER. AT THIS POINT THE PROGRAMMER REALIZED A "PROGRAM LOOP" COULD BE FORMED BY TESTING TO SEE IF REGISTER "L" HAD CYCLED AROUND TO 000 (OCTAL). IF NOT, THE PROGRAM SHOULD JUMP BACK TO THE "LMI 377" IN-STRUCTION. SO, A "LABEL" OF "DOMORE" WAS ASSIGNED TO THE "LMI 377" IN-STRUCTION AND USED AS THE ADDRESS FOR THE "JFZ" INSTRUCTION. SINCE THE ORIGINAL LINE CONTAINING "LMI 377" NOW HAD TO BE MODIFIED TO INCLUDE THE "LABEL" THE PROGRAMMER WENT TO THE COMMAND MODE OF THE EDITOR AND USED A DELETE COMMAND TO ERASE THE ORIGINAL LINE THREE AND THEN INSERTED THE NEW LINE CONTAINING THE LABEL IN ITS PLACE. NEXT THE PROGRAMMER DECID-ED TO ADD SEVERAL INSTRUCTIONS TO SAVE THE ORIGINAL CONTENTS OF THE "H" AND "L" REGISTERS, SO THEY WERE INSERTED BEFORE LINE #1. IN A MATTER OF A FEW SECONDS THE PROGRAMMER HAD BEEN ABLE TO MAKE SEVERAL REVISIONS TO THE ORIGINAL PROGRAM. FINALLY THE PROGRAMMER HAD THE COMPLETED ROUTINE

HOWEVER, A GOOD EDITOR PROGRAM HAS ONE MORE FEATURE THAT REALLY MAKES THE PROGRAM PARTICULARLY VALUABLE - THE ABILITY TO WRITE THE CONTENTS OF THE "TEXT BUFFER" OUT ONTO PAPER TAPE OR MAGNETIC TAPE (AND PERFORM THE REVERSE OF READING DATA INTO THE TEXT BUFFER FROM AN EXTERNAL STORAGE SYSTEM). THUS, AS PROGRAMS ARE CREATED THEY CAN BE SAVED FOR FUTURE USE ON AN EXTERNAL STORAGE DEVICE. A PERSON CAN DEVELOP A LIBRARY OF ROUTINES OR PROGRAMS AND THESE ROUTINES CAN BE READ BACK INTO THE TEXT BUFFER, AND POSSIBLY COMBINED WITH OTHER ROUTINES TO BUILD UP LARGER PROGRAMS.

FOR PROGRAMMERS, THIS FEATURE ALSO ALLOWS THE NEXT STEP IN THE PROCESS OF PROGRAM CREATION, THE CONVERSION OF THE SOURCE LISTING TO MACHINE CODE, TO BE ACCOMPLISHED IN AN ESSENTIALLY AUTOMATIC FASHION. THIS CAN BE DONE BY USING THE TAPE (PAPER OR MAGNETIC) CREATED BY THE EDITOR PROGRAM AS THE INPUT TO ANOTHER TYPE OF PROGRAM CALLED AN "ASSEMBLER." AN "ASSEMBLER" IS A PROGRAM THAT IS ABLE TO PROCESS THE "LABELS" AND MNEMONICS USED IN A SOURCE LISTING AND CONVERT THEM TO MACHINE CODES ASSIGNED TO USER DESIGNATED AREAS IN MEMORY.

OF COURSE, THE FEATURE OF SAVING THE CONTENTS OF THE TEXT BUFFER ON AN EXTERNAL DEVICE CAN BE OF CONSIDERABLE VALUE FOR NON-PROGRAMMING ACTIVITIES TOO! HOW ABOUT, FOR INSTANCE, USING IT AS A SYSTEM FOR RAPIDLY CREATING "PERSONALIZED" FORM LETTERS? PARAGRAPHS OF INFORMATION PERTAINING TO PARTICULAR SUBJECTS COULD BE SELECTED FROM A "LIBRARY," PLACED IN ORDER IN THE TEXT BUFFER, AND THEN PRINTED AS A COMPLETE DOCUMENT.

ONCE ONE BECOMES FAMILIAR WITH THE BASIC CONCEPT OF AN EDITOR PROGRAM ONE SHOULD HAVE LITTLE DIFFICULTY FINDING APPLICATIONS FOR IT. FOR THOSE THAT REALLY WANT TO EXPLOIT ITS CAPABILITIES IT NEED ONLY BE SUGGESTED THAT THE EDITOR PROGRAM BE THE STARTING POINT FOR CREATING DATA "BANKS" THAT COULD BE "MASSAGED" BY OTHER PROGRAMS THAT MIGHT DO SUCH USEFUL FUNCTIONS AS "SELECT" OR SORT OUT INFORMATION OF VALUE FOR THE USER. THINK ABOUT IT - COULD YOU PUT AN EDITOR PROGRAM TO GOOD USE AT YOUR FACILITY?

SOFTWARE REVISION NOTICE - SCELBI PROGRAM #61XX-0007
8H MODEL 33 TTY READ/WRITE PROGRAM

THIS PROGRAM HAS BEEN REVISED TO REVISION A. THE REVISION REMOVES AN EXTRANEIOUS "RLC" INSTRUCTION AT LOCATION 133 ON PAGE 43. TO EFFECT THE REVISION CHANGE THE "RLC" TO A "NO OPERATION" SUCH AS "LAA" AS SHOWN IN THE FOLLOWING PATCH.

ADDRESS	CONTENTS	MNEMONIC	COMMENTS
43 133	300	LAA	/LOAD REG A TO A (NO OPERATION)

INTERFACING THE PE 'SCOPEWRITER' TO THE SCELBI-8H

"POPULAR ELECTRONICS" RECENTLY PUBLISHED CONSTRUCTION PLANS (SEE THE AUGUST, 1974 ISSUE OF "POPULAR ELECTRONICS," STARTING AT PAGE 33) FOR A SIMPLE, LOW COST, ONE LINE 'SCOPEWRITER' WHICH WILL ALLOW UP TO 32 ALPHA-NUMERIC CHARACTERS TO BE DISPLAYED ON AN ORDINARY OSCILLOSCOPE. WHILE THE DISPLAY SYSTEM IS NO WHERE NEAR AS SOPHISTICATED AS THE SCELBI ALPHA-NUMERIC OSCILLOSCOPE INTERFACE, A NUMBER OF OUR CUSTOMERS ALREADY HAVE THE DEVICE AND DESIRE TO INTERFACE IT TO THE SCELBI-8H. WE ARE PRESENTING HERE THE DETAILS OF AN INTERFACE THAT WILL ALLOW THE 'SCOPEWRITER' TO BE DRIVEN BY THE SCELBI-8H. THE PARTS FOR THIS INTERFACE COST LESS THAN \$5.00, AND SINCE THIS INTERFACE ELIMINATES THE NEED FOR THE CONTROL AND DATA SWITCHES ON THE 'SCOPEWRITER,' THE SAVINGS ON THE ELIMINATION OF THE SWITCHES CAN MORE THAN COVER THE COST OF THE PARTS FOR THIS INTERFACE. NATURALLY, THIS INTERFACE WILL ALLOW THE CHARACTERS FOR THE DISPLAY TO BE LOADED UNDER PROGRAM CONTROL (FOR INSTANCE BY USING A SUBROUTINE THAT ACCEPTS CHARACTERS FROM AN ASCII KEYBOARD) AND THUS SAVES A CONSIDERABLE AMOUNT OF TIME OVER HAVING TO LOAD MESSAGES INTO THE 'SCOPEWRITER' BY MANUAL MEANS.

THE SCHEMATIC FOR THE COMPLETE INTERFACE IS SHOWN ON A FOLLOWING PAGE. CONSTRUCTION OF THE INTERFACE IS SIMPLE AND STRAIGHT-FORWARD AND CAN MOST EASILY BE DONE IN "BREAD-BOARD" FASHION. THE CONNECTIONS TO THE 'SCOPEWRITER' CIRCUIT ARE DENOTED BY RECTANGLES. CONNECTIONS LABELED S1 THROUGH S9 SHOULD GO TO THE WIPER POINT OF THE SWITCHES SHOWN IN THE ORIGINAL ARTICLE. THE SWITCHES SHOULD BE REMOVED OR DISCONNECTED FROM THE ORIGINAL DESIGN. IN ADDITION, RESISTORS R1 AND R2 (BOTH 100 OHMS) SHOULD BE REMOVED FROM THE ORIGINAL DESIGN AS THEY WOULD OVERLOAD THE 7474 I.C. WHICH REPLACES SWITCH S2. CONNECTIONS TO THE SCELBI-8H ARE DESIGNATED BY THE SIGNAL NAME USED ON SCELBI SCHEMATICS.

