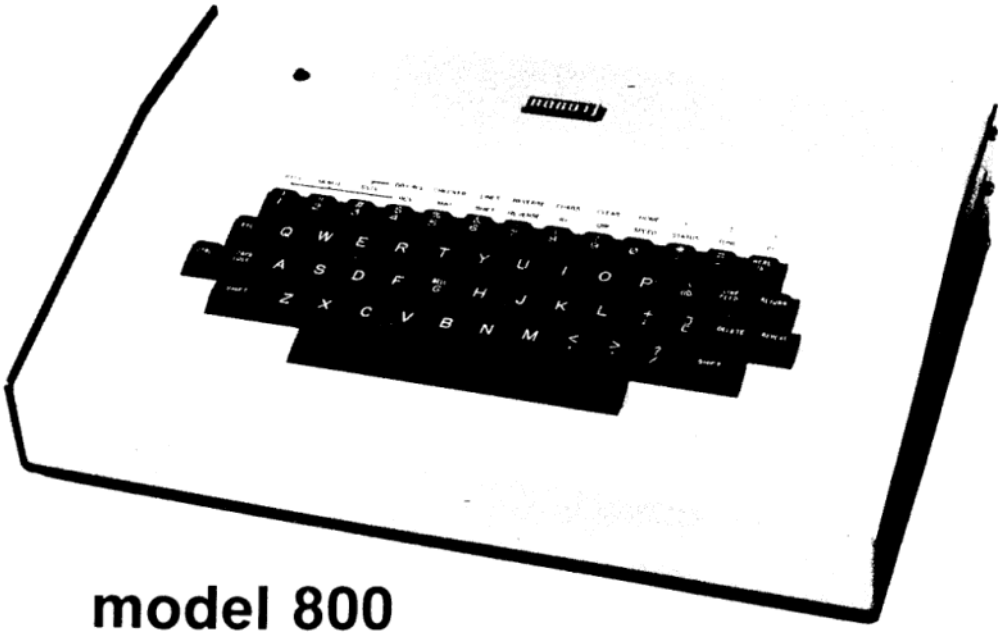
instruction book



model 800 specialty mode terminal

ROBOT

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INSTRUCTION BOOK
MODEL 800
SPECIALTY MODE TERMINAL

SECTION ONE
INTRODUCTION

The ROBOT Model 800 is a complete communications terminal for sending and receiving Baudot, ASCII and Morse Code. In addition, the Model 800 generates alphanumeric character displays for use in Slow Scan Television, and transmits this information in the amateur SSTV format. The Model 800 is a microprocessor based system utilizing the 8085 Microprocessor, 5120 bytes of ROM, and 2560 bytes of RAM. Provisions have been made for future expansion of this memory capacity to double its present amount. An Intel 8251 USART is used for serial I/O and Intel 8155's are used for parallel I/O and keyboard interface.

The Model 800 can be interfaced directly to the audio input and output jacks of communications equipment. It has a built-in terminal unit for demodulation of incoming Morse and RTTY signals as well as an audio frequency shift keyer for transmission. A standard closed circuit television monitor is used for the display and is connected directly to the Model 800 Terminal.

SPECIFICATIONS

INPUT/OUTPUT— ELECTRICAL CHARACTERISTICS

AUDIO INPUT-20 millivolts to 3 volts; 600 ohm impedance.

AUDIO OUTPUT-0 to 3 volts adjustable; 600 ohm impedance.

VIDEO OUTPUT-Standard TV video signal 1.4 volts p-p white positive into 75 ohms, compatible with standard 525 line CCTV monitor (625 lines in 50 Hz countries).

TTY LOOP KEYER OUTPUT-Transistor switched current loop keyer.

CW KEYER OUTPUT-Transistor switched to ground for cathode or grid-block keying.

PTT OUTPUT-PTT line switched to ground during transmit.

SCOPE OUTPUTS-Separate discriminator outputs for oscilloscope monitoring.

INPUT/OUTPUT— SIGNAL CHARACTERISTICS

BAUDOT-7.5 unit code (1 start, 5 data, 1.5 stop) A-Z, 0 to 9, ! " # $ & ' ( ) - : BELL ; , 1 ? / ; CR, LF, LTRS, FIGS, SPEEDS: 60, 66, 75, 100, 132 WPM.

ASCII-110 Baud, 11 unit code (1 start, 8 data, 2 stop) A-Z Upper and Lower case, 0 to 9, ! " # $ % & ' ( ) * = - ' @ BELL + ; [ ] ⟨⟩, . ? /.

MORSE-International Morse Code, A-Z, 0 to 9, ., ? : ; - /, AR, AS, BT, KN, SK.

SSTV OUTPUT-Crystal controlled SSTV Audio-FM 1200 Hz Sync, 1500 Hz Black, 2300 Hz White, 3.0 volts p-p (adjustable) into 600 ohm load. Horizontal sync 6 ms., vertical sync 66 ms.
Notice: The Model 800 does not receive SSTV pictures. An SSTV Scan Converter such as the Robot Model 400 is required for this purpose.

TRANSMIT MODES

BAUDOT, MORSE, ASCII
Continuous-Transmits each character as it is entered on the keyboard.
Word-Transmits whole word when space bar is depressed.
Line-Transmits entire line when complete.
Editing-Delete key causes backspace and erases previous character.
Tune-Locks CW Keyer Output for transmitter tuning.
Transmit Text Buffer-255 characters.
Automatic CR, LF-Prevents splitting of words at the end of each line.

SSTV
Display-Real time display of transmitted text. 36 or 18 characters (6 lines of 6 characters or 3 lines of 6 characters).
Cursors-"Winking" cursor indicates the next character position. Line cursor indicates which portion of the display is being transmitted.
Editing-Cursor controls include up, down, left, right and home to top of screen. CLEAR function causes the entire display to be erased and "homes" cursor.
Fractional Frame-LINES function changes the number of character lines transmitted. Operator may select from 1 to all 6 lines.
Reverse-Causes display to change from normal black on white to white on black.
Test Patterns-6 bar gray scale and checkerboard.

PROGRAMMABLE FEATURES

WRU-8 character programmable WRU code. The Model 800 responds to valid code by transmitting one of its HERE IS messages.

SELCAL-8 character programmable SELCAL Code. The Model 800 responds to receipt of valid code by copying the message immediately following the code into display memory.

HERE IS-2 programmable 64 character HERE IS message memories.

ID-Programmable 8 character ID memory.

OTHER FEATURES

DISPLAY-72 characters per line, 24 lines, 5 x 7 dot matrix (except in SSTV mode).

UNSHIFT ON SPACE-Automatically returns terminal to letters mode when space is sent or received.

KEYBOARD TRANSMITTER CONTROL-Complete transmit control via PTT line.

SIDE TONE OSCILLATOR-Audible side tone oscillator can be enabled for code monitoring. Volume is adjustable via rear panel control.

MORSE TRAINER-Automatically sends random 5 letter groups at selected speeds (3-99) WPM.

ON SCREEN STATUS INDICATOR-Status line shows all operational modes, shifts, and data rates which are in effect.

ON SCREEN TUNING INDICATOR-"Plus-Plus" type, displayed as a moving bar in the status line. Displays relative outputs of the discriminator filters.

MORSE AUTO TRACK-Tracking of received Morse code is totally automatic over the entire range of 3 to 99 WPM.

TEST MESSAGES-RY and "Quick Brown Fox" test messages.

DEMODULATOR

DUAL TWO-TONE ACTIVE FILTER DISCRIMINATOR

SHIFT FREQUENCIES - 170 Hz, 850 Hz.

AUTO START RESPONSE TIME: 3 seconds.

AUDIO FREQUENCY SHIFT KEYER

TYPE - Phase coherent crystal controlled.

DISTORTION - All harmonics below the 15th are 50 db down.

STABILITY - Crystaled controlled to plus or minus .025%.

CONNECTORS AND CONTROLS

KEYBOARD - 55 key alphanumeric array, two-shot molded keytops, matte grey finish, tilted keys.

CAPS LOCK - Key is alternate action.

TO MONITOR - Is a BNC video output connector for connection of fast scan monitor display.

TTY LOOP - Is a phono connector for connection of peripheral TTY equipment to the loop keyer output.

SCOPE MARK - and SCOPE SPACE are phono connectors for connection of an oscilliscope display to the discriminator outputs.

FROM RCVR - Is a phono connector for inputing audio to the Model 800 from the station receiver audio output or from the Model 400 SSTV Converter.

AUX OUT - Is a phono connector auxiliary output jack for connection to an audio tape recorder or the Model 400 SSTV Scan Converter.

TO XMTR - Is a three conductor ¼-inch jack. One conductor is used for the push to talk line which is grounded during transmit. The other two conductors are for audio and ground.

