DS2000 KSR

VIDEO COMMUNICATIONS TERMINAL

INSTRUCTION MANUAL

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HAL DS2000 KSR VIDEO COMMUNICATIONS TERMINAL

TECHNICAL MANUAL

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1. INTRODUCTION

The HAL Communications Corp. DS2000 KSR is a "keyboard-send-receive" video display terminal for transmission or reception of coded communications using either the Baudot or ASCII teleprinter codes. The DS2000 also is capable of keyboard transmission of the Continental Morse telegraphy code. When equipped with the MR2000 accessory board, reception (with text display) of Continental Morse code is added.

The DS2000 is microprocessor controlled and provides many features to assist the operator. In particular, complete terminal control of code, speed, transmit status, synchronous idle, Baudot unshift-on-space, and test and identification message sequencing is readily available from the keyboard. Two separate programmable identification messages (up to 32 text characters each) are also included.

The DS2000 KSR is intended to be operated with a standard good quality video monitor with EIA RS-170 video input. While it may be possible to convert a black and white TV set to serve as a video monitor, this is not generally recommended, as the peak video bandwidth required is approximately 6 MHz and most TV sets have video bandwidths which are somewhat less than this (resulting in poor character definition and "smearing" on the screen). A recommended economy video monitor for this purpose is the Electrohome ESM-914, which is available from HAL Communications Corp. as a DS2000 system accessory.

The DS2000 displays received and transmitted text data on the video monitor in a format of 24 lines of 72 characters each. Non-overprint and selectable unshift-on-space (Baudot only) are automatic receive features of the display. Received text is normally written from the top of the screen downward. When the bottom line is filled, the entire display shifts up one line and succeeding data is written on the bottom line. All standard alpha-numeric characters and standard punctuation symbols (as well as some standard ASCII symbols in ASCII mode) can be written on the screen. An underline cursor indicates the next screen position to be written.

The DS2000 KSR will send and receive five Baudot speeds (60, 66, 75, 100, and 132 wpm), two ASCII data rates (110 and 300 baud) and will transmit Morse code at speeds from 1 to 175 wpm. With the MR2000 optional Morse receive board, the receive speed is automatically tracked between 1 and 175 wpm. The ASCII code is 11 units long for 110 baud and 10 units for 300 baud. The eighth (parity) bit is always set to mark condition.

A KOS (keyboard operated switch) circuit is included in the terminal to allow automatic transmit-receive control of external equipment. This consists of an NPN transistor which is used to switch the KOS control line to ground whenever the DS2000 is actually transmitting data. The control line can thus be used directly to switch medium power (200v, 100ma recommended maximums) positive dc control circuits or relays.

The DS2000 KSR will operate from power sources of 105 to 125 or 210 to 250 VAC, 50 or 60 Hz. The video monitor is connected to the keyboard only through the video cable, and the two units may be separated by up to 100 ft. if desired. A 9-pin connector on the rear panel provides for the connection to a series current

loop for Baudot and/or ASCII data, cathode or grid-block keying Morse outputs, the KOS control line, and appropriate grounding terminals. Morse input connections (for units equipped with the MR2000 accessory) are provided on a separate connector on the rear panel. Video output connection is via a rear-mounted SO-239 UHF connector. The DS2000 KSR is pictured below in Figure 1.

Figure 1. The DS2000 KSR VIDEO COMMUNICATIONS TERMINAL

2. OPERATION

2.1 Display Features

The display of your DS2000 KSR includes many features not previously available in electronic terminals. Among these is the large 24 line display. Since each line is a full 72 characters long, the DS2000 display is directly compatible with the standard 72 character line used with electromechanical printers. The screen has a total capacity of 1728 characters (72 x 24).

When you first turn-on your DS2000, you will see a line of text at the top of the screen that indicates "45 BAUD BAUDOT USOS TX ON DS2000 V1.X". This is the *STATUS LINE* and is used to tell you the current operating conditions of the terminal. Any change in terminal code, data rate (speed), transmit mode, USOS (UnShift On Space) or SYNC (SYNChronous Idle) status will be reflected in the *STATUS LINE* information.

After turn-on, received text (or text to be transmitted from the keyboard) will be placed on line two, immediately below the status line. Succeeding lines of text will be entered on down the screen until the 24th line. When the 24th line is started, the screen will shift upwards (or "scroll-up") and the status line will be shifted off the screen. Text received (or typed) after the 24th line will continue to be displayed on the bottom line of the display and the displayed text will scroll up with each new line. If the terminal status is needed, the status line may be recalled at any time by typing CTRL-6 (STATUS).

> NOTE: Certain terminal control operations will be described in this manual that involve the CTRL and/or the SHIFT keys. Both CTRL and SHIFT keys operate *only* in conjunction with a second key. Therefore, CTRL or SHIFT must be pressed *and held* while operating the second key. For example, to use CTRL-6 (STATUS), press and hold CTRL, tap "6", and release CTRL. Be careful to avoid holding the second key down for more than ½ second or the automatic repeat feature will cause multiple operations!

The display shows all received text as bright letters and all text entered from the keyboard with a lighter intensity ("dim"), providing a convenient indication of the source of the displayed text.

Two cursors are shown on the DS2000 KSR display screen - a flashing underline cursor and a bright square box cursor. The flashing underline cursor indicates the display entry position where new received text *or* keyboard text will be entered. The square box cursor indicates where transmit output will start when keyboard text is to be transmitted. As will be explained in section 2.3, text may be transmitted as typed, composed on the full 24 line screen and held until complete, or entered into a 256 character "blind" buffer (TX HID) while receiving. The key to the flexibility and simplicity of the DS2000 lies in the fact that the screen serves as the receive *and* transmit storage device - transmission takes place *from the displayed dim characters*. Thus, when shifting to a transmit output condition, the square block will quickly scan any bright (received) characters and search for the lower intensity dim characters to begin transmitting. You may therefore observe the block cursor moving from time to time, even while receiving.

The DS2000 features full non-overprint and word wrap-around protection when receiving. Reception of a line-feed (LF) character will cause text to move to the next line, the terminal automatically performing both the LF *and* CR (carriage return) operations. Conversely, reception of the CR characters are ignored to prevent double CR-LF operations. In addition, the display will automatically shift to the next line if a LF character is not received by the end of the 72 character line. In this case, the word wrap-around feature prevents the inadvertent splitting of a word by transferring the entire word to the next line rather than splitting it with the automatic CR-LF operation. Up to 19 characters are transferred to the next line through the word wrap-around. This feature also works when typing text for transmission, automatically inserting the NEW LINE sequence (CR-LF-LTRS for Baudot or CR-LF for ASCII) when required and shifting up to 19 characters to the next line. Thus, you need *not* type RETURN, CR, or LF operations at the end of a line unless a short line is desired.

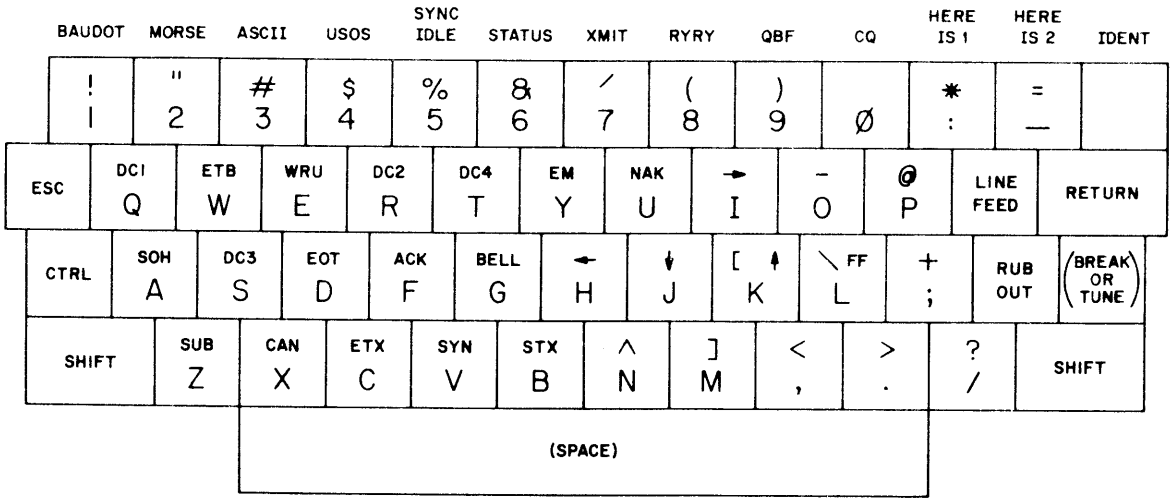


Figure 2. The DS2000 Keyboard

2.2 Keyboard Control Operations

The DS2000 keyboard is arranged in a standard 4-row typewriter configuration as is shown in Figure 2. This keyboard is used both to type text for transmission and to control the DS2000 itself. Most of the keyboard characters that are transmitted are labeled on the keytops. Some of the special characters used in ASCII and Morse in particular are obtained through special key combinations discussed in the pertinent manual section.

The SHIFT and CTRL keys operate only when used in conjunction with a second key, much like the shift key on a typewriter. Therefore, when a SHIFT or CTRL key is called-for, the SHIFT (or CTRL) must be operated at the same time as the second key. A good operating procedure is to first depress and hold the SHIFT (or CTRL) key, press and release the second key, then release the SHIFT (or CTRL) key. In some cases, you may have to hold both the SHIFT and CTRL keys while operating a third key.

The large black RETURN key performs several operations for you: it generates a CR-LF-LTRS sequence in Baudot and a CR-LF sequence in ASCII. In Baudot, ASCII, and Morse the RETURN key shifts the display to the beginning of the next line. The separate CR or LF or LTRS characters may be generated through special CTRL key operations if desired, but normal operation is usually accomplished with the RETURN key.

The blank key between the right-hand SHIFT and RETURN key is used to give a RTTY break (space) condition or a Morse key-down condition. In Baudot or ASCII codes, depression of this key puts the RTTY loop into the *space* condition (no loop current) for as long as the key is held down. In Morse, the transmitter key line is held in the transmitter on condition for as long as the key is held. This "break" or "tune" key works regardless of the XMIT status (OFF, ON, HID). This key allows adjustment of the space tone or frequency of the RTTY station or tuning of the transmitter with the keydown in Morse code mode.

Normal text to be transmitted is entered by simply typing the associated letter, number, or punctuation keys, using the SHIFT to obtain the punctuation where indicated on the keytop. In ASCII code, the DS2000 transmits *only* the upper case, or capital letters of the alphabet; reception of the ASCII code for lower case letters will be displayed as capital letters. The special ASCII control codes indicated on some keytops (SOH, DC3, EOT, etc.) as well as others discussed in section 2.6 may be transmitted by use of the CTRL key. Letters may be erased and corrected any time before transmission by using the RUB OUT key.

The required LTRS (letters) or FIGS (figures) case codes for Baudot are *automatically* inserted as required by the DS2000. Thus, typing Baudot messages is no different than typing on a standard typewriter. The separate LTRS, FIGS, CR, LF, or blank Baudot codes may be sent if desired with special CTRL key combinations discussed in section 2.4.

The top row of number keys is also used to control the operation of the DS2000 itself. The control function is shown by the label printed on the cabinet itself, immediately above the related key. Thus, three functions are associated with the number "1" key: (1) type the number "1" for transmission, (2) type the "!" for transmission (SHIFT - 1), and (3) put the terminal into the Baudot mode or change the Baudot speed (CTRL - 1). Some keys, such as the 6, : , and = also allow a

SHIFT-CTRL- XX operation. The DS2000 controls associated with these keys are listed below.

CTRL - 1 (BAUDOT)	Sets the transmit/receive code of the terminal to BAUDOT (RTTY) code. Each operation of CTRL-1 advances the RTTY code rate to the next higher rate available. The available RTTY rates are: 45, 50, 57, 74, 100 baud 60, 66, 75, 100, 133 wpm After reaching the 100 baud rate, the next CTRL-1 operation gives 45 baud, i.e., the sequence starts over. Rapid changes in rates can be made by holding the CTRL-1 combination down for longer than ½ second; the programmatic repeat feature will then quickly change the rate.
CTRL - 2 (MORSE)	Sets the transmit/receive code of the terminal to MORSE. This causes the message "ENTER WPM >" to appear in the status area of the display. The desired code speed should then be entered either as a 3-digit number or as a one- or two-digit number followed by RETURN. The allowable range is from 1 wpm through 175 wpm.
CTRL - 3 (ASCII)	Sets the transmit/receive code of the terminal to ASCII code. Each operation of CTRL-3 'toggles' the ASCII rate between 110 baud and 300 baud.
CTRL - 4 (USOS)	Turns the Unshift On Space (USOS) feature on or off as shown on the display status line. This feature is only effective when receiving Baudot RTTY transmissions. When activated, the USOS feature automatically resets the receive decoding circuitry to Baudot letters case after reception of a space bar character.
CTRL - 5 (SYNC IDLE)	Turns the SYNChronous idle feature on or off as shown by the display status line indication. This feature provides "fill" characters that can be transmitted if the keyboard entered data is slower than the output transmitting rate. In Baudot, the LTRS character (11111) is used; in ASCII, the NULL character (ØØØØØØØØ); and in Morse the BT (-···-) character. This feature can improve the receiving station's reception of your signal by maintaining synchronization.
CTRL - 6 (STATUS)	Causes the status line to be displayed on the top line of the video monitor.
SHIFT - CTRL - 6 (STATUS)	Displays the status line and clears the rest of the screen.

CTRL - 7 (XMIT)	Change the transmitting mode between ON, OFF, and HIDden. In the ON mode, information entered from the keyboard appears on the display and is transmitted one word at a time. In the OFF mode, information entered from the keyboard appears on the display but is not transmitted. This allows the operator to compose a message for later transmission. In the HIDden mode, information may be entered from the keyboard while receiving, but the keyboard data is not displayed on the video monitor. The control cycle is: ON-OFF-HID-OFF-ON-OFF-HID... etc. for each operation of CTRL-7.
CTRL - 8 (RYRY)	Completes the present line with RY characters in display memory for a Baudot test transmission. In ASCII code, this test message consists of alternate "U*U*U*---" characters. The line is ended with a NEW LINE sequence (CR-LF-LTRS for BAUDOT; CR-LF for ASCII).
CTRL - 9 (QBF)	Transmit the test message: "THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG'S BACK 1234567890". Each test message is preceeded by the NEW LINE sequence.
CTRL - Ø (CQ)	Transmit the message "CQ CQ CQ CQ".
CTRL - : (HERE IS 1)	Transmit the contents of the "HERE IS 1" message area (up to 32 characters).
SHIFT - CTRL - : (HERE IS 1)	Enter or exit the programming mode for the HERE IS 1 message.
CTRL - = (HERE IS 2)	Transmit the contents of the "HERE IS 2" message area (up to 32 characters).
SHIFT - CTRL - = (HERE IS 2)	Enter or exit the programming mode for the HERE IS 2 message.
CTRL - blank (IDENT)	Transmit the contents of the HERE IS 1 message in Morse code at the previously selected Morse rate (regardless of the operating code selected).

2.3 Transmit/Receive Operation:

The transmit and receive sections of your DS2000 function much the same as those of a mechanical keyboard-send-receive (KSR) terminal: received text is displayed, typed text is transmitted, and typing or transmitting takes precedence over reception if both occur simultaneously. However, the DS2000 goes far beyond the capabilities of other terminals, mechanical *or electronic*, in that you may precompose your message to be transmitted and *edit it*, removing spelling errors, etc., *before transmitting*. In fact, up to 256 characters may even be typed *while receiving* and then edited before transmitting by using the TX HID mode of operation. This type of interactive control between the display and keyboard is possible *only* in an integrated package such as the DS2000 or DS3100 terminals and is not a feature of separate keyboard / video generator equipment.