SOFTWARE TO DRIVE THE INTERFACE IS PRESENTED BELOW. THE SOFTWARE CONSIST OF A SUBROUTINE THAT CAN BE CALLED BY A USER PROGRAM THAT WILL CAUSE THE MEMORY OF THE 'SCOPEWRITER' TO BE LOADED WITH ASCII CHARACTERS OBTAINED FROM THE MESSAGE BUFFER CALLED "TABLE." THE PROGRAM WILL THEN CAUSE THE 'SCOPEWRITER' TO DISPLAY THE MESSAGE UNTIL THE SUBROUTINE IS CALLED AGAIN. USER'S CAN GENERATE THEIR OWN PROGRAMS BASED ON THEIR I/O CAPABILITIES THAT WILL ACCEPT CHARACTERS FROM AN INPUT DEVICE AND STORE THEM IN THE MESSAGE BUFFER ("TABLE"). BY ALTERNATING BETWEEN THEIR INPUT ROUTINE(S) AND THE DRIVER ROUTINE PRESENTED HERE, USER'S CAN PROVIDE THEIR OWN CUSTOM TAILORED I/O PROGRAMS THAT UTILIZE THE 'SCOPEWRITER' FOR MESSAGE DISPLAY. HAVE FUN!

SUGGESTED DRIVER ROUTINE FOR THE 'SCOPEWRITER' INTERFACE

```

/SAVE SPACE FOR A 32 CHARACTER BUFFER
/FOR STORING THE MESSAGE IN ASCII FORMAT
/
000 000 000  ORG 000 000
                TABLE, 000
/
000 040 056  ORG 000 040
000 041 000  START, LHI 000  /START SUBROUTINE HERE
000 042 066  LLI 000      /SET PNTR TO ADDR OF "TABLE"
000 043 000
000 044 016  LBI 040      /SET CHARACTER COUNTER
000 045 040

```

```

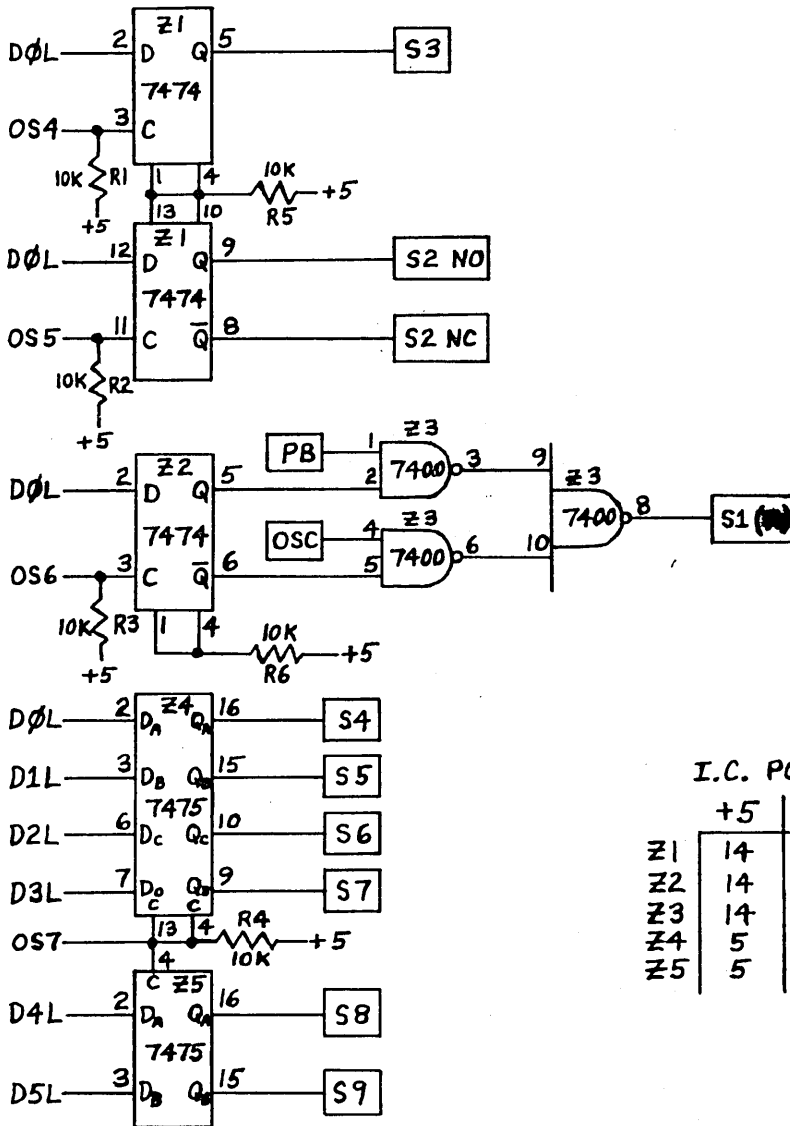
000 046 006 LAI 040
000 047 040
000 050 133 OUT 15 /RESET LOAD
000 051 137 OUT 17 /OUTPUT BLANK
000 052 135 OUT 16 /OUTPUT OSC
000 053 131 OUT 14 /OUTPUT WR
000 054 026 LCI 002 /DELAY ROUGHLY 150 USECS
000 055 002
000 056 021 DEL, DCC
000 057 110 JFZ DEL
000 060 056
000 061 000
000 062 006 LAI 001
000 063 001
000 064 135 OUT 16 /OUTPUT PB
000 065 307 CHAR, LAM
000 066 137 OUT 17 /OUTPUT CHARACTER
000 067 006 LAI 001
000 070 001
000 071 133 OUT 15 /PULSE LOAD
000 072 026 LCI 002 /DELAY 150 USECS AGAIN
000 073 002
000 074 021 DLY, DCC
000 075 110 JFZ DLY
000 076 074
000 077 000
000 100 250 XRA /CLEAR ACCUMULATOR
000 101 133 OUT 15
000 102 060 INL /ADVANCE TABLE POINTER
000 103 011 DCB /DCR COUNTER - DONE?
000 104 110 JFZ CHAR /IF NOT - GET NEXT CHARACTER
000 105 065
000 106 000
000 107 006 LAI 001
000 110 001
000 111 131 OUT 14 /OUTPUT RE COMMAND
000 112 250 XRA
000 113 135 OUT 16 /OUTPUT OSC
000 114 007 RET /RETURN TO CALLING PROGRAM
END

```

'SCOPEWRITER' INTERFACE PARTS LIST

QTY	DESCRIPTION	LOCATION
2	7474 I.C.	Z1, Z2
1	7400 I.C.	Z3
2	7475 I.C.	Z4, Z5
6	10K 1/4 W RESISTOR	R1 - R6

'SCOPEWRITER' INTERFACE - SCHEMATIC DIAGRAM



I.C. POWER

	+5	GND
Z1	14	7
Z2	14	7
Z3	14	7
Z4	5	12
Z5	5	12

□ — INDICATES CONNECTION TO 'SCOPEWRITER' CIRCUIT

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WHERE TO FIND MORE READING MATERIAL

MANY OF OUR CUSTOMERS ARE NEWCOMERS TO THE FIELD OF DIGITAL MINI-COMPUTERS AND FROM THEIR LETTERS AND COMMENTS ARE REALLY EXCITED ABOUT THEIR NEW INTEREST. A PRIMARY PURPOSE OF THIS PUBLICATION IS TO HELP SATISFY THE DESIRES OF THESE PEOPLE FOR INFORMATION ON THE SUBJECT. HOWEVER, SINCE MOST PEOPLE CAN READ A WHOLE LOT FASTER THAN WE CAN WRITE AND SINCE THE DIVERSITY OF THE MINI-COMPUTER FAR EXCEEDS OUR CAPACITY FOR COVERING EVEN A SMALL FRACTION OF THE MANY FIELDS THAT CAN BE ACCOMMODATED BY THE MACHINE, WE COULD NOT ATTEMPT TO SATISFY EVERYONE SINGLEHANDED. FORTUNATELY, A NUMBER OF PUBLICATIONS ARE SPRINGING UP TO MEET THE DEMAND FOR INFORMATION AND SERVE AS INFORMATION EXCHANGES. WE ARE HAPPY TO PROVIDE THE NAMES AND ADDRESSES OF SEVERAL OF THOSE OF WHICH WE HAVE HAD THE OPPORTUNITY TO REVIEW THE MATERIAL PROVIDED.

