MACROTRONICS S80
HAM INTERFACE FOR
THE SORCERER MICROCOMPUTER
USER GUIDE

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L I M I T E D W A R R A N T Y

FOR A PERIOD OF 30 DAYS AFTER PURCHASE, MACROTRONICS WILL REFUND IN FULL THE PURCHASE PRICE MINUS POSTAGE OF ANY FACTORY ASSEMBLED HARDWARE/SOFTWARE SYSTEM WHICH IS FOUND TO BE UNSATISFACTORY BY THE PURCHASER.

FOR A PERIOD OF 30 DAYS AFTER PURCHASE, MACROTRONICS WILL REPLACE ANY CASSETTE WHICH FAILS TO LOAD PROPERLY THROUGH NO FAULT OF YOURS OR YOUR EQUIPMENT.

IF, AFTER CAREFULLY FOLLOWING THE INSTRUCTIONS IN THE MANUAL, YOU ARE UNABLE TO OBTAIN A GOOD LOAD OF THE COMPUTER PROGRAMS PROVIDED, SEND THE CASSETTE POSTAGE PREPAID TO MACROTRONICS AT THE ADDRESS GIVEN BELOW. MACROTRONICS WILL SEND YOU A REPLACEMENT CASSETTE FREE OF CHARGE.

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M A C R O T R O N I C S , I N C .
1125 N. GOLDEN STATE BOULEVARD
TURLOCK, CALIFORNIA 95380

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F O R W A R D

CONGRATULATIONS! WITH THE PURCHASE OF THE S-80 YOU HAVE CONVERTED YOUR EXIDY SORCERER MICROCOMPUTER INTO A STATE-OF-THE-ART HAM COMPUTER SYSTEM. WHAT IS ESPECIALLY EXCITING IS THAT YOU NOW HAVE A POWERFUL, GENERAL PURPOSE COMPUTER WHICH, AMONG MANY OTHER THINGS, WILL ALSO GIVE YOU ALL-MODE HAM CAPABILITIES. AND THE CONVERSION COST LESS THAN A GOOD MEMORY KEYER ALONE!! WHETHER IT WAS THE 'PERFECT' CODE, THE EXTENSIVE PROGRAMMED MESSAGE MEMORIES, THE AVAILABILITY OF BOTH RTTY AND MORSE CODE SENDING AND RECEIVING, THE VERY HIGH SPEED (399 WPM!) CW CAPABILITY, OR ONE OF THE MANY OTHER FEATURES OF THIS SYSTEM WHICH INFLUENCED YOU TO BUY THE S-80, WE FEEL THAT YOU WILL FIND THAT IT ADDS A WHOLE NEW DIMENSION TO YOUR "SHACK". IT REALLY IS A THRILL TO ADD TO A QSO: RIG HERE IS ... AND EXIDY SORCERER MICROCOMPUTER WITH S-80 HAM INTERFACE!

IF YOU HAVE NOT ALREADY DONE SO, PLEASE SEND IN THE WARRANTY REGISTRATION CARD. IT NOT ONLY SERVES TO VALIDATE YOUR WARRANTY, BUT WILL ALSO ALLOW US TO KEEP YOU INFORMED OF NEW DEVELOPMENTS FOR YOUR S-80 (AND MANY EXCITING FEATURES WILL BE ANNOUNCED IN THE NEAR FUTURE!). WE WELCOME COMMENTS AND SUGGESTIONS FOR IMPROVING OUR PRODUCT. PLEASE DROP US A LINE IF YOU HAVE ANY SUGGESTIONS OR QUESTIONS.

ON A PERSONAL NOTE, I ASK YOUR COOPERATION AND UNDERSTANDING IN RESPECTING OUR COPYRIGHTS. I HAVE PERSONALLY INVESTED MY LIFE SAVINGS AND ONE ENTIRE YEAR OF MY TIME TO DEVELOP THESE HAM INTERFACES AND GET MACROTRONICS OFF THE GROUND. THE SUCCESS OF THIS VENTURE, AND THE LIKLIHOOD OF FUTURE SOFTWARE DEVELOPMENTS -OF A NONTRIVIAL KIND- CRITICALLY DEPEND ON AUTHORS NOT GETTING "RIPPED OFF". SO PLEASE, WHEN YOUR CLUB OR BUDDY ASKS FOR A FREE COPY- LET THEM KNOW IT IS UNETHICAL AS WELL AS ILLEGAL AND TELL HIM TO BUY HIS OWN COPY.

BEST OF LUCK AND HOPE TO MEET YOU ON THE AIR.

73,

RON LODEWYCK, N6EE

PRESIDENT

OPERATING INSTRUCTIONS

SETTING UP

THE S-80 SYSTEM WILL RUN ON ANY EXIDY SORCERER WITH BASIC PACK AND 16K (OR MORE) RAM. TO OBTAIN SATISFACTORY RESULTS ON RECEIVING, IT IS ASSUMED THAT YOU HAVE EITHER AN HF RECEIVER COVERING THE AMATEUR FREQUENCIES OR A VHF-FM RECEIVER.

> IN GENERAL, THE S-80 SYSTEM WILL NOT WORK SATISFACTORILY WITH TYPICAL GENERAL COVERAGE SHORTWAVE RECEIVERS. FREQUENCY STABILITY AND SELECTIVITY ARE CRITICAL FACTORS. YOU MUST HAVE AT LEAST SINGLE-SIDEBAND QUALITY EQUIPMENT TO PROPERLY RECEIVE BOTH MORSE CODE AND RTTY. AM OR BROADCAST BAND EQUIPMENT SIMPLY WON'T WORK.

TO TRANSMIT MORSE CODE, YOU WILL NEED A CW TRANSMITTER. TO TRANSMIT RTTY, YOU WILL NEED EITHER: 1) A TRANSMITTER WITH DIRECT FSK INPUT, OR 2) AN AFSK UNIT IN ADDITION TO THE TRANSMITTER.

THE S-80 IS ATTACHED TO YOUR RADIO EQUIPMENT AND TO YOUR SORCERER BY MEANS OF TWO EDGE CONNECTORS. TURN OFF THE COMPUTER. PLUG THE DB25 CONNECTOR INTO THE PARALLEL PORT ON THE BACK OF THE SORCERER SO THAT THE SIDE WITH MOST OF THE WIRES IS CLOSEST TO THE POWER SWITCH.

NOTE: THE FOLLOWING CONNECTIONS TO YOUR RADIO EQUIPMENT ARE MADE TO THE 24 PIN (DUAL 12) EDGE CONNECTOR.

PIN	DESCRIPTION	CONNECT TO
1	GROUND	EQUIPMENT GROUND
2	KEY IN - HI ON KEY OPEN, LO ON KEY CLOSED. HI ON MARK LO ON SPACE	STRAIGHT KEY, BUG OR KEYER FOR 'LOCAL' CW DECODING. RELAY OR KEYER OUTPUT FROM A TU (MUST BE TTL COMPATIBLE)
4	SOLID STATE KEYER	CW JACK ON TRANSMITTER OR CW ID ON AFSK

5,6	RS232 INPUT	RS232 OUTPUT FROM DEMODULATOR
8	PTT NORMALLY OPEN RELAY	PTT LINE ON XMTR
9	SIDETONE OUTPUT. KEYS ON CW OR KEY IN LINE LO.	SMALL, LO-Z SPKR OR HEADPHONES.
J	+5 VOLTS TO LED INDICATOR	+ LEAD OF LED
K	LED	- LEAD OF LED
10	RELAY NORMALLY OPEN	SEE NOTE BELOW
11	RELAY NORMALLY CLOSED	SEE NOTE BELOW
12	RECEIVER AUDIO INPUT	LO Z HEADPHONE JACK OR SPEAKER TERMINALS

NOTE: THE RELAY ALWAYS KEYS ON RTTY AND MAY BE USED TO KEY AN FSK INPUT TO A TRANSMITTER OR THE INPUT TO AN AFSK. ON SOME UNITS THIS MAY REQUIRE A 'PULL-UP' RESISTOR CONNECTED TO EITHER +5 OR +12 VOLTS. +5 IS AVAILABLE ON THE S-80 BOARD. THE RELAY SHOULD NOT BE USED TO KEY A 60 MIL LOOP DIRECTLY AS IT WILL UNDOUBTEDLY BURN UP. IF IT IS DESIRED TO USE THE S-80 IN A 60 MIL LOOP, USE THE OPTIONAL MLK-1 LOOP KEYER MODULE IN PLACE OF THE RELAY.

IF YOU WANT TO TRY OUT THE S-80 QUICKLY, YOU WILL NEED TO MAKE THE FOLLOWING MINIMUM CONNECTIONS:

1. TO GENERATE CODE PRACTICE AND/OR LISTEN TO KEYBOARD SENT CODE; CONNECT A SMALL LOW IMPEDANCE (4-8 OHMS) SPEAKER OR HEADPHONES TO PIN 9.

2. TO RECEIVE CW OR RTTY: CONNECT THE AUDIO OUT (HEADPHONE OR SPEAKER JACK) FROM YOUR RECEIVER TO PIN 12. THE S-80 ACCEPTS A WIDE RANGE OF INPUT IMPEDANCE, HOWEVER, LOW IMPEDANCE WORKS BEST.

3. TO TRANSMIT CW: CONNECT PIN 4 TO THE TIP OF YOUR TRANSMITTER CW JACK, AND PIN 1 TO THE RING OF THE CW JACK.

4. TO TRANSMIT RTTY: IF YOUR TRANSMITTER HAS DIRECT FSK KEYING (E.G. TS-820, FT-901, IC701, ETC.) CONNECT PIN 1 TO GROUND ON THE TRANSMITTER AND EITHER PIN 10 OR 11 (DEPENDING ON YOUR KEYING CIRCUIT) TO THE FSK INPUT. SOME TRANSMITTERS USE NORMALLY OPEN (NO) ON MARK, OTHERS USE NORMALLY CLOSED (NC) ON MARK. YOU WILL HAVE TO DETERMINE WHICH IS "RIGHT-SIDE-UP" FOR YOUR PARTICULAR RADIO. IF YOUR TRANSMITTER DOES NOT HAVE FSK, YOU WILL NEED AN AFSK UNIT. THIS MAKES CONNECTION MORE DIFFICULT. REFER TO APPENDIX 1FOR DETAILS.

5. FOR AUTO TRANSMITTER CONTROL: CONNECT PIN 8 TO THE PUSH-TO-TALK (PTT) LINE ON YOUR TRANSMITTER AND PIN 1 TO GROUND.

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*NOTE: IT IS HIGHLY LIKELY THAT THE PTT SWITCH*
*WILL BE CLOSED WHEN THE SORCERER IS FIRST*
*POWERED UP. IT IS THEREFORE RECOMMENDED THAT*
*THE PTT CONNECTION NOT BE MADE UNTIL THE S-80*
*PROGRAM IS LOADED AND RUNNING. *
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ADJUSTMENTS

TWO PC TRIM POTS (POTENTIOMETERS) ALLOW ADJUSTMENT OF THE PHASE LOCKED LOOP (PLL) FREQUENCY AND THE SIDE TONE VOLUME.

PLL ADJUSTMENT - IT WILL BE NECESSARY TO ADJUST THIS CONTROL TO CORRESPOND TO THE DESIRED FREQUENCY OF THE AUDIO SIGNAL COMING INTO THE S-80 (PIN 12). THIS CONTROL IS SET ONLY ONCE - ALL SUBSEQUENT TUNING IS DONE WITH THE RECEIVER VFO. THE PLL SHOULD BE SET TO A FREQUENCY WITHIN THE RECEIVER PASSBAND. THE RANGE OF THIS ADJUSTMENT IS APPROXIMATELY 800 TO 2200 HERTZ. FOR BEST RESULTS, AND EASE OF TUNING, IT IS RECOMMENDED THAT THE PLL BE SET TO A FREQUENCY OF AT LEAST 1500 HZ.
THE BANDWIDTH OF THE PLL IS APPROXIMATELY 14% OF THE CENTER FREQUENCY. THIS MEANS THAT, AT 2000 HZ, THE BANDWIDTH IS APPROXIMATELY 280 HZ. AT 800 HZ, HOWEVER, THE BANDWIDTH IS ONLY 112 HZ - WHICH IS VERY DIFFICULT TO TUNE IN AND KEEP TUNED IN. TO ADJUST THE PLL, CONNECT THE RECEIVER AUDIO TO PIN 12 AND TURN ON YOUR RECEIVER.

HF RECEPTION - TURN ON THE RECEIVER CALIBRATOR. SELECT THE DESIRED FILTER SELECTIVITY (USB, LSB, CW, FSK, ETC.) ON YOUR RECEIVER. TUNE IN THE CALIBRATOR FOR MAXIMUM SIGNAL STRENGTH ON THE S-METER. TUNE TO THE HIGHEST AUDIO TONE WHICH STILL GIVES THE HIGHEST S-METER INDICATION. NOW TURN THE PLL ADJUSTMENT UNTIL THE LED LIGHTS BRIGHTLY (IF A SPEAKER IS CONNECTED TO PIN 9 , YOU WILL ALSO BE ABLE TO HEAR THE SIDETONE OSCILLATOR COME ON). THE PLL IS NOW SET AND DOES NOT HAVE TO BE REALIGNED UNLESS A DIFFERENT PASSBAND FILTER IS USED.