When you first turn-on your DS2000, the status line shows "TX ON". This indicates that *if characters are typed, they will be transmitted*, much as you would expect with an electromechanical teleprinter. A special feature, unique to HAL Communications terminals, is the WORD MODE of transmission. WORD MODE is *always* active on the DS2000 and gives you a convenient amount of edit capability even if you do not wish to pre-type text. With WORD MODE, a word of text is not transmitted until a character *following the space* is typed. Thus, any time prior to the start of the following word, spelling or typing errors may be corrected a word at-a-time. You may test this feature by typing several words and watching the action of the block cursor. Recalling how the block cursor indicates which characters are being transmitted, notice how it always follows one word behind the keyboard. To end a transmission and send all typed text, end with a RETURN key - RETURN clears the word mode buffer (as well as starting a new line). Also notice that you may type considerably faster than the text is transmitted. This is particularly convenient when transmitting Morse code at speeds less than 50-60 WPM. Again, the block cursor indicates the transmit output progress and you may edit *any* text with the RUB-OUT key *before* it is transmitted. It is important to realize, however, that the terminal will be transmitting and *NOT* receiving when TX ON status is shown and dim characters are on the screen which have not been transmitted. The terminal will resume reception after all dim characters have been transmitted or if CTRL-7 (XMIT) is used to obtain TX OFF status.

Transmit text may be pre-typed using two different techniques - typing text onto the screen with TX OFF or typing into the 256 character "blind" buffer using TX HID status.

Up to 1728 characters of text may be pre-typed and edited with the RUB OUT key if the entire screen is devoted to the transmit text and signals are *NOT* received. To pre-type the screen, simply use CTRL-7 (XMIT) to set TX OFF status, inhibit reception of signals (set ST5000 or ST6000 PRINT to LOCAL), and type the text. After the text is complete, it may be transmitted by typing CTRL-6 (XMIT) *three more times* to get the TX ON status. If text is received *while* typing with TX OFF status, the two sets of text will be interleaved, bright characters for received text and dim for those to be transmitted. Even though the resulting display is confusing, the DS2000 will successfully sort-out the transmit text and send it as typed when TX ON status is chosen. The receive text may be easily distinguished by adjusting the video monitor's intensity so that only the bright receive characters are shown, although the letter spacing will obviously reflect the presence of the interspersed dim transmit characters. A more convenient method of pre-typing the transmit text is to use the 255 character buffer

and type "in-the-blind", much in the same manner as has been done with paper tape on Model 19 and Model 28ASR teleprinters. To use this feature, select the TX HID mode with CTRL-7 (XMIT) and type your text. Since the DS2000 keeps track of the line length, the end-of-line sequence (CR-LF-LTRS) will be automatically inserted as required. As a warning against overfilling the buffer, the DS2000 bell rings on the 237th and all following characters (18 characters from the end of the buffer). If you continue typing after the 237th character, each character typed will ring the bell until 255 characters have been entered. Upon typing the 256th character, the bell stops ringing and characters are no longer saved by the buffer. After the received text has stopped, you may recall all of the pre-typed text to the screen by typing CTRL-7 (XMIT) to get the TX OFF status back. Now, all of the pre-typed text is displayed and may be edited with the RUB OUT key. You may now start transmitting by typing CTRL-7 (XMIT) to get TX ON status as well as continuing typing of the transmit text if required. Both of the HERE IS messages as well as the IDENT, RYRY, QBF, and CQ features may be inserted into the hidden buffer. Each complex message requires only *one key operation* and therefore consumes only *one storage position* in the 255 position hidden buffer.

A further transmit-receive feature characteristic of HAL terminals is the automatic KOS, Keyboard Operated Switch transmit-receive control. The HAL KOS functions in much the same manner as VOX (Voice Controlled Break-In) does on a SSB transceiver. The KOS senses the state of the DS2000 and provides a low impedance switch to ground any time when text is being transmitted from the DS2000, as indicated by the TX ON status *and* movements of the block cursor. To assure that your transmitter and the other station's receiver are ready for your transmission, a two second pause is inserted between the turn-on of the KOS switch (transmitter on-the-air) and the start of text transmission. This avoids any loss of characters that might otherwise occur if there were no delay. The KOS will go back to a receive condition (high impedance to ground) approximately 1/2 second after the final text has been transmitted or if the XMIT status has been switched to TX OFF. The KOS switching transistor is NPN and is capable of switching up to a 100 ma load to ground and withstanding a positive voltage of up to 200 volts when in receive condition.

The reception of your signal may in some cases be improved by using the SYNC, synchronous idle ("diddle") feature of the DS2000. The SYNC feature will fill pauses in transmit output (such as between words when editing) with a LTRS character in Baudot (11111), a NUL character in ASCII (ØØØØØØØØ), or the $\overline{BT}$ character in Morse (-···-). The SYNC character will continue to be inserted until a line is completed *and a new line is not started*. Therefore, when using SYNC, *be sure to always end the transmission with a RETURN key* to make sure that the SYNC characters stop, the terminal goes to receive and the KOS turns the transmitter off!

The IDENT feature of the DS2000 allows Morse identification of your transmission even when the terminal is operating in either Baudot or ASCII codes. The IDENT key will output the contents of HERE IS 1 in Morse code when used and its presence is indicated on the screen by the square brackets [ ] around the HERE IS 1 text.

2.4 Baudot Operation

The DS2000 KSR terminal may be used in teleprinter-type communications systems where the 5 unit serial asynchronous start-stop teleprinter code is used. This code is commonly called "Baudot Code" (also referred to as the "Murray Code"). The Baudot code of the DS2000 KSR corresponds to that commonly used in commercial and radio amateur applications, as shown in Table 1.

The data rate (in bauds) or speed (in words-per-minute) of the terminal can be set for five standard values; 45 baud (60 wpm), 50 baud (66 wpm), 57 baud (75 spm), 74 baud (100 wpm), and 100 baud (133 wpm). At this writing, the 45, 50, 57 and 74 baud rates are permitted for use by U.S. Amateur Radio Operators; the 133 baud rate is sometimes used in European systems. The transmitted characters from the DS2000 have the serial format of Start - Data 1 - Data 2 - Data 3 - Data 4 - Data 5 - Stop pulses. All pulses except the stop pulse are of equal length (time duration = reciprocal of the baud rate); the stop pulse is 1.5 times as long as the data pulses. The Baudot code and data rate are selected with CTRL-1 (BAUDOT) keys; each operation changes to the next higher data rate (45-50-57-74-100-45-50 ... etc.).

Because of the limited number of code combinations permitted by the 5-unit Baudot code (32 total), most code combinations are effectively used twice in two different cases, *Letters Case (LTRS) or Figures Case (FIGS)*. Uniquely defined codes are assigned to LTRS (11111) and FIGS (11Ø11) case characters. As can be seen in Table 1, most keys can have two meanings, depending upon which case is chosen, LTRS or FIGS. The receiving device in the Baudot system is equipped with a case memory that is set by reception of the LTRS or FIGS code and keeps the terminal in that case until another FIGS or LTRS changes the case. Thus if a LTRS code (11111) was the last *case* character received, all later codes received will be interpreted as LTRS case - a ØØØ11 code will be interpreted as the letter "A". Conversely, if the last received case character was FIGS (11Ø11), receipt of the same ØØØ11 code will now be interpreted as a dash (-). Even with the "double-use" of the code combinations, the number of possibilities is still limited and extended symbols and punctuation and lower-case letters are not commonly used with a 5-unit code system; the 7 unit ASCII code is commonly used where additional symbols or lower case letters are required.

In transmitting the Baudot code, it is therefore necessary to *precede* the text with the correct case character (LTRS/FIGS). In mechanical teleprinters and simple electronic keyboards, the keyboard is arranged in only three rows with the numbers and punctuation in a second legend on the lettered keytops. The *operator* must keep track of whether he needs to send a LTRS or FIGS character before typing the chosen key. On the other hand, the DS2000 KSR (as well as previous HAL terminals) has a keyboard arranged in a standard typewriter-style format and the LTRS or FIGS Baudot characters are inserted as required. Thus the operator need not be concerned with manual typing of the case characters. However, they are inserted *automatically* and the resulting output teleprinter code will correctly reproduce on mechanical or electronic Baudot terminals.

When receiving Baudot code, the terminal stores the previously received case character (LTRS/FIGS) and chooses the letter or punctuation for each character accordingly. When weak signals are received, noise (or other signals) can interfere with the reception and cause errors in the reproduction ("hits"). If such an error is interpreted as a case change character, not only is that character misprinted but also all *following* characters are misprinted, until the next case character is received.

This can be particularly damaging to reception of straight text; misinterpretation of noise as a FIGS character will cause all of the following text to appear as numerals and punctuation. To improve reception of text transmissions, the Unshift On Space feature of the DS2000 KSR provides an automatic return to Baudot LTRS case after reception of each space character (ØØ1ØØ). Thus, although the display may misprint a few characters following a noise induced case change to FIGS; the print will shift back to LTRS case after the first space character. The Unshift On Space (USOS) feature is controlled with the CTRL-4 (USOS) key combination and the status line shows USOS when the feature is active. For general conversation, this feature may be left active most of the time. However, when receiving known strings of numbers, such as from weather stations or in computer listings, the USOS feature should be turned off. Also, USOS is generally not useful when receiving "RTTY Art".

The DS2000 KSR features automatic non-overprint and word wrap-around that work on both transmitted and received signals. When composing text to be transmitted, it is simply necessary to type the text - the terminal automatically chooses new lines as required and moves characters to prevent word splitting at the end of a line. *When the text is transmitted*, the necessary CR (carriage return), and LF (line feed) characters are added; when Baudot code is used, the sequence "CR - LF - LTRS" is inserted at the end of each transmitted line.

There are some instances, however, where it is desirable to manually transmit the case characters or carriage control characters. Through use of the CTRL keys, all of these characters may also be sent manually. When manual transmission of a control code is used *only* that code is transmitted and the normal non-overprint protection does not apply; use of CTRL-M to send a LF character (ØØØ1Ø) does *not* also trigger the standard new line sequence (CR LF LTRS). The keys used to produce the control codes and the corresponding display indication are shown below:

	Operation	Code	Type	Display
LF	Line Feed	ØØØ1Ø	CTRL-J	J
CR	Carriage Return	Ø1ØØØ	CTRL-M	M
LTRS	Letters Case	11111	SHIFT-,	<
FIGS	Figures Case	11Ø11	SHIFT-.	>
blank	Null Character	ØØØØØ	ESC	[
BELL	Signal Bell (FIGS case)	ØØ1Ø1	CTRL-G	G

Note that a character is displayed on the screen for each control operation to be transmitted. Since the DS2000 transmits *from the screen* a character is displayed to signal that the operation code should be transmitted. The display characters for the LTRS, FIGS, and blank codes are unique for Baudot and are easily recognizable. However, the codes for LF, CR, and BELL are represented by the letters J, M, and G respectively, the letters corresponding to the keys involved with typing the control code. Although this display may at first appear confusing, these control codes are used infrequently; generation of special characters for these operations would have increased the basic cost of the DS2000 considerably.

As discussed previously, the DS2000 initiates a new line upon reception of each LF (line feed) operation code and ignores all received CR (carriage return) codes. The key operations that show Baudot encoded characters are shown in Figure 3.

As discussed previously, the IDENT key (CTRL-IDENT) can be used to give a Morse output of the contents of HERE IS 1, even while operating Baudot RTTY. The Morse output speed will be at either 20 wpm (the power-on set speed) or the last chosen Morse transmit speed.

TABLE 1. BAUDOT DATA CODE

Bit Number 5 4 3 2 1	Case: Letters	Case: Figures
0 0 0 0 0	BLANK	BLANK
0 0 0 0 1	E	3
0 0 0 1 0	LF	LF
0 0 0 1 1	A	-
0 0 1 0 0	SPACE	SPACE
0 0 1 0 1	S	BELL
0 0 1 1 0	I	8
0 0 1 1 1	U	7
0 1 0 0 0	CR	CR
0 1 0 0 1	D	$
0 1 0 1 0	R	4
0 1 0 1 1	J	'
0 1 1 0 0	N	,
0 1 1 0 1	F	!
0 1 1 1 0	C	:
0 1 1 1 1	K	(
1 0 0 0 0	T	5
1 0 0 0 1	Z	"
1 0 0 1 0	L	)
1 0 0 1 1	W	2
1 0 1 0 0	H	#
1 0 1 0 1	Y	6
1 0 1 1 0	P	Ø
1 0 1 1 1	Q	1
1 1 0 0 0	O	9
1 1 0 0 1	B	?
1 1 0 1 0	G	&
1 1 0 1 1	FIGS	FIGS
1 1 1 0 0	M	.
1 1 1 0 1	X	/
1 1 1 1 0	V	;
1 1 1 1 1	LTRS	LTRS

Notes:

Mark = "1" = Loop Current On
= Negative RS-232 Voltage

LF = Line Feed CTRL-J
CR = Carriage Return CTRL-M
LTRS = Letters Case Shift = SHIFT-,
FIGS = Figures Case Shift = SHIFT-.

RETURN key = CR+LF+LTRS
CTRL-G = BELL
ESC = blank
# = STOP (Figure case H)
(Break) = Space condition (for testing)
Transmission Order = Bit 1 to Bit 5
Start Pulse = 1 unit space
Stop Pulse = 1.5 unit mark

Baud Rate	Avg. WPM	Select Pulse
45.45	60.61	22 ms
50.00	66.67	20 ms
56.92	75.89	17.57 ms
74.20	98.99	13.47 ms
100.00	133.33	10.00 ms

Special Baudot Features:

* Automatic LTRS/FIGS generation when transmitting
* USOS (UnShift On Space) switch selectable for reception of noisy signals
* SYNC (Synchronous Idle) switch selectable to transmit LTRS code to maintain output speed when hand typing. May help reception of your signal.

