DS-3000 KSR

VIDEO DISPLAY

TERMINAL

HAL DS-3000 KSR VIDEO DISPLAY TERMINAL

TECHNICAL MANUAL

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WARRANTY

The HAL Communications DS-3000 KSR Video Display Terminal is fully warranteed against defects in materials and workmanship for a period of one year. Should repair or replacement parts be required, notify HAL Communications Corporation promptly. Please do not return your unit to the factory for repair or adjustment until you have received a written return authorization.

HAL Communications assumes no responsibility for the repair or replacement of parts for units which have been damaged, abused, improperly installed, or modified and reserves the right to change the design of this equipment without incurring obligation to incorporate such changes into existing units. Operation of this equipment without a proper safety ground connection (as described in this manual) will invalidate this warranty. This warranty is not transferable.

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November, 1977 Printing

Illustrations

Addendum to DS-3000 KSR Manual
June 16, 1978

MORSE ONLY OPERATION OF THE DS-3000 V3.2 KSR

The following list of operating procedures is offered to clarify some of the details of CW operation with the HAL DS-3000 V3.2 KSR Terminal. This list should provide adequate information to both receive and transmit Morse code with the terminal, but a thorough study of the manual will reveal still more features available on the DS-3000 KSR V3.

1. Hook-up the cables between the DS-3000 KSR, ST-6000, and transceiver.
2. Set the front panel switches of the DS-3000 to:

   SYNCH IDLE = OFF
   UNSHIFT ON SPACE = OFF
   MODE = CONT
   MODE = BAUDOT (note this!)
3. Turn on the power to the DS-3000 KSR and the transceiver. At this point, leave the ST-6000 power OFF.
4. After the screen warms up, the screen should display:

   "BAUD = 45"
5. Change the right-hand mode switch to MORSE and depress and release the RETURN key. The message on the screen should change to:

   "WPM = ØØØ __"
6. Type one, two, or three numbers that represent your desired transmit Morse code speed in wpm (1 to 199 wpm). BE SURE YOU DO NOT LEAVE THE SPEED SET AT ZERO. For example, entering "25" will set the transmit speed to exactly 25 wpm. This setting in no way affects the receive speed - the DS-3000 KSR automatically adjusts to the speed of the station you are receiving.
7. After typing the transmit speed, depress and release the RETURN key. The speed message will disappear and the screen will be blank, ready to receive signals.

   (A modified form of this procedure can be used at any time to change the transmit Morse code speed - see step 17.)
8. Set the transceiver to CW mode (either SSB mode could also be used for reception only) and peak the receiver as you would normally do on either noise or received signals. Now, tune the receiver to a section of the band where there are FEW signals (but do NOT disconnect the antenna!).

9. With ONLY noise being received by the transceiver, adjust the THRESHOLD control on the DS-3000 KSR front panel, rotating in a clockwise direction until the CW DETECT light starts to flash with the noise. Now, decrease the THRESHOLD control counter clockwise until the light just stops flashing with the noise. This adjustment should hold for all operation on this particular band. The exact setting may change as you change bands due to changing noise conditions, but the proper control position will always be fairly close to this position. Also, the correct setting may change somewhat with filter bandwidth or when another receiver is connected. (Most transceivers do select a narrower bandwidth filter in the CW position than in the SSB position, possibly requiring different THRESHOLD control settings.) Important points to remember are: (1) the light should flash infrequently on noise, but should flash with the CW signal (see next step), and (2) avoid the temptation to be frequently adjusting the THRESHOLD control - the proper setting will not change appreciably under normal conditions.

SPECIAL NOTE: The above references to the THRESHOLD control apply to Version 3.2 DS-3000 KSR terminals. The previous Version 3.1 model does NOT have a front panel threshold control. Rather, this control is circuit-board mounted and can accessed with a small screw driver through a vent-hole in the top left of the cabinet (row 3, hole 4 from the left) as indicated in the DS-3000 KSR manual, page 4-2. Since this adjustment should be required infrequently, this limited access may be adequate. However, should you desire to add the THRESHOLD control to your Version 3.1 terminal, HAL can supply the control, knob, wires, and instructions for modification. However, it is recommended that the control be mounted on the real panel due to clearance restrictions of the Version 3.1 cabinet front panel area.

10. Now, tune-in a CW station - look for a moderately strong signal that sounds like a good "fist" until you are experienced at tuning. (The W1AW code transmissions are excellent for getting familiar with Morse reception.

11. Proper receiver tuning is achieved when the CW DETECT light of the DS-3000 KSR flashes with the signal - light on when the sending key is closed (tone on) and off when the key is open (no tone). To minimize noise interference, quite narrow audio filters are used in the DS-3000 KSR, tuned to an 800 Hz center frequency. Optimum receiver tuning therefore occurs when the CW tone is close to 800 Hz.

12. When the receiver is properly tuned, the CW DETECT light should blink on and off with the CW signal. The DS-3000 will take from 2 to 10 characters to "lock" onto the received signal. Until the KSR starts "tracking" the signal, you may see E's, T's, or other incorrect characters on the screen (star - * - is also common). After the tracking starts, the screen will show the next-to-last received character, always displaying one character behind. The terminal retains the last character to use as a comparison of dot and dash lengths to determine the next character. If the received signal stops, as in a pause or the end of a transmission, the final character will be held for approximately five seconds and then displayed

13. AT ANY TIME, if it appears that the terminal is not responding to the received Morse code, even though the CW DETECT light is flashing correctly, reset the Morse decoder by depressing and holding the CTRL key while pressing the R key (release CTRL after releasing the R key). This reset should correct most "lock-up" problems of the decoder, particularlt those caused by reception of a continuous carrier which may be interpreted by the KSR as a very slow CW signal. (A severe power line transient may cause interruption of the internal computer of the DS-3000 that can only be corrected by turning the AC power off and then back on, as outlined in steps 2 - 7. This is an infrequent occurance, however and the CTRL - R will reset most "lock-up" situations.

14. You can listen to the signal and check the screen to determine how well the signal is being decoded. If a large number of errors are seen, it is probably caused by one of the following problems:

    a. The receiver is not correctly tuned - the CW DETECT light does not "follow" the CW signal.

    b. The signal is so weak that it fades into the noise, thus missing dots or dashes in a character. Our mind does a pretty good job of "filling-in-the-blanks", but the computer just displays what it hears.

    c. There are interfering signals very close in frequency to the desired one. This problem is minimized with the sharp filters in the DS-3000 KSR, but will still cause mis-prints if the frequencies are too close.

    d. There are very strong signals moderately close in frequency to the desired one. What usually happens here is that even though the frequency separation may be fairly wide, the strong signal tends to control the receiver AGC and therefore reduce the volume of the weaker, desired signal indirectly. Use of a good narrow bandwidth CW filter in the receiver helps this problem considerably. Sometimes, turning the AGC off and using a manual RF gain control may also help.

    e. The "fist" of the sending operator is bad. The computer is really quite tolerant of poorly sent CW, but there are some "swing-fists" that defie computer decoder. The only solution in this case is to select another signal and hope that the fellow buys a keyboard soon!

    f. Well sent dots and dashes, but sloppy letters. The computer displays what it "hears" - if you send four unstead of five dots for a five - an "H" will appear instead of a "5"; sending 6 dots will result in a star (*) on the screen, indicating reception of a non-valid Morse character. ALL non-valid characters (includes run-together letters) display as a star (*) on the screen.

15. To transmit CW, just start typing on the keyboard. The CW signal will key the transmitter directly as well as the internal side-tone oscillator of the DS-3000. Note that it is easy to "get-ahead" of the transmitted CW, particularly at low transmitting speeds. The DS-3000 is designed to allow you to get up to 255 characters ahead of the output, but this can be confusing since the code you hear from the side-tone is different from that for the letters you are typing. A little practice will let you get used to this.

16. Until you get really good at typing Morse code, we recommend that you transmit Morse code ONLY using the CONT (continuous) mode because of the confusing outputs that can result from use of Page, Line, or Word modes. After some practice (off the air!), you may wish to try Word mode, but remember, nothing is transmitted until after you type the first letter of the next word in a string. This means that you should always try to stay at least two whole words ahead of the transmitted signal to avoid some potentially confusing pauses for the guy trying to copy your CW! Also, remember to type a RETURN as the very last character of each transmission to assure that the DS-3000 itself goes back to a receive condition.

17. The transmit speed of the DS-3000 KSR is very accurately set with digital electronics to the wpm you select. It stays at that speed until either you change it or the power is turned off. The speed is set initially with the procedure of steps 3 - 7. After the initial setting, you can examine what speed is currently set by typing CTRL - V (press and hold CTRL while typing V, release V before CTRL). This causes the speed message "WPM = Ø25 __" to reappear. If you wish to continue sending at 25 wpm, type RETURN; if you want to change speed, type the new speed and then RETURN. NOTE: If you examine the speed while transmitting the output signal to the transmitter will stop until you hit RETURN, at which time it will resume at the new output speed.

18. In CONT (continuous) mode, go back to receive by not typing and waiting for any accumulated characters to transmit out of the buffer. If you use any of the edit modes (Page, Line, or Word), ALWAYS end each transmission with a RETURN key - this assures that the DS-3000 KSR will go back to receive mode and not be left in transmit mode, waiting for more keyboard typing to be transmitted. To be safe, it is a good operating practice to ALWAYS end a transmission with RETURN in all modes of operation, including BAUDOT and ASCII RTTY.

19. Use CTRL-SHIFT-P to program the HERE IS as explained on page 4-12 of the DS-3000 KSR manual. Similarly, the "QUICK BROWN FOX . . ." test message may be transmitted in Morse with CTRL-SHIFT-O. If you have a lot of characters in the output buffer that you would rather not have transmitted, the entire string may be cancelled with CTRL-X.

20. An additional feature of the DS-3000 KSR V3 is the Morse-to-RTTY data converter. When the Morse mode is selected on the DS-3000 KSR, all received AND transmitted signals also key the RTTY connector of the DS-3000. Thus, if a teleprinter is connected in the loop with the DS-3000 and ST-6000, the Morse messages may also be printed! Two notes of caution, however: (1) the ST-6000 should be set for LOCAL rather than for LINE operation to prevent interference between the demodulator and the DS-3000 when receiving; (2) the RTTY output will

20. (cont'd)
be at the speed AND mode that existed BEFORE you switched to the MORSE mode. Thus in the example of steps 3 - 7, the terminal was initially turned-on for BAUDOT, 45 baud operation, which is what will appear at the RTTY connector when Morse is received or sent. If ASCII, 110 baud had been selected prior to entering the Morse mode, then the RTTY output will be ASCII at 110 baud. In addition to providing a printer interface for Morse, this feature also allows use of the RTTY equipment keyboard or tape equipment to transmit Morse code: loop interuptions are converted into Morse code to be transmitted. Therefore, the DS-3000 KSR and ST-6000 can be combined with other RTTY equipment to produce a very flexible, all-mode station. However, note that loop interruptions by the demodulator due to tones or noise will also be interpreted as data to be transmitted, thus the precaution (1).