OUTPUT LEVEL - Is a control which sets the audio output level between 0 and 3 volts.

TO CW KEY - Is a ¼-inch three conductor jack for connection to the transmitter CW key input.

SIDE TONE - Is a control which sets the volume level of the audible side tone oscillator.

OTHER CHARACTERISTICS

POWER INPUT - Line voltage range is 105 to 125 volts AC or 210 to 250 volts AC (specify) and 50 or 60 Hz (specify). Power consumption is 10 watts.

MECHANICAL - Width: 15.5 inches; Depth: 10.25 inches; Height: 4 inches.

WEIGHT - 10 pounds.

CONSTRUCTION - All solid state circuits on glass epoxy circuit boards. Two tone grey, all aluminum cabinet.

SECTION TWO
INSTALLATION

2.1 UNPACKING

Remove the Model 800 from the carton and remove the protective cover and packing material. If visible evidence of damage is observed, save the box and packing material and notify the transportation company. Check the keys and power switch for freedom of action (Note: The CAPS LOCK key is alternate action). Check the equipment included with the Model 800 against the following packing list:

MODEL 800 PACKING LIST

ITEM	QUANTITY
Model 800 Keyboard	1
6 Foot Shielded Cable with RCA Phono Plugs on each end	1
6 Foot Coax Cable with BNC Plugs on each end	1
6 Foot Three Conductor Shielded Cable with Phone Plug on one end	2
Instruction Manual	1

Locate the Instruction Manual Dividers and insert them in the proper places in your manual. Pages are numbered by section. For example, page 2-1 is the first page of Section Two. The divider marked INSTALLATION should be inserted in front of this page.

2.2 CONNECTING TO RECEIVE

To connect the Model 800 to the station receiver, use the RCA phono plug patch cable furnished, and connect the cable to the rear panel jack marked FROM RCVR. Connect the other end of the cable to the receiver speaker voice coil or 500 ohm output. Using the six foot coax cable with BNC plugs, connect one end to the CCTV monitor video input and the other to the TO MONITOR video output connector on the rear panel of the Model 800.

2.3 CONNECTING TO TRANSMIT

Connect the Model 800 for transmitting as follows: The three conductor shielded cables are terminated on one end with a three wire, quarter inch phone plug. Attach a connector which will mate with the microphone input jack on your transmitter to the free end of one of these cables. Connections are made as indicated in the table below. Using this cable, connect the jack marked TO XMTR on the Model 800 rear panel to the microphone input of the station radio transmitter.

MICROPHONE CABLE WIRING

Color	Function
White	Audio
Shield	Audio (Return)
Red	Push-To-Talk
Black*	Push-To-Talk (Return)

*The black wire connects with the shield to transmitter ground.

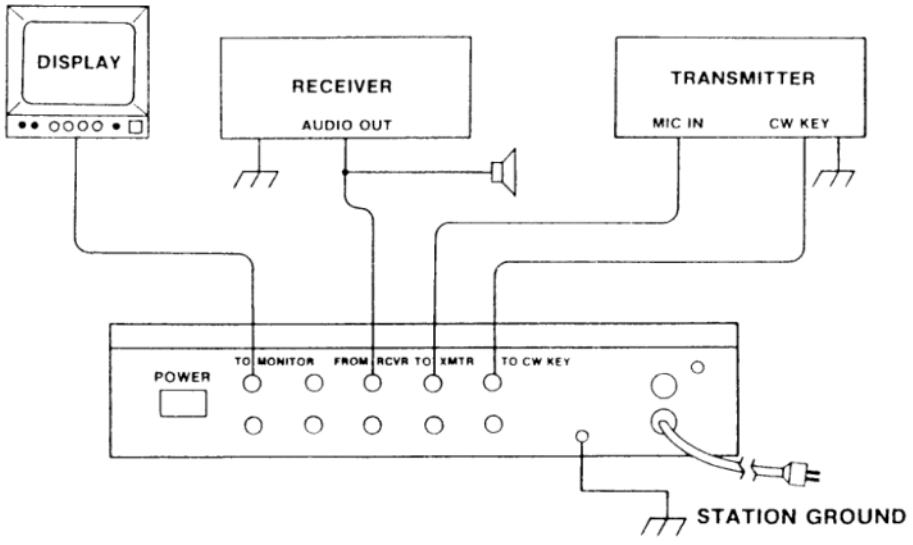

FIG. 2-1. STATION INTERCONNECTION FOR RTTY AND MORSE CODE.

The other three conductor shielded cable is used for CW operation. There are two main types of CW keying used in amateur transmitting equipment. These are grid-block keying and cathode keying. Determine which type is used on your equipment. Attach a connector which will mate with the CW key input on your transmitter to the free end of this cable according to the table below (see Fig. 2-2). Using this cable, connect the jack marked TO CW KEY on the Model 800 rear panel to the CW key input on the transmitter.

CW KEY CABLE WIRING
Transmitter Connections

Color	Grid Block Keying	Cathode Keying
White	Ground	Keying Input
Red	Keying Input	Ground
Black & Shield	Ground	Ground

2.4 CONNECTING TO AN EXTERNAL OSCILLOSCOPE

Mark and space discriminator outputs are available on the rear panel to provide an additional tuning indicator, if desired. Connect the SCOPE MARK jack to the horizontal axis input of an oscilloscope and the SCOPE SPACE jack to the vertical axis input. Output impedance is approximately 1000 ohms, maximum signal amplitude is 6 volts.

2.5 CONNECTING TO EXTERNAL TTY LOOP

A TTY Loop Output is available on the rear panel of the Model 800. A transistor is switched to ground for keying the loop. The TTY LOOP output is connected in series with a standard loop supply (60 ma, 200V typical) and loop sensing devices such as a hard copy printer. Connect the (-) side of the loop supply to the grounded side of the TTY LOOP jack. the (+) side of the supply is connected through the printer to the Model 800 (see Fig. 2-4).

2.6 INTERFACING WITH A MODEL 400 SSTV SCAN CONVERTER

If the Model 800 is to be used in conjunction with the Model 400 SSTV Scan Converter, connect a patch cord between the AUX OUT jack on the rear panel of the Model 800 and the FROM OTHER jack on the rear panel of the Model 400 (See Fig. 2-3). Transmission through the Model 400 may be accomplished by selecting the OTHER position on the TRANSMIT SELECT switch on the Model 400. The TO XMTR jack on the Model 800 need not be used. All other station connections are the same.

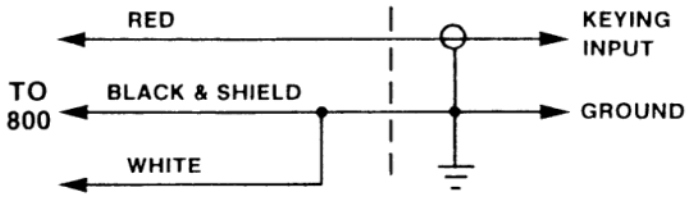

FIG. 2-2A. WIRING FOR GROUNDED GRID KEYING.

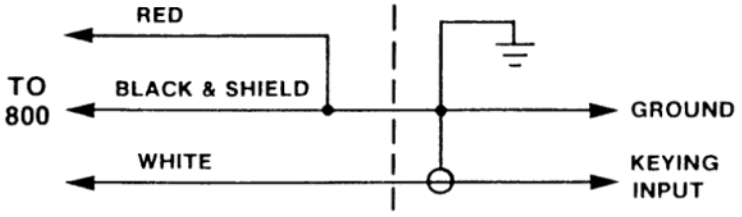

FIG. 2-2B. WIRING FOR CATHODE KEYING.

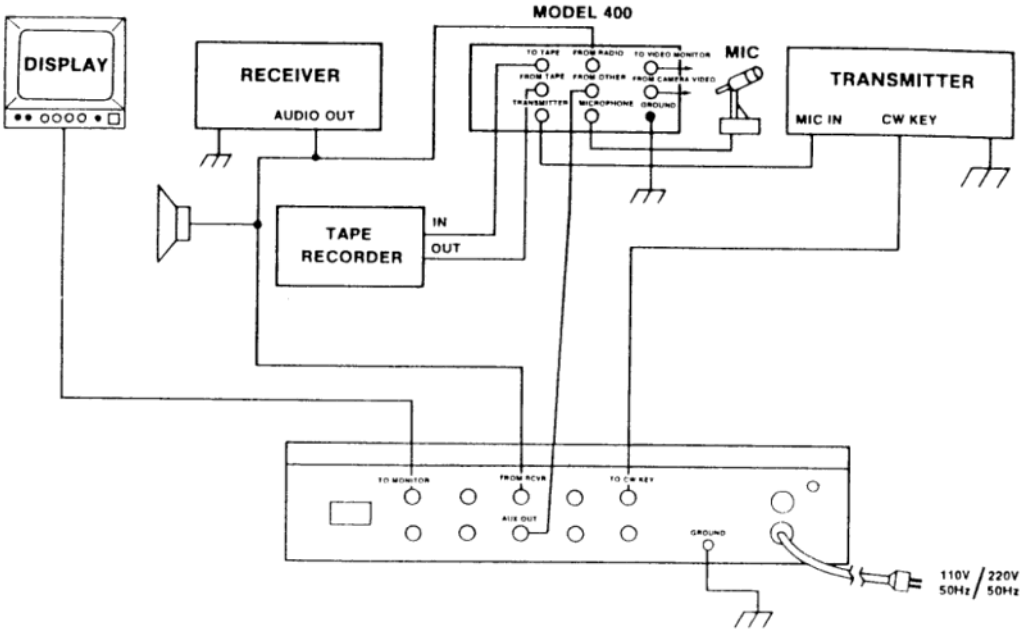

FIG. 2-3. STATION INTERCONNECTION FOR ALL MODES (WITH ROBOT MODEL 400).