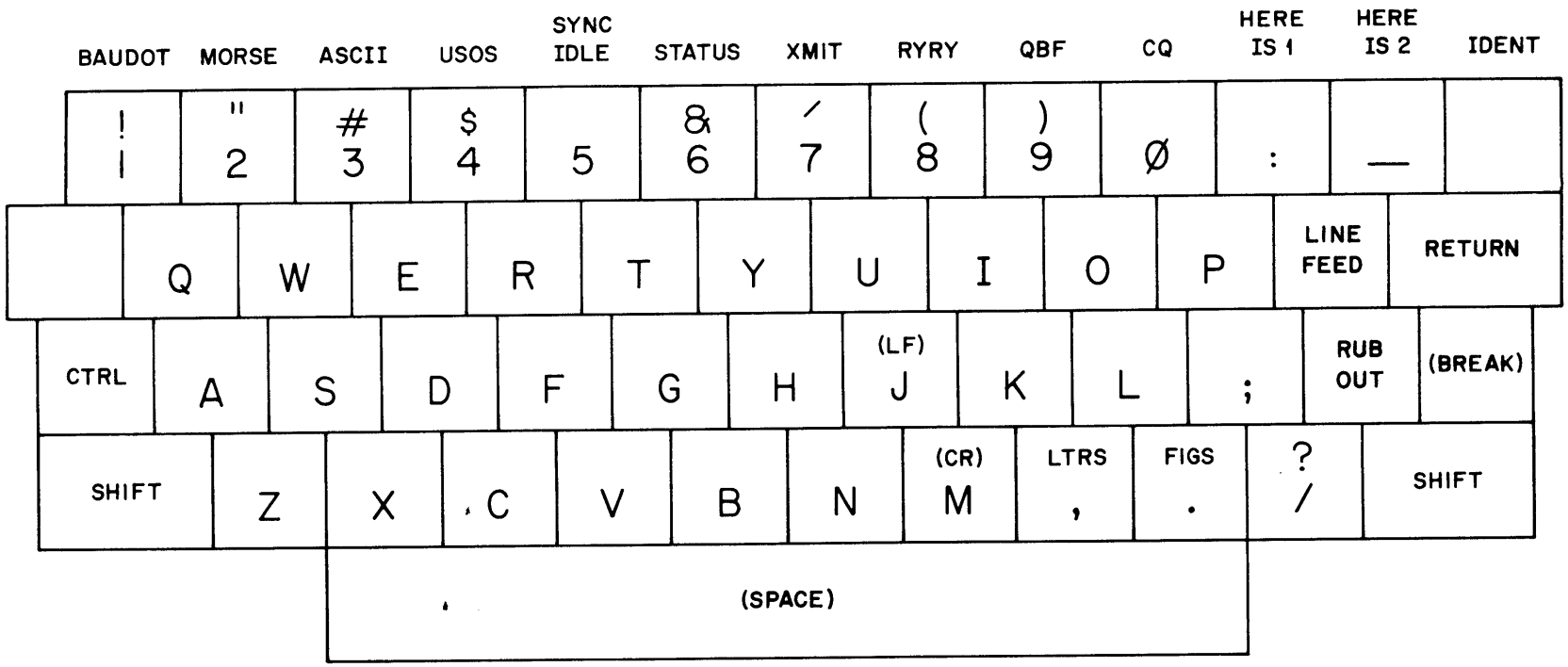


Figure 3. Baudot Keyboard Combinations
( ) = CTRL + key

2.5 Morse Operation

The DS2000 KSR includes the capability of transmitting the Continental Morse Code at any speed between 1 and 175 wpm (words-per-minute), as chosen by the operator. When the MR2000 Morse receive option is added to the basic terminal, reception of Morse code is also possible. The Continental Morse Code used with the DS2000 KSR is shown in Table 2.

To select Morse code or to reset the Morse transmit speed, type CTRL-2 (MORSE). The message "ENTER WPM >" will appear and you should either enter up to three digits to specify the desired transmit speed or a RETURN to save the previously entered speed. The Morse transmit circuitry of the DS2000 is initialized to 20 wpm when power is first turned on. If you type less than three digits, end the speed entry with a RETURN; if three digits are specified, no RETURN is necessary. For example: "7 RETURN" for 7 wpm, "40 RETURN" for 40 wpm, and "125 for 125 wpm. The transmit speed may be changed at any time, even while transmitting.

All of the transmit editing features discussed in section 2.3 are operational when Morse code is used. As discussed, the SYNC character for Morse is $\overline{BT}$ (-···-) and may be turned on or off with CTRL-5 (SYNC IDLE). This feature may improve *automatic copy* of your signal at the higher speeds but may not be desirable at the lower speeds. The key operations for Morse are shown in Figure 4.

The Morse receive circuitry on the MR2000 option uses a phase locked loop detection system that will track minor frequency variations in the received signal. Thus, the system can adapt for frequency instabilities in either the transmitter or receiver, within a tolerance of approximately ±100 Hz. A center frequency adjustment control is accessible through the connector hole for the MR2000 on the rear panel on the DS2000. This control has been preset at the factory for an audio tone of 800 Hz, the common audio passband center frequency of transceivers with CW filters. After some testing, you may wish to check the alignment with your equipment as discussed below. The following steps discuss both initial adjustment of the MR2000 and operating techniques to be used when receiving Morse code. Reception of Morse code is shown on the DS2000 by a star (*) symbol that flashes in the bottom right corner of the screen. Correct tuning is indicated when the star flashes in unison with the key down of the received signal and *not* on noise or other signals.

1. The center frequency control allows adjustment of the reception audio tone frequency of the MR2000 between approximately 400 to 1200 Hz. The control is normally set at the factory for 800 Hz, but its setting should be checked when first installing your MR2000.

2. After connecting the receiver audio output to the audio input to the MR2000 AF IN, set the receiver to a comfortable listening level, in the CW mode with the crystal calibrator (or other CW source) turned on. Use CTRL-2 (MORSE) to put the DS2000 in the MORSE mode. Tune your receiver frequency until the received signal is centered in the CW filter; on most receivers, this will result in a tone of approximately 800 Hz. Now, observing the margin star (*) on the DS2000 screen, rotate the center frequency control and note the relative positions over which the star is on. Set the center frequency control in the middle of this range.

2a. If your receiver does *not* have a CW filter, adjust the receiver tuning for a tone frequency of approximately 800 Hz and then follow the above procedure. (Actually, the center frequency control could be adjusted for other frequencies in the 400 - 1200 Hz range if you prefer).

3. To receive Morse code, turn off the crystal calibrator and adjust the receiver tuning so that the margin star (*) flashes in unison with the received CW signal; the lamp should be ON when the key is down and OFF at all other times. The lamp should not flicker on noise or other signals. You may have to type SHIFT-CTRL-2 (MORSE) to first start the display of Morse characters.

4. In general, it is recommended that you use manual RF gain, rather than AGC when receiving CW to minimize noise interference between words, particularly when receiving moderately slow CW (20 wpm or slower). If AGC is used, choose the slowest response speed available.

5. If a CW filter is available, try reception both with and without the filter. In the face of strong interference, a narrower filter may help noticeably. However, very narrow filters (less than 400 Hz) rarely help because of the additional "ringing" associated with their use. Each receiver has its own characteristics and you will want to experiment with yours to find the best combination.

6. The volume control setting of the receiver may affect the reception on the DS2000 - too loud a setting will usually give an overload condition, indicated by semi-continuous flashing of the margin star (*), not necessarily in unison with the received signal. Too low a setting will be shown by reduced flashing of the margin star (*), often missing dots or dashes. The dynamic range between these two extremes is quite wide and should not be critical. However, the *capture bandwidth* of the phase lock varies with the audio level, being narrow for low level signals and wider for loud signals. Use of a lower audio level in the face of interference may improve the reception because of this narrowed capture bandwidth.

7. Upon occasion, the DS2000 may cease decoding received Morse signals. This condition is usually caused by extended reception of a continuous carrier. The internal automatic speed adjusting program interprets this as a very long dash and attempts to track a very slow CW speed. The automatic tracking circuitry can be reset by pressing SHIFT-CTRL-2 (MORSE). After re-setting the Morse reception circuit, the screen will display several "T" and "E" characters as the speed tracking program adapts to the received signal.

8. The programs of the DS2000 are quite tolerant of improperly sent Morse code: however, there are limits! The worst case of hand-sent CW is represented by run-together characters. The DS2000 programs will try to display a valid letter for the dot-dash combination received between word spaces; if the code is run-together, this may or may not be what the sender *intended*. If a dot-dash combination for the run-together code does not exist, the DS2000 will simply NOT display a character and wait for the next *valid* Morse character. Another common problem with

hand-sent Morse code is improper letter-word spacing. The DS2000 programs may interpret a longer than normal pause in the sending between letters as a word space and space the display accordingly. The practice of sending letters at a high rate with a long space between each letter will therefore produce a display with the letters spaced out rather than clustered in words.

9. The weight of the transmitted code is set at the correct dot-to-dash ratio. However, some transmitter keying circuits employ filtering that may result in improper keying at the higher Morse code speeds (typically higher than 70 wpm). If such a problem is found, the *transmitter* circuitry should be modified to correct the deficiency rather than distorting the code by modifying the weighting.

TABLE 2. CONTINENTAL MORSE CODE

A	·-		1	·----
B	-···		2	··---
C	-·-·		3	···--
D	-··		4	····-
E	·		5	·····
F	··-·		6	-····
G	--·		7	--···
H	····		8	---··
I	··		9	----·
J	·---		Ø	-----
K	-·-	.	(period)	·-·-·-
L	·-··	,	(comma)	--··--
M	--	:	(colon)	---···
N	-·	;	(s-col)	-·-·-·
O	---	-	(dash)	-····-
P	·--·	'	(apos)	·----·
Q	--·-	/	(slash)	-··-·
R	·-·	()	(paren)	-·--·-
S	···	"	(quote)	·-··-·
T	-	?	(query)	··--··
U	··-		$\overline{AR}$	·-·-·
V	···-		$\overline{AS}$	·-···
W	·--		$\overline{BT}$	-···-
X	-··-		ES	·· ···
Y	-·--		$\overline{KN}$	-·--·
Z	--··		$\overline{SK}$	···-·-
			error	·····
			*	undefined

Notes:

· = one dot unit of key down time
- = one dash unit of key down time
  = three dot units

Element space = one dot unit
Letter space = three dot units
Word space = seven dot units

Speed in WPM = $\frac{\text{dots/min}}{25}$
= 2.4 (dots/sec)
= number of Ø's repeated in 26 seconds (1.5% accuracy)

$\overline{AR}$ = SHIFT-P (@)
$\overline{AS}$ = SHIFT-(dash) (=)
$\overline{BT}$ = SHIFT-; (+)
$\overline{KN}$ = SHIFT-(period) (>)
$\overline{SK}$ = SHIFT-: (*)
Error = SHIFT-3, 4, 5, or 6

(TUNE) = Key down (for testing)

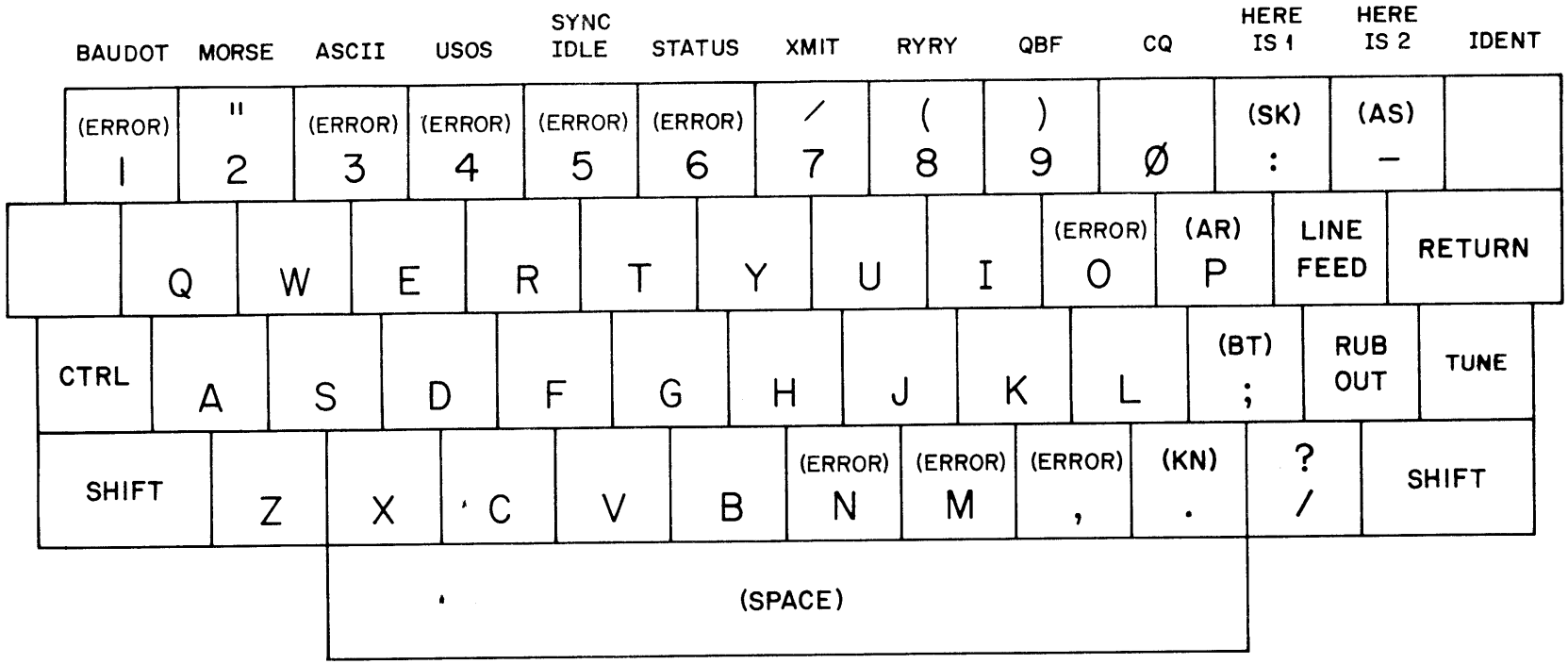


Figure 4. Morse Keyboard Combinations
( ) = SHIFT + key

2.6 ASCII Operation

The DS2000 KSR is also an ASCII communications terminal that may be used in any asynchronous communications or data system using the serial ASCII code. The terminal will receive, transmit, and display a 64 character ASCII symbol table, including upper case letters, numerals, punctuation, and standard ASCII control codes.

The ASCII mode is selected and the data rate chosen with the CTRL-3 (ASCII) key combination. After the ASCII code has been selected, subsequent operation of CTRL-3 (ASCII) keys will toggle the ASCII data rate between 110 and 300 baud data rates (10 and 30 characters per second, respectively). Table 3 shows the ASCII Data Code used with the DS2000.

All of the transmit pre-type and edit features discussed in section 2.3 work with ASCII code. While composing text to be transmitted, any of the ASCII codes may be typed for transmission and a symbol will be displayed. Letters, numerals, and punctuation will be displayed as typed. However, the presence of the special ASCII control codes such as DC1, ETB, DC2, etc. will be shown by the *letter* corresponding to the CTRL key operation. For example, the letter "Q" will be displayed when a DC1 (CTRL-Q) is to be sent; an "E" for WRU (CTRL-E), etc. Upon transmission, the *control code* is sent, rather than the code for the displayed letter. Key operations for the ASCII code are shown in Figure 5.

Reception of all control codes is ignored with the exception of the DEL (delete) code which will cause a back-space and erasure (RUB OUT) operation. Reception of the ASCII code for lower case letters will cause the corresponding upper case letter to be displayed.

As discussed previously, use of the CTRL-IDENT key combination will produce Morse code output of the contents of HERE IS 1 without changing the terminal mode from ASCII. The Morse IDENT is sent at 20 wpm (power-on set speed) or the last previously set code speed.

TABLE 3. ASCII DATA CODE

7	0	0	0	0	1	1
6	0	0	1	1	0	0
5	0	1	0	1	0	1
4 3 2 1						
0 0 0 0	NUL	DLE	SPC	Ø	@	P
0 0 0 1	SOH	DC1	!	1	A	Q
0 0 1 0	STX	DC2	"	2	B	R
0 0 1 1	ETX	DC3	#	3	C	S
0 1 0 0	EOT	DC4	$	4	D	T
0 1 0 1	WRU	NAK	%	5	E	U
0 1 1 0	ACK	SYN	&	6	F	V
0 1 1 1	BEL	ETB	'	7	G	W
1 0 0 0	BS	CAN	(	8	H	X
1 0 0 1	HT	EM	)	9	I	Y
1 0 1 0	LF	SUB	*	:	J	Z
1 0 1 1	VT	ESC	+	;	K	[
1 1 0 0	FF	FS	,	<	L	\
1 1 0 1	RTN	GS	-	=	M	]
1 1 1 0	SO	RS	.	>	N	^
1 1 1 1	SI	US	/	?	O	_

Notes:

Mark = "1" = Loop Current On
= Negative RS232 Voltage

Blank = Space condition (for testing)

DLE = CTRL-P
FS = SHIFT-CTRL-L
GS = SHIFT-CTRL-M
NUL = SHIFT-CTRL-P
RS = SHIFT-CTRL-N
RTN = CTRL-M
SI = CTRL-O
SO = CTRL-N
US = SHIFT-CTRL-O
^ = SHIFT-N

RETURN = RTN + LF

Control Codes to be transmitted are represented on the screen by their corresponding key-top letter: eg: ACK=CTRL-F→"F" on screen.