To summarize, consider these steps to operate the DS-3000 KSR in Morse:

A. Hook-up cables
B. Set DS-3000 switches (IDLE=OFF; USOS=OFF; MODE=CONT; MODE=BAUDOT)
C. Turn-on DS-3000 KSR and transceiver (leave ST-6000 off)
D. See "BAUD = 45"
E. Change MODE to MORSE; See "WPM = ØØØ __"
F. Enter transmit speed and RETURN
G. Tune the receiver away from signals (to noise)
H. Set the THRESHOLD control
I. Tune a CW signal until the CW DETECT light flashes with the signal
J. Correct "lock-up" with CTRL-R
K. See step 14 for ways to improve copy
L. Transmit by typing on keyboard
M. Examine transmit speed with CTRL-V; change = new speed + RETURN.
N. ALWAYS hit RETURN at the end of a transmitted message.
O. Program HERE IS with CTRL-SHIFT-P
P. QUICK BROWN FOX . . . message with CTRL-SHIFT-O
Q. Clear output buffer with CTRL-X

1. INTRODUCTION

The HAL Communications Model DS-3000 KSR is a microprocessor controlled send-receive video display terminal for use in serial data communications. It is available in two standard versions: version 2.X for use in serial Baudot (5-unit) code applications or serial ASCII (8-unit) code applications and version 3.X for use in either Baudot, ASCII or Morse code applications. The features and characteristics of the terminals are, for the most part, controlled by program subroutines that are factory programmed on ROM (read only memory) integrated circuits. The "X" in the version number designates the subroutines used. Thus, as new features are incorporated in the program subroutines, earlier units can be up-dated at moderate cost, reducing obsolescence.

The display portion of the DS-3000 KSR presents received and transmitted data on a CRT (cathode ray tube) screen in a format of 16 lines of 72 characters each. Non-overprint and switch selectable unshift-on-space (Baudot only) are automatic receive features of the display. Received signals are normally written from the top of the screen down. 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.

Transmitted data is entered on a 52 key keyboard arranged in a standard ASCII format (similar to a standard typewriter keyboard). Keyboard data may be transmitted as it is entered. Alternately, the text can be composed, edited, and then transmitted in batches of one word, one line, or the complete page. A 256 character output buffer is used to prevent over-writing if the typing speed exceeds the output data rate. Editing in word, line, and page modes is accomplished by repositioning the cursor and over-typing the segment to be corrected.

The DS-3000 KSR will send and receive five Baudot speeds (60, 66, 75, 100, and 132 wpm), five ASCII data rates (110, 150, 300, 600, and 1200 baud), and 1-175 wpm Morse code (version 3.X only). The ASCII code is 11 units long for 110 baud and 10 units for all other baud rates. The eighth (parity) bit is always set to space.

A user programmable character string of up to 127 characters (63 in version 3.X) may be transmitted with the HERE IS key. Another control combination of keys allows transmission of the standard "THE QUICK BROWN FOX . . ." test message. When the word or line mode of transmission is used, a series of Figs (Baudot) or null (ASCII) codes may be generated while editing to maintain a continuous output data rate. Receipt or transmission of the bell code will cause an audible tone to be generated.

A KOS (keyboard operated switch) circuit is included in the terminal to allow automatic transmit-receive control of external equipment.

The 8080A integrated circuit microprocessor system is used to control the display and transmission functions of the terminal. Flexibility is assured through use of factory-programmed ROMs to store the controlling program subroutines. A total of five circuit boards are used in the DS-3000 KSR: the master logic board, the keyswitch circuit board, the power supply board, the I/O (Input/

Output) interface board, and the signal-bell board. A sixth board, the Morse interface board, is used in Version 3.X. The keyboard and digital electronic circuitry are housed in an attractive metal cabinet.

The DS-3000 KSR will operate from power sources of 105 to 125 or 210 to 250 vac, 50 or 60 Hz. The display portion of the terminal requires only a power and video cable connection to the keyboard section and may therefore be separated by as much as 100 ft. if desired. A six-conductor connector on the rear panel allows connection to either series current loop or EIA - RS-232C compatible data circuits. The KOS (keyboard operated switch) transmit-receive control line is also provided on the data connector. Morse input and output connections (Version 3.X) are made via three-conductor connectors on the rear panel.

Figure 1.1 The DS-3000 KSR Video Display Terminal

2. SPECIFICATIONS

Versions: 2.X Baudot (5-unit) OR ASCII (8-unit) serial code compatible (The "X" denotes the version of the control program subroutine contained in ROM)

3.X Baudot, ASCII or MORSE codes

Input / Output Data:

Voltage Input (compatible with EIA - RS-232C format)

Mark: -5 to -15 VDC
Space: +5 to +15 VDC
Impedance: 120 ohms or greater

Current Input (compatible with current loops)

Mark: 18 - 120 ma
Space: 0 - 2 ma
Impedance: 20 ohms or less (in series with loop)
Isolation: 10 megohms minimum, 200 VDC maximum (to case)

Data Output: Transmitted data keys the loop circuit (Mark = loop current, Space = no loop current) and also provides switched voltage outputs compatible with RS-232C.

Morse Input: (Version 3.X only) 500 unbalanced audio input

Morse Output: (Version 3.X only) Transistor switch for keying a positive or negative voltage to ground. Rated ±150 VDC @ 150 Ma.

Data Rates:

Baudot (5-unit) code:

45 baud	(60 wpm;	select time = 22.0 ms)
50 baud	(66 wpm;	select time = 20.0 ms)
57 baud	(75 wpm;	select time = 17.57 ms)
74 baud	(100 wpm;	select time = 13.47 ms)
100 baud	(132 wpm;	select time = 10.0 ms)

ASCII (8-unit) code:

110 baud	(10 cps)
150 baud	(15 cps)
300 baud	(30 cps)
600 baud	(60 cps)
1200 baud	(120 cps)

(cps = characters-per-second)

Morse code: (Version 3.X only) Data rate variable over the range 1-175 wpm

Data Rate Stability: Crystal controlled to within ± 1.0%

Data Format:

Baudot (5-unit) code: 7.5 unit code; start pulse = 1 unit, data pulses = 5 x 1 unit each, stop pulse = 1.5 units.

ASCII (8-unit) code: 10 or 11 unit code; start pulse = 1 unit, data pulses = 8 x 1 unit each, stop pulse = 2 or 3 units.

DS-3000 KSR VIDEO DISPLAY TERMINAL

CONTENTS:

TABLES:

Keyboard:

Format:	Standard 52 key ASCII arrangement with shift, control, and N-key rollover.
HERE IS:	User programmable character string of up to 127 characters (63 in Version 3.X).
Test:	Generates "THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG'S BACK 0123456789" test message upon command.

Display Characteristics:

Screen capacity:	1152 characters
Character format:	5 x 7 dot matrix
Character polarity:	White characters on a dark screen background
Page format:	16 lines of 72 characters per line
Screen size:	12" (30 cm) diagonal measure (88 in^2; 670 cm^2) (9", 11", 14", and 17" displays are available on special order at extra cost).

Video Output:

Lines per frame:	520 non-interlaced (standard) 624 non-interlaced (optional)
Line and field rate:	15.625 kHz, 60 Hz (standard) 15.625 kHz, 50 Hz (optional)
Timing stability:	Crystal controlled to within $\pm$ 0.1%
Composite video output:	1.0 v p-p, negative sync
Output impedance:	75 ohms
Output connector:	UG-1094, BNC-type coaxial connector
Peak video bandwidth:	6.1 MHz

Physical data:

Cabinet finish:	Textured blue bottom and sides, beige top
Size:	13.5" (34.3 cm) H x 18" (45.7 cm) D x 12" (30.5 cm) W
Weight:	28 lbs (12.7 kg) net; 35 lbs (15.9 kg) shipping
Power requirement:	105 - 125 or 210 - 250 vac, 50-60 Hz, 70 watts

Other features:

Bell:	Audible tone is generated when BELL code is received
Cursor control:	The underline cursor may be positioned to any screen location by keyboard control. Normal "Home" location is the upper-left corner of the display.

Terminal operating modes:

Receive:	Incoming data is normally written from the top line of the display down. After the bottom line of the screen is filled, all lines shift-up (scrolls up) and new data is written on the bottom line. When the display scrolls up, the top line is lost.
Non over-print:	The display will automatically perform a carriage return (CR) and line-feed (LF) operation if the 72 character line is exceeded. To prevent accidental over-printing, the display ignores received CR codes and generates LF as well as CR whenever a LF code is received.

Unshift on space: When the DS-3000 KSR is operated in the Baudot mode, the Unshift-on-space feature may be activated. This feature automatically causes the display to shift to letters (LTRS) case after receipt of a space code. This feature is particularly useful when receiving noisy radio data.

Continuous transmission: When the continuous transmission mode switch is activated, data entry via the keyboard is immediately transmitted. A 256 character output buffer prevents "over-run" if the typing speed exceeds the output data rate. Keyboard data is displayed on the screen starting at the last cursor position.

Line transmission: When the line mode switch is activated, keyboard data may be entered and edited one line at a time. The keyboard entries are written on the bottom line of the display and are not transmitted until after the CR key is operated.

Word transmission: A sub-feature that can be selected (by control keys) when operating in line mode is transmission of keyboard data one word at a time. In this case, keyboard data is not transmitted until a character following a space is typed. The data can thus be composed, edited, and transmitted one word at a time.

Page transmission: Through use of the CTRL - B(STX), CTRL - W(ETB), and CTRL - C(ETX) control keys, keyboard data can be composed and edited a full screen (or "page") at a time. This mode can be selected in either Line or Continuous positions of the mode switch. In page mode, the entire screen is devoted to display of keyboard data. Data is not transmitted until after the CTRL-C sequence is typed.

Synchronous Idle: When the SYNC IDLE switch is activated, LTRS codes (BAUDOT mode) or NULL codes (ASCII mode) are inserted whenever there is a pause in the typing. The SYNC IDLE feature only functions in Line and Word modes and then only when there is keyboard-entered data in the edit buffer. SYNC IDLE does not function in either continuous or page modes.