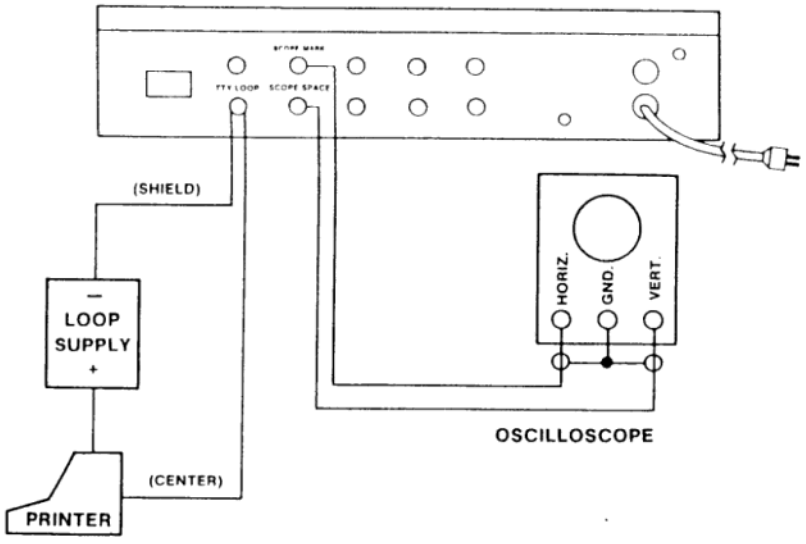

FIG. 2-4. INTERCONNECTION WITH OSCILLOSCOPE DISPLAY AND EXTERNAL TTY LOOP.

SECTION THREE
GET ON THE AIR!

3.1 INTRODUCTION

This section of the instruction manual is designed to give you immediate "hands-on" experience with your new Model 800 Terminal. This section covers only those operating procedures necessary to have your first QSO on RTTY and machine CW. It does not cover any of the more advanced operating features and procedures. These will be covered in Sections Four and Five and should be referred to after you are familiar with your Model 800 and its basic operating procedures. SSTV operation is described in Section Six. Before getting started, some terms will need to be defined.

Throughout this manual operating procedures will be described by naming certain keys which are to be pressed. A given key can have as many as three different functions. Its basic function is that which occurs when the key itself is pressed. A SHIFT function is that which occurs when the SHIFT key is first pushed and held when the object key is pressed. For example, the basic function of the upper left hand key on the Model 800 Keyboard is to print a 1. The SHIFT function of this same key is to print !. In addition, this key also has a third function called its *control* function. A control function is enabled by holding the CTRL key down when the object key is pressed. In our example, this would cause the keyboard to go into the RTTY mode. Almost all of the control functions in the Model 800 are associated with the top row of keys. These keys have silk screened labels above them to identify the control function. The functions which are described in the top line of silk screening are those functions used in the SSTV mode. The functions which are described in the bottom line of silk screening are those used when in the RTTY or Morse Code modes. In this manual, these control function keys will be referred to by the silk screen name, rather than the name on the key itself. In other words, to put the unit into the RTTY mode, we would instruct you to type: CTRL-RTTY, rather than CTRL-1. A few of the control functions are "hidden," that is, they are associated with unlabeled keys. These functions will be described in the next section.

3.2 RTTY OPERATION

When the power is first applied to the Model 800, it "wakes up" in the RTTY mode. A status line at the top of the screen indicates which combination of modes are active. It should read: RECEIVE BAUDOT 60 WPM

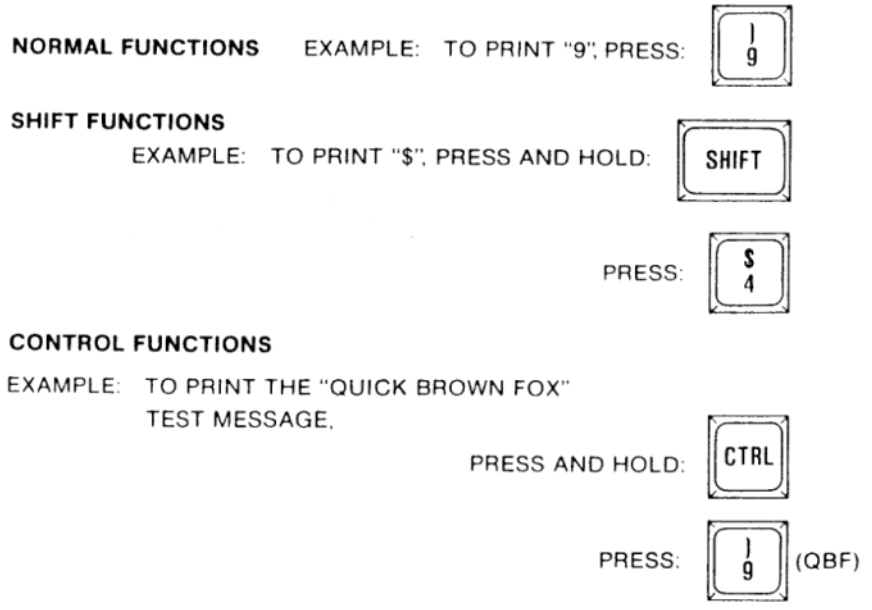

FIG. 3-1. KEY FUNCTIONS.

NORMAL SHIFT 170 HZ. This means that the terminal is now ready to receive RTTY at 60 wpm with normal polarity narrow shift. This is the most commonly used mode in amateur RTTY. Switch your radio onto lower sideband and tune in on an RTTY signal. Tune the receiver for minimum flicker of the tuning indicator bar on the status line. Your terminal should now be printing copy on the display monitor. If it does not, it is possible that the station you have selected is using a different shift, speed, or is transmitting with reverse polarity. If you do not find a station which you can copy, refer to Section Four for the procedures to change these settings.

Before making your first transmission, you should program your call letters into the ID memory. To do this, type: CTRL-I; followed by your call letters; followed by RETURN. The FCC requires that you identify your station by CW at the beginning and end of each transmission, and at least once every 10 minutes. To do this, type: CTRL-ID.

The Escape key (ESC) can be used to toggle the Model 800 Terminal between transmit and receive modes. To start a transmission, type: ESC followed by CTRL-ID, followed by RETURN. This sets up the printer on the other end. Now you are ready to type your message. When the message is complete, you should type: CTRL-ID once again before typing ESC to put the terminal back into the receive mode.

3.3 MORSE CODE OPERATION

Now that you have your "feet wet" on RTTY, you are probably anxious to try your new terminal on machine Morse Code. Operation is much the same in this mode as it is in RTTY. To put the terminal into the Morse Code mode type: CTRL-MORSE. Set the receiver AGC on SLOW. Tune your receiver in on a CW station, adjusting for maximum indication on the tuning bar. Keep in mind that being a machine, the Model 800 requires that there be a certain minimum accuracy in the code it receives for accurate reproduction. The Model 800 automatically tracks the incoming code speed and reads this on the status line.

Unless otherwise instructed, the transmit speed in the Morse Code mode is 13 wpm. To change this, type: CTRL-SPEED, followed by a two digit numerical entry between 3 and 99. The Model 800 Terminal will then transmit at this speed. The ID key retains the call letters you programmed into it earlier and can be used in the Morse Code mode to start and finish your transmissions. Once again, use the ESC key to toggle between transmit and receive.