TURN THE CALIBRATOR OFF. USING THE RECEIVER VFO, TUNE IN A CW SIGNAL SO THAT IT INDICATES MAXIMUM S-METER READING. NOW SLOWLY ROCK THE VFO DIAL BACK AND FORTH UNTIL THE LED FLICKERS (AND/OR THE SIDETONE IS HEARD) IN SYNCHRONIZATION WITH THE SIGNAL. ON SOME RECEIVERS, TUNING MAY BE QUITE CRITICAL DEPENDING ON THE DIAL TUNING-RATIO. YOU MIGHT PREFER DOING THE TUNING USING AN RIT CONTROL IF YOUR RIG HAS ONE.
TO TUNE AN RTTY STATION, SET THE RECEIVER TO THE SPACE FREQUENCY. IF THE LED LIGHTS WHEN THE STATION IS PAUSING, YOU ARE TUNED TO THE MARK, NOT THE SPACE - MOVE THE DIAL SLIGHTLY SO THAT THE LED IS OFF ON MARK (STATION IS NOT SENDING ANY CHARACTERS), BUT FLICKERS BRIGHTLY WHEN A CHARACTER IS SENT.

VHF-FM RECEPTION: ON RTTY, HAVE A FRIEND SEND INTERMITTENT RY'S ON THE CHANNEL, TURN THE PLL SLOWLY UNTIL THE LED FLICKERS ON SPACE (CHARACTERS ARE BEING SENT) BUT IS OFF ON MARK (SENDING STATION IDLE). THE PLL IS NOW SET AND NEEDS NO FURTHER ADJUSTMENT.
ON CW, HAVE A FRIEND SEND A CONTINUOUS TONE ON THE CHANNEL. TURN THE PLL ADJUSTMENT UNTIL THE LED LIGHTS BRIGHTLY. NOTE THAT THE LED IS NOW SET FOR THIS SPECIFIC TONE, SO THAT THE SENDING STATION MUST SEND THE SAME TONE ALL THE TIME.

VOLUME - CONTROLS AUDIO LEVEL OUTPUT FROM SIDE TONE OSCILLATOR. ADJUST FOR COMFORTABLE LISTENING LEVEL ON EITHER HEADPHONES OR A SPEAKER.

OPERATING

AFTER ALL THE CONNECTIONS AND ADJUSTMENTS INDICATED IN THE PRECEEDING SECTION HAVE BEEN MADE, YOU ARE READY TO LOAD THE SOFTWARE. THE S-80 CONSISTS OF TWO SEPARATE PROGRAMS: A MACHINE LANGUAGE SUBPROGRAM AND A BASIC MAIN PROGRAM. PROCEED AS FOLLOWS:

1. CONNECT THE CASSETTE RECORDER TO THE COMPUTER

2. PLACE THE CASSETTE IN THE RECORDER

3. TURN ON THE COMPUTER

4. MAKE SURE THE SHIFT LOCK IS DOWN

5. REWIND THE CASSETTE

6. WHEN THE COMPUTER PRINTS
   READY
   ENTER THE COMMANDS:
   BYE <RETURN>
   BATCH <RETURN>

7. PRESS "PLAY" ON THE RECORDER

8. AFTER THE PROGRAMS ARE LOADED
   READY
   WILL BE DISPLAYED ON THE MONITOR. ENTER THE COMMAND
   RUN
   AND YOUR S-80 WILL EXECUTE

THE PROGRAM HAS FIVE MAJOR MODES OF OPERATION: MORSE SEND, MORSE RECEIVE, CODE PRACTICE, RTTY SEND, AND RTTY RECEIVE. BEGIN BY SELECTING EITHER MORSE OR RTTY SEND MODES WHEN ASKED.

MORSE

IF YOU SELECT THE MORSE SEND MODE, YOU WILL BE ASKED TO ENTER THE SPEED IN WORDS PER MINUTE (WPM). THE RANGE OF ALLOWABLE SPEEDS IS 1 TO 399 WORDS PER MINUTE. THE NUMBER OF WORDS PER MINUTE IS DEFINED HERE AS THE NUMBER OF 50 BAUDS PER MINUTE - I.E. THE NUMBER OF TIMES THE WORD PARIS WILL BE SENT IN ONE MINUTE. SPACING IS INITIATED AT THE RATIO: 1 FOR DIT, 3 FOR DAH, 1 FOR INTERELEMENT SPACE, 3 FOR CHARACTER SPACE AND 7 FOR WORD SPACE. AT SLOWER SPEEDS, YOU MAY WANT TO CHANGE THIS RATIO. THIS OPTION IS EXPLAINED BELOW. THIS SETS THE SENDING SPEED, THE CODE PRACTICE SPEED, AND ALSO INITIALIZES THE RECEIVE SPEED. WHILE IN THE MORSE SEND MODE, YOU HAVE A VARIETY OF OPTIONS:

1. KEYBOARD SENDING - TYPE ANY LETTER, NUMBER OR PUNCTUATION (? . / OR ,). YOU CAN ALSO SELECT FROM THREE SPECIAL CHARACTERS:

TO SEND		PRESS
AR	.-.-.	@
KN	-.--.	<
SK	...-.-	>

(NOTE: .-... AND ..... ARE NOT SUPPORTED. WE SUGGEST YOU USE 'QRX' AND 'E E E' RESPECTIVELY.)
SINCE THE KEYBOARD IS "BUFFERED", YOU CAN TYPE AHEAD UP TO 255 CHARACTERS.

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NOTE: THERE IS NO WARNING GIVEN IF YOU ARE ABOUT TO EXCEED THE TYPE-AHEAD BUFFER. THE PROGRAM WILL "CRASH" IF THE BUFFER IS EXCEEDED.
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NON-MORSE CHARACTERS WILL BE IGNORED BY THE PROGRAM. FOR EXAMPE, * OR # HAVE NO MORSE EQUIVALENT AND WILL BE IGNORED IF TYPED.

2. SPECIAL CONTROL FUNCTIONS - ANY OF SEVERAL CONTROL OPTIONS MAY BE SELECTED BY FIRST PRESSING THE RUN/STOP KEY (THIS PUTS YOU IN THE CONTROL MODE) AND THEN ONE OF THE "SPECIAL FUNCTION" KEYS AS DESCRIBED BELOW AND ILLUSTRATED IN BLOCK DIAGRAM FORM IN FIGURE 1.

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NOTE: MOST OF THESE KEYS ARE
UPPER CASE AND THEREFORE REQUIRE
THE SIMULTANEOUS DEPRESSING OF
THE SHIFT KEY. FOR EXAMPLE,
PRESS RUN/STOP THEN HOLD DOWN
THE SHIFT KEY AND PRESS THE #/3
KEY. # $ % & AND ' ALL
REQUIRE USE OF THE SHIFT.
==================================
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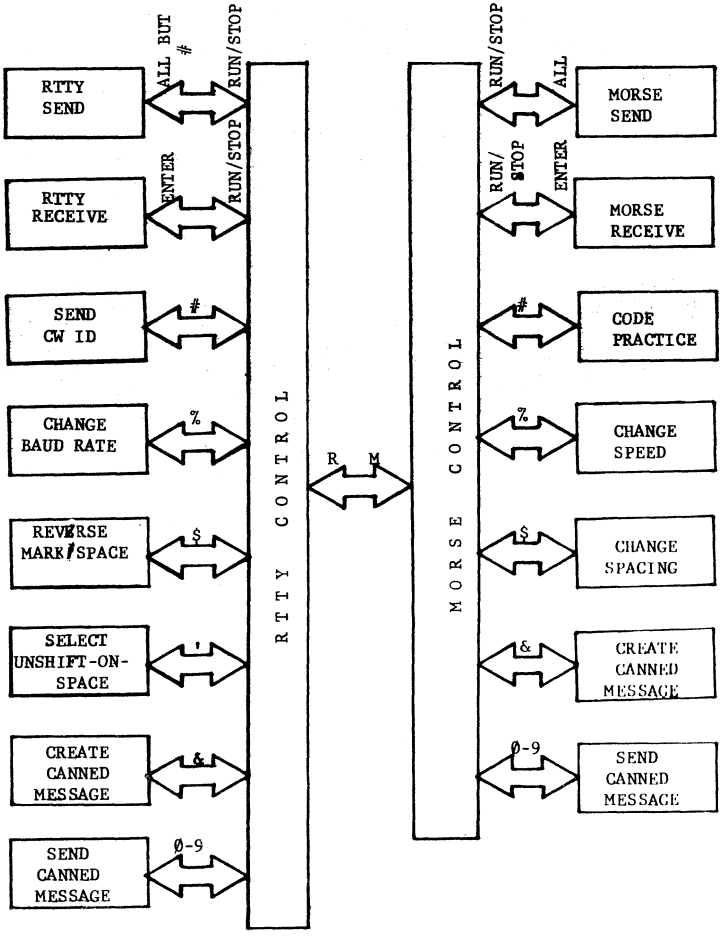
\# START CODE PRACTICE. EXPLAINED LATER IN DETAIL.

$ CHANGE SPACING. YOU CAN SELECT THE DESIRED CHARACTER AND/OR WORD SPACING (BUT NOT THE DIT TO DAH OR INTERELEMENT RATIO). THE PROGRAM INITIALIZES WITH CHARACTER SPACING SET TO THREE TIMES THE LENGTH OF A DIT AND WORD SPACING AT SEVEN TIMES THE LENGTH OF A DIT. ONE COMMON USE FOR DIFFERENT SPACING IS AT LOW SPEED CODE, E.G. BELOW 13 WPM. MANY PEOPLE PREFER TO LEARN AND SEND SLOW CODE WITH INDIVIDUAL CHARACTERS FORMED AT A HIGHER RATE, SAY 13 WPM, BUT LONG PAUSES BETWEEN CHARACTERS AND WORDS. THIS GIVES A SLOW OVERALL NUMBER OF WORDS PER MINUTE, BUT MAKES THE TRANSITION TO FASTER CODE EASIER. AS AN EXAMPLE, SUPPOSE IT IS DESIRED TO HAVE AN OVERALL WPM OF 5 BUT CHARACTERS AT 13 WPM. SELECT A SPEED OF 13 WPM, THEN SELECT A CHARACTER SPACING OF 16 AND A WORD SPACING OF 35. SOME EXPERIMENTATION WILL BE NECESSARY TO FIND THE OPTIMUM SPACING DESIRED.

% CHANGE SPEED. SETS THE CHARACTER RATE IN WPM FOR KEYBOARD SENDING, CODE PRACTICE, AND INITIAL RECEIVING SPEED. (A VARIATION OF APPROXIMATELY - 30% TO 40% WPM ON RECEIVE IS AUTOMATICALLY COMPENSATED FOR .)

FIGURE 1


ALL BUT #
RUN/STOP
RUN/STOP
ALL
RTTY SEND
MORSE SEND
ENTER
RUN/STOP
RUN/STOP
ENTER
RTTY RECEIVE
MORSE RECEIVE
SEND CW ID
#
#
CODE PRACTICE
CHANGE BAUD RATE
%
%
CHANGE SPEED
R
M
REVERSE MARK/SPACE
$
$
CHANGE SPACING
SELECT UNSHIFT-ON-SPACE
'
&
CREATE CANNED MESSAGE
CREATE CANNED MESSAGE
&
Ø-9
SEND CANNED MESSAGE
SEND CANNED MESSAGE
Ø-9
RTTY CONTROL
MORSE CONTROL

& CREATE A CANNED MESSAGE. YOU HAVE TEN PROGRAMMABLE MESSAGE MEMORIES AVAILABLE: 1 THROUGH 0. ENTER THE MESSAGE NUMBER. ANYTHING NOW TYPED WILL NOT BE SENT OVER THE AIR, BUT RATHER, WILL BE STORED IN MEMORY FOR LATER RECALL. TERMINATE THE MESSAGE BY PRESSING THE TAB KEY. EDIT CAPABILITY IS PROVIDED IN THIS MODE, SO YOU CAN DELETE PREVIOUSLY TYPED CHARACTERS BY PRESSING THE RUB/- KEY. SINCE THE EDITING IS BEING DONE IN BASIC, THE INPUT TIME REQUIRED PER CHARACTER IS LONGER THAN YOU MIGHT EXPECT. IF YOU TYPE TOO FAST FOR INSTANCE, YOU WILL GET AHEAD OF THE INPUT AND MISS ONE OR MORE CHARACTERS. A GOOD PROCEDURE WOULD BE TO TYPE SLOW AND STEADY WHILE INPUTTING INTO A MESSAGE MEMORY. YOU WILL NOTE A "COUNT DOWN" COUNTER IN THE UPPER LEFT CORNER OF THE SCREEN. THIS IS AN INDICATOR OF REMAINING MEMORY FOR THIS MESSAGE. EACH TIME A PARTICULAR MESSAGE NUMBER IS SELECTED, THE PREVIOUS CONTENTS WILL BE DELETED AND THE COUNTER WILL BE SET TO 255.
THE MESSAGE MEMORY CAPABILITY IS QUITE POWERFUL, AND ALLOWS YOU TO SAVE A GREAT DEAL OF TIME AND ENERGY. COMMON USES WOULD BE TO STORE: CQ MESSAGES, CONTEST EXCHANGES, DX QSO'S, TRAFFIC, "BRAG TAPES", TEST SEQUENCES, ETC. THE SAME MESSAGE MEMORIES ARE USED IN BOTH MORSE AND RTTY MODES.