ACK = acknowledge
BEL = signal bell
BS = backspace (←)
CAN = cancel
DC1 = device control 1
DC2 = device control 2
DC3 = device control 3
DC4 = device control 4
DLE = data link escape
EM = end of medium
EOT = end of trans.
ESC = escape
ETB = end of block
ETX = end of text
FF = form feed (home)
FS = file separator
GS = group separator
HT = horizontal tab (→)
LF = line feed (↓)
NAK = not acknowledge
NUL = null
RS = record separator
RTN = carriage return
RBO = RUB OUT = DEL
SI = shift in
SO = shift out
SOH = start of heading
STX = start of text
SUB = substitute
SYN = synchronous idle
US = unit separator
VT = vertical tab (↑)
WRU = enquiry (ENQ)
SPC = space

Baud Rate	Char/ Sec.	Select Pulse
110	10.0	9.09 ms
300	30.0	3.33 ms

Transmission order = bit 1 to bit 7
Parity = none; bit 8 = space
Start bit = 1 unit space
Stop bit = 2 unit mark (110 baud)
= 1 unit mark (300 baud)

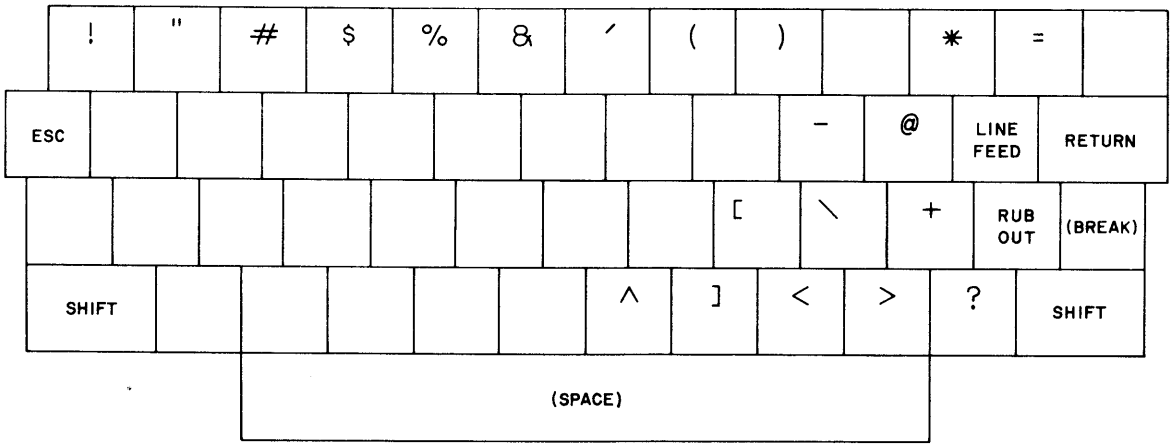


Figure 5a. ASCII Keyboard Combinations
SHIFT + key

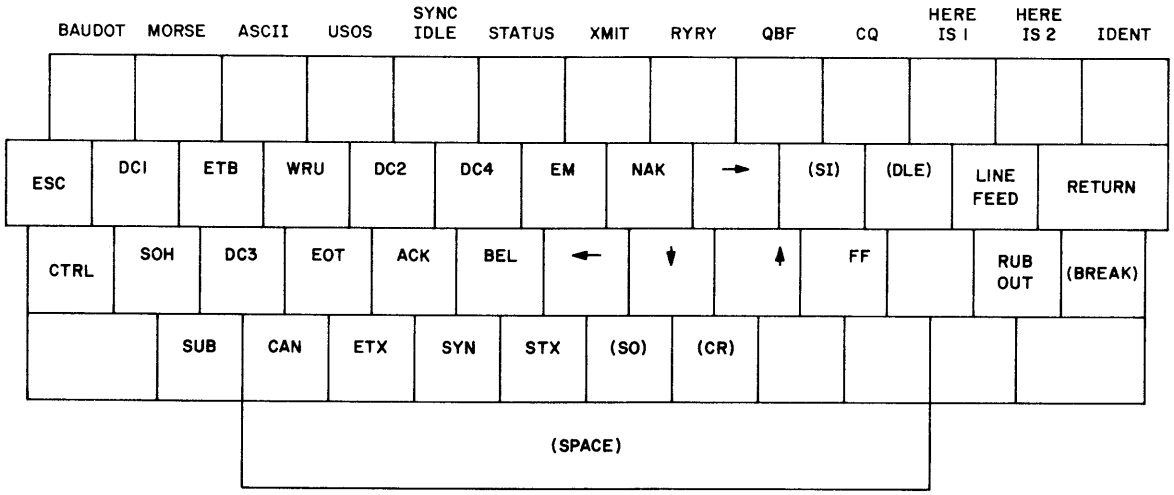


Figure 5b. ASCII Keyboard Combinations
CTRL + key

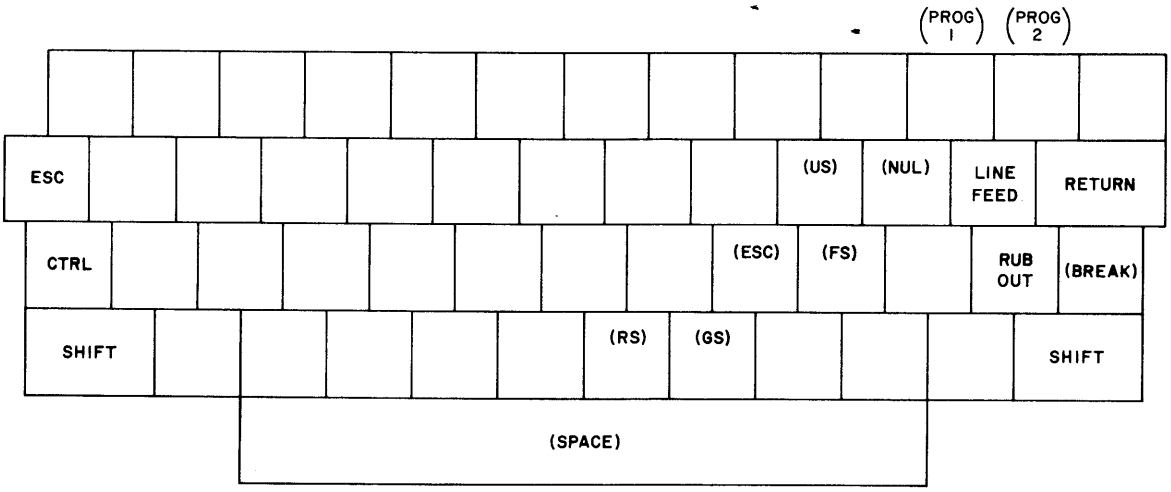


Figure 5c. ASCII Keyboard Combinations
SHIFT + CTRL + key

3. INSTALLATION

3.1 Unpacking

Your new DS2000 KSR has been carefully packed to prevent shipping damage. However, it is recommended that you carefully inspect the terminal for evidence of shipping damage *before you turn it on*! If damage is found, contact the SHIPPING CARRIER immediately; you must place a damage report *with the carrier* before any repairs can be started.

After inspecting the DS2000, locate the accessory package and check the contents against the list below. Report any shortages to us as soon as possible. To expedite any shortage replacements or additional orders for parts, please give the HAL part number.

Table 4 Accessories for the DS2000 KSR

Quantity	HAL Part Number	Description
2	323-91091	9 Pin male connector shell
18	322-91143	Male cable pins
1	310-62086	UHF coaxial cable connector
2	770-10000	1.0 amp fuse
10 ft	830-08671	Two-conductor shielded cable
1	870-02000	DS2000 Instruction Manual

3.2 Initial Turn-on

After unpacking, inspection, and verification of the accessory list, connect the DS2000 video output to a suitable video monitor, such as the Electrohome ESM-914 or similar commercial monitor or to a modified TV set (see section 3.4).

- - - - - - - - - - - - - - - - - - - CAUTION - - - - - - - - - - - - - - - - - - -

Be sure that your power line voltage and frequency match that of the DS2000 KSR and its monitor. A tag on the rear panel of the DS2000 will specify if the unit has been factory set for other than 120 vac, 60 Hz power. The ESM-914 is supplied for either 120 or 240 vac operation but is NOT switchable. Power connections can be changed as required by reference to section 3.3 of this manual.

If a modified TV set is used as a monitor for the DS2000, be sure that the set incorporates an isolating power transformer in its power supply. Failure to properly isolate the TV set ground from the video connections can create a serious shock hazard and cause severe damage to the DS2000. All warranties for the DS2000 are voided if improper connections are made to the DS2000. Also, see section 5 for further warranty and liability limitations.

- -

Now, plug the ac power cord into a suitable power socket (safety grounding type preferred) and turn the front power switch of the DS2000 and monitor on. As the monitor warms up, you should see the Status Line on the top line of the

display; typed characters should be displayed on the screen and the block cursor will indicate transmission output. See section 2 of this manual for further discussion of the operating techniques for the DS2000. If you do not see the status line or the typed text, try adjusting the vertical size, contrast, and intensity controls of the TV display. If this does not fix the problem, refer to section 5, *IN CASE OF DIFFICULTY*.

With the DS2000 turned on and connected to the monitor but *not connected to other equipment*, you may now wish to become familiar with some of the features described in section 2 of this manual. Particularly explore control of the transmitter output, changing of codes and rates, and programming of the HERE IS 1 and HERE IS 2 messages.

3.3 Standard Connections

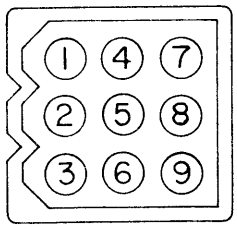
All input and output connections for the DS2000 are provided on two connectors on the DS2000 itself and a third connector on the MR2000 board (accessible through a hole in the DS2000 rear panel). The connections should be made as follows:

a. Ground:
The first cable to be connected, even before the power cords, is a good ground between pieces of equipment. The ground lead is necessary for RF interference prevention and for safety. A $\frac{1}{4}$" wide shield braid run between the cases of all equipment is usually sufficient for both RF and safety grounding. Be sure to include grounding of RTTY machine cases in the ground system and to attach the ground wires to a good earth or water-pipe ground. Do *NOT* defeat the third-prong safety ground on the DS2000 power cord: doing so risks electrical shock and voids the HAL warranties and liabilities (see section 6).

b. Video Output:
The UHF connector on the DS2000 rear panel is the video output of the DS2000. The video is EIA RS170 compatible and has a nominal output impedance of 70 ohms and a peak video output of 1.0 volt. This video output will directly drive any commercial black and white TV set as discussed in section 3.4. A standard coaxial cable (RG59 recommended) fitted with a UHF PL-259 connector can be used to connect the DS2000 to the monitor. This cable may be up to 25 ft. in length if desired although shorter lengths are advised to prevent noise or RF pick-up. A UHF cable connector is provided that may be either crimped or soldered to the RG59 cable.

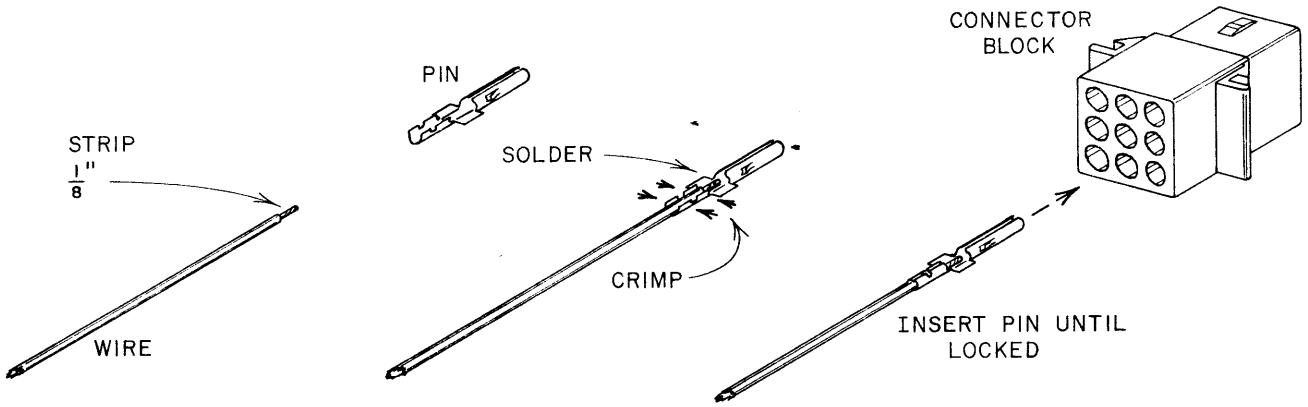
c. Input/Output Connections:
The RTTY loop, Morse key outputs, and KOS output are all provided on a nine-pin plastic connector on the DS2000 rear panel. The connection pin numbers and instructions for preparation of the pins and mating connector are shown in Figure 6. Be sure you double-check the pin location in the plastic shell before inserting it - the pins are *NOT* easily removed!

Connections to the Morse key output are shown in the top half of Figure 7. The DS2000 includes capability for keying either a positive voltage to ground ("cathode" keying circuits) or a negative voltage to ground ("grid-block" keying circuits). Check your equipment manuals for the circuit used to key your transmitter.