Word wrap-around: When either line or word mode is selected, an automatic word wrap-around feature is activated. Word wrap-around prevents the splitting of a word at the end of a line that would normally occur because of the automatic CR-LF feature. If more than 72 characters are typed in a line (between CR operations), the characters following the last space are moved to the next line. In line mode, this also causes the original line to be transmitted (less the characters that have been moved).

Cursor control: The cursor can be positioned anywhere on the screen by using control keys on the keyboard. Editing in line, word, and page modes is accomplished by positioning the cursor where a change is desired and then over-typing any previous text.

The cursor can be moved incrementally (one space or line at a time) in all four directions and can also be positioned directly at the "home" position (upper left corner of screen). Cursor positioning in Baudot mode only affects the display screen and does not generate output data codes. Cursor position instructions in ASCII mode do generate the corresponding output ASCII codes, except when using page, line, or word modes.

KOS: A KOS (keyboard operated switch) circuit is included in the terminal that can be used to control the transmit-receive function of external equipment. An NPN-transistor in the KSR is used to switch the KOS control line to ground under transmit conditions. The control line can therefore be used directly to switch medium power (200 v, 100 ma recommended maximums) positive dc control circuits or a relay. The KOS line is in transmit mode whenever data is output from the terminal.

3. INSTALLATION

3.1 Initial Inspection

Upon receipt of the DS-3000 KSR, unpack the keyboard section and display sections and inspect each carefully for evidence of shipping damage. If evidence of shipping damage is found, contact the carrier immediately. Before discarding the packing material, check that all parts and accessories are accounted for. If any are missing, please notify the factory or distributor in writing. The following parts and accessories are furnished with the DS-3000 KSR:

Accessory Parts:

- 1 - 12 inch long video cable, BNC connector on one end, UHF connector on the other end
- 1 - Non-captive AC power cord
- 2 - 03-09-1061 6-pin male I/O connector shells
- 12 - 02-09-1143 female connector pins
- 1 - 4 ft. I/O cable with I/O connector for loop connection (2-conductor shielded)
- 1 - 4 ft. I/O cable with I/O connector for RS-232 connection (3-conductor)
- 2 - 0.5 ampere, slow-blow fuses
- 1 - Instruction Manual

Additional accessory parts for Version 3.X:

- 2 - 03-09-1031 3-pin male I/O connector shells
- 2 - 03-09-2031 3-pin female I/O connector shells
- 6 - 02-09-1143 female connector pins
- 6 - 02-06-2143 male connector pins
- 1 - 4 ft. Morse input cable, with connector
- 1 - 4 ft. Morse output cable, with connector

3.2 Display Preparation

For shipping convenience, the display and keyboard portions of the DS-3000 KSR have been shipped in separate packages. Figures 3.1 and 3.2 show the mounting and electrical connections required for the video monitors supplied with the 3000 KSR (11-inch and 12-inch, respectively).

To connect the video monitor to the 3000 KSR Keyboard housing use the following procedure:

1. Position the monitor on top of the keyboard housing in normal operating configuration.
2. Connect the display power cord to the female ac receptacle on the rear of the keyboard housing. (Power to this receptacle is supplied through the 3000 KSR power switch on the front panel).
3. Connect the video cable to the BNC connector on the rear of the keyboard housing. When an 11-inch monitor is supplied, connect the UHF connector to either of the two "A-VIDEO IN" connectors on the rear of the display, and set the slide switches on the rear of the display as follows:

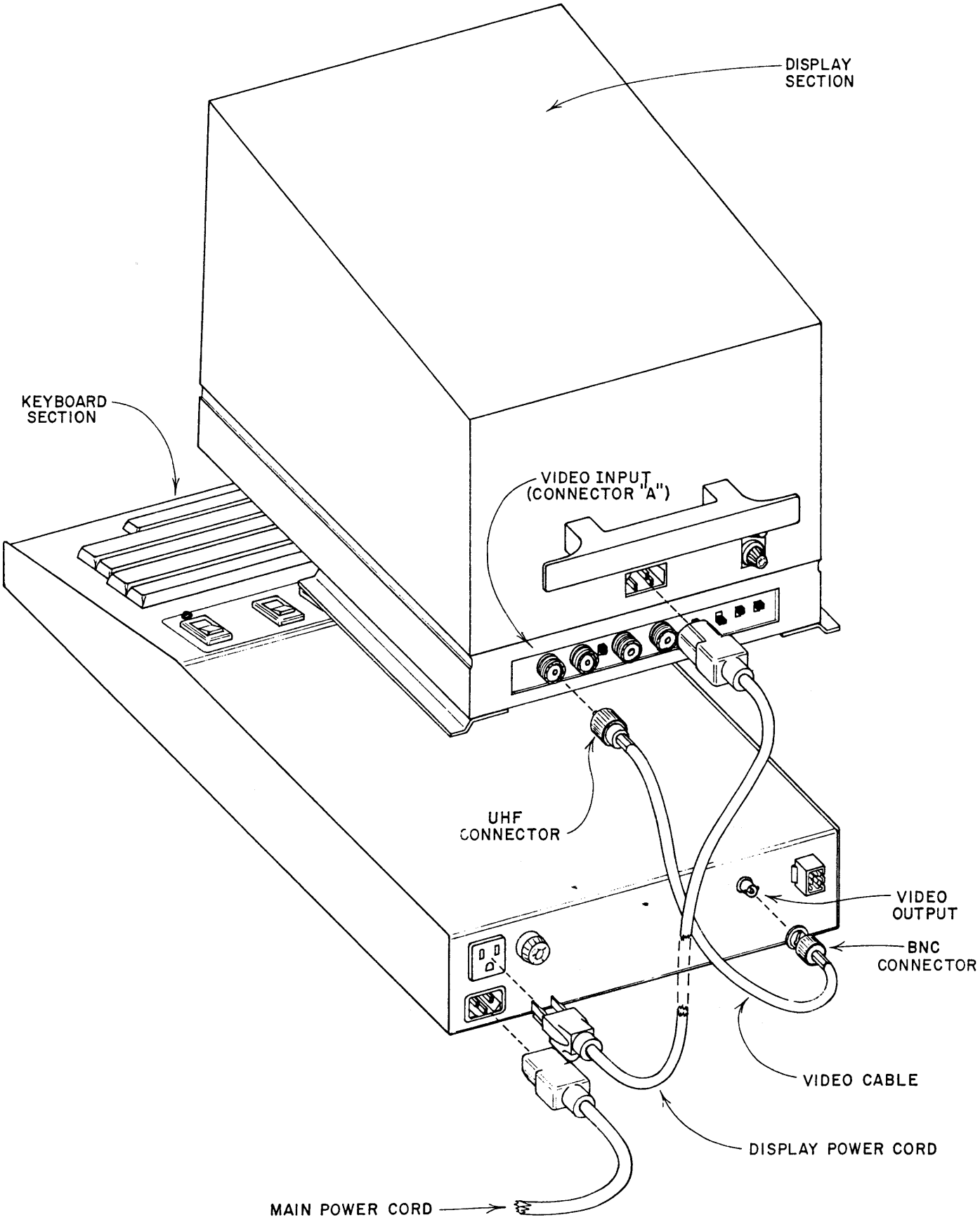

Figure 3.1 Connection of 11 inch display

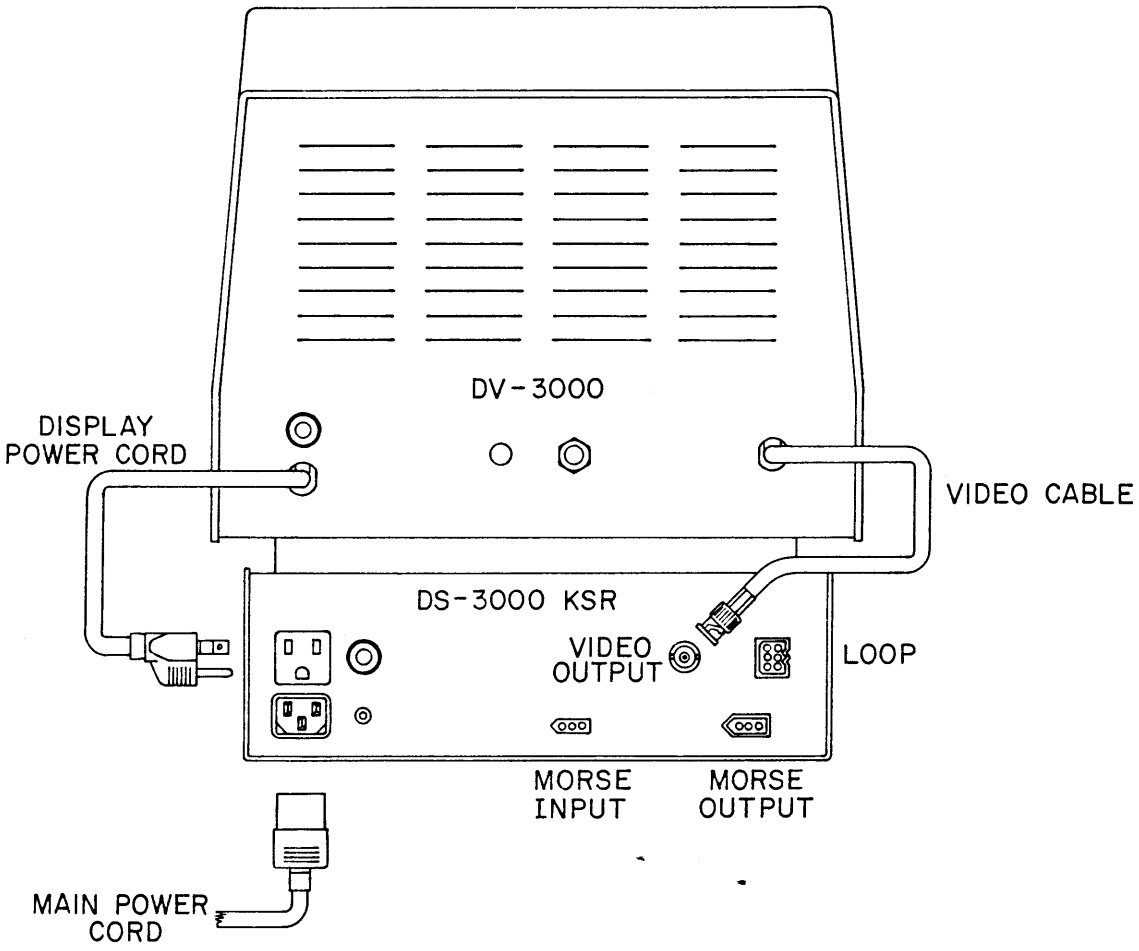

Figure 3.2 Connection of 12 inch display

INPUT - A (up)
SYNC - Int (up)
A - 75 ohms (down)
B - either position
VTR - NORM (up)

4. The display is now connected to the keyboard base. DO NOT APPLY AC POWER AT THIS TIME.

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CAUTION! A SERIOUS SHOCK HAZARD MAY EXIST WHEN CONNECTING THE DS-3000 KSR TO OTHER EQUIPMENT. BEFORE MAKING ANY CONNECTIONS, BE SURE TO DISCONNECT THE DS-3000 KSR AND OTHER EQUIPMENT FROM THE AC POWER LINE.