0 THROUGH 9 SEND MESSAGE MEMORY NUMBER N. SIMPLY PRESS RUN/STOP AND THEN THE MESSAGE NUMBER FROM 0 TO 9. THE ENTIRE MESSAGE WILL BE AUTOMATICALLY SENT.
AN EXAMPLE WILL ILLUSTRATE THE PROCESS OF CREATING AND SENDING CANNED MESSAGES:

```
RUN/STOP &
ENTER MESSAGE NUMBER (0 - 9)? 1
WHAT IS NEW MESSAGE 1
CQ CQ CQ DE N6EE N6EE N6EE "TAB"
RUN/STOP &
ENTER MESSAGE NUMBER (0 - 9)? 2
WHAT IS NEW MESSAGE 2
DX PSE @ K "TAB"
RUN/STOP 1
CQ CQ CQ DE N6EE N6EE N6EE
MORSE SEND MODE
RUN/STOP 1
CQ CQ CQ DE N6EE N6EE N6EE
MORSE SEND MODE
RUN/STOP 2
DX PSE AR K
MORSE SEND MODE
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R TRANSFER TO RTTY SEND MODE

ENTER TRANSFER TO MORSE RECEIVE MODE

CTRL C BREAKS PROGRAM AND TRANSFERS TO BASIC

MORSE RECEIVE MODE

THE SPEED IS INITIALIZED IN THE SEND MODE. THE PROGRAM WILL AUTOMATICALLY ADJUST FOR VARIATIONS IN THE RECEIVED SIGNALS SPEED WITHIN A RANGE OF APPROXIMATELY - 30% TO + 40% WPM. IF THE STATION IS SENDING OUTSIDE THIS RANGE, RETURN TO THE CONTROL MODE (BY PRESSING RUN/STOP) AND RESET THE SPEED.

THE SYSTEM WILL DECODE WELL-SENT MORSE CODE AND DISPLAY IT ON THE VIDEO MONITOR. DUE TO NOISE (QRN), INTERFERENCE (QRM), FADING (QSB), AND NON-UNIFORMITY OF HAND SENT CODE, 100% PERFECT COPY IS NOT USUALLY ATTAINABLE. OF COURSE, COMPUTER OR "MACHINE" GENERATED CODE WILL BE EASIER TO COPY (E.G. W1AW), BUT IS STILL SUBJECT TO QRN, QRM AND QSB.

VERY HIGH SPEED CW (GREATER THAN 100 WPM) IS ESPECIALLY SUBJECT TO ERRORS CAUSED BY QRN, QRM AND QSB. THESE PROBLEMS ARE ALMOST NON-EXISTENT ON VHF-FM, THEREBY MAKING HIGH SPEED CW MUCH MORE PRACTICAL ON THIS MODE. WITH REGARD TO TUNING, THE FOLLOWING FACTORS SHOULD BE KEPT IN MIND:

1. THE BACKGROUND NOISE IN THE RECEIVER MUST BE REDUCED TO A LEVEL SUCH THAT NO CHARACTERS APPEAR ON THE SCREEN WHEN THERE IS NO INCOMING SIGNAL. (TURN DOWN THE RF GAIN CONTROL OR INSERT AN RF ATTENUATOR).

2. EVEN THOUGH MOST CW FILTERS HAVE A CENTER PASSBAND FREQUENCY OF AROUND 1000 HZ, THE PLL WORKS BEST AT HIGHER FREQUENCIES. UNLESS AN IFSHIFT CONTROL IS AVAILABLE TO INCREASE THE CENTER FREQUENCY, IT IS RECOMMENDED THAT THE USB (AND NOT THE CW) FILTER BE USED TO COPY CW. SET THE PLL TO AROUND 2000 HZ FOR BEST DEMODULATION.

3. A DRIFTING SIGNAL WILL REQUIRE FREQUENT RETUNING OF THE RECEIVER VFO TO KEEP GOOD COPY. (THE PLL DOES COMPENSATE FOR SMALL FREQUENCY DRIFT.)

4. THE SPEED SETTING ALLOWS A VARIATION OF APPROXIMATELY - 30% TO + 40% WPM IN THE RECEIVED SIGNALS SPEED. WITHIN THIS RANGE, GOOD COPY SHOULD RESULT. HOWEVER, SOME PROBLEMS WITH CHARACTER AND WORD SPACING MAY STILL OCCUR, PARTICULARLY NEAR THE "EXTREMES" OF THE RANGE OF VARIATION. AS A GUIDE TO CORRECT SPEED SETTING, THERE ARE SEVERAL TYPES OF ERROR WHICH MIGHT BE OBSERVED DUE TO AN INCORRECT SPEED SETTING (OR INCONSISTENCY ON THE PART OF THE SENDING STATION): SUPPOSE WE RECEIVE AN "IDEAL" SEQUENCE OF MORSE CHARACTERS AS FOLLOWS:

AT E
THIS MIGHT BE INCORRECTLY INTERPRETTED AS:

PRINTS	SPEED SET
MTT OR OT	TOO HIGH
IE E OR SE	TOO LOW
ETT T	TOO HIGH
WE	TOO LOW
A T E	TOO HIGH
ATE	TOO LOW

CODE PRACTICE MODE

THE PROGRAM WILL GENERATE RANDOM MORSE CODE FOR TRAINING PURPOSES. USE SPECIAL FUNCTION # TO TRANSFER FROM THE MORSE CONTROL MODE. SELECT EITHER CHARACTERS OR FIVE LETTER WORDS WHEN ASKED TO DO SO. "CHARACTERS" MEANS ANY OF THE LETTERS, NUMBERS, OR PUNCTUATION. FOR EXAMPLE:

XJ6/A VCE4. -UIOP 20Z/S DSEET

IF "WORDS" ARE SELECTED, THE PROGRAM SELECTS RANDOMLY FROM A LIST OF STORED HAM-RADIO RELATED WORDS. FOR EXAMPLE:

RADIO CHINA LIGHT FINAL PLATE

YOU CAN RESET THE SPEED BY RETURNING TO THE MORSE CONTROL MODE BY HOLDING DOWN THE RUN/STOP KEY. RETURN TO CODE PRACTICE WITH THE "#" SPECIAL FUNCTION.

RTTY SEND MODE

ENTER THE RTTY SEND MODE AT THE OUTSET OF THE PROGRAM IN RESPONSE TO THE QUESTION:

MORSE OR BAUDOT RTTY?

OR SELECT THE "R" SPECIAL FUNCTION KEY IN THE MORSE CONTROL MODE. TYPING ON THE KEYBOARD WILL KEY THE RELAY. TO SEND RTTY YOU MUST EITHER HAVE FSK (FREQUENCY SHIFT KEYING) CAPABILITY ON YOUR TRANSMITTER OR ELSE USE AN AFSK (AUDIO FREQUENCY SHIFT KEYING) UNIT (NOT PROVIDED WITH THE S-80). EITHER OF THE RELAY CONTACTS, (NORMALLY OPEN, NORMALLY CLOSED) MAY BE USED AS APPROPRIATE. WITH RIGS LIKE THE KENWOOD TS-820 FOR EXAMPLE, SIMPLY CONNECT THE NC RELAY CONTACTS TO THE FSK JACK AND PUT THE TRANSCEIVER MODE SWITCH TO FSK. REFER TO APPENDIX 1 FOR TYPICAL RTTY INTERCONNECTIONS.

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NOTE: IF YOU ARE NEW TO RTTY, YOU WOULD DO WELL TO READ A LITTLE BEFORE SENDING ON THE AIR. GOOD INTRODUCTIONS ARE CONTAINED IN: RTTY HANDBOOK, 73 MAGAZINE, PETERBOROUGH, NH 03458, RTTY BEGINNERS HANDBOOK, RTTY JOURNAL, PO BOX RY, CARDIFF BY THE SEA, CA 92007, SPECIALIZED COMMUNICATION TECHNIQUES, ARRL, NEWINGTON, CT.

==========

THE KEYBOARD IS BUFFERED, ALLOWING YOU TO TYPE AHEAD UP TO 255 CHARACTERS. PRESSING THE ENTER KEY SENDS A CARRIAGE RETURN AND A LINE FEED. SINCE MOST RTTYERS USE TTY MACHINES HAVING 72 CHARACTERS PER LINE, THE ENTER KEY SHOULD BE PRESSED AT LEAST ONCE EVERY 72 CHARACTERS. THE BAUDOT CODE REQUIRES THE SPECIAL LTRS AND FIGS CHARACTERS TO BE SENT WHEN SHIFTING BETWEEN UPPER AND LOWER CASE. THIS IS DONE AUTOMATICALLY BY THE S-80 SOFTWARE. (IF YOU WISH TO SEND THESE CHARACTERS MANUALLY, ">" GENERATES "LTRS" AND "<" GENERATES "FIGS" - THIS FEATURE COULD BE USED TO MANUALLY CREATE A "DIDDLE").

SEVERAL SPECIAL FEATURES ARE AVAILABLE IN THE RTTY SEND MODE. THESE ARE SELECTED BY FIRST PRESSING THE RUN/STOP KEY (THIS PUTS YOU IN THE RTTY CONTROL MODE) AND THEN ONE OF THE SPECIAL FUNCTION KEYS EXPLAINED BELOW:

\# AUTO CW ID - THIS GENERATES THE FOLLOWING SEQUENCE:

1. THE MESSAGE:
   CW ID FOLLOWS-
   IS SENT IN BAUDOT.
2. THE CONTENTS OF MESSAGE MEMORY 0 IS SENT IN MORSE CODE.
3. THE PROGRAM TRANSFERS TO THE RTTY RECEIVE MODE.

BEFORE SELECTING THE AUTO CW ID, YOU SHOULD ENTER THE DESIRED MORSE CHARACTERS IN MESSAGE MEMORY 0 (USING SPECIAL FUNCTION "&"). A TYPICAL MORSE ID WOULD BE:

```
DE      N6EE      K
```

REFER TO APPENDIX 1 FOR EQUIPMENT INTERCONNECTIONS.

$ REVERSE MARK AND SPACE RECEIVE TONES. THE PROGRAM IS INITIALIZED SO THAT THE LED SHOULD BE OFF ON MARK AND ON ON SPACE. IF YOU PREFER TO HAVE THE LED LIGHT ON MARK AND OFF ON SPACE, USE THIS SPECIAL FUNCTION.

% CHANGE BAUD RATE. SELECT 60, 66, 75 OR 100 WPM. INITIALIZED AT 60 WPM.

& CREATE A CANNED MESSAGE. (0 THRU 9) 255 CHARACTERS MAX. EACH. SAME AS MORSE SEND MODE.

' SELECT AUTOMATIC UNSHIFT-ON-SPACE OR TURN IT OFF. INITIALIZED ON. THIS FEATURE IS GOOD UNDER NOISY RECEPTION CONDITIONS. IF THE LTRS CHARACTER IS MISSED WHILE RECEIVING, IT WILL BE AUTOMATICALLY INSERTED WITH THE FIRST OCCURRENCE OF A SPACE. ONE DISADVANTAGE OF THE AUTO UNSHIFT IS THAT IT WILL GARBLE SEQUENCES OF UPPER CASE CHARACTERS SEPARATED BY SPACES. FOR EXAMPLE, SUPPOSE THE OTHER STATION SENDS:

```
1234<SPACE>56TH
```

WITH AUTO UNSHIFT, YOU WILL COPY:

```
1234<SPACE>TYTH
```

0 THRU 9 SEND MESSAGE NUMBER N. WORKS SAME AS MORSE SEND MODE ONLY IN BAUDOT.

M TRANSFER TO MORSE SEND MODE.

ENTER TRANSFER TO RTTY RECEIVE MODE.

RTTY RECEIVE MODE

IN THE RTTY RECEIVE MODE, THE SYSTEM WILL DECODE A PROPERLY TUNED RTTY SIGNAL AND DISPLAY IT ON THE SCREEN. TUNING IS CRITICAL - GARBLE WILL RESULT FROM A POORLY TUNED SIGNAL. YOU HAVE YOUR RECEIVING VFO TUNED PROPERLY IF:

1. THE LED IS OFF ON MARK (SENDING STATION IDLE)
2. THE LED IS ON ON SPACE (THE LED FLICKERS BRIGHTLY AS RTTY CHARACTERS ARE RECEIVED).
3. GOOD COPY IS BEING DISPLAYED ON THE SCREEN.

IT WILL TAKE SOME PRACTICE TO QUICKLY ADJUST THE RECEIVER VFO TO OBTAIN GOOD COPY. UNDER GOOD SIGNAL CONDITIONS, 100% COPY IS CERTAINLY ATTAINABLE USING THE S-80. KEEP IN MIND, HOWEVER, THAT QRN, QRM, AND QSB MAY CAUSE SOME LOSS OF COPY ("HITS"). A BETTER TERMINAL UNIT (TU) MIGHT BE USED TO IMPROVE COPY UNDER MARGINAL SIGNAL CONDITIONS. THIS IS RECOMMEDED FOR SERIOUS RTTYERS. YOUR S-80 IS COMPATIBLE WITH VIRTUALLY EVERY POPULAR TU. SEE APPENDIX 1 FOR DETAILS.

MOST RTTY STATIONS USE A 72 CHARACTER LINE OF TEXT. THE SORCERER DISPLAYS A MAXIMUM OF 64 CHARACTERS PER LINE. THEREFORE, MOST TEXT WILL REQUIRE TWO LINES ON THE MONITOR FOR EACH LINE AT THE OTHER STATION.

TO RETURN TO RTTY SEND MODE, PRESS STOP/RUN KEY.

HINTS AND KINKS

1. USING THE S-80 AS A GENERAL PURPOSE I/80 BOARD.

THIS FEATURE ALONE IS WORTH THE ENTIRE PRICE OF THE S-80! YOU CAN EASILY USE THE S-80 TO CONTROL A WIDE VARIETY OF "OUTSIDE WORLD" PERIPHERAL DEVICES. YOU CAN MAKE USE OF THREE SEPARATE OUTPUT SWITCHES: 1 SOLID STATE AND 2 SEPARATE RELAYS. IN A BASIC PROGRAM, YOU CAN TURN SWITCHES ON OR OFF USING THE INP STATEMENTS. IN A MACHINE LAN PROGRAM, USE THE IN INSTRUCTION (NOT OUT). THE FOLLOW LISTS EACH SWITCH AND THE PORTS WHICH TURN IT ON OR

PINS	TYPE OF SWITCHING	S
1,10	RELAY NORMALLY OP	& 4
1,11	RELAY NORMALLY C	& 4
1,4	NPN SOLID STATE	& 1
1,7	RELAY NORMALLY	5 & 6
1,8	RELAY NORMALLY	5 & 6

FOR EXAMPLE, SUPPOSE YOU WI AUDIO CASSETTE RECORDER ON AND OFF IN SYNCHRONIZAT RIAL PROGRAM YOU HAVE WRITTEN IN BASIC. AT E POINTS IN THE PROGRAM, INSERT:

```
100 X = INP(3)          RECORDER WITH RELAY
200 X = INP(4)          FF RECORDER WITH RELAY
```

TO USE THE S-80 AS AN OU MUST HAVE THE DATA IN THE FORM OF MAKE-BREAK FOR EXAMPLE FROM A RELAY OR NPN OPEN COLLECTOR CI THE DATA IN TO THE S-80 VIA PINS 1 AND 2. WHEN DED, PORT 2 WILL HAVE A VALUE OF 254. WHEN PIN 2 UNDED), PORT 2 WILL HAVE A VALUE OF 255. T AN TEST THE VALUE OF PORT 2 TO INPUT DATA TO YOUR EXAMPLE, SUPPOSE PIN 2 AND 1 ARE CONNECTED TO WHICH IS SET TO GO ON AND OFF AT CERTAINS TIMES DU YOU COULD USE THIS TO TELL YOUR SORCERER TO PER FUNCTIONS - LIKE TURN ON YOUR SPRINKLERS, HOUSE TER, DINNER, ETC. HERE'S HOW THIS MIGHT BE INSERTED IN PROGRAM:

```
100 X = INP(2)
110 IF X = 255 THEN 100 ELSE GOSUB1000
.
.
.
1000 X = INP(3)     : REM TURNS ON POWER RELAY
```

VOID ENTIRE PAGE

2. CHANGING THE PITCH OF THE SIDE TONE OSCILLATOR.

THE FREQUENCY OF THE SIDE TONE MAY BE CHANGED BY REPLACING RESISTOR R16. REDUCING THE RESISTANCE INCREASES THE FREQUENCY. A 100K POT COULD BE INSERTED IN PLACE OF R16 TO GIVE AN ADJUSTABLE SIDE TONE FREQUENCY. IT SHOULD BE NOTED THAT THE PRESENT SIDE TONE FREQUENCY IS AROUND 600 HERTZ WHICH IS TOO LOW TO BE DEMODULATED BY THE PLL. THUS, IF YOU WANTED TO TAPE THE OUTPUT OF THE SIDE TONE AND THEN PLAY IT BACK TO THE S-80 RECEIVE PROGRAM FOR TESTING PURPOSES, YOU WOULD HAVE TO INCREASE THE SIDE TONE FREQUENCY (PREFERABLY TO AROUND 2000 HERTZ).

TROUBLE SHOOTING

IF YOUR S-80 IS NOT FUNCTIONING PROPERLY, CHECK OUT THE FOLLOWING BEFORE SENDING THE UNIT BACK TO THE FACTORY FOR REPAIR:

MAKE SURE THAT -

1. THE 25 PIN CONNECTOR IS ATTACHED TO THE PARALLEL PORT WITH THE BULK OF THE WIRES CLOSEST TO THE POWER BUTTON, AND THAT THE 24 (DUAL 12) CONNECTOR PINS ARE PROPERLY ALIGNED WITH THE "FINGERS" ON THE S-80 BOARD.
2. THE WIRES ARE MAKING GOOD CONTACT WITH THE 24 PIN CONNECTOR.
3. THE BOARD IS NOT SHORTING AGAINST A METAL CASE OR TABLE.
4. THE LED ON THE BOARD IS LIGHTING.
5. THE PLL HAS BEEN PROPERLY ADJUSTED AS EXPLAINED IN THE OPERATING INSTRUCTIONS.
6. THE VOLUME CONTROL ON THE BOARD IS TURNED UP SO THAT YOU CAN HEAR THE SIDE TONE IN A SPEAKER.
7. ALL IC'S AND THE RELAYS ARE PROPERLY ALIGNED IN THEIR SOCKETS.
8. THE TEMPERATURE OF ALL IC'S SHOULD BE COOL OR WARM AT MOST. NONE SHOULD BE "HOT" TO THE TOUCH.

IF THESE CHECKS HAVE ALL BEEN MADE AND THERE IS STILL A PROBLEM, RETURN THE ENTIRE S-80, INCLUDING CASSETTE, TO THE FACTORY.

THEORY OF OPERATION - SOFTWARE

THE S-80 SOFTWARE CONSISTS OF TWO PROGRAMS: A BASIC MAIN PROGRAM AND A MACHINE LANGUAGE SUBPROGRAM. BEING IN BASIC, THE MAIN PROGRAM IS EASILY MODIFIED TO SUIT INDIVIDUAL USER NEEDS (E.G. LINKING TO A LOGGING PROGRAM, MODIFYING MESSAGES TO PERFORM NUMERICAL SEQUENCING FOR CONTEST OPERATION, ETC.). THE BASIC PROGRAM REQUIRES APPROXIMATELY 7K RAM. A LISTING OF THE BASIC PROGRAM IS GIVEN IN APPENDIX 2.

THE MACHINE LANGUAGE SUBPROGRAM IS LOCATED AT THE HIGH END OF 16K MEMORY FROM 34A0 TO 7FFFH. ALL CRITICAL TIMING IS PERFORMED IN MACHINE LANGUAGE. CONTROL IS RETURNED TO BASIC WHEN THE RUN/STOP KEY IS DEPRESSED. A COMPLETE FLOWCHART IS GIVE TO HELP EXPLAIN THE LOGIC OF THE S-80 SOFTWARE. IN ADDITION, TABLE 1 IS A MEMORY MAP GIVING USEFUL ENTRY POINT AND EXPLAINING KEY VARIABLES.

TABLE 1

LOCATIONS	ROUTINE OR VARIABLE NAME	PURPOSE
3EB9	MORSE SEND	INPUT KEYBOARD CHAR - SEND IN MORSE CODE
3EBD	MORSE RECEIVE	INPUT MORSE CODE - DISPLAY ASCII ON VIDEO
3B6F	SEND FROM BUFFER	TRANSMITS PRESENT CONTENTS OF BUFFER UP TO CHARACTER 04H
3EC7	RTTY SEND	INPUT KEYBOARD CHAR - SEND IN BAUDOT
3ECE	RTTY RECEIVE	INPUT BAUDOT - DISPLAY ASCII ON VIDEO
3C1D	.1MS TIMER	DELAY TIMER - .0001 SECOND
3C14	1MS TIMER	DELAY TIMER .001 SECOND
381A	MORSE SPEED	TIMING CONSTANTS IN .1, .001 AND .0001 SECONDS
3824	MORSE SEND TABLE	BIT PATTERNS + NO. BITS TO SEND
3500	MODE FLAG	1=RTTY, 0=MORSE
3501	LENGTH	NO. OF BYTES IN STRING
3502	STRING ADR. 1	LSB OF START OF STRING
3503	STRING ADR. 2	MSB OF START OF STRING
3581	MORSE RECEIVE TABLE	LOOK UP TABLE - ASCII EQUIVALENT
3891	L4, L5	DIT LENGTH ON RECEIVE NO. OF .1 AND .001 SEC.
3895	L6,L7	DAH LENGTH ON RECEIVE NO. OF .1 AND .001 SEC.
3897	KEY STATE	BYTE VALUE REQUIRED FOR KEY UP
3EE1	OM, OT	START BIT LENGTH: .001 AND .0001 SECONDS
3EE2	TM, TT	RTTY RECEIVE DELAY LENGTH: .0001 AND .001 SEC = (START - 7)/2 MSEC
3EE5	SP	BYTE VALUE REQUIRED FOR SPACE: NORMAL = 254
3EE9	LEVEL	#BITS TO SEND FOR EACH RTTY CHAR (BAUDOT=5)