AMATEUR COMPUTER SOCIETY NEWSLETTER
c/o STEPHEN B. GRAY
260 NOROTON AVENUE
DARFEN, CT. 06820

THE NEWSLETTER WHICH MR. GRAY PUTS OUT APPEARS PRIMARILY TO BE A REVIEW OF HARDWARE MANUFACTURERS NEW PRODUCTS, PLUS NEWS AND TIPS FOR SUBSCRIBERS ON A VARIETY OF SUBJECTS SUCH AS WHERE TO LOCATE CERTAIN TYPES OF COMPONENTS, NEWS OF SPECIAL PROJECTS AND APPLICATIONS, ETC. THE AMATEUR COMPUTER SOCIETY NEWSLETTER HAS BEEN AROUND FOR A NUMBER OF YEARS AND THE ORGANIZATION CATERES PRIMARILY TO THOSE WITH PROFESSIONAL COMPUTER BACKGROUNDS WHO ARE ALSO COMPUTER HOBBYIST. A SAMPLE ISSUE IS AVAILABLE FOR \$1.00.

MARK-8 USER'S GROUP
CABRILLO COMPUTER CENTER
4350 CONSTELLATION
LOMPOC, CA. 93436

THE "MARK-8 USER'S GROUP" WAS STARTED BY MR. SINGER IN RESPONSE TO THE "MARK-8" COMPUTER PROJECT PUBLISHED IN "RADIO-ELECTRONICS" MAGAZINE DURING THE SUMMER OF 1974. THE "MARK-8" USES AN 8008 CPU CHIP AS DOES OUR SCALBI-8H. TO DATE THE PUBLICATION HAS CONTAINED INFORMATION ON DEBUGGING THE MARK-8, A NUMBER OF IDEAS ON I/O DEVICES AND INTERFACES, LISTINGS OF USER'S, NEWS ON WHERE TO OBTAIN COMPONENTS, ETC.. THE GROUP PLANS TO START PUBLISHING SOFTWARE ROUTINES IN THE NEAR FUTURE AND DOES NOT LIMIT ITS COVERAGE TO JUST THE "MARK-8." NOVICES TO COMPUTER TECHNOLOGY, AND THOSE THAT LIKE TO "BUILD IT FROM SCRATCH" WOULD PROBABLY LIKE THIS PUBLICATION AND THE PUBLICATION COULD BE OF GENERAL INTEREST IF THEIR SOFTWARE PLANS TAKE FORM. THE PUBLICATION STARTED AS A "FREE" MICROGRAPHED NEWSLETTER SENT TO THOSE WHO PROVIDED SASE'S (SELF ADDRESSED STAMPED ENVELOPES) AND HAS BEEN APPEARING APPROXIMATELY MONTHLY SINCE SEPTEMBER, 1974. HOWEVER, IN THE LATEST ISSUE THEY INDICATED THE PUBLICATION WOULD SOON REQUIRE SOME FORM OF REGULAR FUNDING. WRITE FOR INFORMATION TO THE ABOVE ADDRESS.

PERHAPS THE BEST PUBLICATION WE HAVE SEEN TO DATE COMES OUT OF RALEIGH, NORTH CAROLINA. THREE GENTLEMEN DOWN THERE HAVE TEAMED UP TO PUT OUT A REALLY FINE LITTLE JOURNAL CALLED "THE COMPUTER HOBBYIST." THESE FELLAS KNOW THEIR STUFF AND ARE PUTTING IT IN WRITING IN FINE

FORM. THE FIRST COUPLE OF ISSUES STARTED OUT WITH A HOST OF FEATURE ARTICLES INCLUDING COMPLETE PLANS FOR A "VECTOR" CRT INTERFACE, A NUMBER OF TIPS ON SOFTWARE, DETAILS ON INTERFACING A TTY TO AN 8008 BASED SYSTEM, NEWS ON WHERE TO GET PARTS AND SURPLUS EQUIPMENT, A GENERAL DESCRIPTION OF CURRENTLY AVAILABLE TTY EQUIPMENT ETC. THE WRITERS ARE CURRENTLY MOSTLY INTO 8008 WORK BUT SAY THEY WILL NOT LIMIT THEMSELVES TO THAT DEVICE. THEY ARE RUNNING AN 8K 8008 SYSTEM WITH CRT AND A HARD-COPY FACILITY TO LAYOUT AND EDIT THEIR PUBLICATION. WATCH THIS LITTLE PUBLICATION - IT SHOWS SIGNS OF GOING PLACES! SUBSCRIPTIONS ARE \$6.00 YEARLY (PUBLISHED MONTHLY) - AND POSSIBLY YOU CAN PURCHASE BACK COPIES OF THE FIRST SEVERAL ISSUES (STARTED IN NOVEMBER, 1974) - RECOMMENDED FOR ALL LEVELS OF COMPUTER HOBBYIST! SUBSCRIPTIONS AND INFORMATION AVAILABLE FROM:

THE COMPUTER HOBBYIST
BOX 295
CARY, NORTH CAROLINA 27511

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*****
*****
***
***          LOOKING FOR TELETYPEWRITERS?          ***
***
***          WE FREQUENTLY GET REQUESTS FROM PEOPLE WHO DESIRE TO PUR- ***
*** CHASE TELETYPEWRITERS TO USE WITH THEIR MINI-COMPUTER. WE DO ***
*** NOT SUPPLY THEM BUT WE KNOW OF THE FOLLOWING SOURCES.          ***
***
***          NATIONAL TELETYPEWRITER CORPORATION          ***
***                207 NEWTOWN ROAD                      ***
***                PLAINVIEW, N.Y. 11803                 ***
***                PHONE: (516) 293-0444                 ***
***
***          THE ABOVE HANDLES MOSTLY COMMERCIAL QUALITY RECONDITIONED ***
*** MODEL 32 (BAUDOT) AND MODEL 33 (ASCII) MACHINES. LAST TIME ***
*** WE CHECKED THEY WERE GETTING ABOUT $500.00 FOR A MODEL 32 ASR ***
*** AND $800.00 FOR A MODEL 33 ASR, AND ABOUT $200.00 LESS FOR RO ***
*** (RECEIVE ONLY) PRINTERS.                               ***
***
***
***          ANDY ELECTRONICS, INC.                       ***
***                639 LONG DRIVE                        ***
***                HOUSTON, TX. 77017                   ***
***                PHONE: (713) 641-0576                 ***
***
***          THE ABOVE HAS A VARIETY OF OLDFP (AND LOWER COST) MODELS ***
*** MOST OF WHICH UTILIZE BAUDOT (5 LEVEL) CODE. PRICES START AT ***
*** ABOUT $120.00 FOR RECONDITIONED MODELS, AND ABOUT HALF THAT ***
*** FOR "AS IS" UNITS.                                     ***
***
*****
*****
```

MULTIPLE PRECISION ADDITION WITH THE SCLEBI-8H

MANY USERS WHO WANT TO USE THE DIGITAL COMPUTER TO PERFORM MATHEMATICAL OPERATIONS SEEM TO GET "HUNG UP" OVER HOW TO HANDLE NUMBERS THAT ARE TOO LARGE TO FIT IN ONE MEMORY WORD OR CPU REGISTER. SINCE THE SCLEBI-8H ONLY HAS 8 BITS IN A WORD, THE LARGEST NUMBER THAT CAN BE REPRESENTED IN A SINGLE REGISTER IS A MERE 255 (DECIMAL) OR, IF ONE DESIRES TO MAINTAIN THE SIGN OF THE NUMBER AND USES ONE BIT IN THE WORD FOR THE SIGN INDICATOR, THEN THE LARGEST NUMBER THAT CAN BE REPRESENTED IN A SINGLE WORD IS A PALTRY 127 (DECIMAL) - HARDLY ENOUGH TO BOTHER USING A COMPUTER TO MANIPULATE SUCH LIMITED MAGNITUDES!

AH, BUT WAIT. WE ALL KNOW THAT THE MAGNITUDE OF A NUMBER STORED IN AN "N-BIT" REGISTER IS $(2^N)-1$ AND THUS THE SIZE OF THE NUMBER THAT CAN BE STORED IN A REGISTER ESSENTIALLY DOUBLES FOR EVERY BIT ADDED TO A REGISTER. SO, IF ONE WERE TO STORE A NUMBER IN TWO REGISTERS, OR WORDS IN MEMORY IN A SCLEBI-8H ONE WOULD HAVE ENOUGH BITS TO REPRESENT NUMBERS AS LARGE AS $(2^{16})-1$ OR 65,535 (DECIMAL). IF ONE OF THESE 16 BITS WERE RESERVED FOR THE SIGN OF THE NUMBER THEN THE LARGEST NUMBER THAT COULD BE STORED IN THE TWO WORDS WOULD BE $(2^{15})-1$ OR 32,767. THAT IS QUITE A BIT MORE THAN THE VALUE OF 127 THAT CAN BE HELD IN ONE WORD! WHY STOP AT HOLDING A NUMBER IN TWO WORDS? NO NEED TO, WE CAN USE THREE WORDS TO STORE A NUMBER (PLUS SIGN) AND REPRESENT NUMBERS UP TO $(2^{23})-1$ WHICH IS 8,388,607 DECIMAL. STILL NOT ENOUGH - USE STILL AN ADDITIONAL WORD TO ALLOW REPRESENTING A SIGNED NUMBER UP TO A VALUE OF $(2^{31})-1$ WHICH IS APPROXIMATELY 1,07,483,647. YOU CAN GO AS FAR AS YOU NEED TO. GENERALLY ONE SELECTS THE NUMBER OF SIGNIFICANT DIGITS THAT WILL BE IMPORTANT IN THE CALCULATIONS TO BE PERFORMED AND MAKES SURE THAT ENOUGH WORDS ARE USED TO GET THE "PRECISION" REQUIRED FOR THE APPLICATION. THE USE OF MORE THAN ONE WORD TO STORE AND MANIPULATE NUMBERS AS THOUGH THEY WERE IN ONE LARGE CONTINUOUS REGISTER IS COMMONLY REFERRED TO AS "MULTIPLE-PRECISION" ARITHMETIC. YOU WILL OFTEN HEAR COMPUTER TECHNOLOGISTS SPEAKING OF "DOUBLE-PRECISION" OR "TRIPLE-PRECISION" ARITHMETIC. THIS SIMPLY MEANS THAT THE MACHINE IS USING TECHNIQUES (GENERALLY PROGRAMMING TECHNIQUES) THAT ENABLE IT TO HANDLE NUMBERS STORED IN TWO OR THREE REGISTERS AS THOUGH THEY WERE ONE NUMBER IN A VERY LARGE REGISTER.

THE SCLEBI-8H IS CAPABLE OF MULTIPLE-PRECISIONS ARITHMETIC. IN FACT IT DOES IT QUITE NICELY BECAUSE THE DESIGNERS OF THE INTEL 8008 CPU CHIP USED IN THE SCLEBI-8H INCLUDED SOME SPECIAL INSTRUCTIONS FOR JUST SUCH WORK! MULTIPLE PRECISION ARITHMETIC IS NOT DIFFICULT - IT TAKES A LITTLE MORE "ORGANIZATION" OF THE PROGRAM TO HANDLE AND STORE NUMBERS THAT ARE STORED IN MULTIPLE WORDS - BUT WITH THE USE OF EFFECTIVE "SUBROUTINING" OR "CHAINING" OPERATIONS THE TASKS CAN BE HANDLED WITH EASE.

TO USE MULTI-PRECISION ARITHMETIC ONE MUST ESTABLISH A CONVENTION FOR STORING THE SECTIONS OF ONE LARGE NUMBER IN SEVERAL REGISTERS. FOR THE PURPOSES OF THIS DISCUSSION, WE WILL ASSUME "TRIPLE-PRECISION" ARITHMETIC IS BEING PERFORMED AND BECAUSE OF THE SUBROUTINE ILLUSTRATED LATER, THAT NUMBERS TO BE DEALT WITH ARE STORED IN THREE CONSECUTIVE MEMORY LOCATIONS ARRANGED AS FOLLOWS.

MEMORY LOCATION "N"	=	LEAST SIGNIFICANT 8 BITS
MEMORY LOCATION "N+1"	=	NEXT SIGNIFICANT 8 BITS
MEMORY LOCATION "N+2"	=	MOST SIGNIFICANT 7 BITS + SIGN BIT

THUS, THE THREE WORDS COULD BE CONSIDERED AS JOINED TOGETHER TO CONTAIN ONE LARGE 23 BIT "SIGNED" NUMBER AS SHOWN IN THE FOLLOWING DIAGRAM.

MEM LOCATION "N+2" MEM LOCATION "N+1" MEM LOCATION "N"

```
*****
*S X X X X X X X*
*****
*****
*X X X X X X X X*
*****
*****
*X X X X X X X X*
*****
```

MOST SIGNIFICANT BITS NEXT SIGNIFICANT BITS LEAST SIGNIFICANT BITS

FOR THE PURPOSE OF ILLUSTRATING THE OPERATIONS OF THE MULTI-PRECISION ROUTINE SHOWN BELOW LET US ASSUME THAT A NUMBER EXISTS IN THE PRESCRIBED FORMAT AT LOCATIONS 100, 101 AND 102 ON PAGE 02, AND A SECOND NUMBER TO BE ADDED TO THE FIRST RESIDES AT LOCATIONS 300, 301 AND 302 ON PAGE 03.

THE ROUTINE TO ADD THE TWO NUMBERS HAS BEEN DEVELOPED AS A GENERAL PURPOSE "N"TH PRECISION ROUTINE. PRIOR TO CALLING THE ROUTINE IT IS NECESSARY TO SET UP REGISTERS "H" & "L" TO POINT TO THE LEAST SIGNIFICANT PORTION OF ONE OF THE NUMBERS, AND REGISTERS "D" & "E" MUST CONTAIN THE ADDRESS OF THE LEAST SIGNIFICANT PORTION OF THE SECOND NUMBER. ALSO, REGISTER "B" MUST BE SET TO THE "PRECISION," OR NUMBER OF MEMORY WORDS USED TO CONTAIN THE MULTI-WORD NUMBER. THE INITIALIZING PROCEDURE MUST BE DONE PRIOR TO CALLING THE "ADD" SUBROUTINE.

THE "ADD" SUBROUTINE ITSELF USES TWO EXTERNAL SUBROUTINES WHICH ARE SHOWN FOR REFERENCE PURPOSES. THE SUBROUTINE LABELED "SWITCH" EXCHANGES THE CONTENTS OF THE "H" & "L" AND "D" & "E" REGISTERS SO THAT THE MEMORY POINTER REGISTERS ("H" & "L") CAN BE ALTERED TO POINT TO THE DIFFERENT LOCATIONS WHERE THE TWO NUMBERS TO BE ADDED ARE STORED. THE SUBROUTINE TERMED "ADV" IS USED TO ADVANCE THE ADDRESS POINTED TO BY REGISTERS "H" & "L."

```

                                /MULTIPLE-PRECISION ADD ROUTINE
                                /
                                /INITIALIZE POINTERS AND SET PRECISION
                                /
INIT,  LHI 002            /SET PAGE FOR LSW OF FIRST NUMBER
        LLI 100           /AND LOCATION ON PAGE FOR LSW OF FIRST NUMBER
        LDI 003           /NOW SET PAGE ADDR FOR LSW OF SECOND NUMBER
        LEI 300           /AND LOCATION ON PAGE FOR LSW OF SECOND NUMBER
        LBI 003           /SET PRECISION VALUE (3 WORDS)
                                /
                                /NOW CALL THE ADD SUBROUTINE - ASSUME
                                /OTHER INSTRUCTIONS ARE IN THIS SECTION
                                /TO HANDLE THE RESULT OF THE ADDITION ETC.
                                /
        CALL ADD         /ADD THE TWO TRIPLE-PRECISION NUMBERS
        .                /
        .                /USER INSTRUCTIONS TO HANDLE THE RESULT
        .                /
                                /
                                /HERE IS THE "N"TH PRECISION SUBROUTINE
                                /
ADD,   NDA               /ALWAYS CLFAR CARRY FLAG AT START OF RTN
ADDMOR, LAM             /GET FIRST NUMBER INTO ACCUMULATOR
        CAL SWITCH       /EXCHANGE CONTENTS OF "H" & "L" AND "D" & "E"
        ACM               /PERFORM THE ADDITION WITH THE SECOND NUMBER
        LMA               /PUT RESULT IN PLACE OF SECOND NUMBER
        DCB               /DECREMENT "PRECISION" COUNTER
        RTZ               /FINISHED WHEN COUNTER EQUAL 000