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3.3 Power Source

Unless otherwise specified ALL DS-3000 KSR terminals are connected for operation from 105 to 125 vac, 60 Hz power sources. If the terminal has been factory connected for other than the above power source, it will be indicated by a tag on the rear panel that gives the power line voltage and frequency for that particular unit. If it is necessary to change the power line voltage or frequency, please refer to Appendix 1 for the proper procedure. Note that it is necessary to change the power supply of BOTH the keyboard cabinet AND the display if the line voltage is changed. Change of power line frequency requires a jumper change on the logic circuit board.

3.4 Input/Output Data Connections ("LOOP" connector)

The data connector ("LOOP") can be wired for either current loop or voltage sensing (EIA - RS-232C compatible) data circuits. The KOS (keyboard operated switch) control line is also available on this connector. Two factory-prepared cables are furnished with the DS-3000 KSR, one for use in current loop circuits and one for use with voltage sensing circuits. In addition, two sets of connector shells and pins are provided so that additional cables may be constructed if desired. If it is necessary to prepare additional cables, follow the assembly procedure outlined in Figure 3.3. Be careful that the pins are inserted correctly in the shell since they are not easily removed.

3.5 Connection to a series current loop

The loop output connections of the DS-3000 KSR are isolated from ground and may therefore be placed at any convenient location in the data loop. The KSR loop connections are polarity sensitive, however, and care must be taken that the more positive loop connection is made to pin 6 of the loop connector (white wire of the factory prepared loop cable). Loop current flow should be in the direction of pin 6 to pin 4 (current flows from positive to negative convention). The loop power supply voltage and current should be within the limitations given in the specifications (250 VDC, 18 to 120 ma). Typical connections between the DS-3000 KSR and other loop-connected equipment are shown in Figure 3.4.

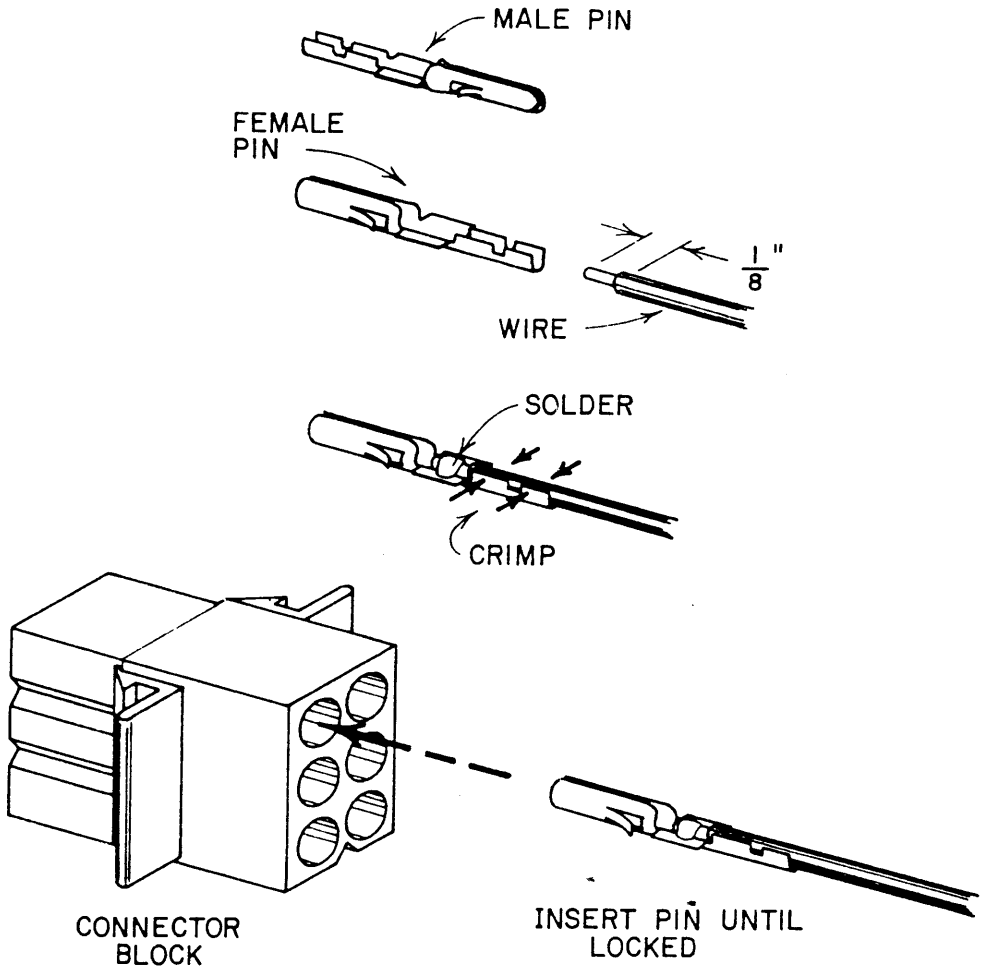
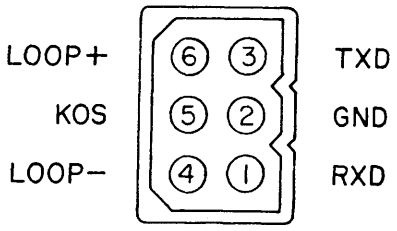
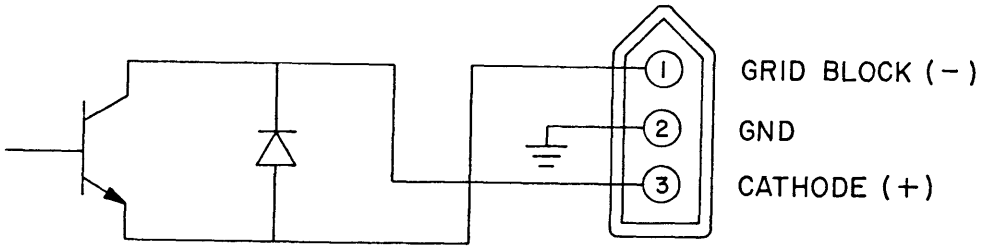


Figure 3.3 Preparation of data I/O connection



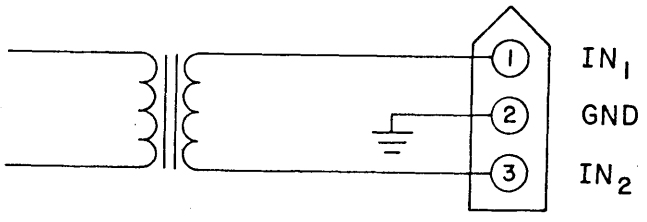
(a) Six pin serial I/O connector



NOTE: FOR GRID BLOCK KEYING,
JUMPER PIN 3 TO PIN 2.

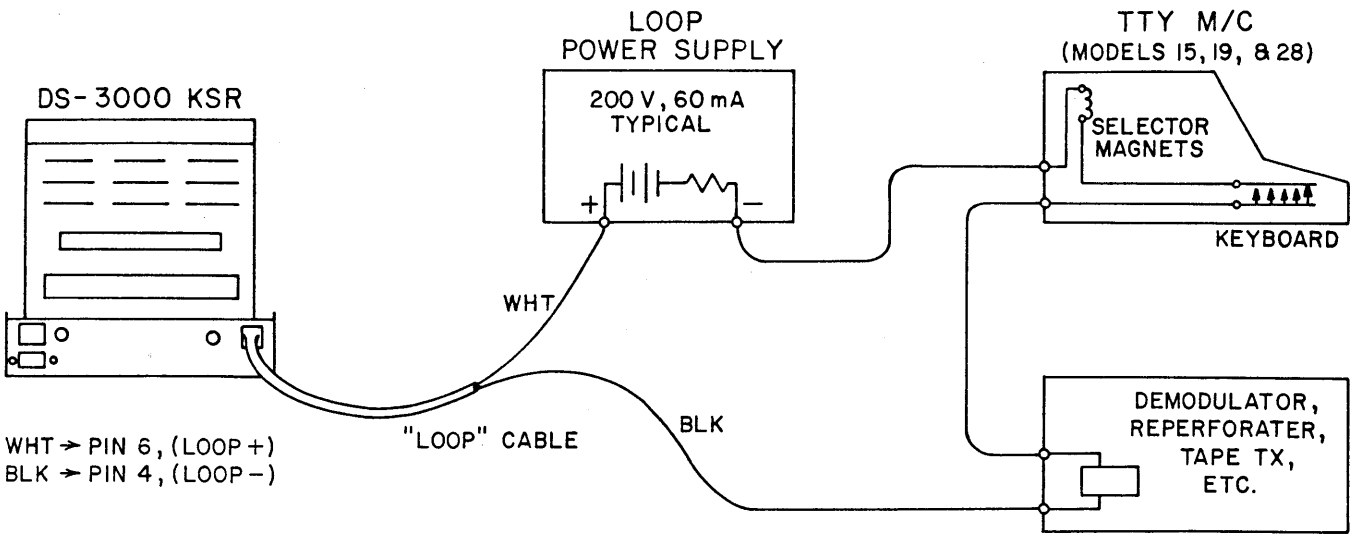
FOR CATHODE KEYING,
JUMPER PIN 1 TO PIN 2.