3EEA	HM, HT	STOP BIT LENGTH: .001 AND .0001 SECONDS
3EEC	SHIFT	UNSHIFT FLAG: 0=AUTO ON, 1=AUTO OFF
34A0	VIDEO	
3BA0	KEYBOARD	

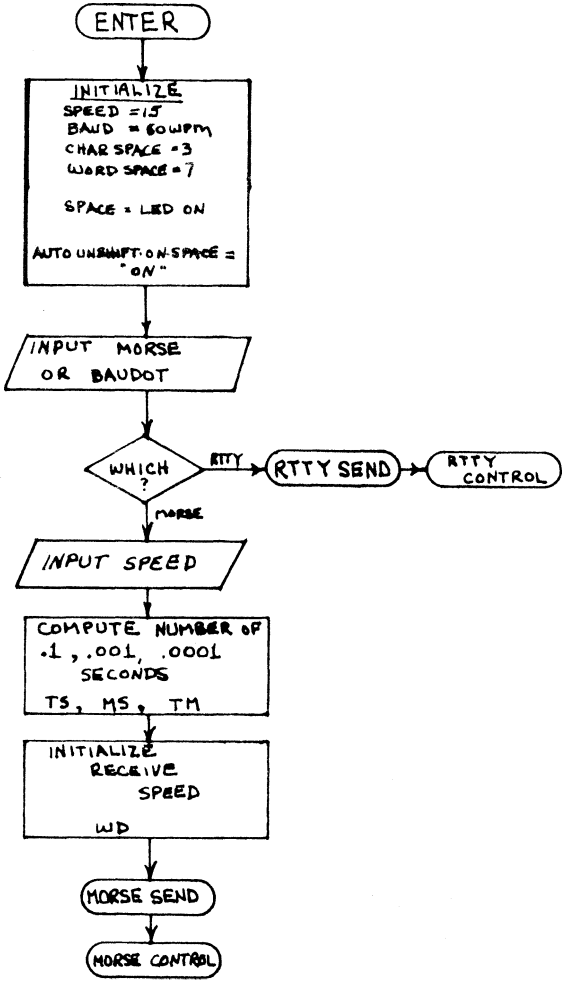
NOTE: OMIT LOCATIONS 3500-3503 FROM TABLE ABOVE.

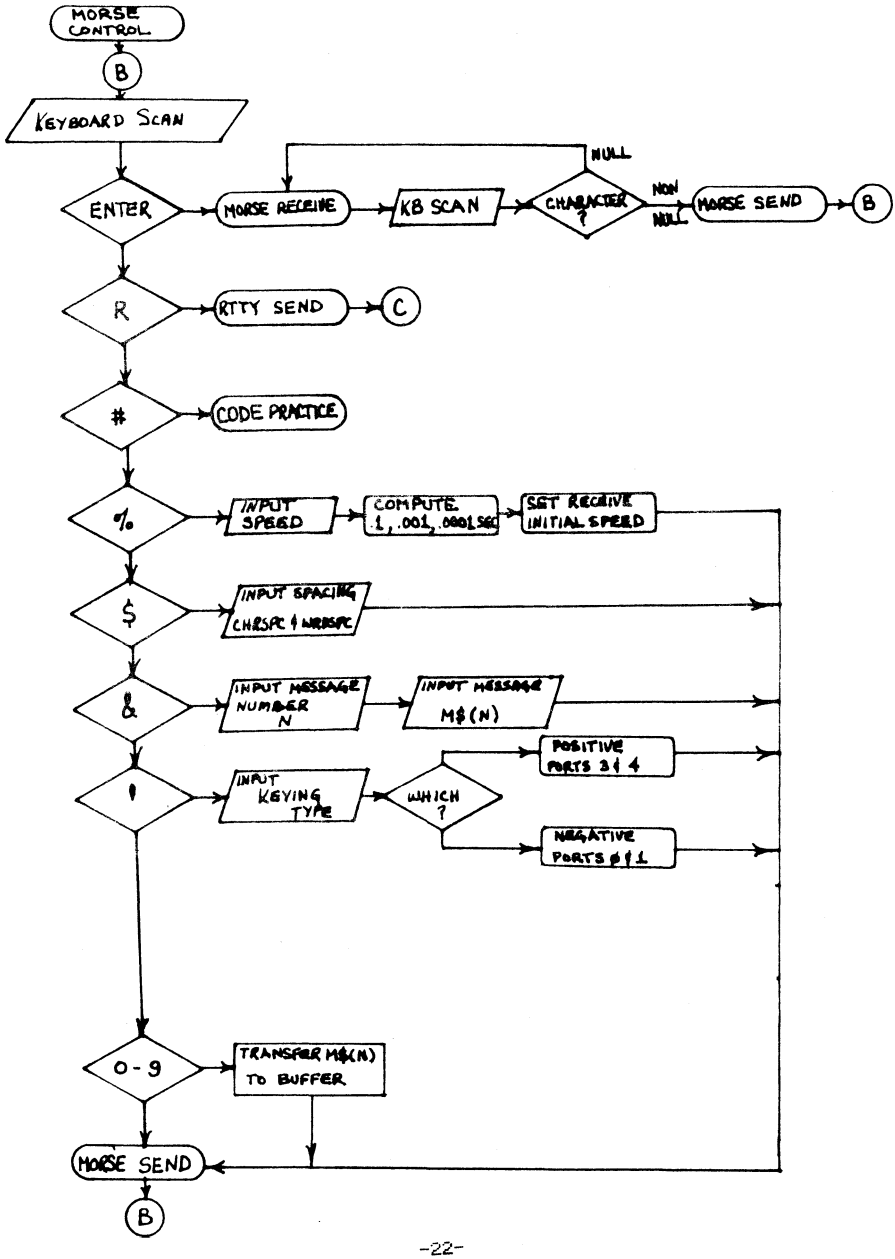
ADD: 3EDE MODE FLAG 1 = RTTY, 0 = MORSE

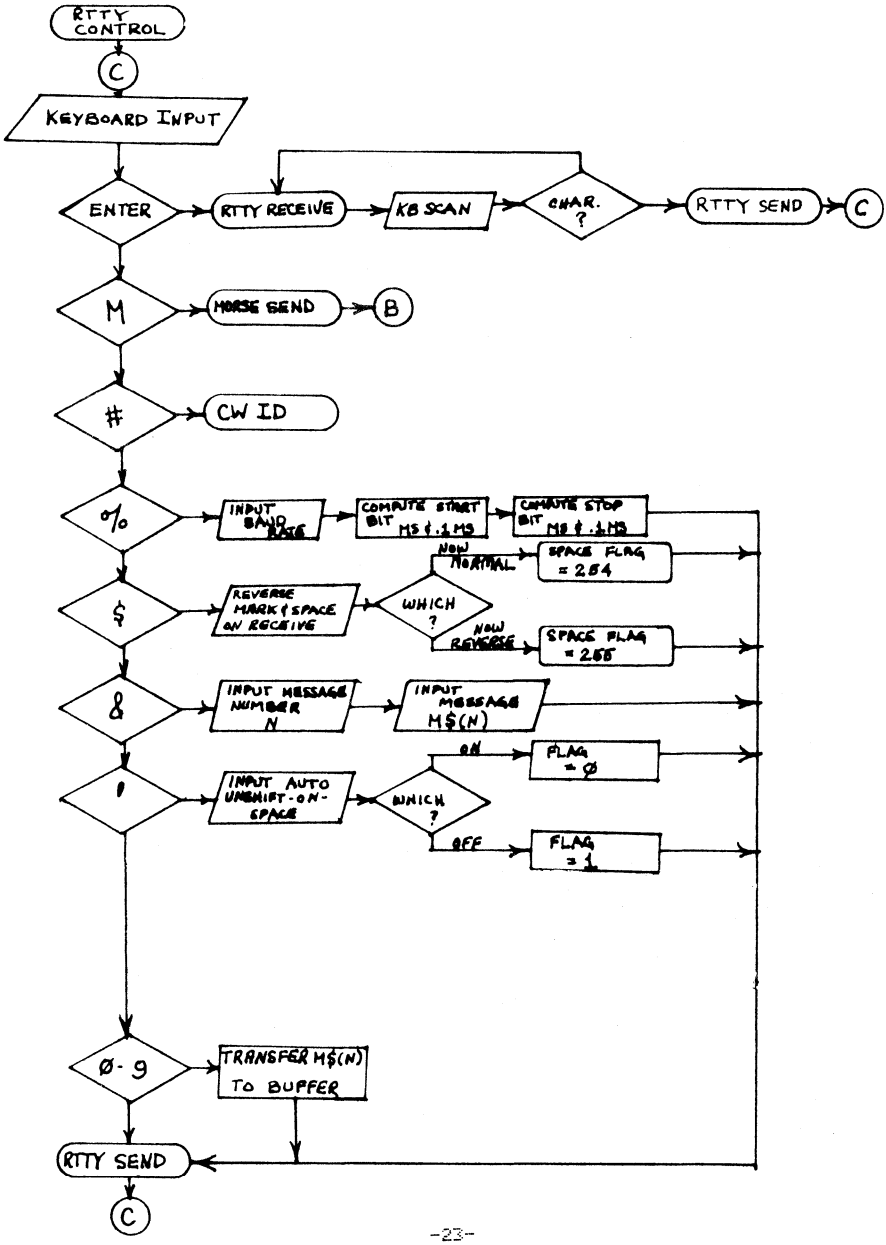
IN THE MONITOR: SET 0=3B5D

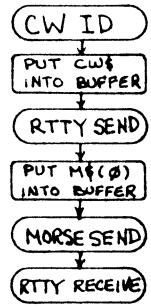
WILL DIRECT SORCERER OUTPUT TO BUFFER.

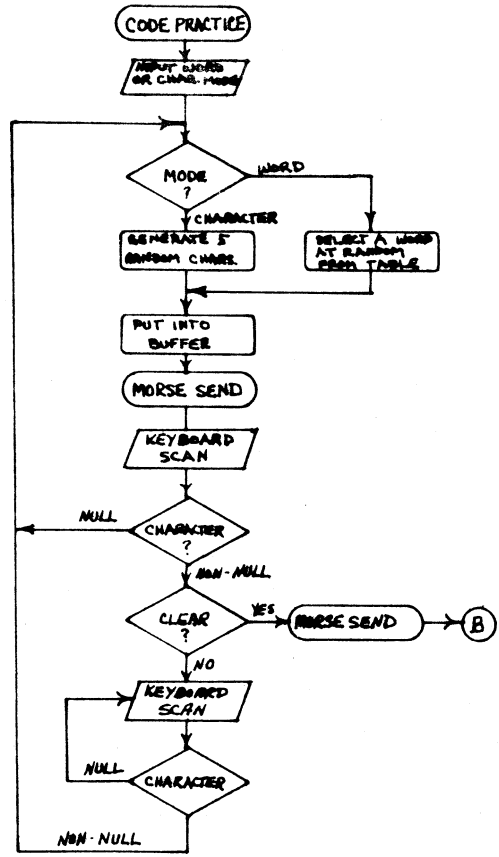
CALL 3B6F TO SEND BUFFER (SET 3EDE WITH MODE FIRST

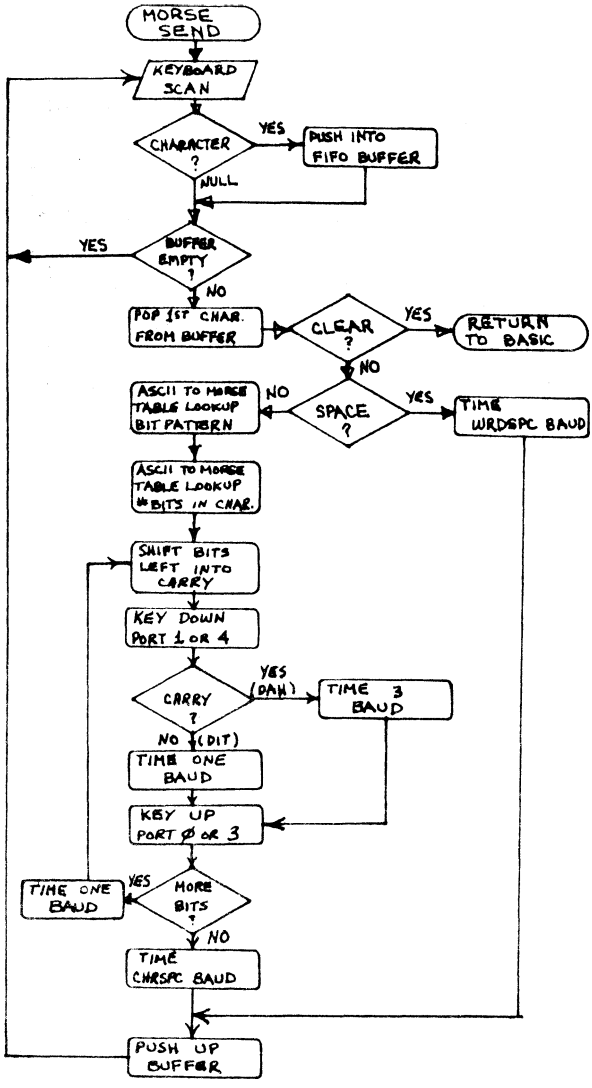

ENTER
INITIALIZE
SPEED =15
BAUD = 60WPM
CHAR SPACE =3
WORD SPACE =7
SPACE = LED ON
AUTO UNSHIFT ON SPACE = "ON"
INPUT MORSE OR BAUDOT
WHICH ?
RTTY
RTTY SEND
RTTY CONTROL
MORSE
INPUT SPEED
COMPUTE NUMBER OF .1, .001, .0001 SECONDS
TS, MS, TM
INITIALIZE RECEIVE SPEED
WD
MORSE SEND
MORSE CONTROL

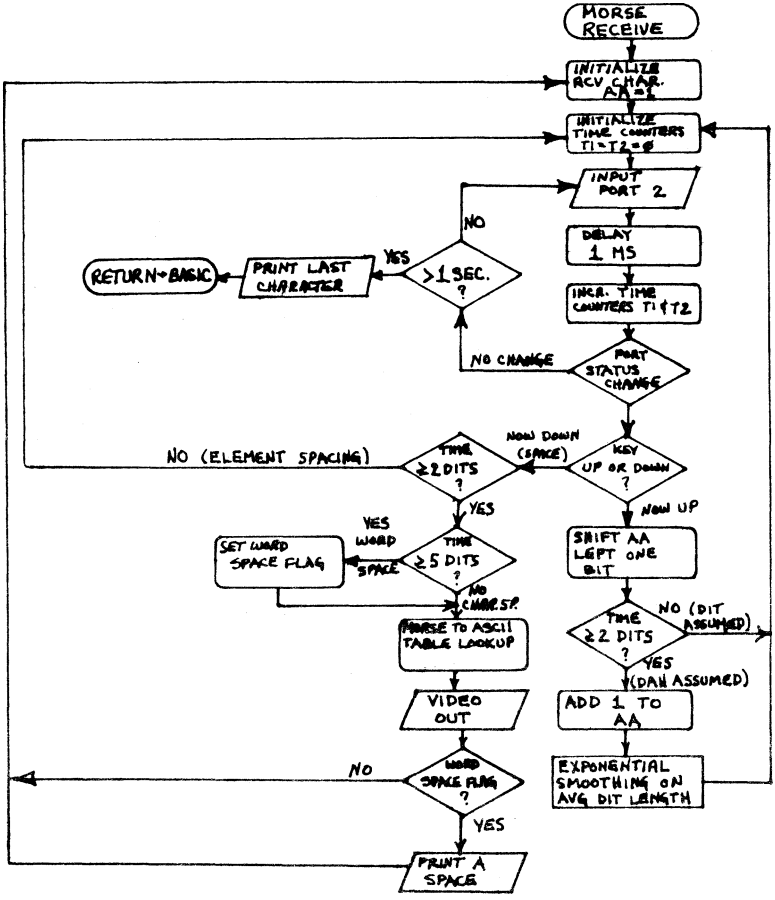

MORSE CONTROL
B
KEYBOARD SCAN
ENTER
MORSE RECEIVE
KB SCAN
CHARACTER ?
NULL
NON NULL
MORSE SEND
B
R
RTTY SEND
C
#
CODE PRACTICE
%
INPUT SPEED
COMPUTE .1, .001, .0001 SEC
SET RECEIVE INITIAL SPEED
$
INPUT SPACING CHRSPC & WRDSPC
&
INPUT MESSAGE NUMBER N
INPUT MESSAGE M$(N)
!
INPUT KEYING TYPE
WHICH ?
POSITIVE PORTS 3 & 4
NEGATIVE PORTS #1 & 1
0 - 9
TRANSFER M$(N) TO BUFFER
MORSE SEND
B

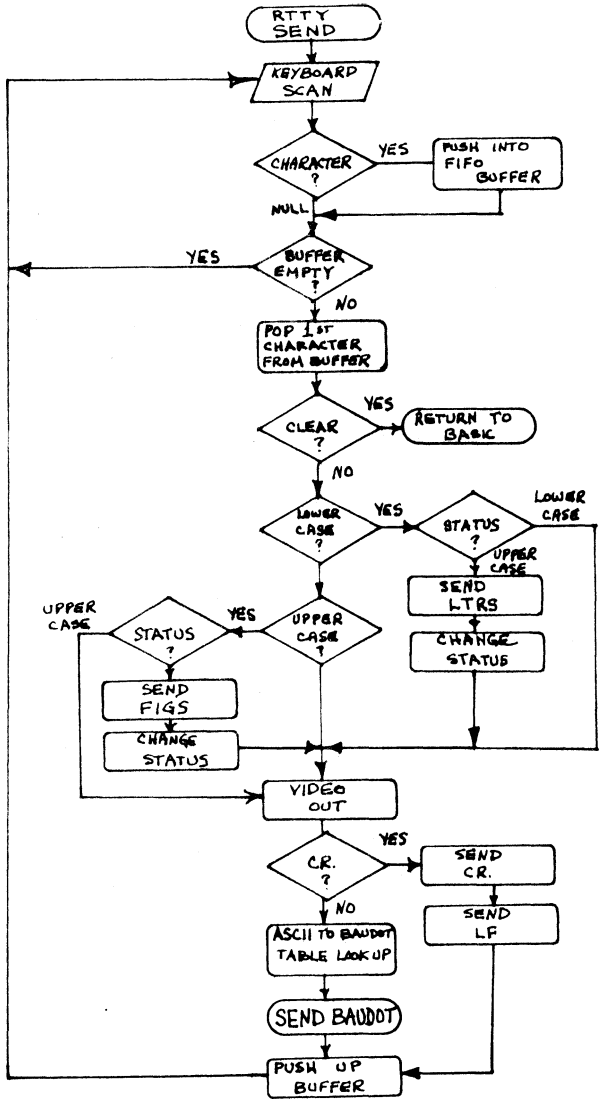

RTTY CONTROL
C
KEYBOARD INPUT
ENTER
RTTY RECEIVE
KB SCAN
CHAR. ?
RTTY SEND
C
M
MORSE SEND
B
#
CW ID
%
INPUT BAUD RATE
COMPUTE START BIT MS ÷ .1 MS
COMPUTE STOP BIT MS ÷ .1 MS
$
REVERSE MARK & SPACE ON RECEIVE
WHICH ?
NOW NORMAL
SPACE FLAG = 254
NOW REVERSE
SPACE FLAG = 255
&
INPUT MESSAGE NUMBER N
INPUT MESSAGE M$(N)
'
INPUT AUTO UNSHIFT-ON-SPACE
WHICH ?
ON
FLAG = 0
OFF
FLAG = 1
Ø - 9
TRANSFER M$(N) TO BUFFER
RTTY SEND
C

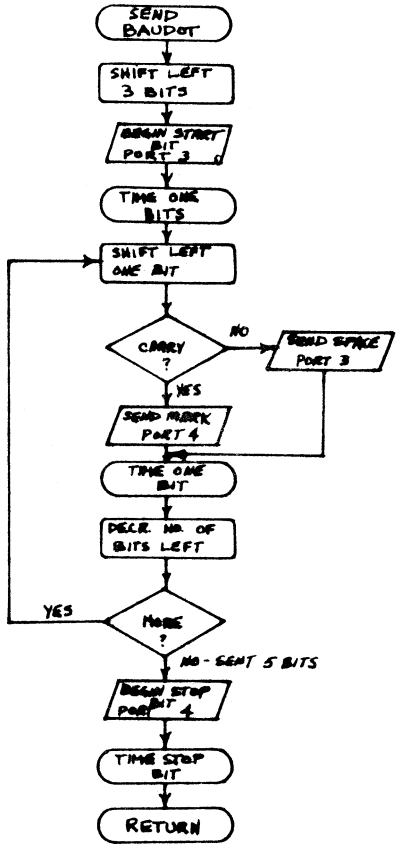

CW ID
PUT CW$ INTO BUFFER
RTTY SEND
PUT M$(Ø) INTO BUFFER
MORSE SEND
RTTY RECEIVE

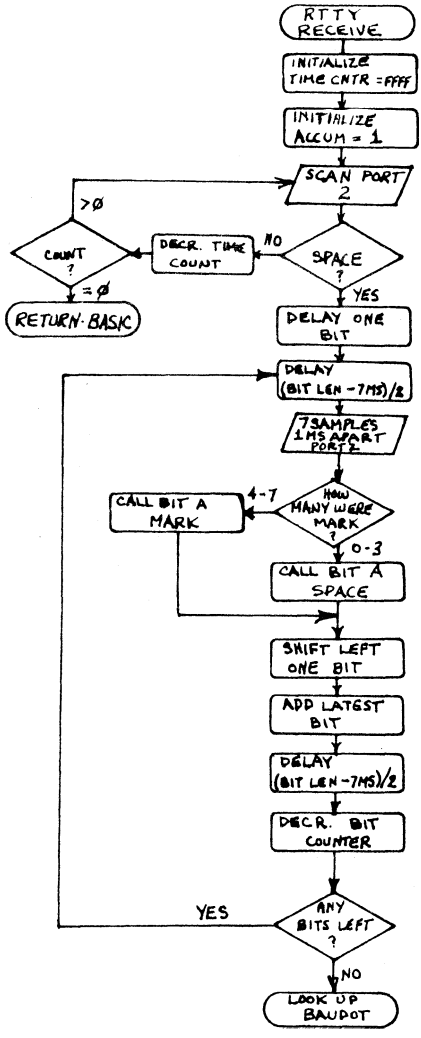

CODE PRACTICE
MODE ?
WORD
CHARACTER
PUT INTO BUFFER
MORSE SEND
KEYBOARD SCAN
CHARACTER ?
NULL
NON-NULL
CLEAR ?
YES
MORSE SEND
B
NO
KEYBOARD SCAN
CHARACTER
NULL
NON-NULL

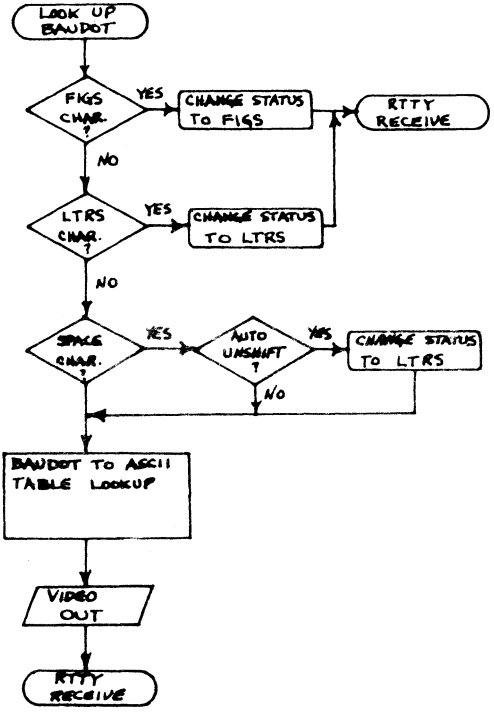

MORSE SEND
KEYBOARD SCAN
CHARACTER ?
YES
PUSH INTO FIFO BUFFER
NULL
BUFFER EMPTY ?
YES
NO
POP 1ST CHAR. FROM BUFFER
CLEAR ?
YES
RETURN TO BASIC
NO
ASCII TO MORSE TABLE LOOKUP BIT PATTERN
NO
SPACE ?
YES
TIME WRDSPC BAUD
ASCII TO MORSE TABLE LOOKUP #BITS IN CHAR.
SHIFT BITS LEFT INTO CARRY
KEY DOWN PORT 1 OR 4
CARRY ?
YES (DAH)
TIME 3 BAUD
NO (DIT)
TIME ONE BAUD
KEY UP PORT Ø OR 3
TIME ONE BAUD
YES
MORE BITS ?
NO
TIME CHRSPC BAUD
PUSH UP BUFFER


MORSE RECEIVE
INITIALIZE RCV CHAR. AA=1
INITIALIZE TIME COUNTERS T1=T2=0
INPUT PORT 2
DELAY 1 MS
INCR. TIME COUNTERS T1 T2
PORT STATUS CHANGE
NO CHANGE
NO
>1 SEC. ?
YES
PRINT LAST CHARACTER
RETURN→BASIC
KEY UP OR DOWN ?
NOW DOWN (SPACE)
NOW UP
TIME ≥2 DITS ?
NO (ELEMENT SPACING)
YES
SHIFT AA LEFT ONE BIT
TIME ≥2 DITS ?
NO (DIT ASSUMED)
YES (DAH ASSUMED)
ADD 1 TO AA
EXPONENTIAL SMOOTHING ON AVG DIT LENGTH
TIME ≥5 DITS ?
YES
WORD SPACE
SET WORD SPACE FLAG
NO CHAR SP
MORSE TO ASCII TABLE LOOKUP
VIDEO OUT
WORD SPACE FLAG ?
NO
YES
PRINT A SPACE


RTTY SEND
KEYBOARD SCAN
CHARACTER ?
YES
PUSH INTO FIFO BUFFER
NULL
BUFFER EMPTY ?
YES
NO
POP 1ST CHARACTER FROM BUFFER
CLEAR ?
YES
RETURN TO BASIC
NO
LOWER CASE ?
YES
STATUS ?
LOWER CASE
UPPER CASE
SEND LTRS
CHANGE STATUS
UPPER CASE
STATUS ?
YES
UPPER CASE ?
SEND FIGS
CHANGE STATUS
VIDEO OUT
C.R. ?
YES
SEND C.R.
SEND LF
NO
ASCII TO BAUDOT TABLE LOOKUP
SEND BAUDOT
PUSH UP BUFFER


SEND BAUDOT
SHIFT LEFT 3 BITS
BEGIN START BIT PORT 3 0
TIME ONE BITS
SHIFT LEFT ONE BIT
CARRY ?
NO
SEND SPACE PORT 3
YES
SEND MARK PORT 4
TIME ONE BIT
DECR. NO. OF BITS LEFT
MORE ?
YES
NO - SENT 5 BITS
BEGIN STOP BIT PORT 4
TIME STOP BIT
RETURN


RTTY RECEIVE
INITIALIZE TIME CNTR = FFFF
INITIALIZE ACCUM = 1
SCAN PORT 2
>Ø
COUNT ?
=Ø
RETURN-BASIC
DECR. TIME COUNT
NO
SPACE ?
YES
DELAY ONE BIT
DELAY (BIT LEN -7MS)/2
7 SAMPLES 1MS APART PORT 2
4-7
HOW MANY WERE MARK ?
0-3
CALL BIT A MARK
CALL BIT A SPACE
SHIFT LEFT ONE BIT
ADD LATEST BIT
DELAY (BIT LEN -7MS)/2
DECR. BIT COUNTER
YES
ANY BITS LEFT ?
NO
LOOK UP BAUDOT


LOOK UP BAUDOT
FIGS CHAR. ?
YES
CHANGE STATUS TO FIGS
RTTY RECEIVE
NO
LTRS CHAR. ?
YES
CHANGE STATUS TO LTRS
NO
SPACE CHAR. ?
YES
AUTO UNSHIFT ?
YES
CHANGE STATUS TO LTRS
NO
BAUDOT TO ASCII TABLE LOOKUP
VIDEO OUT
RTTY RECEIVE