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CAL ADV /IF NOT FINISHED - ADVANCE ADDEND POINTER
CAL SWITCH /GET POINTER TO FIRST NUMBER AGAIN
CAL ADV /AND ADVANCE IT TOO
JMP ADDMOR /CONTINUE WITH NEXT BYTE UNTIL LOOP EXITED
/
/HERE IS THE "SWITCH" SUBROUTINE
/
SWITCH, LCH /TEMPORARILY LOAD "H" INTO "C"
LHD /PUT "D" INTO "H"
LDC /NOW PUT FORMER "H" FM "C" INTO "D"
LCL /TEMPORARILY LOAD "L" INTO "C"
LLE /PUT "E" INTO "L"
LEC /AND PUT FORMER "L" FM "C" INTO "E"
RET /EXIT SUBROUTINE
/
/AND HERE IS THE "ADV" SUBROUTINE
/
INL /ADVANCE CONTENTS OF REG "L"
RFZ /RETURN IF NOT INTO NEW PAGE
INH /BUT IF NEW PAGE ADVANCE "H" TOO
RET /THEN EXIT SUBROUTINE
/

```

IT SHOULD BE NOTED THAT THE BASIC "ADD" SUBROUTINE AS SHOWN ABOVE CAN BE USED TO PROCESS NUMBERS STORED IN FROM ONE TO "N" WORDS SIMPLY BY SETTING UP REGISTER "B" PRIOR TO CALLING THE SUBROUTINE.

IT SHOULD ALSO BE NOTED THAT THE SUBROUTINE IS "DESTRUCTIVE" TO THE ORIGINAL VALUE OF THE NUMBER THAT IS ADDED BECAUSE THE RESULT OF THE ADDITION OPERATION IS STORED THERE. SO, IF ONE WISHED FOR SOME REASON TO SAVE THE VALUE OF THE ADDEND ONE SHOULD MAKE SURE THAT IT IS SAVED IN SOME OTHER LOCATION(S) PRIOR TO CALLING THE "ADD" SUBROUTINE.

IT SHOULD ALSO BE NOTED THAT THE "ACM" TYPE OF ADD INSTRUCTION VERSUS THE "ADM" ONE WAS USED IN THE ROUTINE. READERS MAY REFER TO CHAPTER 2 IN "THE SCALBI-8H USER'S MANUAL" TO REVIFW THE IMPORTANT DIFFERENCE BETWEEN THE TWO TYPES OF INSTRUCTIONS- ESSENTIALLY THAT THE "ACM" INSTRUCTION USES THE CONTENTS OF THE CARRY FLAG WHEN PERFORMING THE ADDITION - AN ESSENTIAL ELEMENT WHEN PERFORMING MULTI-PRECISION ARITHMETIC BECAUSE THE CARRY FROM ONE REGISTER MUST BE ADDED INTO THE NEXT SIGNIFICANT PART OF THE MULTI-WORD NUMBER!

AS A FINAL REMARK, THE "ADD" SUBROUTINE READILY HANDLES NEGATIVE NUMBERS IF THEY ARE PUT IN THEIR "TWO'S COMPLEMENT" FORM BEFORE CALLING THE SUBROUTINE AND THUS THE SAME ROUTINE CAN BE USED TO PERFORM BOTH ADDITION AND, EFFECTIVELY, SUBTRACTION.