(b) Morse output connector (version 3.x only)

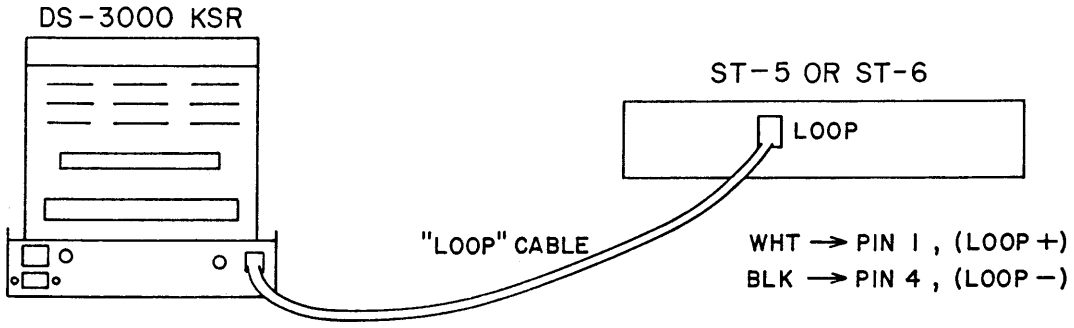


(c) Morse audio input connector (version 3.x only)

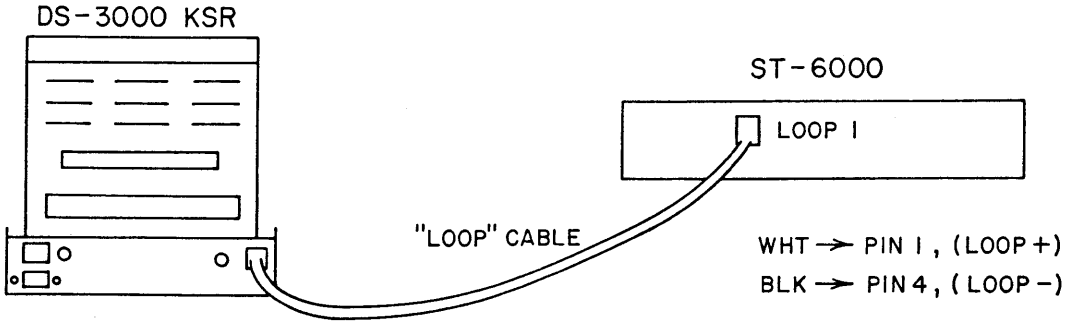
Figure 3.4 Rear panel connectors



(a) Typical series current loop connection with TTY machines and loop power supply



(b) Connection to ST-5 or ST-6 Demodulators



(c) Connection to ST-6000 Demodulator

Figure 3.5 Connection of the terminal to current-loop circuits

3.6 Connection to a voltage sensing data circuit

The DS-3000 KSR can also be connected to EIA - RS-232C compatible voltage sensing data circuits. The voltage levels of the external equipment should be compatible with those listed in the specifications section. Three wires are required to connect to RS-232 interfaces; receive data in, transmit data out, and signal ground. The plug connections and wire color of the factory-prepared cable are shown below:

Receive data:	Pin 1	White wire
Transmit data:	Pin 3	Red wire
Signal ground:	Pin 2	Black wire

When used in a radio teleprinter system, the DS-3000 KSR voltage I/O interface can be connected directly to the ST-5, ST-6, and ST-6000 demodulators for receive functions. However, the transmit data can be easily connected to the AFSK oscillator circuit only in the ST-6000. Therefore, loop connection is recommended when used with the older ST-5 and ST-6 demodulators.

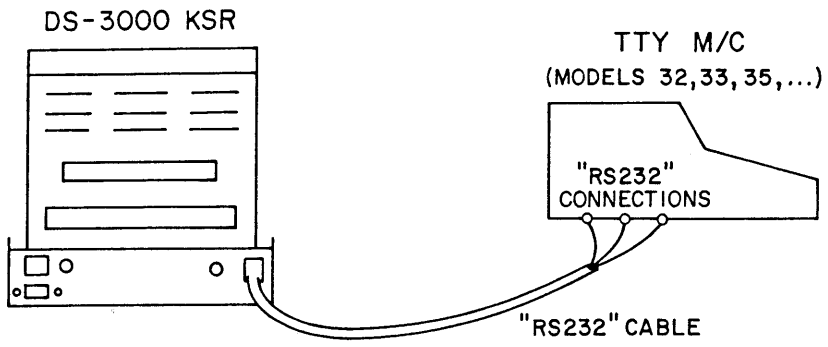
3.7 KOS Control Line Connections

The KOS (keyboard operated switch) control line is also available on the "LOOP" connector. The KOS function is intended to give automatic control of transmit-receive circuits in a data communications system. An open-collector power NPN transistor serves as the KOS switch element in the terminal. When data is to be transmitted, the transistor is "turned-on" presenting a low impedance between the KOS connector terminal and system ground. Conversely, in receive mode, the transistor is "off", presenting a very high impedance to system ground. A typical application of the KOS feature would be to activate the push-to-talk circuitry of a radio transmitter. Note, however, that since an NPN switch transistor is used, the controlled line must be at positive dc potential in open-circuit condition. Moreover, the open circuit voltage of the line should not exceed +200 volts and the closed circuit current should be less than 100 ma. The KOS switching transistor can also be used to switch a dc relay which may then switch ac or dc loads.

The KOS feature can be used with either loop or voltage sensing I/O systems. Use the preparation procedure outlined in Figure 3.3 to connect a pin to the KOS wire of the system and then insert the pin into the chosen data connector shell (loop or voltage sensing) in the hole corresponding to pin 5. Typical applications of the KOS control line are shown in Figure 3.6.

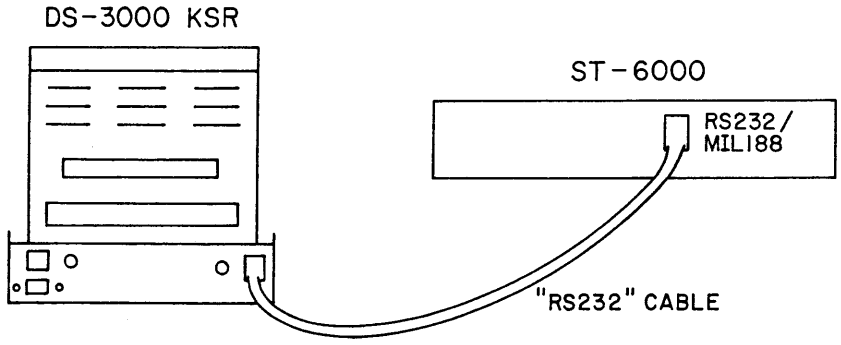
3.8 Grounding

The DS-3000 KSR cabinet should ALWAYS be connected to an adequate ground system. A three-prong grounding type ac power plug is furnished for connection to a grounded-outlet power system. If the building wiring to the wall outlet is correct, use of the grounding ac plug should furnish an adequate SAFETY ground return for the instrument. However, it is good practice to first assure that the outlet is correctly wired with an ac voltmeter before plugging in the unit. If a three-prong ac power outlet is not available, use a three-to-two prong ac adaptor at the wall socket and connect a separate ground lead to the DS-3000 cabinet. When 205 to 250 vac power mains are used, be sure that the cabinet is connected to an adequate safety ground. OPERATION OF THIS EQUIPMENT WITHOUT AN ADEQUATE SAFETY GROUND INVALIDATES THE WARRANTY.



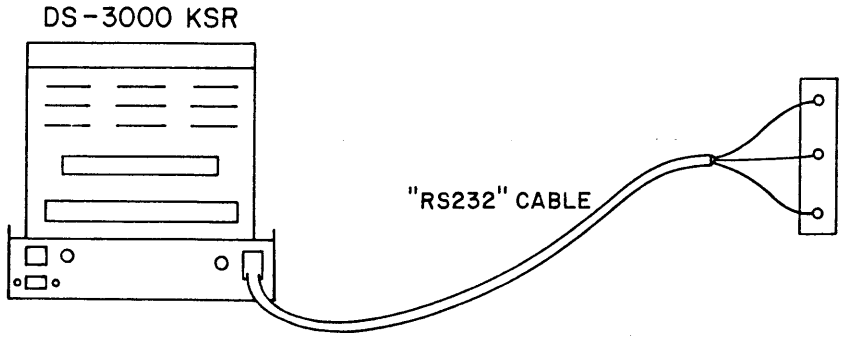
WIRE COLOR	DS-3000 FUNCTION	TTY FUNCTION
WHITE	RECEIVE	KEYBOARD
RED	TRANSMIT	PRINTER
BLACK	SIGNAL GROUND	SIGNAL GROUND

(a) Typical RS-232C connections to a TTY machine



WIRE COLOR	DS-3000 FUNCTION	ST-6000 PIN NO.
WHITE	RECEIVE	1
RED	TRANSMIT	4
BLACK	SIGNAL GROUND	5

(b) Connection to ST-6000 Demodulator



WIRE COLOR	DS-3000 FUNCTION
WHITE	RECEIVE DATA
RED	TRANSMIT DATA
BLACK	SIGNAL GROUND

(c) General connections to EIA - RS-232C circuits

Figure 3.6 Connection of the terminal to EIA - RS-232C I/O circuits

When the DS-3000 KSR is used in a radio communications system that includes medium and high power transmitters, a short length of low-inductance wire should be used to interconnect all cabinets of the system (including the DS-3000 KSR cabinet) together and to a good radio-frequency ground. Lack of a good RF ground connection may cause false triggering of the logic circuitry by stray RF fields. Open-wire feed-line systems with high standing-wave-ratios can be particularly troublesome to digital equipment. When good RF grounds are provided and low SWR feed-line matching techniques are used, the DS-3000 KSR will work with even very high powered transmitter systems.