```
1 GOTO30000
2 OUT255,127
3 POKE16088,0
4 PRINTTAB(16);"COPYRIGHT 1978 R. LODEWYCK":PRINT:PRINT
5 PRINTTAB(20);"<VERSION 1.1>"
8 DATA0,205,160,59,50,248,0,201:FORI=248TO255:READJ:POKEI,J:NEXT
10 ZM=PEEK(-4096)+PEEK(-4095)*256
12 ZO=ZM-47
15 SC=10000
17 EOT$=CHR$(4)
20 L4=14481:L5=14482:L6=14485:L7=14486
21 L0=-3968:EI=8:FT=255:FS=256:TW=2:NF=95:FF=44:O=1:MO=1:P=1
25 POKE14365,2:POKE14366,6:POKE14487,255
30 POKE14361,6:POKE14362,0:POKE14363,60
50 B$=CHR$(10)+CHR$(13)
51 CW$=B$+"CW ID"+B$+EOT$
60 SFF=64:FF=55:SX=16:O=1:OM=16097:OT=16098:TM=16099
61 TT=16100:SP=16101:P=16102:O=16103:LEVEL=16104:E=31:F=32:FV=59
62 ST=63:TR=13:HM=16106:HT=16107:L=1
80 NW=115:DIMW$(NW):FORI=0TO115:READW$(I):NEXT
150 FORI=1TO1000:NEXT:PRINTCHR$(12)
151 INPUT"MODE (M=MORSE CODE, B=BAUDOT RTTY)";B$
152 IFB$="M"THENGOSUB200:GOTO1000
153 GOTO9990
200 PRINT:PRINT"ENTER SPEED IN WPM";:INPUT SD
210 IF SD>399ORSD<1THEN200
212 PRINT"WPM NOW "SD:WD=SD*1.2:SD=SD*1.21
280 TV=INT(1.2/SD*SC):TZ=TV-INT(TV/10)*10:MS=(TV-TZ)/10
281 TS=INT(MS/100)
290 MS=MS-TS*100:POKE14362,TZ:IFTZ=0THENPOKE14362,1
300 POKE14363,MS:POKE14364,TS
314 T2=2400/WD:POKEL4,INT(T2/100):POKEL5,T2-INT(T2/100)*100
315 T5=8400/WD:POKEL6,INT(T5/100):POKEL7,T5-INT(T5/100)*100
320 RETURN
400 REM
SET
410 PRINT:PRINTCHR$(1);:POKEZM-6,64:POKEZM-5,7:POKE16092,192:RET
URN
500 POKEZM-7,PEEK(-2112):POKE13568,31:OUT255,127:RETURN
1000 GOSUB400:GOSUB500
1005 PRINT"MORSE SEND MODE-"
1010 POKE260,185:POKE261,62
1020 POKE16088,128:X=USR(0):POKE16088,0:GOTO1300
1200 GOSUB400:PRINT"MORSE RECEIVE MODE-"
1210 POKE260,192:POKE261,62:X=USR(0)
1220 IF PEEK(13568)<>0THEN 1210
1230 POKEZM-7,PEEK(-2112):GOTO1000
1299 REMMORSE CONTROL
1300 GOSUB500:PRINT:PRINT"MORSE CONTROL MODE-"
1302 POKE260,249:POKE261,0
1305 X=USR(0):B=PEEK(248):IFB=0THEN1305
1306 POKE16094,0
```