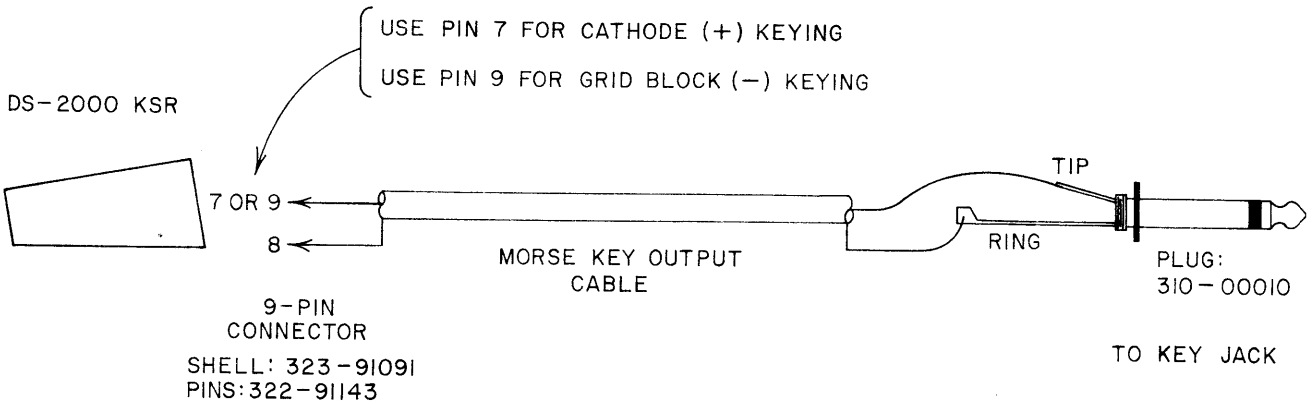
1	+	TRANSMIT LOOP	BAUDOT OR ASCII
2	−		
3	+	RECEIVE LOOP	
4	−		
5	GND		
6	KOS		
7	CATHODE KEY OUT (POSITIVE)		
8	GND		
9	GRID-BLOCK KEY OUT (NEGATIVE)		

INPUT/OUTPUT CONNECTOR

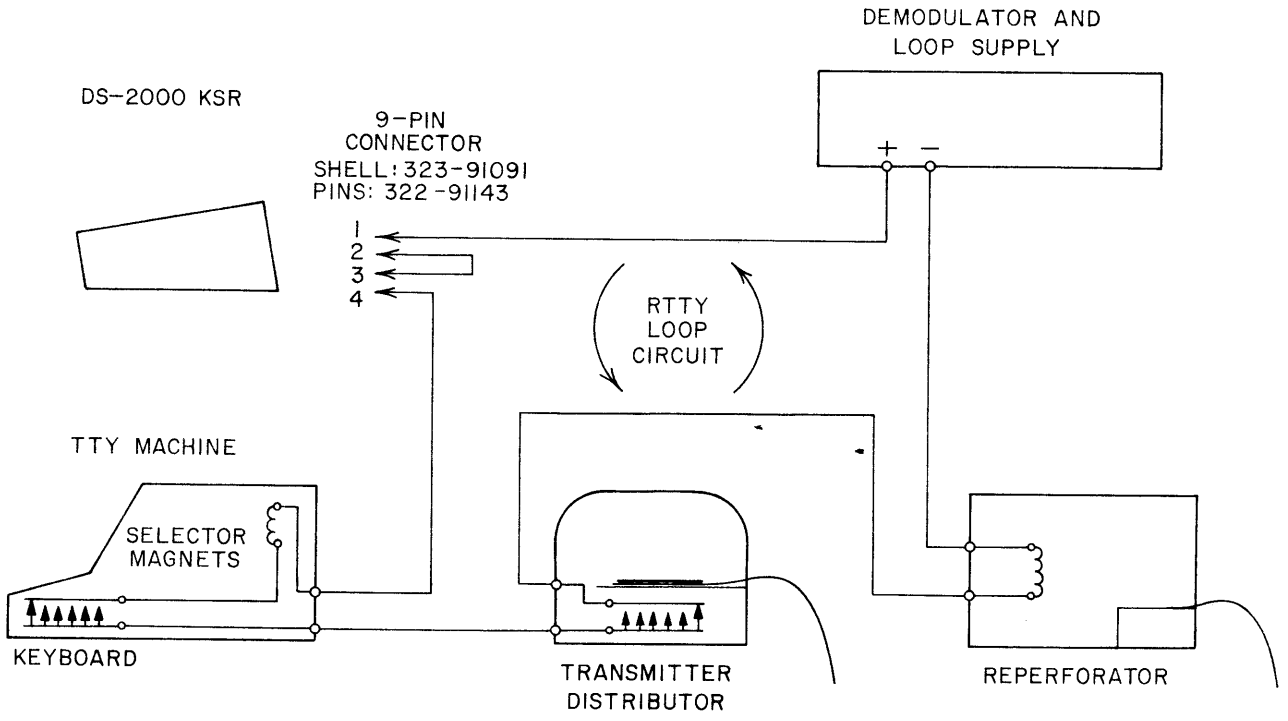


PREPARATION OF PLASTIC SHELL CONNECTOR

Figure 6. Input / Output Connections



MORSE OUTPUT CONNECTION



STANDARD RTTY LOOP CONNECTIONS

Figure 7. Morse Output and RTTY Loop Connections

If you have several pieces of equipment to key (such as the Morse key line of the transceiver and the CW ID line of the RTTY demodulator), both positive and negative outputs may be used *simultaneously*.

Connection of the DS2000 into the RTTY loop is shown in the lower diagram of Figure 7. Notice that a jumper is required between pins 2 and 3 on the connector. This is because the receive and transmit loop sections of the DS2000 are brought-out separately; if only reception is desired, hook the loop to pins 3 and 4 and leave pins 1 and 2 unconnected. The standard loop connection is, however, as shown with the polarity shown on the loop connections.

The KOS (Keyboard Operated Switch) circuit can be connected to the transmit-receive control line of the station (PTT line in most cases) to give automatic send-receive operation of the station. As discussed in section 2, the KOS functions as a RTTY - VOX circuit and automatically turns on the transmitter when text is to be sent. The KOS transistor in the DS2000 is NPN and can switch a *positive* voltage to ground (200 vdc maximum open circuit, 100 ma maximum in KOS "ON" condition). The KOS transistor can directly switch positive voltage PTT (Push-To-Talk) circuits as is shown in the top half of Figure 8 but must be isolated from negative voltage circuits as is shown by the relay circuit in the lower half of Figure 8.

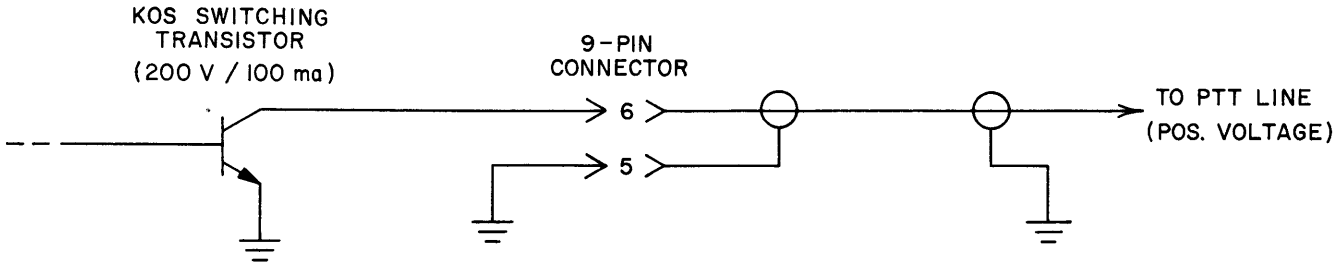
Although shielded cable is not *essential* when connecting to the input/output connector, its use certainly further reduces any possibility of problems from RF into or out of the DS2000 terminal.

d. Morse Input Connections:
Refer to Appendix B for correct cable connections for Morse Audio Input.

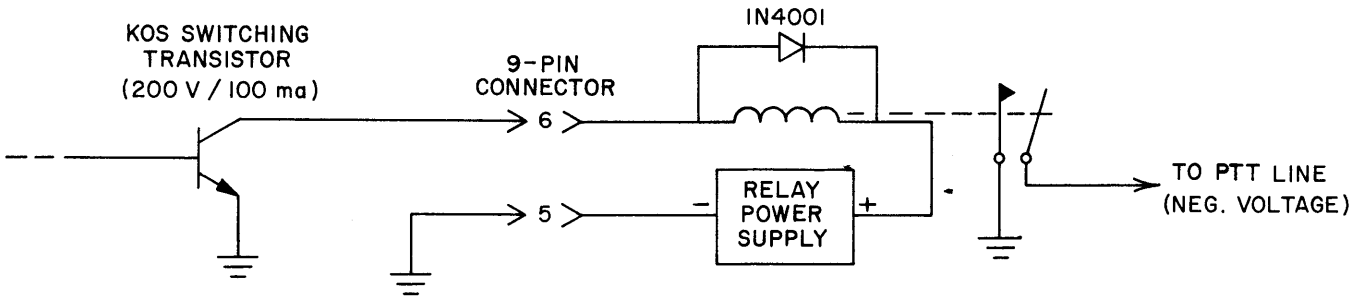
A typical RTTY/Morse interconnection of the DS2000, ST5000, ESM-914, and a HF Transceiver is shown in Figure 9 and 10.

3.4 Using a Television Set as a Monitor

Most standard American television sets can be easily modified to serve as video monitors. The change does not affect normal operation of the set except that the cable should be removed from the TV set for normal viewing. The 24



CONNECTION KOS CIRCUIT (POSITIVE VOLTAGE)



CONNECTION TO KOS CIRCUIT (NEGATIVE VOLTAGE)