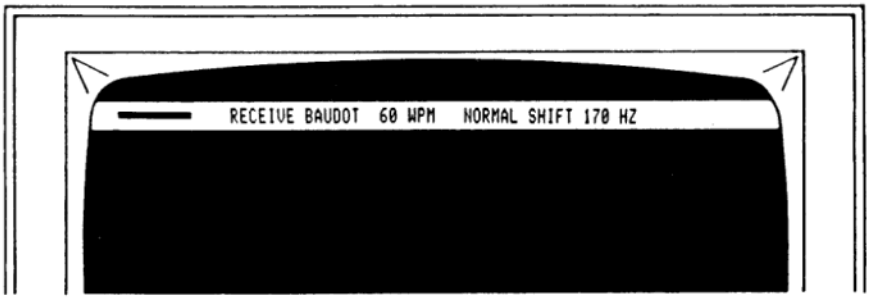

FIG. 3-2. POWER-UP STATUS.

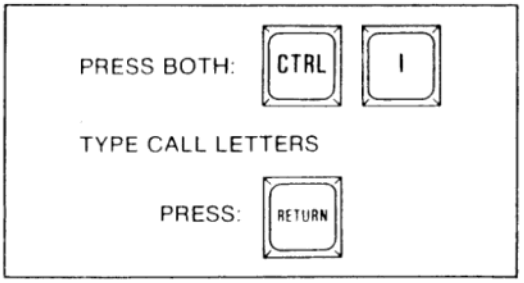

FIG. 3-3. PROGRAMMING ID MEMORY.

SECTION FOUR
RTTY OPERATION

4.1 INTRODUCTION

This section of the instruction manual is intended to give the owner a more detailed description of the operation of the Model 800 on RTTY. Section 4.2 discusses the RTTY concepts referred to in this manual. The following paragraphs describe the advanced operating features and procedures of the terminal. In order to obtain optimum performance from the Model 800, the user should carefully read this section, and try the operations described.

4.2 BACKGROUND INFORMATION

To fully understand and appreciate RTTY, it is highly recommended that you do some background reading on this subject (i.e., *Specialized Communications Techniques* (ARRL); *RTTY Handbook*, etc.). This is important not only for your own enjoyment of the mode, but those you meet on the air will also appreciate your competency on this subject. An example of incompetence caused by ignorance is the newcomer to RTTY who begins his transmissions by typing CARRIAGE RETURN 24 times in order to clear his TV screen. This does not make too many points with the chap on the other end who is watching paper crank out of his machine and go to waste! A brief overview of RTTY concepts is given here so that you may understand the operating features and procedures described later.

As most amateurs are familiar with Morse Code transmission, this description will begin by comparing RTTY with conventional CW. RTTY and CW are similar in that they use standard codes for communication of text information. The two basic distinctions between them are the codes which they use for communication and the method by which they are transmitted. The predominate code used on CW is International Morse, which is designed for interpretation directly by a human being. It is a variable length code, in that different characters have a differing number of transmission elements. The predominant code used on RTTY is Baudot. The FCC has recently approved the use of ASCII in the United States, which will add a new dimension to RTTY. Both of these codes were designed for interpretation by machines, and are fixed length codes; Baudot uses five transmission elements per character, and ASCII uses eight elements per character (not including start and stop bits).

CW is transmitted as a series of "On-Off" conditions which are used to create and interrupt the transmitted

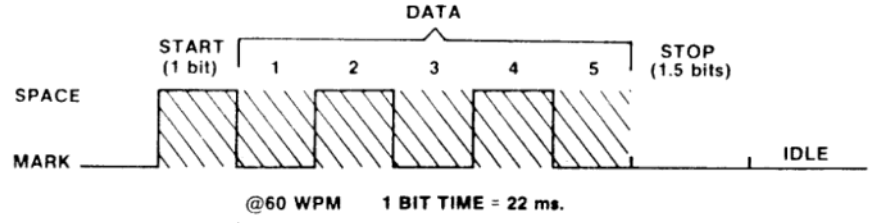

FIG. 4-1. BAUDOT CODE TIMING DIAGRAM (60 WPM).

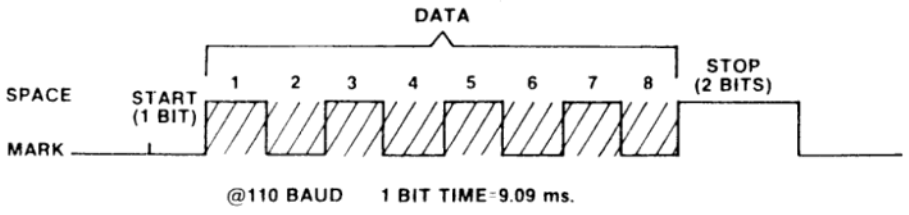

FIG. 4-2. ASCII CODE TIMING DIAGRAM (110 BAUD).

carrier (and eventually the audio tone which the operator listens to). The relative duration and spacing of the code elements are used to convey intelligence. In RTTY, the transmitter is operating continuously. The traditional method for modulating the transmitter was to shift the carrier between two slightly different frequencies ("frequency shift keying" or FSK). With the improvements which have been made to SSB transmitters in recent years, audio frequency shift keying (AFSK) has become popular on RTTY. With audio frequency shift keying, frequency shifted audio tones are supplied to the microphone jack of the transmitter. Despite which keying method is used, the RTTY signal output of a receiver is composed of two audio tones which differ slightly in frequency. The higher frequency tone of this pair is commonly referred to as a "space" and the lower tone of the pair is commonly referred to as a "mark." It is the combination of mark and space pulses which make up the codes used for RTTY. The difference in frequency between the mark and space tones is known as the "shift." In the early days of amateur RTTY, the only shift which was allowed was 850 Hz. Today, any shift below 900 Hz may be used, and amateurs have settled upon 170 Hz as a standard. 170 Hz is often referred to as "narrow shift" and 850 Hz is referred to as "wide shift." Commercial stations typically use a shift of 425 Hz.

There are several situations which can cause the mark and space frequencies to be inverted, where instead of the mark being the low tone, the mark is high. One such situation is when the transmitting and receiving stations are operating on different sidebands. The Model 800 Terminal has provisions for reversing the polarity of the incoming signal in these situations. It is standard practice to use lower sideband for all RTTY operations.

Proper receiver tuning is imperative for reliable RTTY reception. The RTTY demodulator in the model 800 uses two active discriminator filters for separating the mark and space tones. Optimum RTTY tuning is had when the outputs of these filters are evenly matched. The tuning indicator system on the Model 800 is the "plus-plus" type (see Fig. 4-3). It alternately displays the outputs of the mark and space discriminators. The tuning indicator is a bar on the status line which varies in length with respect to the output amplitude of the discriminators. If the receiver is mistuned, these outputs will differ and the bar will change in length as it shifts between mark and space. Due to the speed of the frequency shifting, this causes the bar to "flicker." The receiver should be tuned to minimize the flicker in the bar. For those who prefer an oscilloscope display tuning indicator, the scope outputs on the back panel of the Model 800 can be used for this purpose.

4.3 RTTY OPERATING INSTRUCTIONS

DISPLAY - Figure 4-3 illustrates the status line on the display used in the RTTY mode. The status line is used to give the operator direct feedback when changing

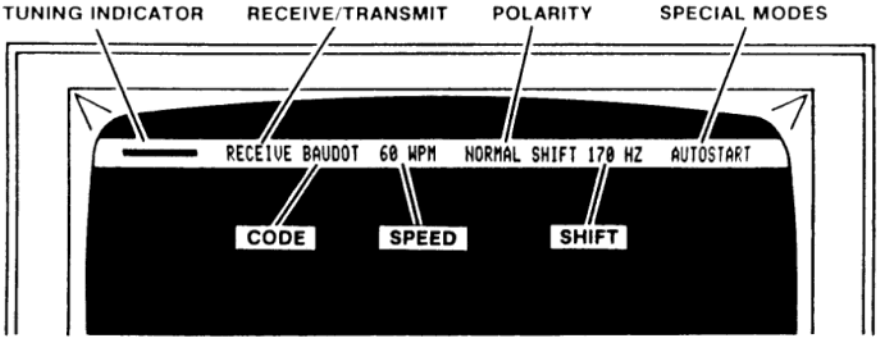

FIG. 4-3. STATUS INDICATOR LINE, RTTY MODE.

modes or programming message memories. As the operations are described, try them on the terminal taking note of changes in the status line.

SPECIAL RECEIVE MODES-There are two special functions which can be selected and used when in the receive mode. CTRL-RCV is used to select these modes. Typing CTRL-RCV will cause the terminal to go into the receive mode if it was previously in the transmit mode. Typing CTRL-RCV when the terminal is already in the receive mode will cause it to change into one of the special receive modes as indicated by the status line. The first special receive mode which is encountered is AUTOSTART. The second special receive mode which is encountered (enabled by typing CTRL-RCV again), is SELCOM. These special modes are described in the following paragraphs. Typing CTRL-RCV yet another time causes the terminal to revert to the "normal" mode where neither the AUTO START nor the SELCOM modes are enabled.

AUTO START-This mode prevents writing of unwanted characters on the display in the absence of a legitimate RTTY carrier. In this mode, the machine will require three to four seconds of RTTY carrier before it will print characters.