```

*****
***                               N O T I C E                               ***
***                                                                                   ***
***   THE PRECEEDING ARTICLE WAS BASED ON A TINY PORTION FROM A                 ***
***   NEW BOOK NOW IN THE MANUSCRIPT STAGES AT SCALBI COMPUTER CON-             ***
***   SULTING, INC. THE NEW BOOK, DEVOTED ENTIRELY TO MACHINE LAN-             ***
***   GUAGE PROGRAMMING OF THE SCALBI-8H, IS SCHEDULED FOR PUBLICA-           ***
***   TION IN EARLY SPRING. THE ABOVE ARTICLF IS REPRESENTATIVE OF           ***
***   THE LEVEL OF THE MATERIAL ABOUT HALF WAY THROUGH THE BOOK, AF-         ***
***   TER THE READER HAS BEEN WELL INDOCTRINATED IN PROGRAMMING FUN-         ***
***   DAMENTALS. OTHER EXTRACTIONS FROM THE NEW BOOK WILL BE PROVI-         ***
***   DED IN THIS PUBLICATION IF READER RESPONSE IS FAVORABLE.               ***
*****

```

A SIMPLE, LOW COST, FAST MANUAL PROGRAM LOADER PERIPHERAL

ONE OF THE FIRST THINGS A NEW SCLEBI-8H OWNER LIKES TO PROCURE IS SOME SORT OF DEVICE THAT WILL REDUCE THE EFFORT REQUIRED TO LOAD PROGRAMS INTO MEMORY. MANY USER'S START OUT WITH A TAPE UNIT, OR A KEYBOARD DEVICE OF SOME TYPE THAT WILL ALLOW THEM TO AUTOMATICALLY LOAD IN LARGE PROGRAMS ONCE AN INITIAL "BOOTSTRAP" LOADER HAS BEEN PLACED IN MEMORY. THOSE THAT CAN AFFORD IT USUALLY HAVE A SUITABLE "BOOTSTRAP" LOADER PUT ON A PROM (PROGRAMMABLE READ ONLY MEMORY) SO THAT THEY CAN BEGIN OPERATING THE SYSTEM AS SOON AS THEY POWER UP. HOWEVER, A SUBSTANTIAL NUMBER OF OUR USERS ARE DEVELOPING THEIR COMPUTER FACILITY ON TIGHT BUDGETS AND MUST PUT OFF THE LUXURY OF PROMS FOR THE TIME BEING. WHILE VIRTUALLY ANY PROGRAM CAN BE "TOGGLED" INTO MEMORY USING THE CHASSIS SWITCHES ON THE SCLEBI-8H, THE PROCESS BECOMES QUITE TEDIOUS ONCE ONE STARTS PLAYING WITH ROUTINES THAT ARE MORE THAN 10 TO 20 INSTRUCTIONS IN LENGTH BECAUSE THE OPERATOR MUST CONSTANTLY SET THE CHASSIS SWITCHES TO THE "LMI" INSTRUCTION, ADVANCE THE COMPUTER WITH THE STEP BUTTON TO THE "IMMEDIATE" PORTION OF THE INSTRUCTION AND THEN SET THE SWITCHES TO THE DATA TO BE LOADED INTO MEMORY, ADVANCE THE STEP BUTTON TO FINISH THE INSTRUCTION, THEN SET THE SWITCHES FOR AN "INL" COMMAND, ADVANCE THE STEP BUTTON, AND GO BACK TO THE "LMI" INSTRUCTION TO INSERT THE NEXT WORD IN MEMORY ETC. IS THERE A BETTER WAY TO MANUALLY LOAD PROGRAMS? YOU BET THERE IS - AND IT DOESN'T COST VERY MUCH TO IMPLEMENT IT. JUST THE INVESTMENT IN EIGHT TOGGLE SWITCHES AND A SMALL MINI-BOX OR METAL PLATE ON WHICH TO MOUNT THEM IN A POSITION CONVENIENT TO THE OPERATOR. WIRE THE SWITCHES TO COMMON ON ONE SIDE AND RUN THE OTHER SIDE OF EACH SWITCH TO ONE INPUT DATA LINE OF ANY INPUT PORT. (REFER TO THE SCHEMATIC DIAGRAM ON THE NEXT PAGE).

NOW USE THE SCLEBI-8H CHASSIS TOGGLE SWITCHES TO FIRST PUT THE FOLLOWING SHORT ROUTINE IN MEMORY.

ADDRESS	CODE	MNEMONIC	COMMENTS
000 000	1XX	INP X	/INPUT FROM PORT X
000 001	370	LMA	/PLACE ACC CONTENTS IN MEM
000 002	060	INL	/ADVANCE LA MEMORY POINTER
000 003	000	HLT	/STOP - WAIT FOR OPERATOR

NOW SET UP REGISTERS "H" AND "L" TO THE STARTING ADDRESS WHERE YOU DESIRE TO PLACE THE PROGRAM THAT IS TO BE LOADED INTO MEMORY. THEN SET THE CHASSIS TOGGLE SWITCHES TO 005 (RST 0 INSTRUCTION). NOW SET THE INPUT PORT SWITCHES TO THE VALUE THAT IS TO BE LOADED INTO MEMORY. HIT THE "INTERRUPT" SWITCH AND THEN THE "RUN" BUTTON. SET THE INPUT SWITCHES TO THE VALUE TO BE PLACED IN THE NEXT MEMORY LOCATION. REPEAT THE CYCLE OF DEPRESSING THE "INTERRUPT" THEN THE "RUN" BUTTON. THATS ALL THERE IS TO IT! LOSE YOUR PLACE? STEP THROUGH ONE CYCLE AND OBSERVE THE ADDRESS LAMPS AS THE LMA INSTRUCTION IS EXECUTED TO VERIFY YOUR LOCATION!

BE CAREFUL IF YOUR GOING TO LOAD A PROGRAM THAT CROSSES PAGES IN MEMORY. IN THAT CASE YOU CAN EITHER INSERT AN "INH" INSTRUCTION WITH THE CHASSIS TOGGLE SWITCHES - OR, IF YOU DO IT A LOT - USE THE PROGRAM BELOW AS THE LOADER.

ADDRESS	CODE	MNEMONIC	COMMENTS
000 000	1XX	INP X	/INPUT FROM PORT X
000 001	370	LMA	/PLACE ACC CONTENTS IN MEM
000 002	060	INL	/ADVANCE LA MEMORY POINTER

ADDRESS	CODE	MNEMONIC	COMMENTS
000 003	110	JFZ NO	/CHECK FOR NEW PAGE
000 004	007		/IF NOT NEW PAGE THEN
000 005	000		/DO NOT ADVANCE "H"
000 006	050	INH	/ADV "H" IF CROSS PAGE
000 007	000	HLT	/STOP - WAIT FOR OPERATOR

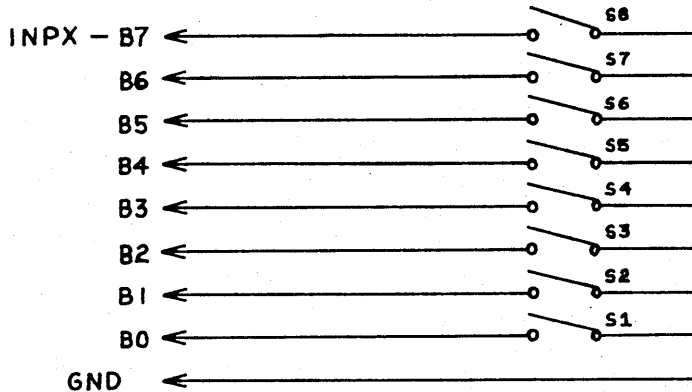


DIAGRAM FOR SIMPLE FAST MANUAL LOADER PERIPHERAL

SOFTWARE REVISION NOTICE - SCELBI PROGRAM #62XX-0011
ASCII MAG FILE WRITE & READ PROGRAM

THIS PROGRAM HAS BEEN REVISED TO REVISION A. THE REVISION CORRECTS A DEFICIENCY IN THE TTY OUTPUT ROUTINE "DIRECT" TO ENSURE THAT A STOP BIT IS TRANSMITTED AT THE END OF A CHARACTER. THE DEFICIENCY WILL NOT BE NOTICED UNLESS BIT 8 IS A LOGIC "0" WHICH WILL NOT NORMALLY OCCUR WHEN HANDLING STANDARD ASCII CODE. THE FOLLOWING PATCH WILL CORRECT THE DEFICIENCY.

CHANGE LOCATIONS 237, 240 AND 241 ON PAGE 02 TO:

ADDRESS	CONTENTS	MNEMONIC	COMMENTS
02 237	106	CAL PATCH1	/PATCH TO SET UP STOP BIT
02 240	077		
02 241	003		

AND INSERT THE "PATCH1" SUBROUTINE STARTING AT LOCATION 077 ON PG 03