Figure 8. KOS Circuit Connections

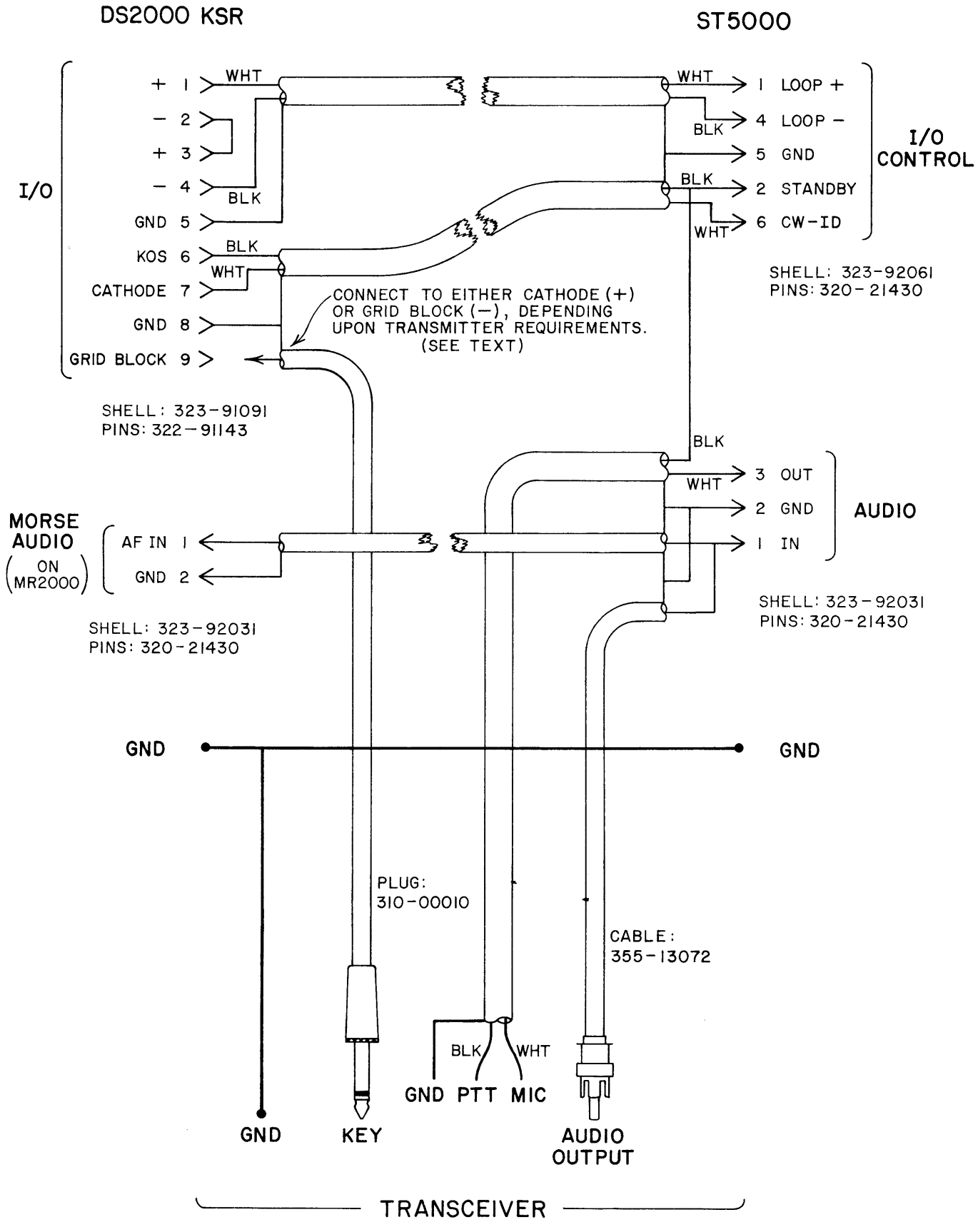


Figure 9. DS2000 and ST5000 System Connection Schematic

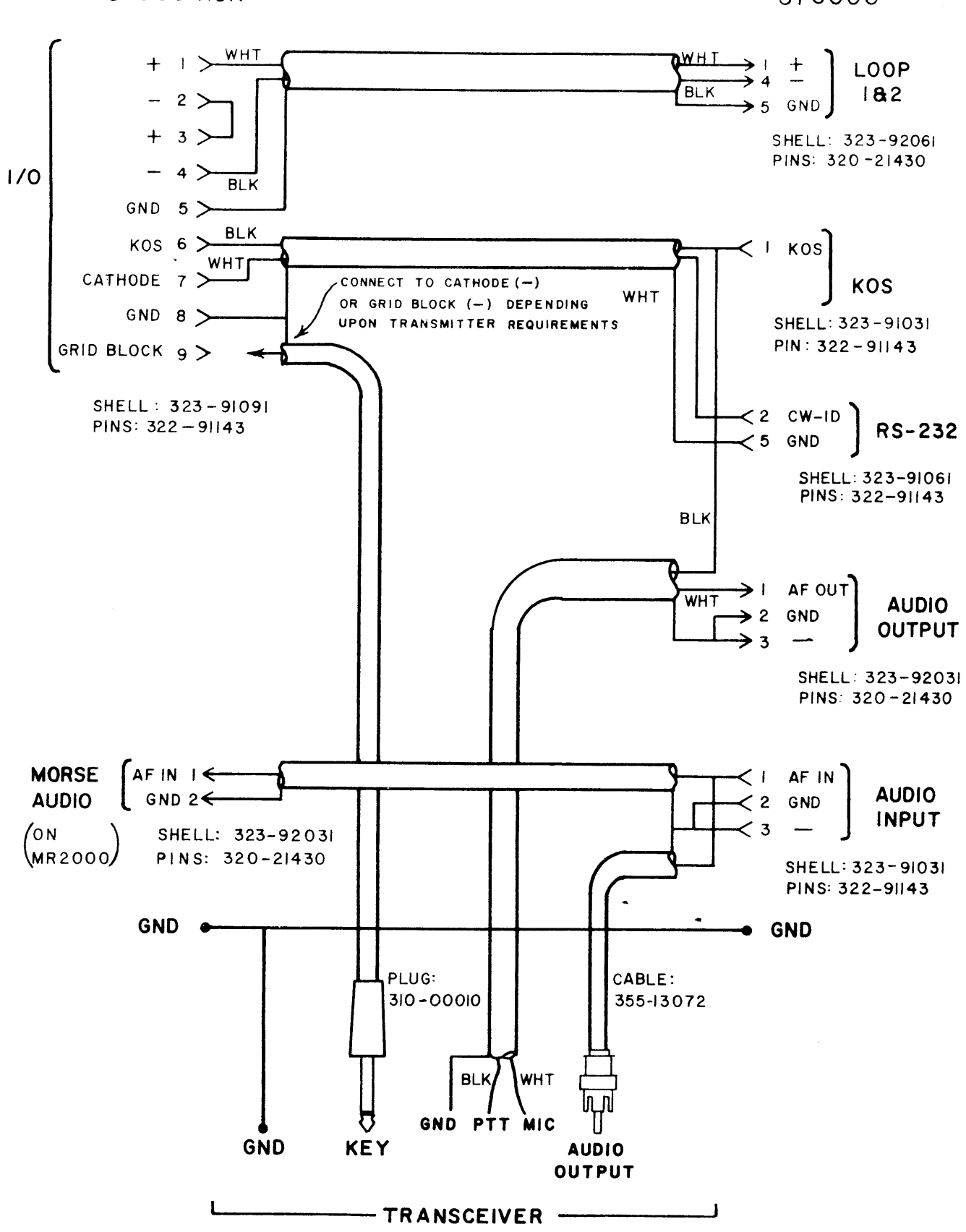


Figure 9a DS2000 and ST6000 System Connection Schematic

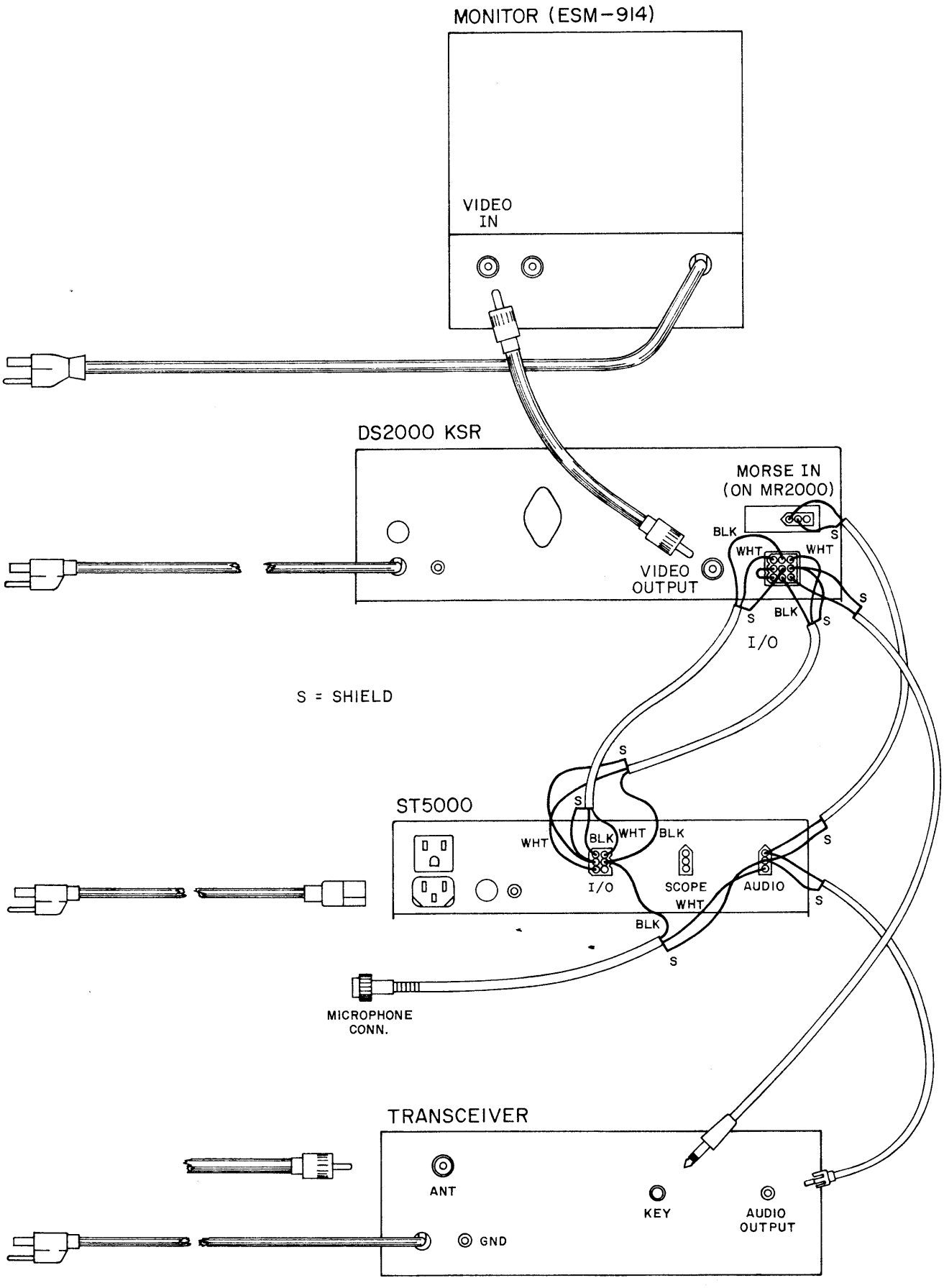


Figure 10. DS2000 and ST5000 System Connection Pictorial

line by 72 characters per line display of the DS2000 may require some adjustment of the TV set even after the video input is installed. A typical characteristic of particularly low cost TV sets is that the deflection circuits are purposely designed to over-scan the face of the tube. This does not greatly affect the appearance of a television program but may cause loss of several characters along both right and left hand sides of the character display. Therefore, it is usually necessary to reduce both the horizontal and vertical size of the TV scan. Some sets have these adjustments, other sets may require consultation with your local television repair man on the best technique to be used with a particular set. Another common problem of low-cost television sets is corner distortion of the image. Again, this may not noticeably affect the television program viewing but can make characters in the corners illegible. In any case, the higher the quality of your television set, the better the character display will be.

CAUTION: Do not attempt to use as a monitor any television receiver in which one side of the AC line is connected to the chassis or circuit ground unless you supply AC power to the set from a reliable isolation transformer.

The modification is simply a matter of capacitively coupling the external video signal to the input of the first video amplifier stage. Figure 11a shows a typical transistorized video circuit. Although the component values and the biasing method may be slightly different in your set, the circuit will be essentially as shown. The video signal is injected at point A.

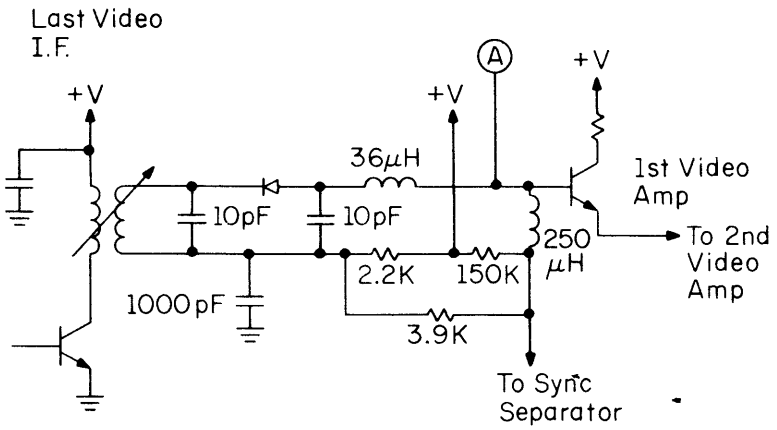


Figure 11a Typical Transistor Video Detector

The modified circuit is shown in Figure 11b. Connect the negative end of a 100 ufd, 16 volt electrolytic capacitor to the base of the first video amplifier transistor. Mount a BNC connector on the cabinet as close as possible to the transistor. Using a short length of hookup wire, connect the center pin of the BNC connector to the positive end of the capacitor. If the distance is short, the capacitor leads themselves may take the place of the hookup wire. On the other hand, if the distance is greater than six inches, substitute a length of coaxial cable. Miniature coax, such as RG-174/U, may be used even though its characteristic impedance is 50 ohms.

Figure 11c shows a typical video circuit using tubes. The external video signal is injected at point A. Connect the negative end of a 10 ufd, 100 volt electrolytic capacitor to the detector side of the existing coupling capacitor, as shown in Figure 11d. Note that a 75 ohm resistor is wired across the input connector to provide the proper load impedance for the DS2000 output.

Some tube-type sets may require a video level of 3 volts peak-to-peak to provide good contrast. In that case a two-stage video amplifier, such as that shown in Figure 11e may be inserted in the line from visual display system to the television set.

In some sets the video at the coupling point may have reverse polarity, with positive-going synchronization pulses and negative video information. This situation will often be found in transistorized sets which use a negative power supply and PNP transistors. The unity-gain phase inverter shown in Figure 11f may be inserted in the line from the DS2000 to reverse the video signal polarity.

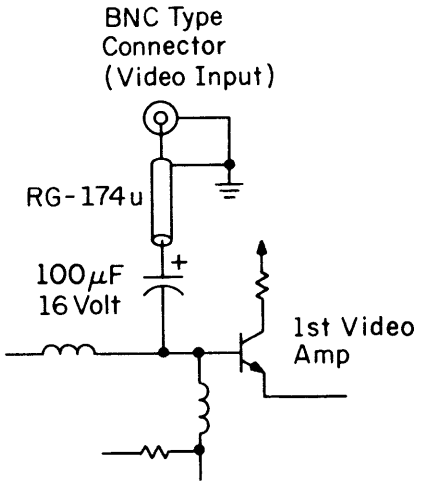


Figure 11b Modified Transistor Video Detector

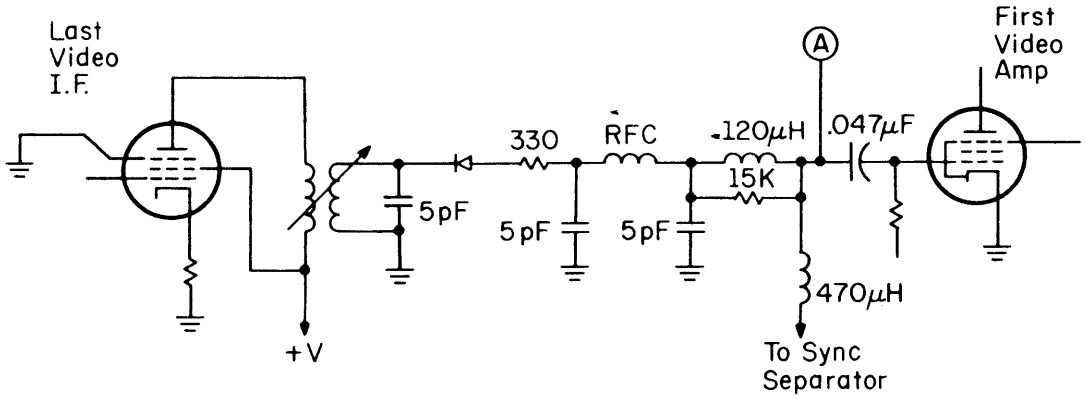


Figure 11c Typical Tube-type Video Detector

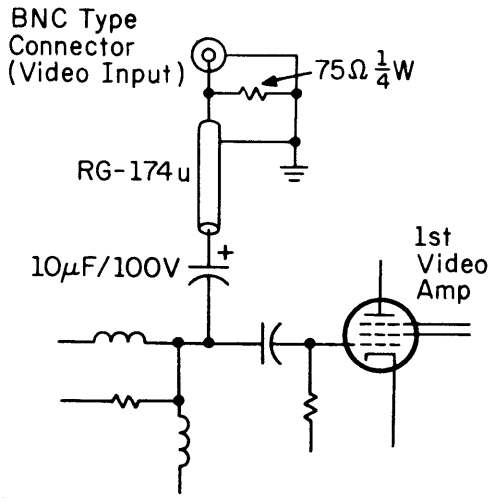


Figure 11d Modified Tube-type Video Detector

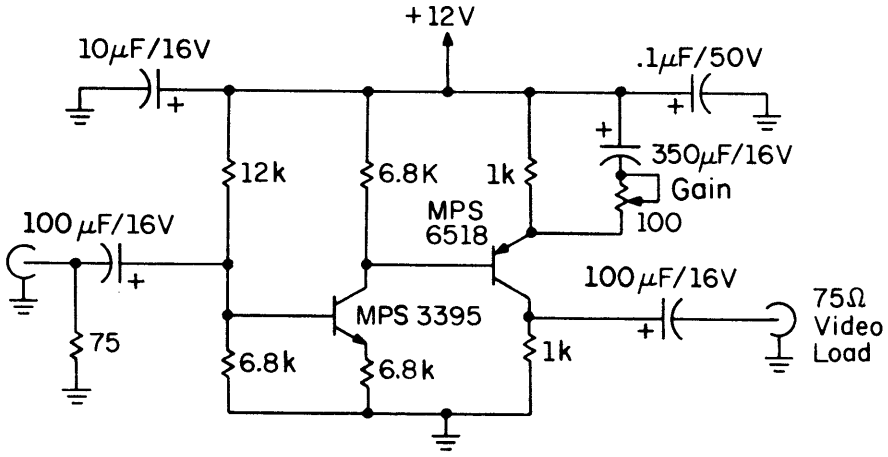


Figure 11e Video Amplifier

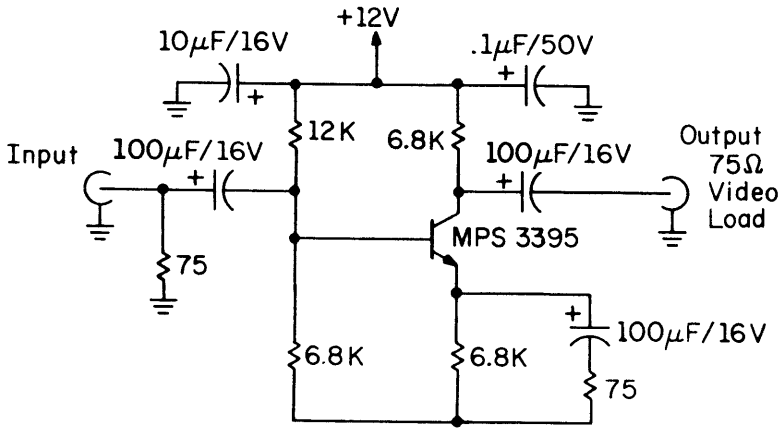


Figure 11f Video Inverter

3.5 Power Line Voltage and Frequency Changes

Voltage

The DS2000 KSR can be connected for operation from either 95 to 125 VAC or 190 to 250 VAC power lines. In addition, provision is included to compensate for lower than the normal 120/240 VAC U.S. standard power voltage.

Power transformer primary winding taps must be changed to accomodate the various power line voltage possibilities. Refer to Figure 12 for the following discussion.

110 to 125 VAC

The DS2000 KSR is normally factory-wired for this connection unless the unit specifically ordered otherwise. Any other power connection will be indicated by a tag on the rear panel. If it is desired to convert a unit previously wired for another voltage range, follow the wiring diagram in Figure 12a.

95 to 110 VAC

If the power line voltage available is CONSISTENTLY lower than 110 volts, the transformer may be re-wired as shown in Figure 12b. If however, line voltage problems are caused by poor line regulation that allows greater than a 15 volt change in the line voltage, the user should either contact his power company to correct the regulation problem or install a constant-voltage regulating transformer. The terminal could be damaged if the low-voltage taps are used and the line voltage at some point in time is high.

220 to 250 VAC

This connection is normally supplied for export use when so requested by the customer. If this connection has been factory installed, it will be indicated on a tag on the rear panel. If it is desired to change a unit previously connected for 110 to 125 VAC operation, follow the instructions of Figure 12c. The primary jumper wires (Jumpers "A" and "B") are purposely long enough to allow conversion that involves removal of Jumper "B" and moving only ONE end of Jumper "A".

190 to 220 VAC

If the power line voltage is CONSISTENTLY lower than 220 volts, the connection shown in Figure 12d should be used. The same precautions discussed with regard to voltage regulation above also apply to this connection. Poor line voltage regulation may not result in satisfactory terminal operation.

****

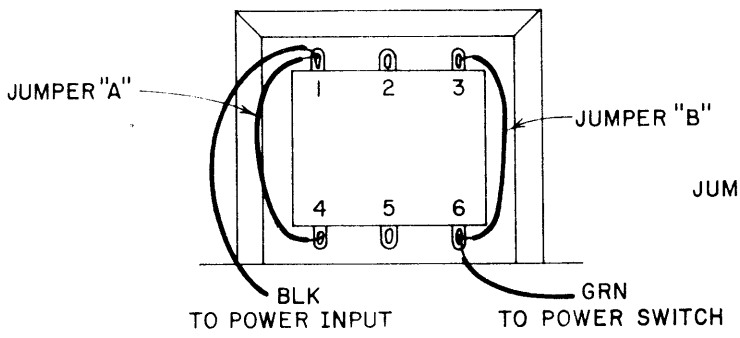
CAUTION: DO NOT MAKE ANY CHANGES IN POWER CONNECTIONS UNTIL THE TERMINAL HAS BEEN DISCONNECTED FROM THE POWER LINE AND OTHER EQUIPMENT.