SELCOM-The SELCOM feature (Selective Communications) is composed of two basic parts: automatic answer back "Who are you," and automatic message recording (Selective Calling or "SELCAL"). These features provide totally automatic station operation. Both features use an eight character code to activate them. The user programs the "Who are you" (WRU) code by typing: CTRL-W followed by the eight character code, followed by RETURN. During the programming process, the status line will display each key entry. The "SELCAL" code is programmed by typing: CTRL-S, followed by the eight character code, followed by RETURN. The terminal is inactive until it receives one of the programmed SELCOM codes. If it receives the "Whe are you" code, its response is to automatically go into the transmit mode and transmit the contents of the first HERE IS message (the HERE IS feature is described later). If it receives the "SELCAL" code, its response is to go into the receive mode and copy down any message which follows. The transmitting station must end the message with "NNNN" in order to shut down the receiving station. The Model 800 will not write any new information unless it receives an additional SELCAL code.

TRANSMIT MODES-There are three transmit modes which may be selected by the user. CTRL-XMIT is used to select these modes. Typing: CTRL-XMIT when in the receive mode will cause the terminal to go into the transmit mode. On "power-up," the terminal would use the CONTINUOUS transmit mode, where each letter is transmitted as it is typed. Typing: CTRL-XMIT when the terminal is already in the transmit mode will cause it to change to a new mode. These modes are displayed on the status line. The first mode change encountered is the WORD mode where the terminal transmits each entire word when it is completed (when the space bar is hit). This allows the operator to use the DELETE key in order to edit mistakes in the word prior to transmission. Typing: CTRL-XMIT again causes the terminal to go into the LINE mode, where the terminal transmits each entire line as it is completed, allowing editing of the entire line. Line completion is detected by a RETURN entry or by the automatic carriage return feature. This feature automatically transmits a carriage RETURN and LINE FEED when a word is completed (space entry) between the 64th and 72nd character in a given line.

CHANGING SPEEDS-There are six commonly used speeds in RTTY communication. These are: 60, 66, 75, 100 and 132 wpm (Baudot); and 110 Baud ASCII. To change speeds type: CTRL-SPEED. Each time you type CTRL-SPEED, the terminal will automatically shift to the next higher speed. On the fifth time, the terminal will change its operating code from Baudot to ASCII. On the sixth time, the terminal will revert back to 60 wpm Baudot.

CHANGING SHIFTS-To change shifts, type: CTRL-SHIFT. The terminal will toggle between 850 Hz and 170 Hz shift each time the CTRL-SHIFT key is depressed. (Note: For copying 425 Hz shift commercial broadcasts, use the 850 Hz mode).

REVERSE KEYING-Certain situations may cause a station to transmit RTTY code with reverse polarity (mark and space frequencies inverted). One example of this situation is caused by the transmitting station being on a different sideband from that of the receiving station. To compensate for this, the operator may choose to reverse the mark and space frequencies by typing: CTRL-REVERSE. Typing: CTRL-REVERSE a second time will return the terminal to the normal mode.

TEST MESSAGES-"RY" and "Quick Brown Fox" are two commonly used test messages on RTTY. To access the "RY" message, type: CTRL-RY. To access the "Quick Brown Fox" test message type: CTRL-QBF.

AUTOMATIC ID MEMORY-Typing: CTRL-ID will cause the terminal to automatically transmit a preprogrammed eight character string by 100 Hz shift CW. To program this string, type: CTRL-I, followed by the characters in the string, followed by RETURN.

HERE IS MESSAGES-The Model 800 has two programmable 64 character HERE IS message memories. The first HERE IS message is accessed by pressing the HERE IS key. The second HERE IS message is accessed by typing: SHIFT-HERE IS. To program the first HERE IS message, type: CTRL-H, followed by the contents of the message, followed by RETURN. To program the second HERE IS message, type: CTRL-H twice followed by the contents of the message, followed by RETURN.

STATUS LINE-It is possible to erase the Status Line so that all 24 lines of the display can be used for text. To do this, type: CTRL-STATUS. Typing this again will make the Status Line reappear.

TUNE-TUNE is a feature used for Transmitter tune up. When enabled, it gives a "Lock Key" condition to the transmitter through the CW KEY line. To enable this feature, type: CTRL-TUNE. To disable, type: CTRL-TUNE again.

WORD WRAP-AROUND-This feature is used in the receive mode to prevent splitting of words at the end of a line. This is a totally automatic feature which need not be enabled. If the transmitting station begins a new word after the 64th character in a line, and this word is not finished at the end of the line, the Model 800 will erase the first portion of the word at the end of the line and move it all to the beginning of the following line.

TUNING INDICATOR-The Tuning Indicator for the RTTY mode is the black bar located on the left end of the status line. Optimum receiver tuning is had when there is a minimum amount of movement or "flicker" in this bar. Details on the operation of this tuning indicator are given in the background information section 4.2.

TRANSMIT BUFFER-If the typist is typing faster than the machine is sending, a 255 character buffer memory is used (on a first in-first out basis) to store the information until is it transmitted.

SPECIAL FUNCTION KEYS

ESC-Toggles the terminal between transmit and receive.

RETURN-Transmits a carriage return and line feed command to the other station. Returns the local cursor to the left hand side of the display and scrolls the display one line.

NOTE: A separate carriage return without line feed function is not used in that it is impossible to "over strike" a video display.

LINE FEED-Used only in the SSTV mode.

CAPS LOCK-This is an alternate action key, which is used only in the ASCII mode. Both upper and lower case ASCII are available on the Model 800. Upper case letters are obtained by use of the SHIFT key. When depressed, the CAPS LOCK key causes the terminal to use only upper case letters.

DELETE-The DELETE key is used for editing mistakes prior to transmission. When pressed, this key causes the cursor to back up and erase any character which is there. It is not possible to delete any characters which have been transmitted, as this is not a transmittable function. This key would be used primarily in the WORD and LINE transmission modes, where transmission of characters is not immediate. In the CONTINUOUS mode, the DELETE key will backspace over any characters which have not yet been transmitted (this situation arises when the typist is ahead of the transmission). When it reaches a character which has been transmitted, it will become inoperative.

REPEAT-This key is used for transmitting a series of the same character or function in succession. To use this key, depress and hold down the key which is to be REPEATed. Depress and hold down REPEAT at the

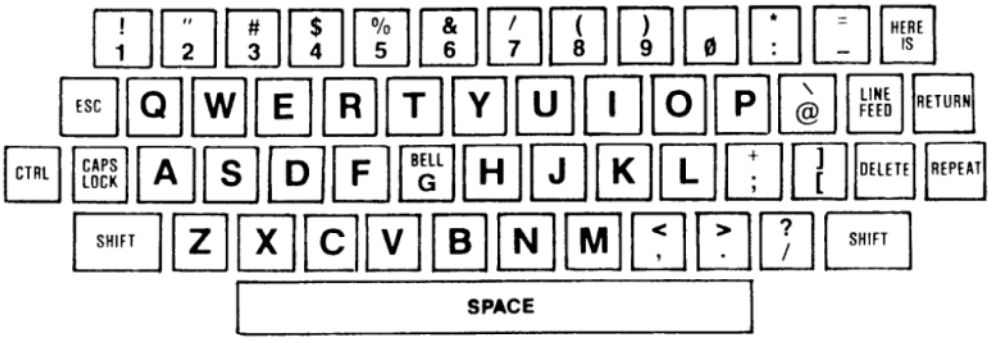

FIG. 4-4. MODEL 800 KEYBOARD.

same time and the terminal will begin printing a succession of characters, or implementing the function which has been selected. To discontinue this, release the keys. For example, to back space and erase an entire line, press and hold the DELETE and REPEAT keys simultaneously.

SHIFT-This key is used to change the function of the keys on the keyboard. In the ASCII mode, this key shifts the terminal between the upper and lower case letter transmission. On numbered keys, it shifts the terminal to the character printed on the top of the key.

In the Baudot mode, there are no lower case letters. However, the SHIFT key is still used to access the figures on the tops of the keys. Because Baudot is a five unit code, there are only 32 possible characters which can be transmitted. Figure 4-4 illustrates the traditional communications-type keyboard which has only 32 keys. On this type of keyboard, letters and figures share the same keys. In order to transmit a figure, the operator would press the FIGS key which causes the machines at both ends to shift into the figures mode. Any keys that are typed while in this mode would print the figures shown on the upper half of the key. To return to normal letters printing, the LTRS key is used. FIGS and LTRS are standard Baudot characters which are transmitted in order to change the machines between these modes. Because the Model 800 is used in modes other than Baudot, we did not want to use this more cumbersome 32 character keyboard.