```
1310 IF B=4THEN 1302
1311 IFB=23THEN1302
1312 IFB>=48ANDB<=57THENPOKE16094,0:GOSUB 1500
1315 IFB=38THENGOSUB1400:GOTO1000
1320 IFB=37THENGOSUB200:GOTO1000
1330 IFB=82THEN9990:REM GOTORTTY EXEC
1340 IFB=13THEN 1200
1350 IF B=36THEN 1600
1360 IF B=35THEN1700
1390 GOTO1000
1400 REM ENTER MESSAGE
1405 PRINTZ$:PRINT:PRINT:PRINT:PRINT:PRINT:PRINT
1406 PRINT
1410 INPUT"ENTER MESSAGE NUMBER (0-9)";J
1412 IFJ<0ORJ>9THEN1410
1420 PRINT"MESSAGE";J;":":PRINT M$(J)
1425 PRINTCHR$(17)
1430 PRINT "  WHAT IS NEW MESSAGE";J
1435 I=0:S=-3840
1436 X=USR(0):B=PEEK(248):IFB=0THEN1436
1437 IFB>31THENM$(J)="":GOTO1475
1438 GOSUB400:RETURN
1440 PRINTCHR$(17);250-I
1450 X=USR(0):B=PEEK(248):IFB=0THEN1450
1460 IFB=4THENM$(J)=M$(J)+CHR$(13)+CHR$(10)+EOT$:GOTO1490
1470 IFB=127THENIFI>0THENI=I-1:M$(J)=LEFT$(M$(J),LEN(M$(J))-1):G
OTO1480
1475 M$(J)=M$(J)+CHR$(B):I=I+1
1476 POKES+I,B:POKES+I+1,95:GOTO1440
1480 POKES+I+1,95:POKES+I+2,32:GOTO1440
1490 PRINT CHR$(17):FORI=1TO9:PRINT:NEXT
1491 FORI=1TO4:PRINTTAB(64);"":NEXT
1492 PRINT CHR$(17):FORI=1TO9:PRINT:NEXT:PRINTM$(J)
1495 GOSUB400:RETURN
1500 REM
SEND MESSAGE

1504 J=B-48
1505 IFM$(J)=""THENPRINTJ;"Empty":RETURN
1510 GOSUB9000
1515 PRINT M$(J):X=USR(0)
1520 GOSUB 9100
1530 GOSUB500:RETURN
1599 REM MORSE SPACING
1600 C=PEEK(14365)+1
1605 PRINT"CHARACTER SPACING";C;"(theoretical=3)";:INPUTC
1610 IFC<2THENC=2
1620 POKE14365,C-1
1625 C=PEEK(14366)+1
1630 PRINT"WORD SPACING";C;"(theoretical=7)";:INPUTC
1635 IF C<2THENC=2
1640 POKE14366,C-1:GOTO1000
```

```
1700 REM CODE PRACTICE GENERATOR
1710 PRINTZ$:PRINT:PRINT:PRINT"CODE PRACTICE MODE":PRINT
1715 O=1:SI=5:ZF=5:K=47:KK=44:FS=57:ST=63:ET=8:SF=64:NN=99
1717 INPUT"CHARACTERS OR WORDS (C OR W)";B$
1720 GOSUB400:GOSUB9000
1730 IFB$="W"THEN 1744
1731 REMPRATCICE CHARACTORS
1732 FORI=1TO5
1733 FORJ=1TO5:A=RND(A-J-44)*47+44:IFA>57ANDA<63THENA=A+8
1734 PRINTCHR$(A);:NEXT
1737 PRINT " ";EOT$;
1740 X=USR(0):POKE16111,0:IFPEEK(13568)<>0THEN NEXT:PRINT:GOTO17
32
1741 GOSUB9100:GOSUB500:PRINT:GOTO1000
1742 GOSUB 9100:GOTO 1000
1744 REM PRTCICE WARDS
1745 FORI=1TO6:A=RND(A-I-LEN(W$))+NW
1750 PRINT W$(A)+" "+EOT$
1760 X=USR(0):POKE16111,0:IFPEEK(13568)<>0THEN NEXT:PRINT:GOTO 1
745
1764 GOTO 1741
1765 GOSUB9100:GOTO1000
1770 DATABREAK,AWARD,APRIL,BANDS,AMAZE,BOXED,ADDED,BASIC,BOARD
1772 DATACABLE,DIODE,CRAZE,CRAZY,CLOCK,CLIPS,CODED,DIALS,DIGIT,C
OLD
1774 DATAELECT,EIGHT,EVERY,EXIST,EARLY,EGYPT
1776 DATAFIXED,FLOPS,FANCY,FULLY,FIELD,FINAL,FARAD,FAULT,FIXED
1778 DATA GRANT,GLAZE,GIVEN,HEARD,GOING,HAITI
1780 DATAJAZZY,KOREA,LEVEL,LIGHT,LINES,LOGIC,LUNAR,LIMIT,LIBYA
1782 DATA MOTOR,METER,MOUNT,MIXED,MIXER,MERIT,MARCH,MELEE,MORSE
1784 DATA NOISE,NAMES,OCCUR,OTHER,OSCAR,PLAYS,POWER,PLATE,PANEL
1786 DATA PULSE,POINT,QUICK,QUIET,QUIRK,QUACK,QUITE
1788 DATAROTOR,READY,RADIO,RELAY,RATED,RATES,REALM,SHAFT,SPEED
1790 DATASTATE,STEEL,SEVEN,SOLID,SLIDE,SINCE,SIDED,SHORT,SPIKE
1792 DATASPAIN,TONES,THERE,THREE,TOTAL,TAXED,TAPED,TUNED,TAKES
1794 DATA THOSE,TRIED,TRACK,TEXAS,TOKYO,THINK
1796 DATAWORLD,VISIT,WHITE,VOICE,WHICH,VOLTS,WIRED,VIDEO,UNITS
9000 REM
SETUP BUFFER
9010 ZL=PEEK(ZO):ZH=PEEK(ZO+1)
9020 POKEZO,93:POKEZO+1,59
9030 POKE260,111:POKE261,59
9040 RETURN
9100 POKEZO,ZL:POKEZO+1,ZH:RETURN
9980 REM RTTY EXEC
9990 GOSUB400:PRINT"RTTY SEND MODE-"
9995 OUT 255,135
10000 POKE260,199:POKE261,62:POKE16088,128:X=USR(0):POKE16088,0
10100 GOTO13000
```

```
13000 REMRTTY CONTROL
13004 GOSUB500:GOSUB400:PRINT"RTTY CONTROL-"
13005 POKE260,249:POKE261,0
13010 X=USR(0):B=PEEK(248):IFB=0THEN13010
13100 IFB=4THEN13005
13110 IFB=23THEN13005
13120 IFB>=48ANDB<=57THENPOKE16094,1:GOSUB1500
13130 IFB=13THEN20000:REM RTTY SEND
13140 IFB=38THENGOSUB1400:GOTO9990:REM CREATE MESSAGE
13200 IFB=37THEN16000:REMCHANGE BAUD RATE
13400 IFB=35THEN17000:REM CW ID
13500 IFB=77THEN1000
13800 IFB=36THEN18000
13850 IFB=39THEN18500
13900 GOTO 9990
16000 REM CHANGE BAUD RATE
16500 PRINT:INPUT"ENTER BAUD RATE AS WPM (60,66,75, OR 100)";WPM
16550 IFWPM=60THENM1=22:T1=8:M2=8:T2=1:M3=31:T3=0:M4=21:T4=1:GOT
O16900
16600 IFWPM=66THENM1=20:T1=9:M2=7:T2=0:M3=28:T3=4:M4=19:T4=1:GOT
O16900
16650 IFWPM=75THENM1=18:T1=1:M2=5:T2=6:M3=25:T3=0:M4=16:T4=7:GOT
O16900
16700 IFWPM=100THENM1=13:T1=5:M2=3:T2=5:M3=19:T3=0:M4=12:T4=6:GO
TO16900
16750 PRINT:PRINT:GOTO16500
16900 POKEOM,M1:POKEOT,T1:POKETM,M2:POKETT,T2:POKEHM,M3:POKEHT,T

16905 POKE16090,M4:POKE16091,T4
16910 PRINT"WPM NOW";WPM:GOTO9990
17000 REM CW ID SEND
17005 POKE16094,1
17010 GOSUB9000:PRINT CW$:X=USR(0)
17015 IFPEEK(13568)=0THEN17030
17020 POKE16094,0:PRINT" ";M$(0);EOT$:X=USR(0)
17030 GOSUB 9100
17050 GOTO 20000
18000 REM
INVERT MARK/SPACE RECIEVE TONES
18010 IFPEEK(SP)=254THENPOKESP,255:GOTO18030
18020 POKESP,254
18030 PRINT:PRINT"MARK/SPACE RECEIVE TONES REVERSED"
18040 PRINT:PRINT"LED SHOULD LIGHT ON ";:
18045 IFPEEK(SP)=254THENPRINT"SPACE -":GOTO9990
18050 PRINT"MARK -":GOTO9990
```