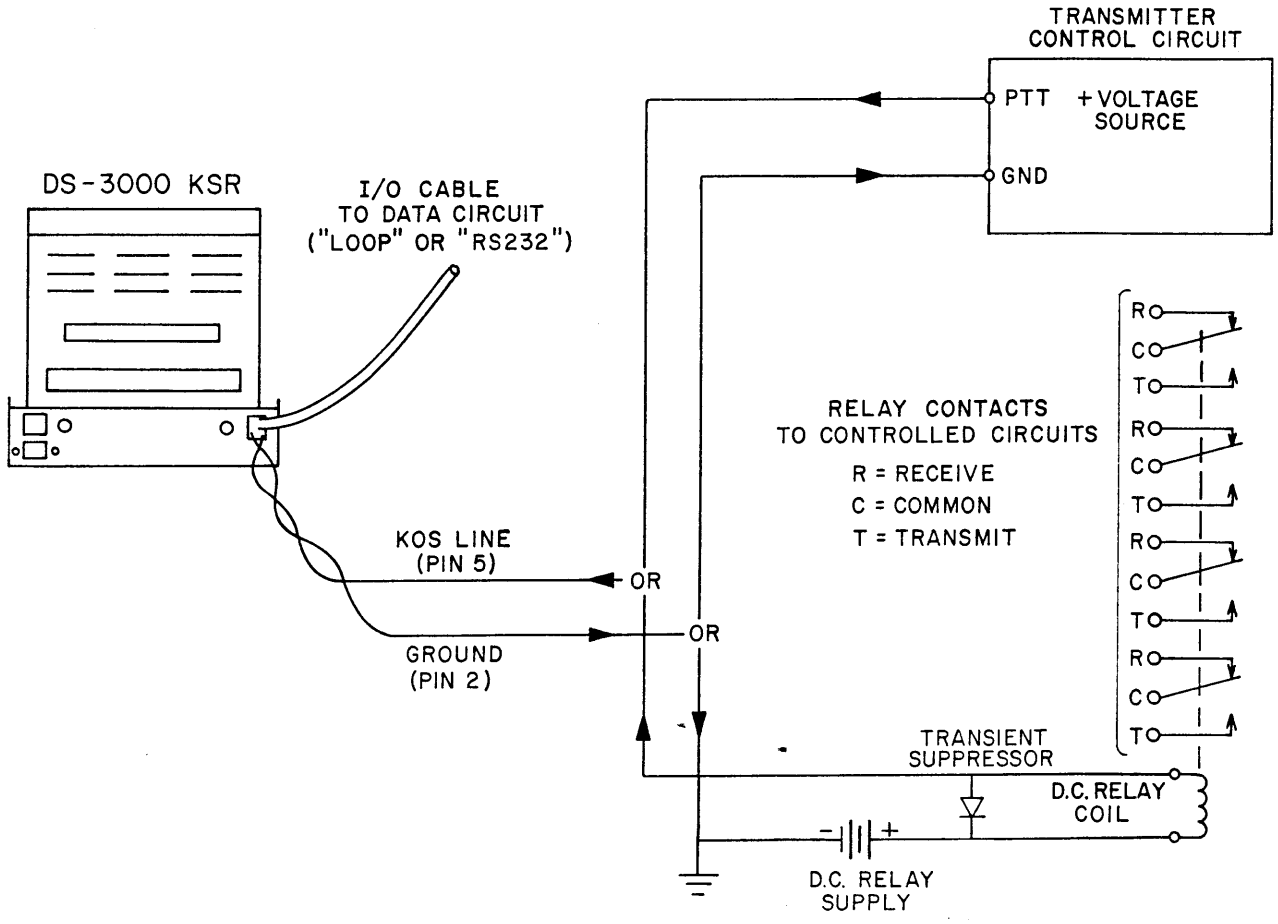


Figure 3.7 Connection to the KOS control circuit

4. OPERATION

The DS-3000 KSR contains advanced features designed to allow many operator conveniences previously unavailable in either electronic or electro-mechanical data terminals. The operating instructions presented in this section will help you to take full advantage of the terminal's capabilities. Please read all sections carefully before operating your DS-3000 KSR.

4.1 Reception of data

The DS-3000 KSR will display serial received data that is transmitted at one of five speeds (60, 66, 75, 100, and 132 wpm) in the 5-unit Baudot code. In addition, the terminal will receive data at 110, 150, 300, 600, or 1200 baud in the 8-unit serial ASCII code. The input data can be obtained from either a series current-loop circuit or from an EIA - RS-232C voltage sensing data circuit. The Version 3.X terminal also accepts Morse code audio signals ranging from 1 to approximately 180 words per minute.

Received data is displayed on the screen in lines of 72 characters each with up to 16 lines on the screen. The display will start at the previous cursor position and continue line-by-line to the bottom of the screen. When the bottom line has been written, the display shifts-up ("scrolls") one line and new information is written on the new bottom line thus formed. When the display scrolls, the previous top line is not retained.

To prevent overprinting, the display automatically performs carriage-return (CR) and line-feed (LF) operations if more than 72 characters are received in a given line. Also, received CR functions are ignored and CR and LF operations performed whenever the line-feed code is received. Thus, if, under noisy receiving conditions, the line-feed code is missed, the display will continue to the end of the line and perform the automatic CR - LF sequence at that time. Without these features, receipt of only the CR code would cause overprinting of the previous line and loss of data. In Morse code reception, the Version 3.X terminal simply performs the automatic CR and LF at the end of the line.

The operating data rate of the DS-3000 KSR in Baudot or ASCII modes is changed by use of control keys on the keyboard. To determine the present data rate of the terminal, depress and hold the control key (CTRL) and then depress the V key. The message "BAUD = xxx" will be shown on the screen with "xxx" being the baud rate. The operator should note that it is always the baud rate, rather than wpm or cps (characters per second), that is given in the "BAUD = xxx" message. When using the Baudot code, the conversion from baud rate to wpm is:

45 baud = 60 wpm
50 baud = 67 wpm
57 baud = 75 wpm
74 baud = 100 wpm
100 baud - 132 wpm

If the CTRL - V key sequence is again performed, the data rate of the terminal will be incremented to the next higher rate. Depressing the carriage return (RETURN) key will return the display to reception of data.

For example, if the terminal has been receiving 60 wpm Baudot signals, the first operation of the CTRL - V sequence will cause the message "BAUD = 45" to appear on the screen. If the RETURN key is actuated, the terminal will return to display of 60 wpm data. However, if a second CTRL - V sequence is performed instead, the message "BAUD = 50" will appear on the screen, indicating that the terminal is now operating at a data rate of 50 baud (67 wpm). As before, a RETURN key operation allows the terminal to continue display of data, now at a rate of 50 baud. A similar technique can be used to increment the terminal to the other data rates, 57 baud (75 wpm), 74 baud (100 wpm), and 100 baud (132 wpm). The terminal returns back to 45 baud (60 wpm) after the 100 baud rate. The procedure is exactly the same for the ASCII mode. The order of rate increment for ASCII mode is: 110, 150, 300, 600, 1200, 110 baud and so on. Remember, the first CTRL - V key sequence indicates the present operating rate of the terminal. Subsequent operation of the CTRL - V keys causes the data rate to increment up. A RETURN key allows the display of data at the last indicated data rate.

In Morse code reception (Version 3.X), the incoming signal speed is automatically tracked. The terminal will track Morse speeds of 1 to approximately 180 words per minute independent of sending speed. Before attempting to receive CW, follow the instructions in 4.2 below for setting transmit speed.

The audio level control for Morse reception with the Version 3.X terminal is adjustable. This level is pre-set at the factory for optimum performance with a specific receiver. Since each receiver differs in characteristics, the unit should be adjusted for optimum Morse reception with your equipment.

Access is provided to the white threshold adjustment potentiometer through the vent holes on top of the KSR base. To adjust the audio level of your Version 3.X KSR, locate the row of vent holes nearest the keyboard. This is row 1. Insert a small screwdriver blade into row 3, hole 4 from the left. USE CAUTION TO TOUCH ONLY THE WHITE POTENTIOMETER. To increase sensitivity to signal level, rotate the adjustment pot to the right. If the KSR is being triggered on noise, decrease sensitivity by rotating the pot to the left. Only very small changes are necessary in this potentiometer setting. (Serial numbers 430 and higher the potentiometer is mounted on front panel).

Proper tuning of a CW signal will activate the CW detect light on the front panel. Optimum tuning is achieved when the CW detect light is synchronized with the received code. Receive speed is automatically matched to the signal. The Version 3.X terminal will require several characters to determine the incoming code speed. Once the terminal has found the proper speed, it will copy the incoming signal unless the spacing or speed changes appreciably. If the space changes beyond an acceptable range, the unit will miss a few characters while attempting to reset its copying speed. The Version 3.X terminal is set to copy Morse with standard spacing as defined by the ARRL in Publication No. 18, Learning the Radiotelegraph Code. Unrecognized characters are printed as *.

When first tuning a Morse signal with Version 3.X, it may be necessary to reset Morse reception by depressing the CTRL and R keys. Excessive noise bursts may also cause the terminal to "lock up." CTRL-R (reset) should then be executed.

When the terminal is operated in the Baudot mode, an UNSHIFT-ON-SPACE feature may be enabled with the front panel switch. In this mode, reception of a space code will automatically place the display in letters case, regardless of the previous case received. This feature is also most convenient when receiving noisy

data in that it prevents accidental case changes caused by noise transients. If this feature is not desired, it should be disabled by turning the UNSHIFT-ON-SPACE switch OFF.

The DS-3000 KSR can be operated in either the 5-unit Baudot code or the 8-unit ASCII code. Version 3.X will also operate in Morse mode. Both the receive AND transmit portions of the terminal are controlled by the MODE switch. When the DS-3000 KSR is used in an amateur radio station, the operator should take care to transmit only those data speeds and codes for which he is legally licensed.

4.2 Transmission of data

The DS-3000 KSR will transmit data at the same five Baudot speeds and ASCII speeds as outlined above for reception. Changing the terminal speed affects BOTH receive and transmit functions of the terminal in ASCII or Baudot modes.

For transmission in Morse mode (Version 3.X), the mode selector switch is moved to Morse (center position). If the terminal has been turned on in another mode and no data rate was selected in that mode, the RETURN should be depressed ONCE to activate Morse mode. If the terminal is turned on in Morse mode, or if you switch from activity in another mode, the terminal will respond with the Morse mode prompt:

WPM = 000

This means that the terminal is set for a sending speed of zero words per minute. Enter the rate at which you wish to send and hit RETURN. Do not attempt to send CW at zero words per minute! This will cause the terminal to lock-up in a constant key-down state. The only way to defeat this condition is to turn the terminal off for a moment and back on.

If you wish to reset the sending speed in Morse mode, depress CTRL-V and the terminal will prompt with:

WPM = 025

The 25 is an example indicating the present speed for which you have the terminal set. It will actually be the number you typed in previously. If you wish to keep the same speed, simply hit RETURN. If you wish to change speed, type in the new speed and hit RETURN. Since the terminal prompts with the previous speed setting, this feature can be used to determine the speed you are using if you should forget.

Morse sending and receiving functions of the Version 3.X KSR are independent. It is recommended that a sending rate be set first if the terminal is to be used on the air. This will help to avoid the embarassing situation of "lock-up" on the air if you should happen to leave the KSR set at zero words per minute and try to transmit.

In Morse mode (Version 3.X) transmit takes precedence over receive. If you are receiving CW and press a key, the unit will stop receiving and transmit the character. Received and transmitted signals in CW are echoed to the Loop and EIA circuits in either Baudot or ASCII, depending on which mode the unit was in before switching to Morse. This allows for hard copy of the received and transmitted CW. The Baudot or ASCII speed must be set with CTRL-V prior to entering Morse mode.

When completing transmission with the DS-3000 KSR in any mode, a single CR (RETURN) should be sent. This tells the terminal that you have completed transmission and are ready to receive. The KOS line will be turned off and the terminal will expect to see incoming data.