ADDRESS	CONTENTS	MNEMONIC	COMMENTS
03 077	006	PATCH1, LAI 001	/SFT STOP BIT
03 100	001		
03 101	106	CAL NMS	
03 102	255		
03 103	002		
03 104	007	RET	

REVISED PROCEDURES FOR LOADING PROGRAMS PROVIDED BY SCELBI ON
AUDIO TAPE CASSETTES

THE FOLLOWING IS A COPY OF THE REVISED INSTRUCTIONS FOR UTILIZING THE SCELBI AUDIO CASSETTE INTERFACE TO READ SCELBI PREPARED PROGRAMS USING THE 62XX-0003 AND 62XX-0004 PROGRAMS. THESE NEW INSTRUCTIONS ARE BEING ISSUED TO CLARIFY SEVERAL POINTS AS A RESULT OF USER "FEEDBACK."

PROCEDURE FOR LOADING THE TAPE READ PROGRAM
USING THE BOOTSTRAP LOADER.

PRELIMINARY SET UP

1. PLACE A CASSETTE WITH A PROGRAM OR DATA RECORDED ON IT INTO THE RECORDER.
2. PLUG THE SILVER PHONE PLUG INTO THE EARPHONE JACK.

IMPORTANT

WHEN READING IN A PROGRAM OR DATA FROM TAPE, THE LARGE RED (OR BLACK) PHONE PLUG SHOULD NOT BE PLUGGED INTO THE RECORDER MIC. OR AUX. INPUT SINCE THE SIGNAL COMING FROM IT MAY INTERFERE WITH THE SIGNAL BEING READ FROM THE TAPE.

3. START THE RECORDER IN THE PLAY MODE.
4. ADJUST THE VOLUME CONTROL UP FROM THE MINIMUM LEVEL UNTIL THE INDICATOR DSI JUST TURNS ON WHILE THE DATA IS BEING PLAYED IN. TURN THE VOLUME ABOUT 1/8 OF A TURN HIGHER THAN THIS POINT. THIS IS THE SETTING THE VOLUME CONTROL SHOULD BE SET TO FOR RECORDING AND PLAYING BACK DATA.

LOADING THE TAPE READ PROGRAM

1. CAREFULLY TOGGLE IN THE BOOTSTRAP LOADER PROGRAM, 61XX-0004, STARTING AT PAGE 01 LOCATION 300.
2. TOGGLE THE FOLLOWING OCTAL VALUES INTO THE RESPECTIVE REGISTERS.

LOAD REG A WITH 300 (LAI 300)
LOAD REG C WITH 200 (LCI 200)
LOAD REG H WITH 001 (LHI 001)
LOAD REG L WITH 120 (LLI 120)

3. PLACE THE CASSETTE WITH THE TAPE READ PROGRAM, 61XX-0003, INTO THE RECORDER AND SET IT TO THE START OF THE TONE WHICH PRECEEDS THE PROGRAM.
4. PLUG THE SILVER PHONE PLUG INTO THE EARPHONE JACK.
5. TOGGLE A 'JUMP TO LOCATION 300 ON PAGE 01' INSTRUCTION IN ON THE FRONT PANEL BUT DO NOT PRESS RUN.
6. START THE TAPE RECORDER IN THE PLAY MODE.

7. PRESS RUN ON THE COMPUTER.
8. WATCH BIT 5 OF THE LOW ADDRESS LAMPS CAREFULLY. WHEN THE PROGRAM IS BEING READ IN BIT 5 WILL INCREASE IN INTENSITY. APPROXIMATELY 8 SECONDS AFTER BIT 5 BECOMES BRIGHTER IT WILL GO DIM. THIS INDICATES THE END OF THE PROGRAM.
9. AT THIS TIME, PRESS THE INTERRUPT BUTTON TO STOP THE PROGRAM. NOTE: THE BOOTSTRAP LOADER PROGRAM DOES NOT STOP WHEN THE PROGRAM IS READ IN. IT MUST BE STOPPED MANUALLY.
10. STOP THE TAPE RECORDER.
11. JUMP OFF PAGE AND TOGGLE A 'LOAD A FROM MEMORY' INSTRUCTION (LAM -- 307) AND CHECK THAT THE MEMORY POINTER IS AT LOCATION 265 ON PAGE 01.

PROCEDURE FOR LOADING PROGRAMS USING THE
TAPE READ PROGRAM #61XX-0003

1. SET THE TAPE UNIT TO THE CORRECT VOLUME AND TONE SETTINGS.
2. PUT THE CASSETTE IN THE TAPE RECORDER WITH THE PROGRAM TO BE READ IN ON IT AND SET IT TO THE START OF THE TONE WHICH PRECEEDS THE PROGRAM.
3. PLUG THE SILVER PHONE PLUG INTO THE EARPHONE JACK.
4. TOGGLE THE FOLLOWING LOADING INFORMATION INTO THE RESPECTIVE REGISTERS.

LOAD REG L WITH THE FIRST LOCATION TO BE READ IN.
LOAD REG H WITH THE PAGE TO BE LOADED.
LOAD REG E WITH THE CHECKCOUNT (THE CHECKCOUNT IS THE TOTAL NUMBER OF WORDS TO BE READ IN.)

5. TOGGLE A 'JUMP TO LOCATION 120 ON PAGE 01' INSTRUCTION IN ON THE FRONT PANEL SWITCHES BUT DO NOT PRESS RUN.
6. START THE RECORDER IN THE PLAY MODE.
7. PRESS RUN ON THE COMPUTER.
8. THE COMPUTER WILL STOP WHEN IT IS FINISHED READING IN THE PROGRAM.
 - A) IF ALL THE MEMORY CONTENT LIGHTS ARE OUT THE PROGRAM WAS READ IN CORRECTLY.
 - B) IF ALL THE MEMORY CONTENT LIGHTS ARE ON THE PROGRAM DID NOT READ IN CORRECTLY AND SHOULD BE RELOADED.
9. STOP THE RECORDER.

IN CASE OF DIFFICULTY READING IN PROGRAMS GENERATED
BY SCELEI ON CASSETTE TAPE.

IF THE PROGRAM DOES NOT APPEAR TO BE READING THE TAPE AT ALL
(INDICATED BY NO CHANGE IN THE INTENSITY OF BIT 5 IN THE LOW AD-
DRESS LAMPS) THE FAILURE MAY BE DUE TO ONE OF THE FOLLOWING:

1. THE PROGRAM READING THE TAPE IS NOT CORRECTLY LOADED IN
MEMORY. THIS CAN BE CHECKED BY EXAMINING THE CONTENTS OF
EACH MEMORY LOCATION OF THE LOADING PROGRAM.
2. THERE IS A BAD CONNECTION BETWEEN THE TAPE UNIT, INTER-
FACE AND COMPUTER. CHECK THAT ALL CABLES ARE CONNECTED
TO THE 'PROPER' SOCKETS AND THAT THEY ARE NOT LOOSE.
3. THE 'SYNC' SIGNAL IS NOT CONNECTED TO P1-10 AND P2-10 OF
THE TAPE UNIT INTERFACE. THIS SIGNAL MUST BE GOING TO THE
PINS MENTIONED FOR THE TAPE INTERFACE TO WORK. THE SYNC
SIGNAL COMES FROM XA02-BA OF THE SCELEI-8H.

IF THE PROGRAM APPEARED TO READ IN BUT THE DATA READ IN WAS NOT
CORRECT, IT MAY BE DUE TO ONE OF SEVERAL REASONS.

1. THE TIMING IN THE READ PROGRAM IS NOT CORRECTLY SET FOR
THE TAPE RECORDER BEING USED. THE RECORDER MAY BE RUN-
NING AT A SLIGHTLY DIFFERENT SPEED THAN THAT USED BY
SCELEI WHEN MAKING THE TAPE. TO CORRECT FOR THIS POSSIBLE
VARIATION, THE TIMING LOOP IN THE READ PROGRAM SHOULD
BE ADJUSTED. FOR THE TAPE READ PROGRAM, 61XX-0003, VARY
THE DELAY CONSTANT AT LOCATION 257 PAGE 01 FROM ITS VALUE
OF 021, BY PLUS OR MINUS 1, 2 OR 3 UNTIL A CORRECT READ
IN IS OBTAINED.