```
18490 REM
UNSHIFT-ON-SPACE OPTION
18500 PRINT:INPUT"A=AUTO UNSHIFT M=MANUAL UNSHIFT ";B$
18510 IFB$="A"THENPOKE16108,0:GOTO18530
18520 POKE16108,1
18530 PRINT:PRINT"AUTOMATIC UNSHIFT-ON-SPACE IS";
18540 IFB$="A"THENPRINT" ON -":GOTO9990
18550 PRINT"OFF -":GOTO9990
20000 REM*RTTY RECIEVE
20005 GOSUB400:PRINT"RTTY RECEIVE MODE-"
20010 POKE260,206:POKE261,62:X=USR(0)
20020 IF PEEK(13568)<>0 THEN 20010
20030 GOSUB500:GOTO9990
30000 CLEAR3000:Z$=CHR$(12):PRINTZ$
30010 Z$="┌┐└┘":Z$=Z$+Z$
30012 PRINTZ$
30020 PRINT"";TAB(63);""
30030 PRINT"";TAB(16);"MACROTRONICS S-80 Ham Interface";
30040 PRINTTAB(63);"":PRINT"";
30050 PRINTTAB(20);"for the EXIDY Sorcerer";TAB(63);""
30055 PRINT"";TAB(63);""
30060 PRINTZ$:PRINT:PRINT:PRINT:PRINT:PRINT
30065 Z$=CHR$(12)
30070 GOTO2
65000 STOP
```

APPENDIX 1
RTTY EQUIPMENT INTERCONNECTIONS

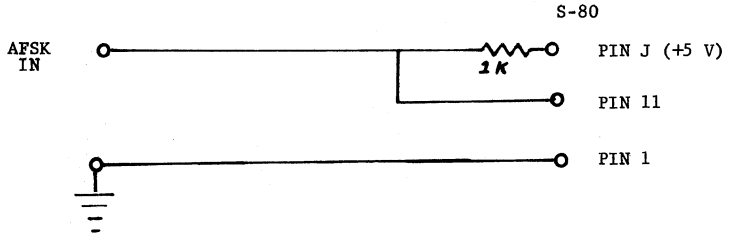
IF YOU ARE NEW TO RTTY, YOU SHOULD READ A GOOD INTRODUCTION BEFORE GOING ON THE AIR. SEE THE REFERENCES CITED EARLIER.

TRANSMITTING

TO SEND RTTY ON THE AMATEUR FREQUENCIES, YOU WILL REQUIRE A MEANS OF FREQUENCY MODULATING YOUR SIGNAL. TWO METHODS ARE IN COMMON USE TODAY:

1. FREQUENCY SHIFT KEY (FSK) THE TRANSMITTER VFO (NOT USED ON VHF-FM). SOME TRANSMITTERS AND TRANSCEIVERS (SUCH AS KENWOOD TS-820, YAESU FT901, ICOM 701, ETC.) HAVE THIS CAPABILITY BUILT IN. IN THIS CASE, SIMPLY CONNECT THE FSK JACK TO THE RELAY CONTACTS ON THE S-80. YOU WILL NEED TO DETERMINE IF YOUR FSK CIRCUITRY REQUIRES MAKE-ON-SPACE OR MAKE-ON-MARK. BOTH ARE PROVIDED FOR ON THE S-80 BOARD. IF YOUR TRANSMITTER DOES NOT HAVE THIS FEATURE, REFER TO CHAPTER V OF THE RTTY HANDBOOK OR THE RTTY SECTION OF THE SPECIALIZED COMMUNICATION TECHNIQUES HANDBOOK PUT OUT BY ARRL.

2. AUDIO FREQUENCY SHIFT KEY (AFSK) THROUGH THE MICROPHONE INPUT. THIS IS THE EASIEST AND PROBABLY MOST COMMON METHOD IN USE ON THE HAM BANDS TODAY. IT IS USED ON BOTH THE HF AND VHF BANDS. SEVERAL COMMERCIAL AFSK UNITS ARE AVAILABLE - LOOK THROUGH ANY ISSUE OF THE RTTY JOURNAL, HAM RADIO MAGAZINE, QST, 73 MAGAZINE, OR WORLD RADIO NEWS. LOUGHMILLER <<"DIGIRATT", HAM RADIO MAGAZINE, SEPT. 1977>> DESCRIBED A SIMPLE BUT VERY STABLE AFSK UNIT. A VERY SIMPLE CIRCUIT WAS DESIGNED BY WB2RHM AND DESCRIBED IN SEPT. 69 QST. IT SHOULD COST LESS THAN $10.00 AND HAS PROVISIONS FOR WIDE OR NARROW SHIFT, AND ALSO A CW ID JACK WHICH MAKES IT IDEAL FOR USE WITH THE S-80. EXACTLY HOW TO CONNECT THE AFSK UNIT TO THE S-80 WILL DEPEND ON HOW IT IS TO BE KEYED. SOME UNITS, FOR EXAMPLE, HAVE A "GROUND ON SPACE" INPUT. SOME REQUIRE A POSITIVE VOLTAGE ON MARK AND NEGATIVE OR ZERO ON SPACE, AND OTHERS CONNECT ONLY THROUGH A LOCAL LOOP. THOSE WHICH REQUIRE A MAKE-BREAK SIMPLY CONNECT TO THE RELAY CONTACTS. THOSE WHICH REQUIRE A + VOLTAGE TO KEY CAN BE TIED TO A "PULL-UP" RESISTOR THROUGH THE RELAY. 5 VOLTS IS AVAILABLE ON PIN J OF THE EDGE CONNECTOR. HERE'S A TYPICAL CONNECTION:



AFSK UNITS WHICH KEY THROUGH A LOCAL LOOP CAN BE ACCOMODATED BY REPLACING THE RELAY WITH THE OPTIONAL MLK-1 LOOP KEYER MODULE. THIS ALLOWS THE S-80 TO CONNECT IN SERIES WITH THE LOCAL LOOP AND OPTICALLY ISOLATES THE HIGH VOLTAGE FROM THE S-80 AND YOUR SORCERER. WITH THE MLK-1 IN THE RELAY SOCKET, CONNECT THE 'LOOP +' TO PIN 10 AND THE 'LOOP -' TO PIN 11.

RECEIVING

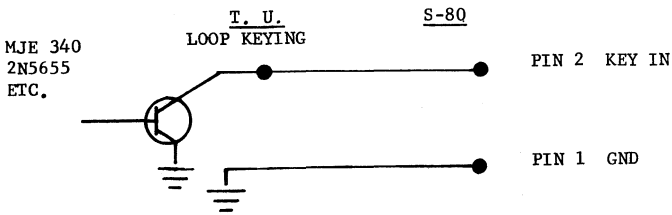
THE BUILT IN TERMINAL UNIT (TU) OF THE S-80 CONSISTS OF A SINGLE IC - THE 567 PHASE LOCKED LOOP. THIS CIRCUIT IS ADEQUATE TO DEMODULATE A FSK SIGNAL OR CW SIGNAL UNDER GOOD SIGNAL CONDITIONS. IN THE PRESENCE OF HEAVY QRN, QRM, OR QSB, HOWEVER, PERFORMANCE WILL BE MARGINAL. SEVERAL ADVANCED DESIGN TU'S ARE AVAILABLE COMMERCIALLY, INCLUDING THE MACROTRONICS FSD-1. SEVERAL EXCELLENT TU'S HAVE BEEN DESCRIBED IN THE LITERATURE, AND MANY OF THE CIRCUITS ARE NOW AVAILABLE IN KIT FORM. LOOK THROUGH RECENT ISSUES OF THE MAGAZINES MENTIONED ABOVE.

AN EXTERNAL TU MAY BE CONNECTED TO THE S-80 IN ANY OF SEVERAL WAYS.

1. THROUGH A LOCAL LOOP. WITH THE MLK-1 LOOP KEYER MODULE IN THE RELAY SOCKET, SIMPLY CONNECT 'LOOP +' TO PIN 10 AND 'LOOP -' TO PIN 11. NO OTHER CONNECTIONS ARE REQUIRED (FOR EITHER TRANSMITTING OR RECEIVING IF YOUR TU HAS AN AFSK UNIT KEYED THROUGH THE LOOP).

2. THROUGH THE RS232 INPUT. THE S-80 ACCEPTS AN RS232 VOLTAGE INPUT (+ OR - 12 VOLTS) ON RECEIVE. MOST TU'S WILL HAVE SUCH AN OUTPUT MARKED EITHER RS232 OR FSK. THIS VOLTAGE IS USUALLY DERIVED FROM THE LOOP CURRENT, SO THE LOOP MUST BE CLOSED AND DRAWING 60 MA. ON MOST TU'S FOR THIS TO WORK. CONNECT TO PINS 5 AND 6 ON THE S-80.

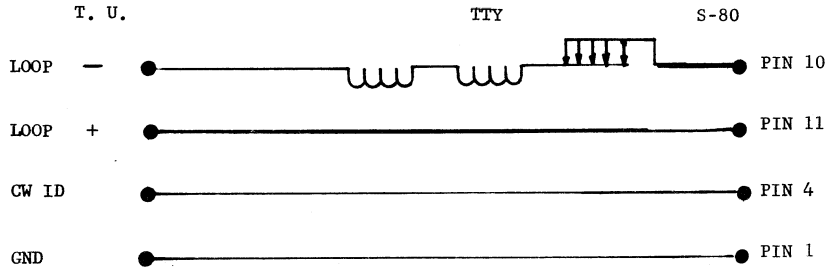
3. THROUGH THE KEY IN PIN. IF YOUR TU HAS A LOOP KEYER TRANSISTOR OR A RELAY OUTPUT, YOU CAN CONNECT DIRECTLY TO THE KEY IN CIRCUIT. MAKE CERTAIN YOU DO NOT CONNECT ANY VOLTAGE HIGHER THAN +5 VOLTS TO PIN 2. RIGHT SIDE UP SHOULD GIVE GROUND ON SPACE AND OPEN OR +5 VOLTS ON MARK. TO CONNECT THE LOOP KEYER TRANSISTOR:

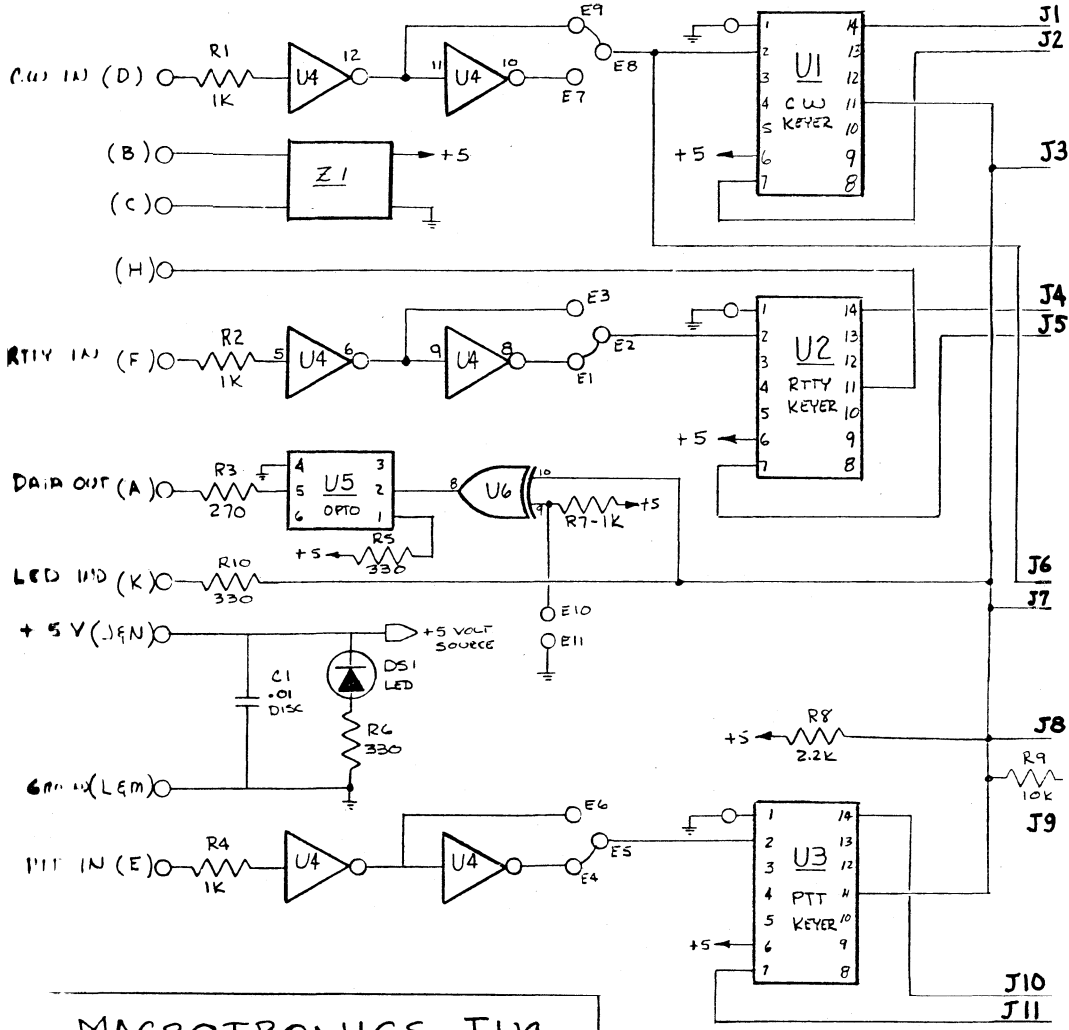


NOTE: THE ABOVE CONFIGURATION WILL GIVE MARK/SPACE INVERTED. SELECT MARK/SPACE REVERSE ON THE S-80.

HARD COPY

YOU CAN USE YOUR S-80 IN A LOCAL LOOP WITH A WIDE VARIETY OF TTY EQUIPMENT, INCLUDING A BAUDOT PRINTER. YOU MUST USE THE OPTIONAL MLK-1 LOOP KEYER MODULE IN PLACE OF THE RELAY, HOWEVER. THE MLK-1 PROVIDES SIMPLE TWO WIRE CONNECTION TO THE LOOP FOR BOTH RECEIVE AND TRANSMIT CAPABILITY, THUS ALLOWING HARD COPY. ASSUMING YOU HAVE AN AFSK UNIT IN YOUR TU, NOTHING ELSE WOULD BE REQUIRED TO INTERFACE THE S-80 FOR RTTY. HERE IS A TYPICAL STATION HOOKUP USING THE MLK-1 AND A TU:





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S80 INTERFACE

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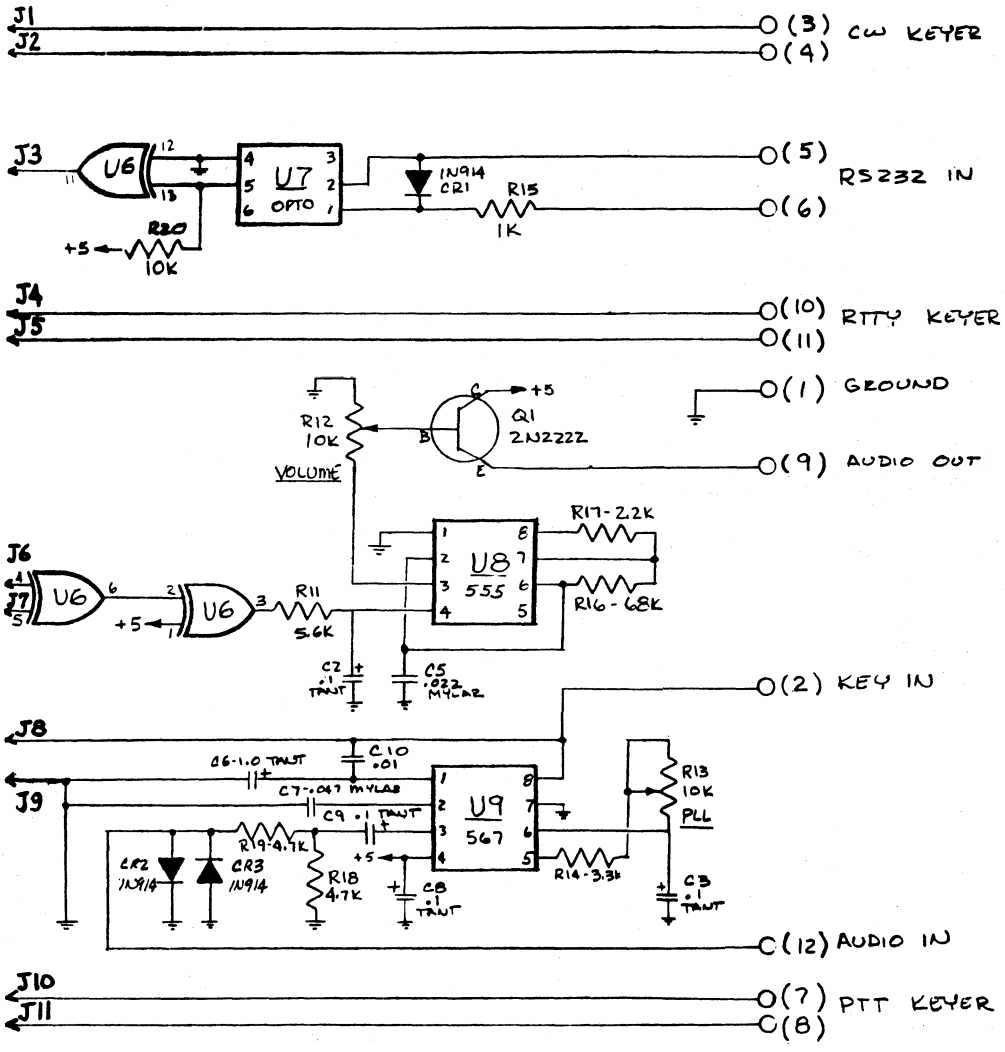

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DES	IC	+5	GRD
U4	74LS04	14	7
U6	7486	14	7