****

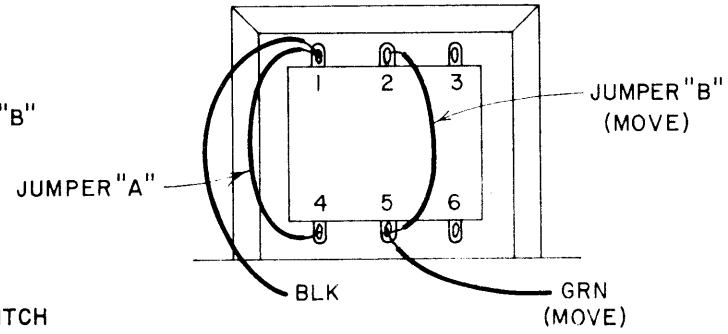
Power Frequency Changes

The power supply sections of the DS2000 work equally well for power line frequencies of 50 or 60 Hz. However, a jumper change on the circuit board is required to optimize a DS2000 for either 50 Hz or 60 Hz operation. Therefore, it is strongly advised that applications requiring 50 Hz power line operation be noted *when the equipment is ordered* so that the proper changes can be made *at the factory*. A terminal set for the incorrect line frequency may have noticeable screen "jitter".

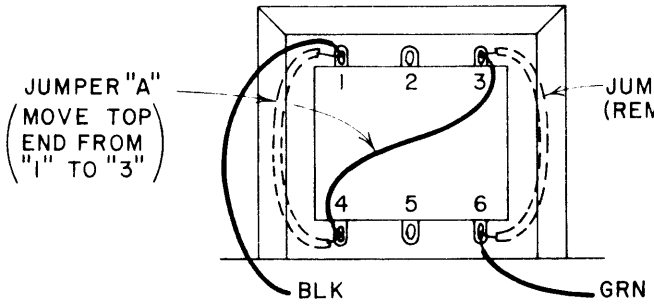
Unless otherwise specified, the DS2000 is set at the factory for operation with 60 Hz power lines. To change to operate with a 50 Hz power source, it is necessary to insert a wire jumper on the DS2000 circuit board at location "B". Jumper location "B" is at the upper left-hand corner of the board when viewed from the IC side of the board (keytops on reverse side). It is marked with a "B" on the board and is immediately above the 10920 kHz crystal. This is the only change required to operate with 50 Hz power lines.



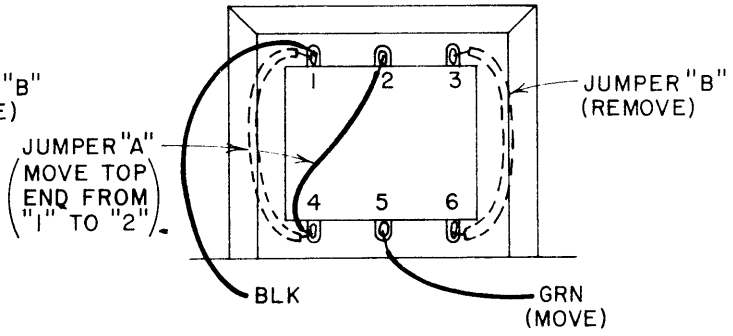
(a) 110 - 125 VAC Connection (Standard)



(b) 95 - 110 VAC Connection



(c) 220 - 250 VAC Connection



(d) 190 - 220 VAC Connection

Figure 12. Power Transformer Voltage Tap Connections

4. In Case of Difficulty

4.1 Care and Feeding of Your DS2000 KSR

Your DS2000 KSR is the latest of five generations of terminal design and manufacture by HAL Communications. In every way, it has been designed, constructed, and tested to assure years of trouble-free operation. However, there are a number of simple procedures that you, the user, can follow that will further improve the reliability, performance, and lifetime of the terminal. The following suggestions are offered to help preserve a long operating life for your DS2000 KSR.

1. Environment:

   Electronic equipment is very susceptible to variations in temperature, relative humidity, and to dust and dirt accumulations. The DS2000 will operate in normal room temperature environments and should be as tolerant of temperature extremes as is its human operator. However, inadvertent blockage of the ventilating holes on the bottom or rear panel surfaces will cause the *internal* temperature of the terminal to rise considerably above the ambient room temperature and may in fact cause a circuit failure. Also, accumulations of dust and dirt, particularly when accompanied by high humidity conditions can also cause over-heating and may result in long-term corrosion of the internal circuitry. Therefore, try to locate the terminal so that its ventilating holes are not obstructed and try to avoid extremely dusty or dirty environments.

   In the normal course of operations, the terminal and its display in particular may eventually attract a build-up of dust or smoke "haze". This may be expected in even the cleanest areas, particularly if tobacco smoking is permitted. The display screen, because of the air flow around it and the high voltage applied to the crt actually attracts particulate contaminants, causing what may appear to be a gradual fading of screen intensity. Therefore, cleaning of both any plastic covers and the face of the crt itself should be done often. *Be careful when cleaning plastic cover - it will scratch easily.* The cleaning materials available for phonograph records are excellent for plastic cleaning but may lack in cleaning strength if too much dirt has accumulated.

2. Electrical Connection:

   All electrical connection points of the DS2000 KSR have maximum voltage and current ratings as given in these manuals. If these maximums are exceeded for even a short period of time, considerable damage to the terminal may result. Therefore, be very careful to know the ratings of the DS2000 and the characteristics of the interfacing equipment before connecting the two. Some common causes of electrical failures have been found to be:

   a. Inadequate grounding, causing RF interference problems as well as sensitivity to ac power line transients.
   b. Incorrect connection of the high voltage loop supply causing destruction of the feature to which it was incorrectly connected.
   c. Inadvertent use of more than one loop supply causing a very high loop voltage or current, destroying the loop switching transistor.

d. Damage due to lightning or other transients on the power line or station antenna system. Obviously a good lightning protection system may help as will disconnecting the terminal from the power line and/or other equipment during electrical storms. However, such things are unpredictable and the DS2000 is no more susceptible to such problems than other equipment in the station; protective measures taken for other equipment are probably also wisely applied to the DS2000.

4.2 Typical Operational Problems:

Because a large number of features are offered in the DS2000 KSR, it is by nature a complicated device. Therefore, there may be times when it first appears that the terminal has either quit completely or has "gone off to do its own thing." If some of the circuitry has failed, you may well get these symptoms; however, more likely the terminal is doing what we instructed and we've forgotten what the response is. As you become familiar with the DS2000 such "operator errors" will be resolved.

The status line can be the best key to what is happening to the DS2000 at a given time. If the DS2000 does appear to be in unexplainable mode, call the status line to the display with CTRL-6 (STATUS).

Often, mistyping one key for another may cause an entirely different result from that intended. Some of the more confusing conditions you may encounter are:

1. Forgetting to terminate the programming of a HERE IS segment. Normally, when you finish typing the desired HERE IS message text, you should terminate the programming with a SHIFT-CTRL-HERE IS operation. Failure to SHIFT- or CTRL- just means that text continues to be stored in the HERE IS buffer *until the 32nd character is typed:* the programming is *automatically terminated* when the HERE IS buffer is filled. If, after over-flowing the HERE IS buffer storage, you type another SHIFT-CTRL-HERE IS operation, the HERE IS programming will now be re-opened, *erasing the previous program text.* This can be particulary confusing if exactly 32 characters are written into a HERE IS storage. A clue to the terminal's state is contained in the flashing underline cursor: during programming, the underline cursor is NOT on the screen; rather, an "x" is placed in the HERE IS programming area to indicate keyboard position in the HERE IS program. Some experimentation will familiarize you with the use of these clues.

2. When *separate* LF or CR characters are to be transmitted in Baudot or when RETURN is programmed into the HERE IS messages, their presence is shown on the screen by the equivalent letter associated with the key as explained in section 2.2. The operation, rather than the representative letter is actually transmitted by the DS2000. (RETURN is represented by "M" in the HERE IS message).

3. When SYNC IDLE is used and KOS controls the transmit-receive circuitry, the synchronous idle feature will keep the KOS and the DS2000 in a continuous transmit condition (output sync characters) until a new line is keyed with the RETURN key *if no characters are typed on the new line.* Therefore, when using SYNC IDLE, you must end each transmission with RETURN as the last character typed.

4. The transmit control of the DS2000 cycles between TX ON - TX OFF - TX HID - TX OFF - TX ON, etc. You may lose track of which TX OFF position you have in the cycle and select TX HID when you expected TX ON condition. Always check the status line when changing the terminal transmit state.

5. The "bail-out" keys are:

CTRL-7 (XMIT): Will stop transmission of text.
CTRL-6 (STATUS): Displays terminal status on top line.
SHIFT-CTRL-6 (STATUS): Clears display of all text except status on top line.
SHIFT-CTRL-2 (MORSE): Resets Morse receive decoding.
Power Switch: START OVER! (full panic!)

4.3 Repair Procedures:

In the event that your DS2000 KSR develops a malfunction, the first step is to carefully note *all* of the symptoms of the problem. Statements such as "BROKE" or "DON'T WORK" are of little help to the service technician and usually lead to longer repair times than might be otherwise required. Try to provide as much information concerning the failure as you can when you contact the factory. The following are some of the things we will be concerned with at the factory:

1. Model Number
2. Serial Number
3. How long have you owned it?
4. Does the problem happen immediately or only after the terminal is turned on for a while? If so, how long?
5. What terminal modes, rates, codes, etc conditions are associated with the failure? Does it happen only in receive, transmit or both?
6. Are there extenuating circumstances? (Lightning storm, spilled something on keyboard, dropped unit?)
7. Is the problem confined to either the display or keyboard sections (if you can tell).
8. Add *anything* else to the description you think would be helpful.

After you have determined answers to the above, write or phone the factory (or your export dealer) and we will see to a prompt repair of the terminal. The people you talk to at the factory will try to come up with a solution that minimizes the "down-time" to get your terminal working again as soon as possible. Under some circumstances, it may be possible to isolate the problem to one circuit board assembly and supply you with a replacement board; in other cases it may be necessary to have the entire terminal returned for repair. In any case, we both want to have the terminal fixed and returned to service as soon as possible.

Because of the complexity of the circuitry used in the DS2000, we do *not* recommend that you personally undertake repairs beyond the substitution of boards or sub-assemblies following factory instructions.

The one year limited warranty (listed in full at the back of this manual) provides for factory repair of the DS2000 for a full year after purchase. Please read this warranty carefully to determine the full extent of the privileges and limitations. Note especially, that we do ask you to pay shipping charges to us and we then pay the return charges to you. HAL Communications highly recommends

that shipping be made via UPS whenever possible; be sure to insure for the full value of any returned materials.

To avoid confusion and delays please *DO NOT RETURN MATERIALS TO THE FACTORY WITHOUT PRIOR COMMUNICATIONS WITH AND APPROVAL OF HAL PERSONNEL.* Usually, HAL will send you a written Factory Return Authorization to be included with the equipment. In no case should you send a piece of equipment back without including in the box with the equipment documentation to identify you, the owner with a specific piece of equipment (serial number and model) and at least a reference as to the nature of the problem and the name of the HAL employee you talked with.

The factory address for shipping of repairs is:

HAL COMMUNICATIONS CORP.
807 E. GREEN STREET
URBANA, ILLINOIS 61801

5. SPECIFICATIONS

Input/Output:

Baudot:	18-120 ma, 200 vdc (max.) current loop
ASCII:	18-120 ma, 200 vdc (max.) current loop
Morse:	Transmit = transistor switches to ground to key either negative voltage ("grid-block"), or positive voltage ("cathode") circuits.
	Receive = (with optional Morse receive board) 0.5 v nominal, 10v maximum p-p (600 ohm), 800 Hz audio input.

Data Rates:

Baudot:	45, 50, 57, 74, 100 baud (60, 66, 75, 100, 132 wpm).
ASCII:	110, 300 baud (10, 30 characters per second)
Morse:	Transmit = settable to within 1 wpm, 1 to 175 wpm. Receive = automatically track 1 to 175 wpm (with optional Morse receive board).

Data Codes:

Baudot:	7.5 Unit code (1 start, 5 data, 1.5 stop) A-Z, Ø-9, -?:$!&#'().,BELL;/"LTRS FIGS CR LF space blank; Automatic FIGS/LTRS and CR/LF inserted as required.
ASCII:	110 baud, 11 unit code (1 start, 8 data, 2 stop) 300 baud, 10 unit code (1 start, 8 data, 1 stop) A-Z (upper case only), Ø-9, !"#$%&'()*+,-./:;<>=?@[]^_\, NUL SOH STX ETX EOT ENQ ACK BEL BS HT LF VT FF CR SO SI DLE DC1 DC2 DC3 DC4 NAK SYN ETB CAN EM SUB ESC FS GS RS US RUB OUT.
Morse:	Continental Morse Code: A-Z, Ø-9, .,?:;-'/()" AR AS BT ES KN SK.

Transmit Mode:

WORD:	Text is transmitted one word at a time. The word is transmitted when the first character of the following word is typed or after a RETURN at the end of a line.
Editing:	Two cursors on the display show relative position of transmitted signal from DS2000 (or received signal when receiving) and position of keyboard entry. Keyboard cursor may be re-positioned for error correction to any place on the current line that has not yet been transmitted.
Hidden:	Up to 255 characters may be pre-typed into hidden buffer WHILE RECEIVING. After reception is completed, entire pre-typed text is called to screen for EDITING before it is transmitted.

Video Output:

Format:	72 characters per line, 24 lines total. 5 x 7 dot matrix pattern.
Electrical:	75 ohm, 1.0 volt p-p, compatible with EIA RS-170 standards; peak video bandwidth = 6.1 MHz; UHF, SO-239 type connector.

Programmable Features:

HERE IS:	Two separate and programmable HERE IS messages with up to 32 characters per message.
IDENT:	Sends contents of HERE IS-1 in Morse code, regardless of code terminal may be using.

Deluxe Features:

USOS:	On Baudot reception, reverts to LTRS case after reception of each SPACE character.
SYNC:	Synchronous idle to assist other station's reception. Fills time between characters with LTRS (11111) in Baudot, NUL (ØØØØØØØØ) in ASCII, and BT (-···-) in Morse.
KOS:	Keyboard Operated Switch to control the transmit-receive circuitry of a radio station.
Status Line:	The Current terminal operating parameters can be displayed at any time on the top line of the display.
Keyboard:	Standard 52 key ASCII arrangement with SHIFT and CTRL; terminal controls are made with CTRL key plus one of top row of keys - all control features are clearly labeled.
Test Messages:	The standard QBF test message (THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG'S BACK Ø123456789) or alternate code patterns (RYRY ... in Baudot, U*U* ... in ASCII).
Side Tone:	Approximately 800 Hz tone with internal speaker.

Mechanical Data:

Size:	14.1" W x 9.25" D x 4.35" H; 6 lbs net, 10 lbs shipping (35.8 x 23.5 x 11.1 cm; 2.73 kg net, 4.55 kg shipping)
Colors:	Textured blue bottom, beige top
Power:	105-130 vac 50/60 Hz; 210-250 vac 50/60 Hz; 20 watts

Options:

Display

Monitor:	ESM-914 Recommended; 9" diagonal measure screen
Morse Receive:	MR2000 Morse receive option circuit board. Plugs into socket on main circuit board of DS2000. Has audio filter, detection, and processing circuitry to allow reception of Morse code audio (800 Hz tones). Audio input connections and a center frequency adjust control are accessible from rear of DS2000 cabinet after installation. A new set of ROM devices are included with the option.