4.2.1 Output Buffer

The output section of the terminal includes a 256 character output buffer memory. ALL transmitted data is passed through this buffer, whether it originates directly from the keyboard or from a stored source (such as HERE IS, Test Message, or an edited message from word, line or page mode). The buffer memory assures that data is not lost if the input data rate (from the keyboard, for instance) is faster than the output transmission rate. Data is clocked out of the buffer memory continuously at the selected rate until the buffer is empty. When the buffer is empty, the output is held in the MARK state until more data is ready for transmission. To clear the buffer and also stop transmission in any sending mode, hit CTRL-X.

4.2.2. KOS circuit

An automatic transmit-receive control circuit, called KOS (for Keyboard Operated Switch) is included in the DS-3000 KSR. This line can be used to control the status of external equipment as outlined in the Installation section (section 3.7). The KOS transistor is in the transmit condition (transistor "ON" - low impedance to ground) whenever there is data to be transmitted in the output buffer memory. Therefore, in continuous mode, the KOS line is activated each time a key is depressed. In the edit modes (word, line, and page modes), the KOS is not activated until the editing is completed and the message is to be transmitted.

4.3 Keyboard functions

Most of the transmit and some of the receive functions of the DS-3000 KSR are controlled by use of the SHIFT and CTRL (control) keys in conjunction with the other 50 keys of the keyboard. Figure 4.1 shows the full keyboard of the terminal with labeling as it appears on the keytops. By using the SHIFT and/or CTRL keys, up to four different sets of information can be generated for each key. Actually, only a few of the keys can be used to generate valid functions for each level.

If neither the SHIFT or CTRL keys are depressed, the alpha-numeric character set depicted in Figure 4.2 is generated. In either Baudot or ASCII codes, the terminal generates code for only CAPITAL (upper-case) letters. Similarly, only capital letters are displayed. If a case-change is required in Baudot code (for instance when a number key is typed after a series of letters), the terminal automatically inserts the required FIGS (figures) or LTRS (letters) code before sending character code.

If the SHIFT key is depressed AND held while another key is pressed, the characters shown in Figure 4.3 are transmitted. This character set consists primarily of punctuation symbols. In Baudot mode, only those symbols that have valid Baudot code combinations are generated. Non-valid Baudot punctuation symbol keys generate blank code output data when depressed. As explained above, case codes are inserted as required when Baudot mode is selected.

If the CTRL (control) key is depressed AND held while another key is pressed, the character set shown in Figure 4.4 is available. This set is largely ASCII control codes and result in output data only when the ASCII mode is selected.

The fourth possible combination is generated when BOTH the SHIFT and CTRL keys are depressed AND held while other keys are operated. This character set is shown in Figure 4.5. These codes are strictly ASCII control codes and, in some cases, duplicate those previously possible with other SHIFT and CTRL key combinations. Figure 4.6 indicates special characters for Morse mode (Version 3.X) operation.

4.4 Terminal operating modes

Data can be transmitted from the keyboard in one of four different operation modes; a character at-a-time (as typed), a word at-a-time (with edit capability within the word), a line at-a-time (with edit capability within the line) or a complete, 1152 character, screen at-a-time (with edit capability anywhere on the screen). The operating procedures and features of these modes are discussed in the following paragraphs.

4.4.1 Continuous mode

When the front panel LINE - CONT MODE switch is in the CONT position, characters are transferred to the output buffer memory and then transmitted immediately after each key is depressed. The 256 character buffer prevents loss of output data if the typing rate should exceed the output data rate. The KOS control line is activated to transmit state each time a key is pressed. Characters typed on the keyboard are displayed on the screen, starting at the previous cursor position. The keyboard over-rides the receive function of the display and input data is ignored whenever the keyboard is being used.

4.4.2 Line Mode

When the LINE - CONT MODE switch is in the LINE position, a complete line of characters can be typed and edited before being transmitted. With the switch in this position, typing of any character will put the terminal in an edit mode in which the display is devoted to the keyboard until a carriage-return (RETURN) is typed. While in this mode, the display ignores any received data. The information is not transferred to the output buffer and therefore not transmitted until the RETURN key is operated. The KOS control line changes to transmit condition when the RETURN key is actuated and stays in this condition until the complete line has been transmitted out of the output buffer. Information typed in the line can be changed or corrected at any time before RETURN is operated by using the backspace key (CTRL - H) and over-typing or by using the RUB OUT key. Using the RUB OUT key will cause the cursor to backspace and will delete the character previously in the position. Conversely, the backspace (CTRL - H) key shifts the cursor back one position but does NOT delete the character unless it is over-written. The CTRL - I sequence will move the cursor forward one position.

The SYNC IDLE feature can be activated in this mode to "fill" the time gap while a line is being composed and edited. However, the KOS line stays in transmit condition and data is transmitted (either letters codes or edited text lines) until the SYNC IDLE switch is turned OFF.

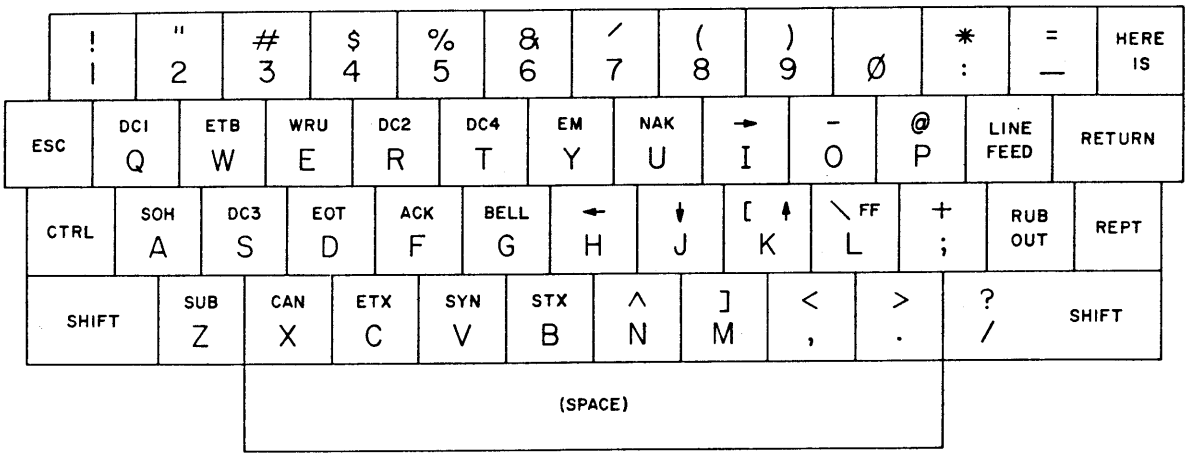


Figure 4.1 Keyboard layout and symbols

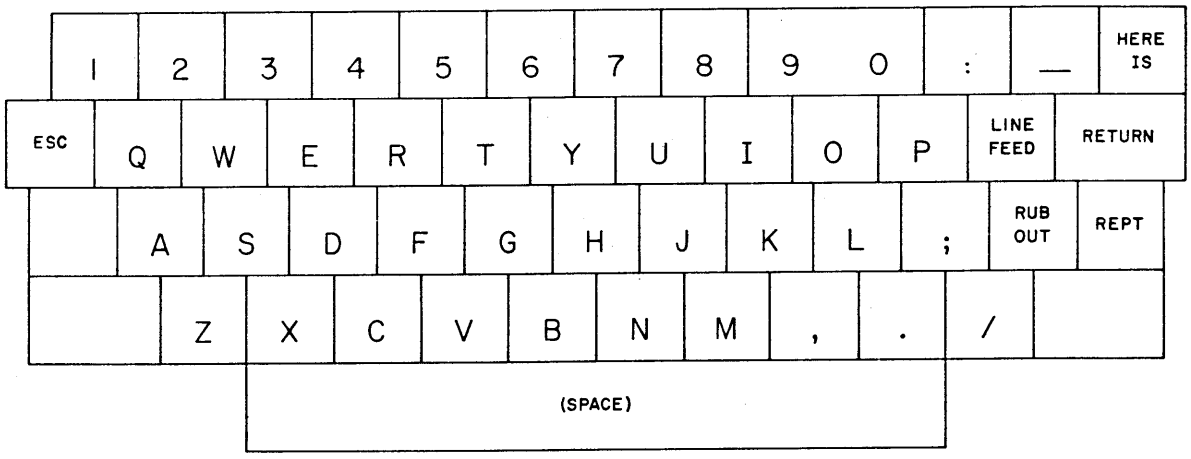


Figure 4.2 Keyboard functions with neither SHIFT or CTRL operations

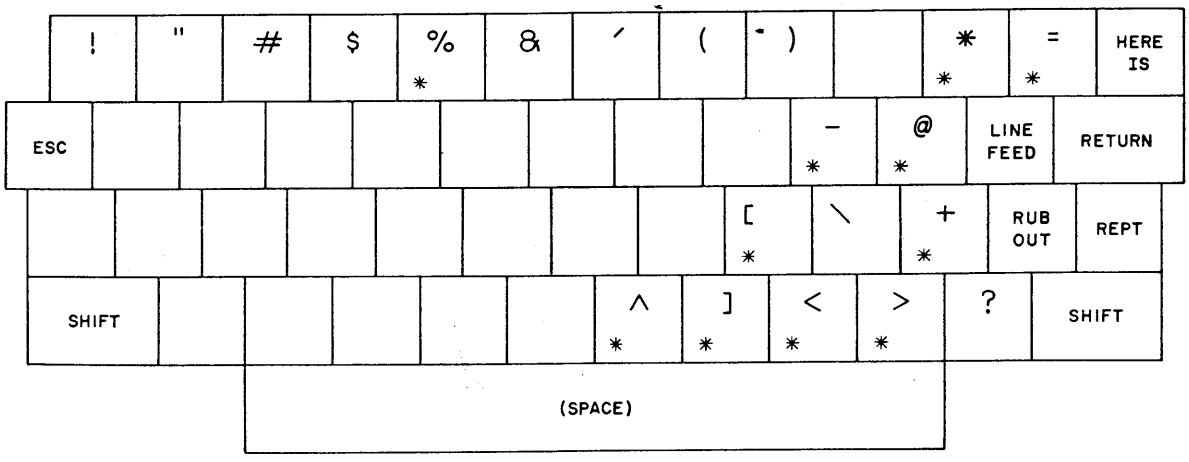


Figure 4.3 Keyboard functions with SHIFT but not CTRL operations
Note: Starred (*) keys generate output code only in ASCII mode.