In the Baudot mode, the Model 800 automatically transmits the FIGS and LTRS functions. For example, to transmit a dollar sign with the Model 800, you would type: SHIFT-4 (see keyboard). The actual transmission sequence in Baudot would be: FIGS-D (see Fig. 4-5). If you then wanted to return to letters to transmit say "X" on the Model 800, you would just type: X. The actual transmitted sequence would be: LTRS-X. As another example of this, say that you wish to type a six letter call sign such as WB6XXX. You would type on the Model 800: W B 6 X X X. The actual transmitted Baudot code would be: W B FIGS Y LTRS X X X (See Fig. 4-5). There may come a time when you wish to transmit these functions manually. RTTY operators often transmit a series of LTRS characters during pauses or at the beginning of transmissions to get the machine at the other end running in sync. LTRS may be manually transmitted by itself by typing CTRL-L on the Model 800. FIGS may be manually transmitted by typing CTRL-F on the Model 800. Remember that under normal circumstances it is not necessary to do any conversions on your keyboard for the Baudot character format. This is all done automatically by the Model 800. This information is included here so that you are aware that these modes exist and that the conversion process has taken place.

All programmed character strings (HERE IS, ID, ETC.) are stored in ASCII format. The Baudot conversion is done at the time of transmission. The LTRS and FIGS characters are not stored. In other words, WB6XXX only requires six spaces of character memory. You do not have to allow for LTRS and FIGS.

CTRL-B-The Baudot "Blank" or null character is transmitted by typing: CTRL-B.

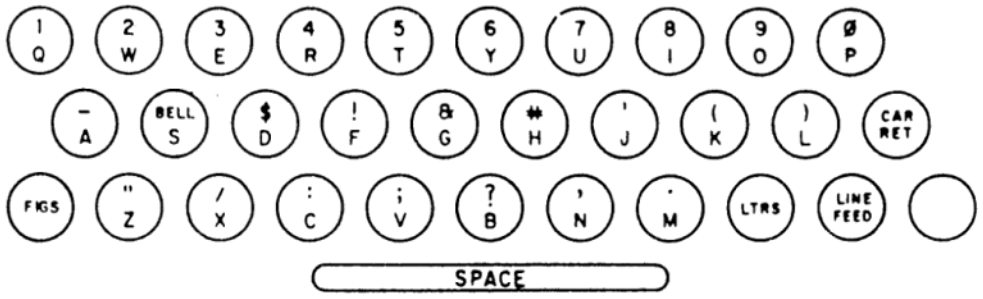

FIG. 4-5. TYPICAL COMMUNICATIONS-TYPE KEYBOARD.

SECTION FIVE
MORSE OPERATION

5.1 INTRODUCTION

This section of the Instruction Manual is intended to give the owner a more detailed description of the operation of the Model 800 on Morse Code. Section 5.2 discusses the concepts relevent to Morse Code which are referred to in this manual. The following paragraphs describe the advanced operating features and procedures of the terminal. In order to obtain optimum performance from the Model 800, the user should carefully read this section and try the operations described.

5.2 BACKGROUND INFORMATION

Continental Morse Code is a variable speed, variable length code originally conceived for human interpretation. There is a special timing relationship between the dots and dashes of the Morse Code which we use for machine interpretation. Figure 5-1 illustrates this relationship. The basic timing element of Morse Code is the "dot." One "dash" is equal to the length of three dots; one dot length is used between elements of the same letter; and three dot lengths are used between letters of the same word and seven dot lengths are used between words. To fully appreciate machine Morse Code communication, the operator should be familiar with these relationships as well as the methods used for the interpretation of the code.

Figure 5-2 is a flow chart diagram of the computer program used in the Model 800 for interpretation of Morse Code. In this explanation, a single transmitted bit of information (dot or dash) is referred to as a "mark" in that the mark discriminator filter (1275 Hz) is used in the Morse Code receive mode. The length of the inputed mark is first determined by measuring against a clock. This is then compared against a quantity known as "average mark." Average mark is a quantity which is the computed average time required for two dot lengths. Because a "dot" is a single dot length and a "dash" is three dot lengths, by comparing the inputed mark with the average mark, it can be determined if it is intended to be a dot or a dash. If the inputed mark length is less than the "average mark" length, it is a dot. If the inputed mark length is greater than the average mark length, it is a dash. This separated character element is then averaged with the last character element of its kind which was received, to create a new average element length. The element is then added to any previous elements which have been received. A new

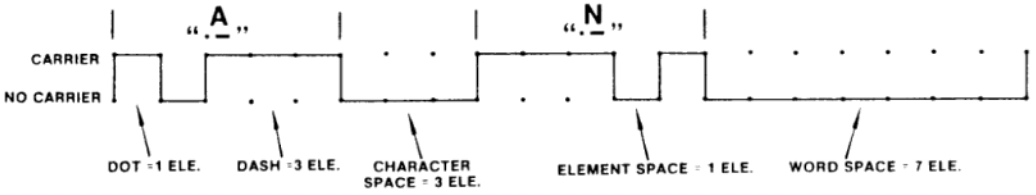

FIG. 5-1. MORSE CODE TIMING.

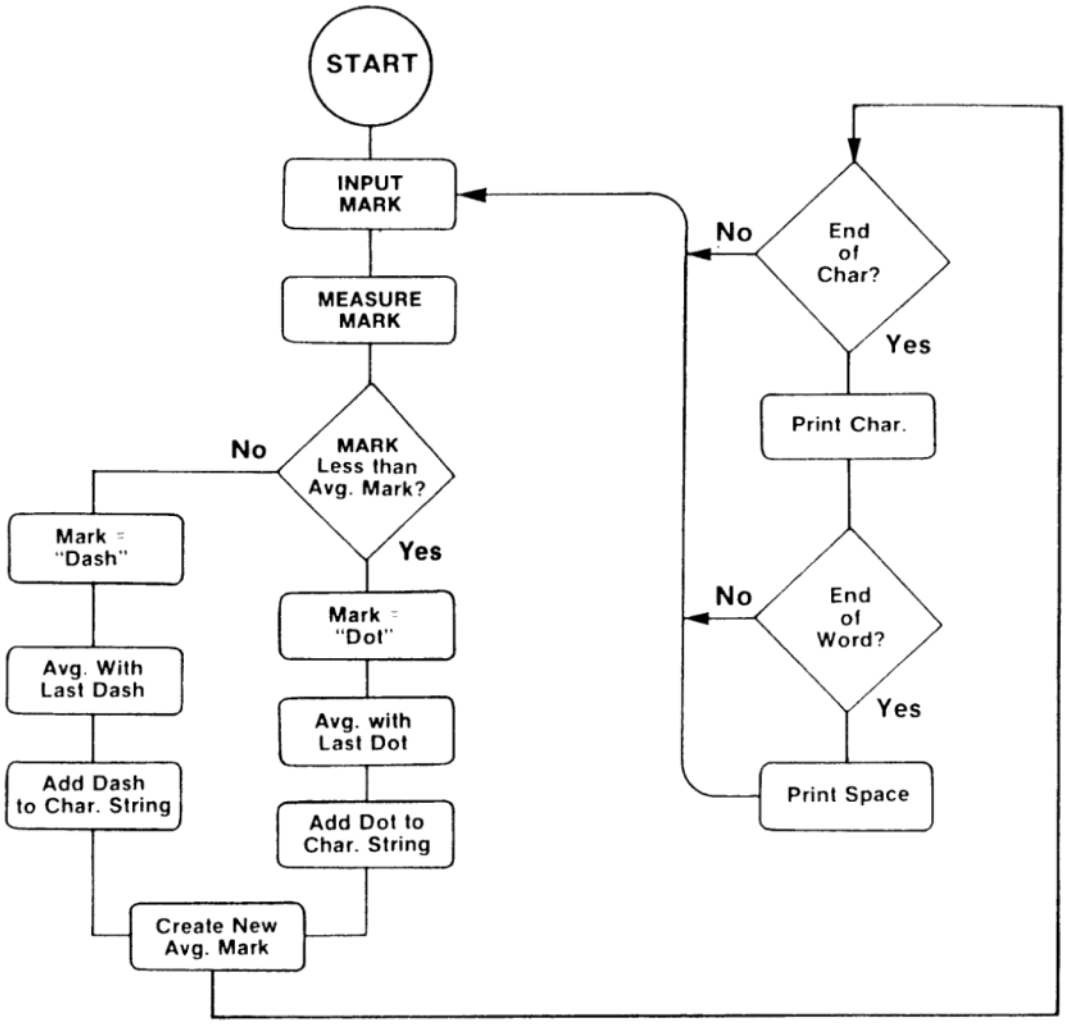

FIG. 5-2. FLOW CHART FOR MORSE CODE INTERPRETER.