2. THE PROGRAM READING THE TAPE IS NOT CORRECTLY LOADED IN
MEMORY. THIS CAN BE CHECKED BY EXAMINING THE LOADING
PROGRAM.

FEATURE ARTICLES BEING PLANNED FOR THE NEXT ISSUE (APRIL, 1975)

IN THE NEXT ISSUE OF THIS PUBLICATION WE ARE PLANNING ON PRESENTING
SEVERAL FEATURE ARTICLES INCLUDING A DISCUSSION ON THE USE OF AN ASSEM-
BLER PROGRAM, MORE MULTIPLE-PRECISION MATHEMATICAL ROUTINES, AND AN IN-
TEGRATED CIRCUIT TESTER WITH COMPLETE SCHEMATIC AND SEVERAL SAMPLE PRO-
GRAMS.

BY THE NEXT ISSUE WE EXPECT TO HAVE A NUMBER OF CONTRIBUTIONS FROM
USERS TO BEGIN EXPANDING THE SCOPE OF THE PUBLICATION. IF YOU HAVE
SOMETHING TO CONTRIBUTE PLEASE FORWARD IT TO THE ADDRESS ON THE LAST
PAGE OF THIS BULLETIN TO THE ATTENTION OF THE "DIGEST EDITOR."

INTERFACING THE PF KEYBOARD TO
THE SCLEBI-8H MINI-COMPUTER

FOR OPERATOR COMMUNICATIONS WITH A COMPUTER THE MOST COMMON DEVICE IS A KEYBOARD. THERE HAVE BEEN SEVERAL ARTICLES RECENTLY WHICH DESCRIBE AN ECONOMICAL ASCII ENCODED KEYBOARD WHICH CAN BE USED FOR OPERATOR COMMAND INPUT AND DATA AND TEXT ENTRY. A POPULAR ONE IS THE ARTICLE IN THE APRIL 1974 ISSUE OF POPULAR ELECTRONICS. THE KEYBOARD DESCRIBED THERE IS A SUITABLE LOW COST INPUT DEVICE FOR THE SCLEBI-8H.

THERE ARE SEVERAL CHARACTERS, HOWEVER, WHICH ARE OFTEN DESIRABLE ON AN ASCII KEYBOARD WHICH ARE NOT PROVIDED ON THE ORIGINAL PE KEYBOARD. THESE CHARACTERS ARE THE LEFT ARROW (←) AND RUBOUT, WHICH IS OFTEN REFERRED TO AS DELETE. THESE CHARACTERS ARE OFTEN USED BY SCLEBI SOFTWARE (PROGRAMS). THESE CHARACTERS CAN BE ADDED BY USING TWO OF THE UNDEFINED KEYS ON THE KEYBOARD.

THE LEFT ARROW HAS AN OCTAL CODE OF 337 WHICH WOULD PLACE IT BETWEEN THE W AND THE 7 AND BELOW THE VERTICAL ARROW (↑) ON THE 6X8 MATRIX SHOWN IN FIGURE 1 OF THE PE ARTICLE. FIGURE 1 OF THIS ARTICLE SHOWS THE MODIFIED PORTION OF THE 6X8 MATRIX. TO CONNECT THIS KEY, RUN A WIRE FROM ONE CONTACT OF THE UNDEFINED KEY TO BE USED OVER TO THE P.C. LAND WHICH IS COMMON TO KEYS G, O, W, 7 AND ?. CONNECT ANOTHER WIRE FROM THE OTHER CONTACT OF THE UNDEFINED KEY CHOSEN FOR THE LEFT ARROW OVER TO THE P.C. LAND WHICH IS COMMON TO X, Y, Z AND ↑.

RUBOUT HAS AN OCTAL CODE OF 377. TO FORM THIS CODE, IT IS NECESSARY TO ADD 3 DIODES (D21, D22 AND D23) AS SHOWN IN FIGURE 2 OF THIS ARTICLE. IC1 AND IC2 CORRESPOND TO IC1 AND IC2 OF THE PE KEYBOARD. CONNECT THE ANODE OF D21 TO PIN 7 OF IC2. CONNECT THE ANODE OF D22 TO PIN 9 OF IC2. CONNECT THE ANODE OF D23 TO PIN 8 OF IC1. CONNECT THE CATHODES OF D21, D22 AND D23 TO ONE CONTACT OF THE UNDEFINED KEY TO BE USED FOR RUBOUT. CONNECT THE OTHER CONTACT OF THE UNDEFINED KEY TO GROUND (PIN 4 OF IC2).

THE PF KEYBOARD COULD BE CONNECTED DIRECTLY TO AN INPUT PORT OF THE SCLEBI-8H USING THE KP LEAD TO INDICATE THAT A CHARACTER IS AVAILABLE, HOWEVER SEVERAL PROBLEMS WOULD ARISE. WHEN A CHARACTER IS DEPRESSED ON THE PE KEYBOARD, THE CODE FOR THAT CHARACTER IS AVAILABLE AT THE KEYBOARD OUTPUT AND THE KP LEAD GOES LOW. A COMPUTER PROGRAM SENSING KP AS A LOW COULD READ IN THE CHARACTER FROM THE KEYBOARD. HOWEVER, ONE PROBLEM ARISES WHEN THE PROGRAM FINISHES PROCESSING THE CHARACTER IT HAS ACCEPTED AND COMES BACK TO GET A NEW CHARACTER FROM THE KEYBOARD. IT WOULD BE VERY DIFFICULT FOR IT TO DETERMINE WHETHER THE NEXT CHARACTER IS A NEW ENTRY OR ONLY THE PREVIOUS CHARACTER STILL BEING DEPRESSED. ALSO, IF MORE THAN ONE KEY IS DEPRESSED THE COMBINED CODES FOR THE KEYS WILL APPEAR AT THE OUTPUT OF THE KEYBOARD GIVING AN ERRONEOUS INPUT TO THE COMPUTER.

TO ELIMINATE THESE TYPE OF PROBLEMS, AN INTERFACE BETWEEN THE KEYBOARD AND THE COMPUTER IS NEEDED WHICH WILL LATCH IN THE FIRST CHARACTER DEPRESSED ON THE KEYBOARD AND INDICATE TO THE COMPUTER THAT THE CHARACTER IS AVAILABLE. THEN, WHEN THE CHARACTER HAS BEEN ACCEPTED, THE COMPUTER MUST RESET THE INTERFACE BEFORE THE INTERFACE ACCEPTS ANOTHER CHARACTER FROM THE KEYBOARD. AN INTERFACE THAT PERFORMS THIS TYPE OF FUNCTION ALLOWING EFFICIENT AND ACCURATE MEANS OF ENTERING CHARACTERS FROM THE PF KEYBOARD IS SHOWN IN FIGURE 3.

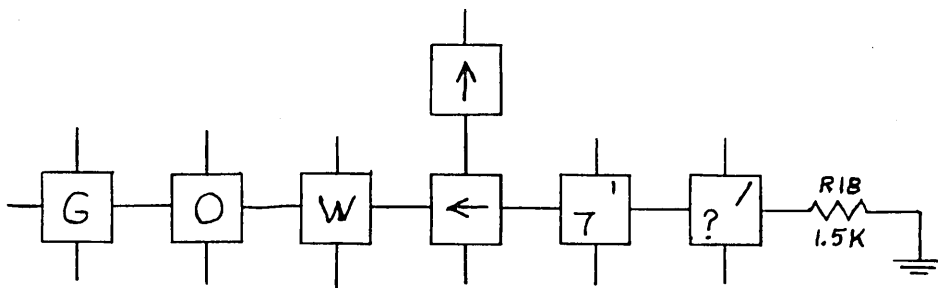


FIG. 1

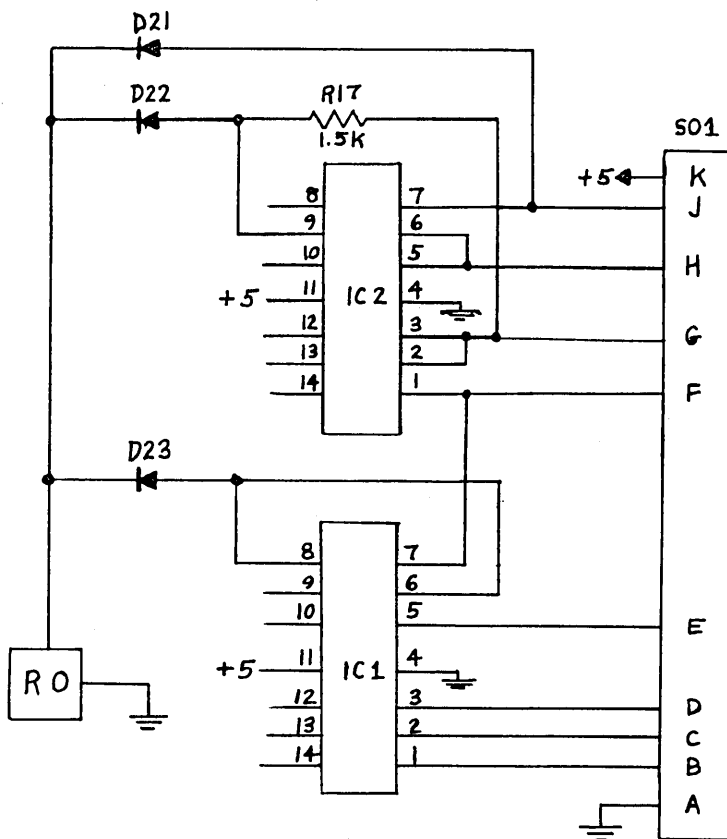


FIG. 2

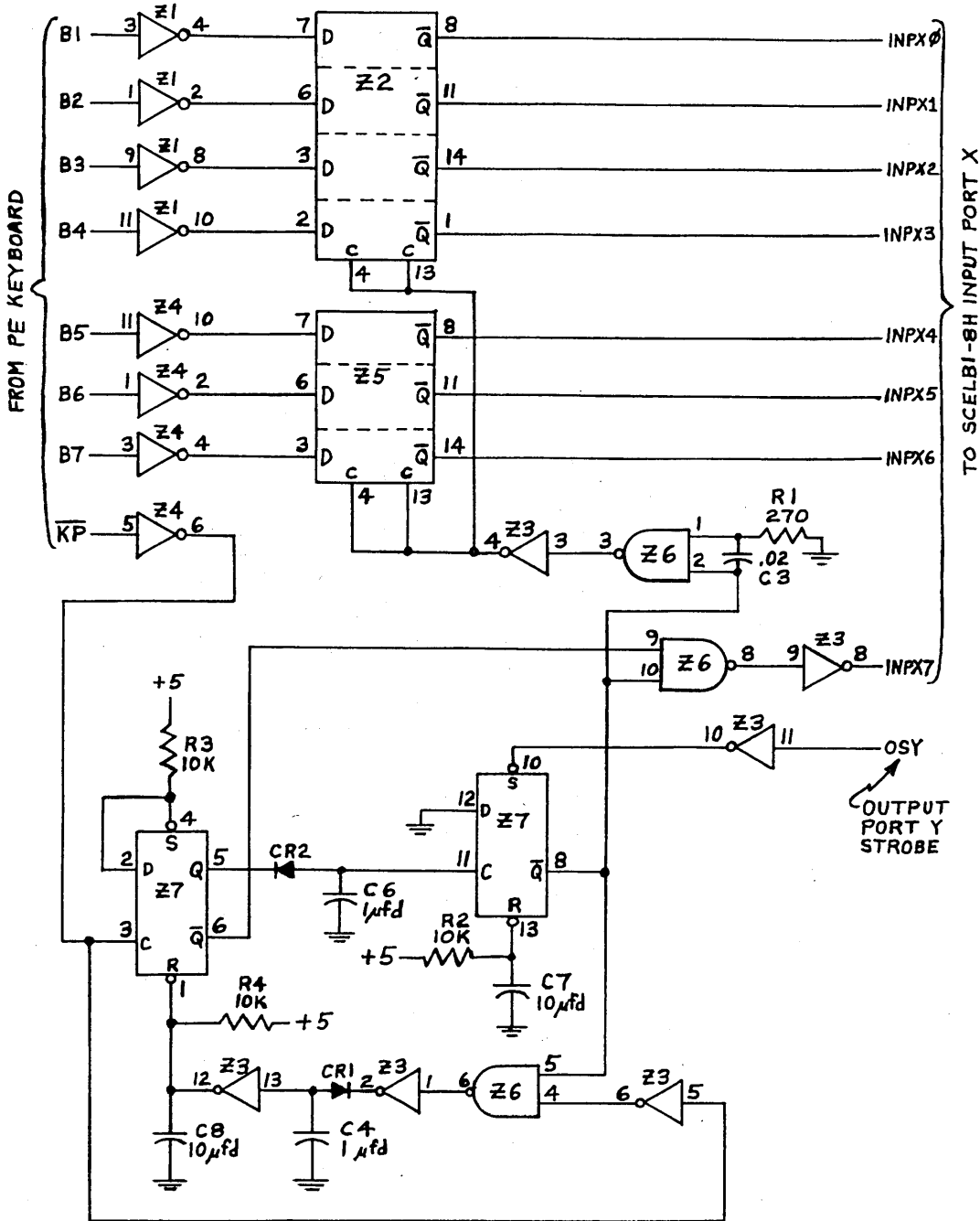


FIG. 3

THIS INTERFACE LATCHES IN THE CODE FOR THE CHARACTER WHEN THE KEY IS DEPRESSED AND INDICATES A CHARACTER IS AVAILABLE WHEN THE KEY IS RELEASED. IT DOES NOT ACCEPT ANOTHER CHARACTER UNTIL THE COMPUTER RESETS THE CHARACTER AVAILABLE STATUS, THEREBY ALLOWING ONLY ONE CHARACTER TO BE ENTERED AT A TIME. THIS BASIC INTERFACE CAN ALSO BE ADAPTED TO OTHER STYLE KEYBOARDS OR USED AS A PARALLEL INPUT INTERFACE FOR OTHER DATA ENTRY DEVICES. THE CIRCUIT SHOWN IN FIGURE THREE PERFORMS THE DESCRIBED FUNCTIONS. READERS CAN BUILD THIS CIRCUIT IN BREADBOARD FASHION AS THE LAYOUT OF COMPONENTS IS NOT CRITICAL. CONNECTIONS TO THE KEYBOARD AND COMPUTER ARE DESIGNATED BY SIGNAL NAMES. (A FLEXIBLE ARRANGEMENT OF THE INTERFACE WITH CIRCUITRY ON A P.C. CARD CAN ALSO BE OBTAINED FROM SCFLBI IN EITHER KIT OR ASSEMBLED AND TESTED FORM).

* * * * *

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