HAL COMMUNICATIONS CORP.
P.O. BOX 365
URBANA, IL 61801

LIMITED WARRANTY

HAL Communications Corp. of Urbana, Illinois, hereby warrants to the original purchaser only that any new equipment manufactured by HAL Communications Corp. shall be free from defects in materials and workmanship for a period of one year from the date of original purchase. In the case of parts kits, this warranty applies only to materials and not to workmanship in kit assembly.

In the event of a defect in materials or workmanship during the warranty period, HAL Communications Corp. will, at its own expense, repair the defective unit and replace any defective parts. Costs of shipping the unit to HAL Communications Corp. shall be paid by the purchaser, as well as costs of removal and reinstallation of the unit. HAL Communications Corp. will bear the shipping costs incurred in returning the unit to the purchaser.

To obtain service under this warranty, the original purchaser should do the following:

1. Notify, as soon as possible, the Customer Service Department at HAL Communications Corp., Urbana, Illinois, either in writing or by telephone, of the existence of a possible defect;
2. At the time of notification, identify the model or serial number, the approximate date of purchase, the place of purchase, and the possible defect;
3. Hold the unit until a written return authorization is received.
4. Return the unit, freight prepaid, upon the receipt of the written return authorization.

Correct installation, use, maintenance, and repair are essential for proper performance of this product. The purchaser should carefully read the technical manual.

This warranty does not apply to any defect which HAL Communications Corp. determines is due to any of the following:

1. Improper maintenance or repair, including the installation of parts or accessories that do not conform to the quality and specifications of the original parts;
2. Misuse, abuse, neglect, improper installation, or improper operation (including operation without a proper safety ground connection);
3. Accidental or intentional damage.

All implied warranties, if any, are limited in duration to a period of one year from the date of original purchase. Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.

HAL Communications Corp. disclaims any liability for incidental or consequential damages arising out of the use of, or inability to use, this product. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

APPENDIX A -- MR2000 INSTALLATION INSTRUCTIONS

To install your MR2000 Morse receive board in the DS2000 KSR, first turn on the KSR and note the version of software indicated in the status line at the top of the video screen. Newer units will indicate "DS2000 V2.X" and older KSRs will read "DS2000 V1.1." If your KSR indicates the latter, you will need to change four read-only memory (ROM) integrated circuits inside the KSR. If the video screen indicates the more recent V2.X software already being installed, then no ROM changes will be necessary.

Next, turn off the KSR and unplug the LINE cord from the ac outlet. Now remove the top cover of the cabinet by unscrewing the four retaining phillips-head screws located on the sides of the DS2000 (two screws on each side). If these screws are fitted with internal-star type grounding lockwashers, make sure that these are removed and put aside for reinstallation after the MR2000 has been installed.

Place the DS2000 on the work surface in front of you so that the rear panel is away from you. The top cover, containing the keyboard, can be lifted off to one side and placed on one edge. This should be done so that none of the connecting cables are strained. If you have difficulties, disconnect the mating Molex connectors between the keyboard and the KSR cabinet bottom.

Note the four small mounting holes on the rear panel of the DS2000, and the larger connector-clearance hole located between the two on the left. Remove the mounting hardware from the MR2000 board and hold the board up against the rear panel so that the three-pin Molex connector lines up with the rear-panel clearance hole. Check to see that the four holes in the MR2000 board line up with their corresponding holes in the KSR rear panel. Then mount the MR2000 board to the rear panel using the mounting hardware included with the board. (See Fig. 1.) The phillips-head screws should be pushed through the holes in the cabinet from the back side. Then the grounding washers should be installed, followed by the metal spacing tubes. The MR2000 board should be fitted into position next, and secured with the four lock-washer nuts provided.

Check to ensure that all four sets of mounting hardware are tightened securely. Then connect the power cable from the MR2000 to the mating connector (six-pin Molex) inside the bottom section of the DS2000. The multi-conductor ribbon cable with the 16-pin DIP header on the end should be inserted into the mating DIP socket located on the DS2000 keyboard. OBSERVE PROPER ORIENTATION! (See Fig. 2). Note that both the header and the mating socket have one beveled corner. These should be matched up, and the pins aligned with the socket before the header is pressed into place. DO NOT use excessive force when connecting the header and socket.

Finally, change the four ROMs, if necessary (indicated in paragraph one). To change the memory chips, place the blade of a small screwdriver or a pocket knife under one end of a ROM, and twist gently to unseat the pins. A back-and-forth twisting motion should unseat the pins on both sides. Then carefully lift the ROM out of the socket and replace with the NEW ROM that has the same memory number on its label (Ø, 1, 2, or 3). When inserting each new ROM, be sure to align the device pins with the socket holes before pressing down. Also, ensure that the pin-one end of the device (the end with the small notch) is facing toward the edge of the DS2000 board. Replace each of the four ROMs, making sure that V1.1 software is removed and V2.1 software is installed (See Fig. 3).

BE SURE TO SAVE THE OLD V1.1 SOFTWARE AND RETURN IT TO THE FACTORY TO OBTAIN PROPER CREDIT. Please slide ICs into plastic tube, insert in envelope provided, and send to HAL Communications Corp., Box 280, Urbana, IL 61801.

Reconnect any disconnected cable ends, then replace the cabinet top cover, and fasten with screws and grounding washers.

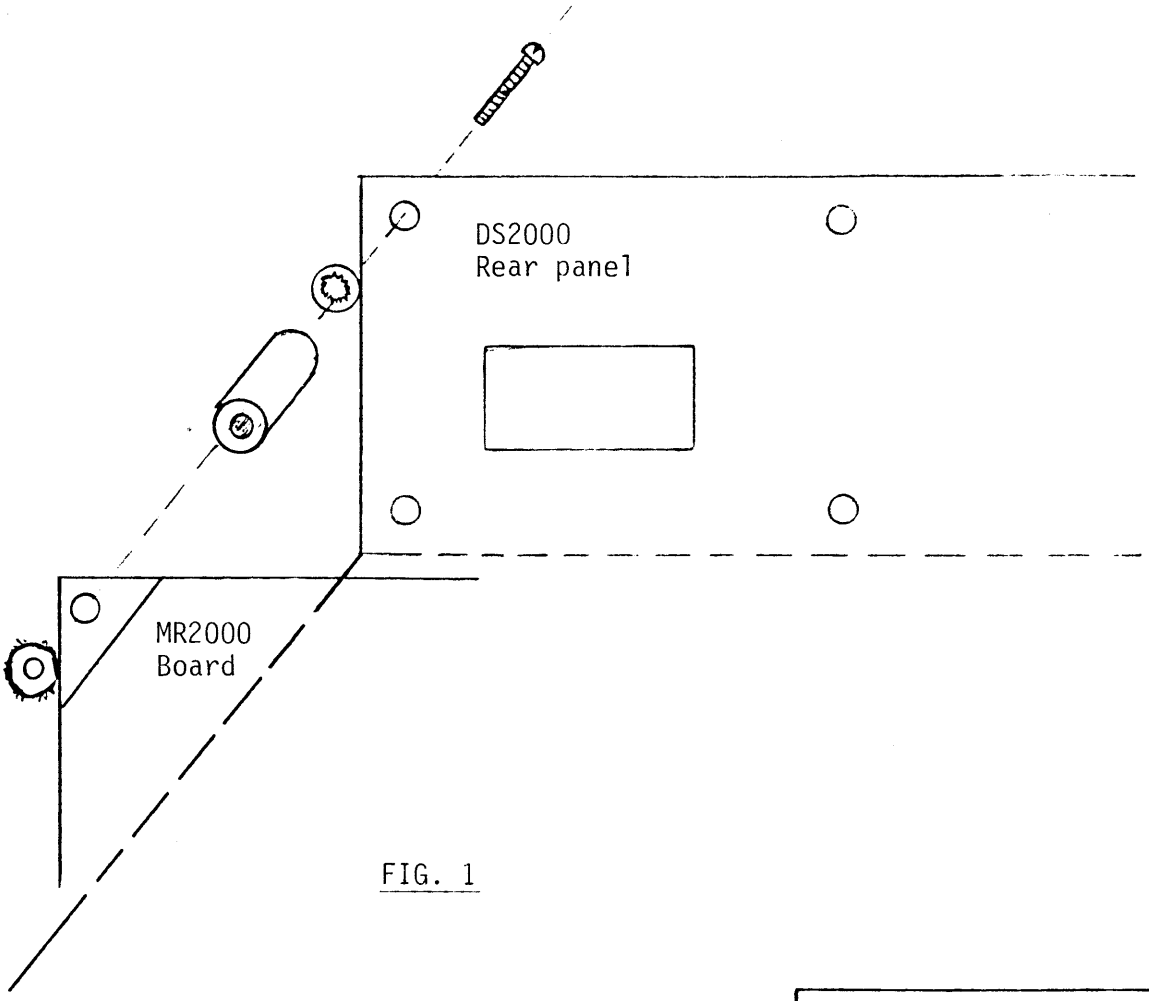


FIG. 1

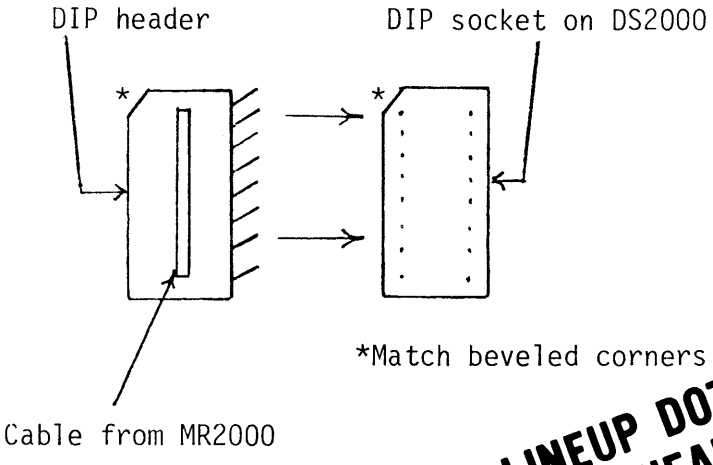


FIG. 2

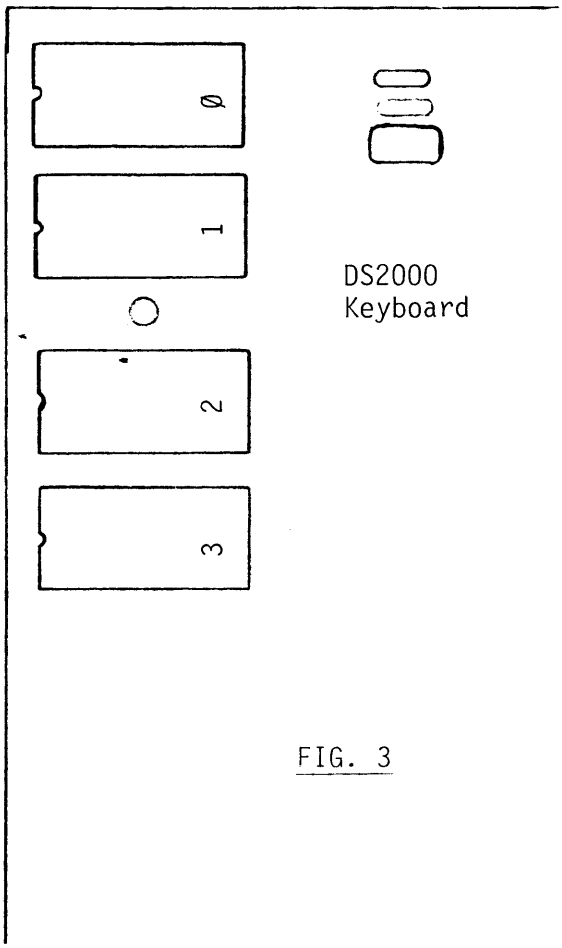
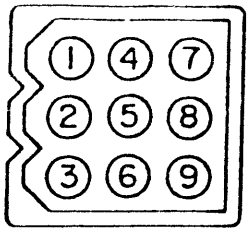


FIG. 3

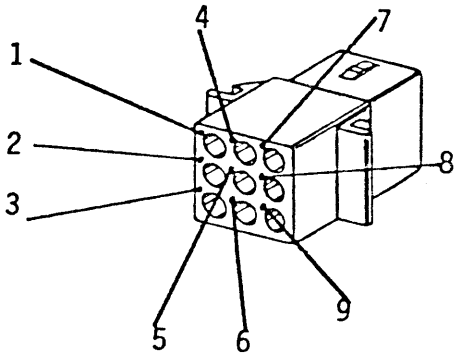
LINEUP DOT ON DIP HEADER WITH DOT ON DIP SOCKET.

I/O CONNECTOR WIRING

Female I/O connector, as seen from the back of the DS2000. Note that pin numbers are as shown ONLY when connector is oriented with keyed side on left, as shown here.



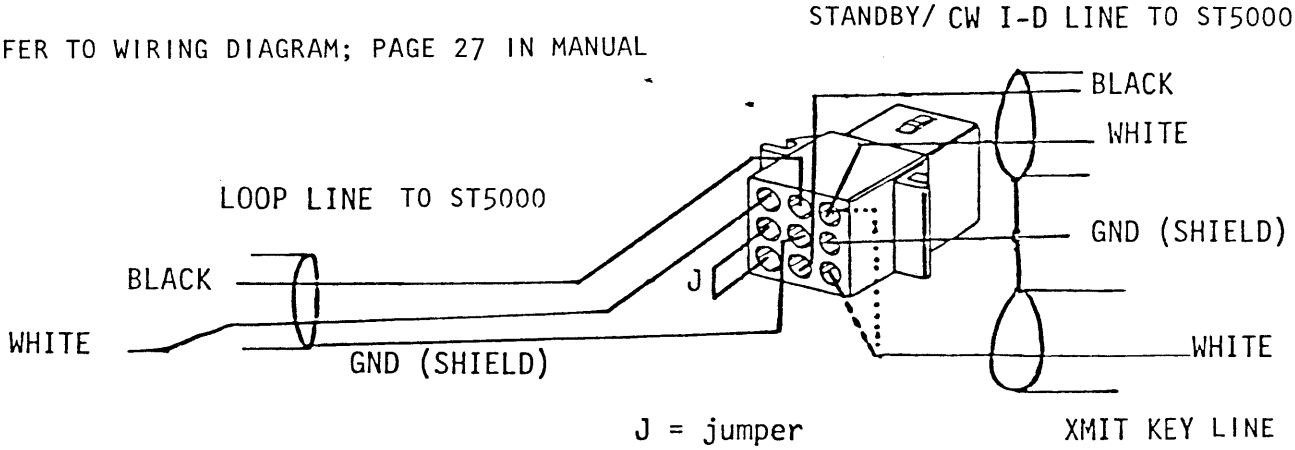
Shown here is the male Molex connector that mates with the female connector on the rear apron of the DS2000. In this view, the connector is shown from the rear. In the spots indicated, there are pin-number designations molded in the plastic. Note that these numbers are as shown ONLY when connector is oriented with the keyed side (side with small "V-shaped" grooves) on the left. When the connector os in this position, the pin numbers should be right-side up, and easily readable. The number associated with each pin hole is located at approximately 11 o'clock in relation to the hole.



To wire connector:

1. Strip wires back approximately 1/8-inch.
2. Install FEMALE Molex pins on wires, as shown in manual (page 23).
3. Insert pins into Molex connector shell, taking care to ensure that the correct wires are installed in all pin holes. Check the completed connector against the diagram below.

REFER TO WIRING DIAGRAM; PAGE 27 IN MANUAL



KEYING CONN.
USE ONLY ONE: Dotted line to pin 7 = cathode-keying connection
Dashed line to pin 9 = grid-block keying connection