"average mark" (two dot lengths) is then computed by taking the average dot length and the average dash length and averaging them. This "double running average" technique accomplishes several things: it allows for some margin of error in the timing of the incoming code; it automatically tracks incoming code over its entire speed range; tracking adjustments are made with every transmitted character element, allowing for speed variations. The incoming speed measurement (in wpm) is calculated from the "average mark" length and is displayed on the status line.

A timing routine then checks the spacing between transmitted elements to see if the character has been completed. If the spacing between elements is greater than two dot lengths ("average mark") the terminal assumes that the character has been completed, compares the accumulated string of dots and dashes with its character set and prints the result. If the spacing is greater than six dot lengths, it assumes that a word has been completed and prints a space following the character.

As you can see, the Model 800 uses a fairly sophisticated routine for interpreting Morse Code. Keep in mind however, that there are limits to its toleration of "poor code." One of the advantages that we humans have over any machine is the ability to recognize words, thereby compensating for mistakes made by the sending operator.

DISPLAY - To select the MORSE mode, type: CTRL/MORSE. The status line is used to give the operator direct feedback when changing modes or programming message memories. As the operations are described, try them on the terminal taking note of changes in the status line.

TRANSMIT/RECEIVE - To put the unit into the TRANSMIT mode, type: CTRL/XMIT. To put the terminal back into the RECEIVE mode, type: CTRL/RCV. The ESC (Escape) key may also be used to toggle the terminal between transmit and receive. Each time this key is depressed, the terminal will toggle modes.

TRANSMIT MODES - There are four transmit modes which may be selected by the user. CTRL/XMIT is used to select these modes. Typing CTRL/XMIT when in the receive mode will cause the terminal to go into the transmit mode. On "power up" the terminal would use the CONTINUOUS transmit mode where each letter is transmitted as it is typed. Typing CTRL/XMIT when the terminal is already in the transmit mode will cause it to change to a new mode. These modes are displayed on the status line. The first mode change encountered is the WORD mode where the terminal transmits each entire word when it is completed (when the space bar is hit). This allows the operator to use the DELETE key in order to edit mistakes in the word prior to transmission. Typing CTRL/XMIT again causes the terminal to go into the LINE mode, where the terminal transmits each entire line as it is completed, allowing editing of the entire line. Line completion is detected by a RETURN entry or by the automatic carriage return feature. This feature automatically returns the cursor to the left hand side of the display and scrolls the display one line when a word is completed (space entry) between the 64th and 72nd character in a given line. RETURN and LINE FEED are not transmitted in the Morse Code mode. These commands effect the local display only. Typing CTRL/XMIT again will put the terminal into the "random" mode. This causes the terminal to generate and transmit five-character groups of random letters at the selected speed for Morse Code practice purposes. In order to use this mode, the sidetone oscillator must be enabled. This is an excellent training device for improving Morse copying proficiency. The operator can turn the monitor off while copying and then turn it back on later to check copy. To stop the terminal, type: ESC (puts the terminal into the receive mode) or CTRL/XMIT (puts the terminal back into the continuous mode).

TUNING CW - When tuning in a CW station, tune the receiver so that the tuning indicator bar (on the status line of the display) is at maximum length during code reception. The sidetone oscillator can also be enabled, and the processed Morse Code can be used as a tuning aid. In the MORSE mode, the receiver AGC should be set to SLOW.

SPEED SELECTION - In the MORSE mode, you may transmit between 3 and 99 wpm. At the higher speeds, you will notice that the Model 800 "rounds off" the speed to a slightly different number than that which was selected. These speeds are much more convenient for the 800 to generate accurately in software. On "Power-up," the Model 800 will transmit at 13 wpm. To select the desired speed, type: CTRL/SPEED, followed by a numerical entry for the speed desired. There is no setting required for the received speed. The Model 800 terminal will automatically track the incoming code at any speed within its range. The incoming code speed is indicated on the status line.

SIDE TONE OSCILLATOR - The internal side tone oscillator can be enabled by typing: CTRL/T. This is useful in the "Morse trainer" mode. It is also useful when receiving code off the air. The side tone oscillator is connected to the output of the code processor so that what you hear is the "corrected" code as the computer interprets it. It is interesting to compare the incoming code from the radio with the "corrected" version. The SIDE TONE level control on the rear of the Model 800 adjusts the volume level of the side tone.

CODE TRANSLATION - The Model 800 will perform code translation from Morse Code into Baudot or ASCII for hard copy printing purposes. In the Morse Code mode, the TTY LOOP keyer output is in the form and speed of the last RTTY mode selected. In other words, if you have a hard copy printer which operates at 110 Baud ASCII, you should put the terminal into this mode before going into the Morse Code mode.

TUNE - Typing CTRL/TUNE causes the keyboard to go into a "lock key" state for transmitter tune up. To unlock the key, type: CTRL/TUNE again or type: ESC.

TEST MESSAGES - The "RY" and "Quick Brown Fox" test messages may also be used in the Morse Code

mode. To access the "RY" message, type: CTRL-RY. To access the "Quick Brown Fox" test message, type: CTRL-QBF.

AUTOMATIC ID MEMORY-Typing CTRL-ID will cause the terminal to automatically transmit a preprogrammed eight character string. To program this string, type: CTRL-I, followed by the characters in the string, followed by RETURN. It is not necessary to re-program this memory if it was previously programmed in another mode.

HERE IS MESSAGES-The Model 800 has two programmable 64 character HERE IS message memories. The first HERE IS message is accessed by pressing the HERE IS key. The second HERE IS message is accessed by typing: SHIFT-HERE IS. To program the first HERE IS message, type: CTRL-H, followed by the contents of the message, followed by RETURN. To program the second HERE IS message, type: CTRL-H twice followed by the contents of the message, followed by RETURN.

STATUS LINE-It is possible to erase the Status Line so that all 24 lines of the display can be used for text. To do this, type: CTRL-STATUS. Typing this again will make the Status Line reappear.

WORD WRAP-AROUND-This feature is used in the RECEIVE mode to prevent splitting of words at the end of a line. This is a totally automatic feature which need not be enabled. If the transmitting station begins a new word after the 64th character in a line, and this word is not finished at the end of the line, the Model 800 will erase the first portion of the word at the end of the line and move it all to the beginning of the following line.

TRANSMIT BUFFER-If the typist is typing faster than the machine is sending, a 255 character buffer memory is used (on a first in-first out basis) to store the information until it is transmitted.

SPECIAL FUNCTION KEYS

ESC-Toggles the terminal between transmit and receive.

LINE FEED-In the Morse Code mode, this key scrolls the local display up one line. It does not transmit any command to the receiving station.

RETURN-Returns the local cursor to the left hand side of the display and scrolls the display one line. Does not transmit any command to the receiving station.

CAPS LOCK-This is an alternate action key, which is used only in the ASCII mode. This key is inactive in the Morse mode.

DELETE-The DELETE key is used for editing mistakes prior to transmission. When pressed, this key causes the cursor to back up and erases any character which is there. It is not possible to delete any characters which have been transmitted, as this is not a transmittable function. This key would be used primarily in the WORD and LINE transmission modes, where transmission of characters is not immediate. In the CONTINUOUS mode, the DELETE key will backspace over any characters which have not yet been transmitted. When it reaches a character which has been transmitted, it will become inoperative.

REPEAT-This key is used for transmitting a series of the same character or function in succession. To use this key, depress and hold down the key which is to be REPEATed. Depress and hold down REPEAT at the same time and the terminal will begin printing a succession of characters, or implementing the function which has been selected. To discontinue this, release the keys. For example, to backspace and erase an entire line, press and hold the DELETE and REPEAT keys simultaneously.

SHIFT-This key is used to change the function of the keys on the keyboard. In the Morse Code mode, it is used to select figures marked on the upper part of the key.

SPECIAL CHARACTER STRINGS-In Morse Code, there are several special character strings which are used as delineators in messages. These are "hidden" control functions on the Model 800. They are accessed on the keyboard as follows:

AR-(End of Message): CTRL-A

AS-(Wait): CTRL-W

BT-(Pause): CTRL-B

KN-(go ahead, but only the station(s) called): CTRL-K

SK-(Signing off): CTRL-S

SECTION SIX
SSTV OPERATION

6.1 BACKGROUND INFORMATION

Slow scan TV differs significantly from Morse, ASCII and Baudot in the method of transmission. SSTV was designed for communication of grey scale pictures as opposed to alphanumeric characters only. Instead of transmitting a binary code, SSTV transmits a raster directly, line by line, as in broadcast television. SSTV uses an audio FM subcarrier which, like AFSK is inputed to the transmitter through its microphone jack. This audio FM is modulated to sweep through the picture according to the grey level content of the picture being transmitted. The amateur SSTV standards use a 128 line picture which is transmitted in 8.5 seconds at a bandwidth of just over 1 KHz. Because this standard differs drastically in speed from that of broadcast television, it is necessary to have a device such as the Model 400 which is capable of storing an entire grey scale picture in a memory in order to do the speed conversion necessary for displaying on a standard TV set.

On SSTV, the Model 800 Terminal has a supportive role as a message generation and transmission device. According to SSTV operating conventions, in order to have a confirmed two-way SSTV contact, the stations need to have successfully transmitted and received each other's call letters. With the Model 800 you can do this simply by typing the characters as opposed to the use of "menu boards" or hand lettered graphics. This is especially handy for those who are doing contest or DX work on SSTV.

The display in the SSTV mode is drastically different from that in the RTTY and the Morse modes. There is a maximum of only six characters along each line and up to six total lines of characters. There are two reasons for this. First, the TV display in the SSTV mode has only 128 lines of resolution as opposed to the 525 lines of normal TV. Second, it is important that the letters be large enough to be clearly readable by that overseas DX you are trying to work!

Because SSTV is used in conjunction with voice transmission, it is necessary to be able to switch back and forth between voice (microphone) operation and video operation when on SSTV. SSTV equipment such as the Model 400 Scan Converter is set up to do this by means of front panel switching. When used on SSTV, the Model 800 would normally be interfaced to the

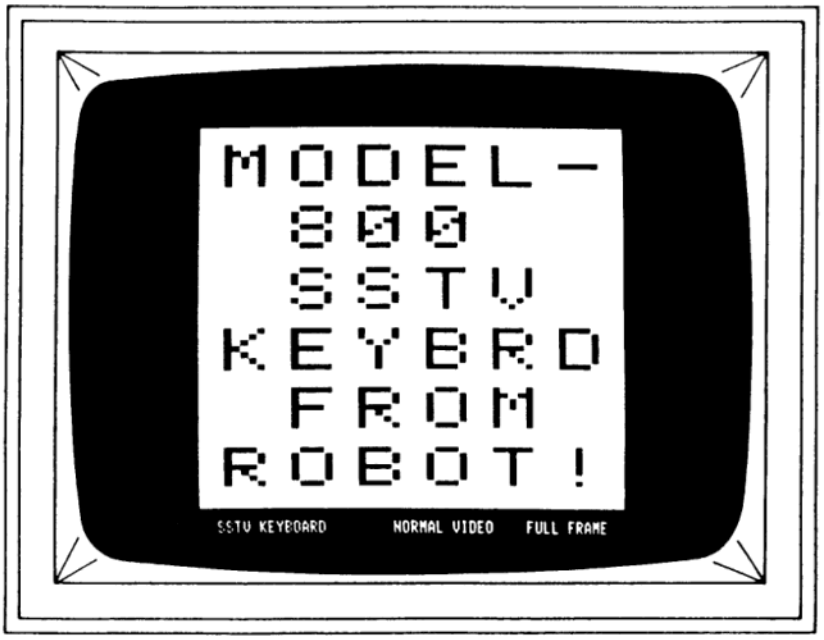

FIG. 6-1. MODEL 800 DISPLAY IN THE SSTV MODE.

transmitter through this SSTV gear so that it can be switched in and out also. It is not necessary for you to own other SSTV gear in order to try your terminal out on this mode, however. The same interface to the transmitter for RTTY may be used for transmissions on SSTV. Tune to one of the common SSTV frequencies (such as 14.230) and establish communication with another station as you would for any other SSB contact. When you wish to transmit the SSTV graphic, you will have to unplug your station microphone and plug in the patch cable coming from the Model 800. The transmitter would have to be keyed manually or by VOX, as the PTT line is not keyed by the terminal in the SSTV mode.

6.2 TRANSMITTING SSTV GRAPHICS

In the SSTV mode, the Model 800 transmits only. Other Slow Scan TV equipment is necessary for receiving SSTV pictures. Upon selection of the SSTV mode, the Model 800 immediately goes into the transmit mode. The PTT line on the TO XMTR jack is not keyed in the SSTV mode. To select the SSTV mode, type: CTRL-SSTV. The control functions along the top row of keys now take on the new functions described in the top row of silk screening on the panel. As you can see, the display in the SSTV mode is totally different from that of the other modes in the terminal. The raster area is a square (1:1 aspect ratio) in order to conform to the amateur SSTV standard picture format. The status line in this mode is at the bottom of the picture. A black horizontal line runs through the display from top to bottom. This line indicates to the operator exactly what portion of the slow scan TV frame is being transmitted. The "winking" cursor line tells the operator which character position is to be filled next.

6.3 SSTV OPERATING FUNCTIONS

GREY SCALE-Typing the GRY SCL key causes the Model 800 Terminal to transmit a Slow Scan TV six bar grey scale. This is indicated by the status line at the bottom of the display. The keyboard display remains the same, allowing the operator to compose a message while transmitting the test pattern.

CHECKERBOARD-Typing CTRL-CHECKER key causes the Model 800 Terminal to transmit a checkerboard test pattern. This is indicated on the status line on the bottom of the display. The local display is again not affected so that the operator can compose messages during the checkerboard transmission.

PARTIAL FRAME-This feature allows the operator to transmit a portion of a frame when the message does not use the full six line field. Transmitting partial frames reduces transmission time (i.e. transmitting three lines instead of six requires four seconds instead of eight). The operator can select any number of lines between a minimum of one and maximum of six for transmission. To do this, type: CTRL-LINES, followed by a numerical entry between one and six (i.e. three). To return to full frame mode type: CTRL-LINES followed by six. Using this feature allows the operator to transmit the top portion of a given graphic while composing the bottom portion.

BLACK/WHITE REVERSAL-Typing CTRL-REVERSE causes a black/white reversal of the SSTV output. This is indicated on the status line and not on the local display. To return to normal video type: CTRL-REVERSE again.

LARGE CHARACTERS-The Model 800 Terminal has two character formats in the SSTV mode: 6 lines of 6 "square" characters and three lines of 6 "tall" characters. The terminal is normally in the 6 X 6 mode. Typing CTRL-CHARS key will toggle the terminal into the 3 X 6 "tall" characters mode. Typing: CTRL-CHARS again will return the terminal to the normal 6 X 6 characters mode.

SCREEN CLEAR-Typing CTRL-CLEAR erases the entire screen of characters and moves the cursor to the upper left hand corner.

CURSOR CONTROL-These features allow the operator to move the cursor around the screen for editing purposes. Typing CTRL-HOME causes the cursor to move to the upper left hand corner without erasing the screen. Typing CTRL followed by one of the three directional arrow keys, causes the cursor to move one space in the direction of the arrow. The LINE FEED is used for moving the cursor downwards. The right hand arrow key is used when the operator wishes to move the cursor to the right without erasing text. Using the space bar for this will erase characters which are already on the screen. Typing RETURN causes the terminal to move the cursor down one line and to the left side of the display. The DELETE key moves the cursor back one space and erases any character which is present. The REPEAT key, when used in conjunction with another character key will continue entering a string of those characters as long as it is held down.

SECTION EIGHT
QUICK REFERENCE GUIDE

PROGRAMMING

	Keystrokes
HERE IS message #1	CTRL-H; (message); RETURN
HERE IS message #2	CTRL-H; CTRL-H; (message); RETURN
ID memory	CTRL-I; (call); RETURN
WRU memory	CTRL-W; (code); RETURN
Selcal Memory	CTRL-S: (code); RETURN

RTTY FUNCTIONS

Function	Keystrokes
Select **RTTY** Mode	CTRL-RTTY
Transmit	CTRL-XMIT or ESC
Receive	CTRL-RCV or ESC
Change **Shift**	CTRL-SHIFT
Reverse Shift **Polarity**	CTRL-REVERSE
RY Test Message	CTRL-RY
Quick Brown Fox Test Message	CTRL-QBF
Change Speed	CTRL-SPEED
Disable **Status** Line	CTRL-STATUS
Enable **Status** Line	CTRL-STATUS
Lock CW Key	CTRL-TUNE
Send **ID**	CTRL-ID
Continuous Transmit	CTRL-XMIT*
Word Transmit	CTRL-XMIT*
Line Transmit	CTRL-XMIT*
AUTOSTART	CTRL-RCV*
SELCOM	CTRL-RCV*
HERE IS Message #1	HERE IS
HERE IS Message#2	SHIFT-HERE IS
ASCII Operation	CTRL-SPEED*
Carrage Return, Line Feed	RETURN
Backspace and Delete	DELETE
Repeat a letter or function	REPEAT + desired key
BELL	CTRL-BELL
Send Baudot LTRS Character	CTRL-L
Send Baudot FIGS Character	CTRL-F
Send Baudot Blank Character	CTRL-B

*This feature is enabled by repeated depressions of the key indicated. The status line shows which mode has been selected.