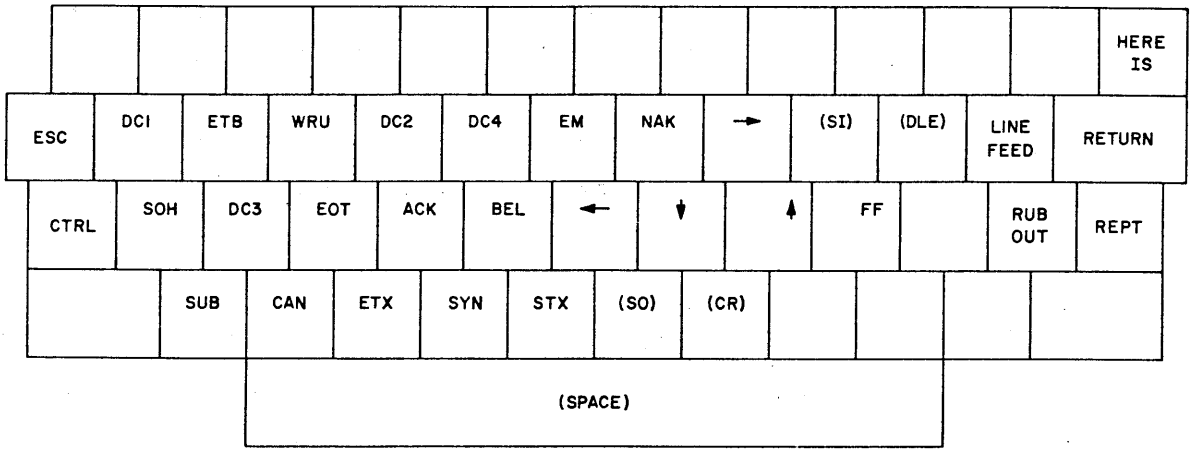


Figure 4.4 Keyboard functions with CTRL but not SHIFT operations
Note: This keyset will generate output code only in ASCII mode. However, some combinations may be used for editing and control functions in either ASCII or Baudot modes.

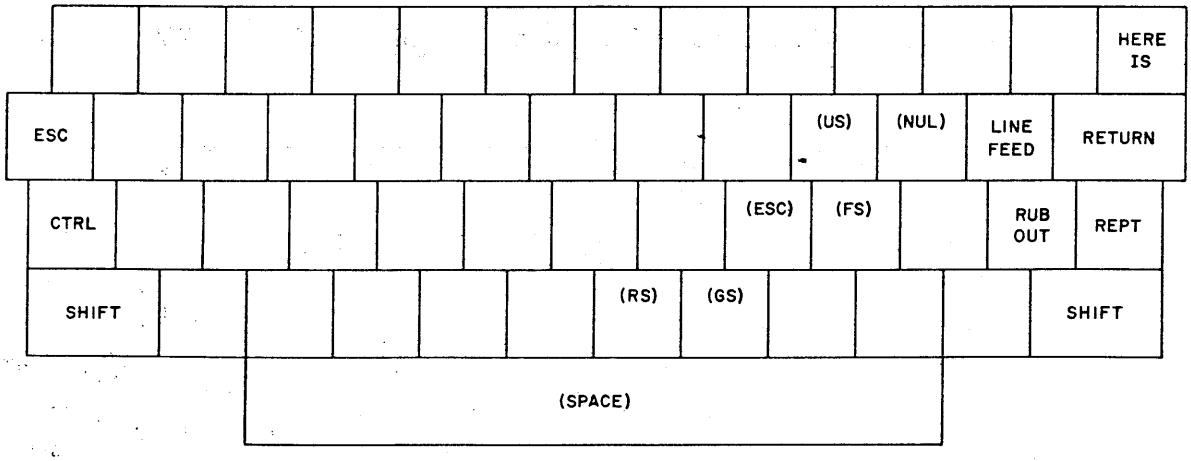


Figure 4.5 Keyboard functions with both SHIFT and CTRL operations
Note: This keyset will generate output code only in ASCII mode. However, some combinations may be used for editing and control functions in either ASCII or Baudot modes.

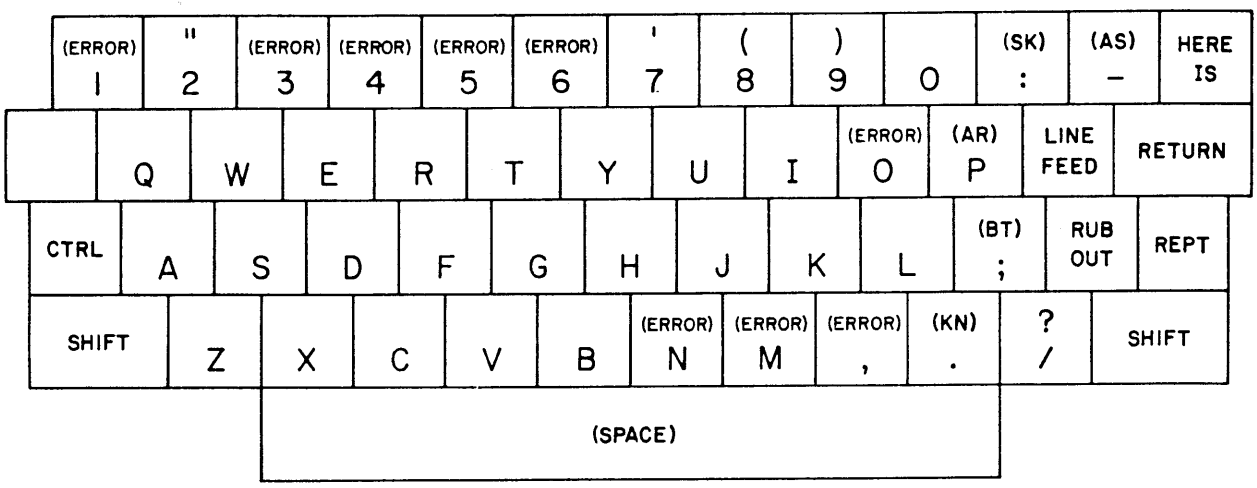


Figure 4.6 Keyboard functions with SHIFT operations
Note: This keyset will generate output of Morse characters in Morse mode only. This set of characters must be sent in continuous mode only.

4.4.3 Word wrap-around

Another feature that works in the line mode is word wrap-around. The word wrap-around feature is designed to prevent the splitting of words if the line length of 72 characters is exceeded. If, for instance, more than 72 characters are typed in a given line, the terminal will "back-up" to the previous space, move all characters between the space and the end of the line to the next line, generate a carriage-return / line-feed (CR/LF) sequence, transmit the line, and be ready for more text on the next line. Thus, in line mode, the user need not concern himself with end-of-line problems such as hyphenating split words or generation of the CR/LF sequence. Refer to section 4.5 for more discussion of the end-of-line sequence. As before, when the line is transmitted, the KOS line will go to the transmit condition.

4.4.4 Word mode

Another edit mode that can be used when the LINE - CONT MODE switch is in LINE position is the word mode. With the switch in LINE MODE, typing the sequence CTRL - F (hold CTRL key down while pressing F) will allow data transmission one word at a time. As in line mode, the display indicates the data being typed and therefore ignores received signals during this time. The actual word is not transferred to the output buffer until a character following a space is typed. At this time, the KOS control line goes to transmit condition and the word is transmitted at the operating speed previously selected. The KOS line returns to receive condition after the word has been transmitted. For example, consider the following character stream:

CTRL - F H E L L O (space) T E S T (space) 1, 2, etc.

The CTRL - F sequence puts the terminal in word mode, devoting the display to the keyboard. The word "HELLO" is displayed as typed but not transmitted until the letter "T" of "TEST" is typed. At any time prior to typing "T", the CTRL - H backspace code could have been used to change any letter of "HELLO" or the entire word if desired. The terminal may be returned to line mode by typing a second

As in line mode, the SYNC IDLE feature may be used to give a continuous output data stream, noting that the KOS will remain in transmit mode as long as the SYNC IDLE switch is ON. The word wrap-around feature also functions in word mode. RUB OUT and CTRL - H (backspace) are the only cursor control codes that work in word mode.

4.4.5 Page mode

The most flexible edit mode is page mode. The page mode can be activated in either position of the LINE - CONT switch by using the CTRL - B(STX) sequence of keys. Once initiated, the display is devoted to the keyboard and ignores any received data until the edited page has been transmitted. Editing of the written text can be done by repositioning the cursor with the five cursor control keys. Cursor control keys are:

CTRL - H:	(back-arrow)	back-up cursor one space
CTRL - J:	(down-arrow)	move cursor down one line
CTRL - K:	(up-arrow)	move cursor up one line
CTRL - I:	(forward-arrow)	move cursor forward one space
CTRL - L:	(FF = form feed)	move cursor to "home" position and erases entire screen. ("home" = upper left corner of display)

All of the above cursor control functions require depressing AND holding the CTRL (control) key while pressing the second key. Note that some functions are the same as normal page controls, for instance:

CTRL - J (down-arrow) is the same as LINE FEED
CTRL - L (FF) is the same as form-feed

All of the above cursor control key combinations with exception of CTRL - L are non-destructive. Although the cursor may replace a character on the screen, that character is retained in memory unless it is over-written. However, the RUB OUT key causes the cursor to back-up and deletes the character formerly occupying that location. The RUB OUT key is very useful when editing text in line, word, or page modes.

When the terminal is operated in any of the edit modes, the cursor control functions ONLY affect the display and the message content being prepared for transmit; in Version 2.X the ASCII codes corresponding to these commands are not generated. However, in continuous mode, use of the cursor control keys affects the display AND transmits the ASCII codes. Obviously, since no Baudot codes exist for these functions, a special code is not generated in either case.

The normal procedure to use when composing a message in page mode is to first activate page mode with the CTRL - B(STX) sequence, position the cursor in the "home" position with the CTRL - L(FF) sequence, and proceed to type the desired text. If an error is made, use the cursor control functions to position the cursor at the error and over-type the correction. When the cursor is repositioned to a screen location formerly occupied by a character, the screen will show ONLY the cursor. However, the original character is retained until it is overtyped by a printing character or space, unless the RUB OUT key is used, as explained earlier.

When the complete message has been composed and edited, type a CTRL - W(ETB) to indicate the end of the message and reposition the cursor to the start of the message using the control keys. To transmit the message, type CTRL - C(ETX). The KOS line will now go to transmit condition and the message will be transmitted at the rate previously selected with the speed control keys. Transmission will cease and the KOS line return to receive condition after all text up to the point at which the CTRL - W sequence was inserted. The location of the CTRL - W command is shown on the screen by a star (*).

Although it is more common to start composing text at the "home" position, the page mode can be made to start and end at any screen location desired. The terminal will transmit all data from the initial cursor position and continue transmitting until the CTRL - W sequence is found or until the original cursor position is again encountered. If it is desired to retransmit the same message, simply reposition the cursor to the start of the message and type the CTRL - C sequence. If the CTRL - W keys are not used to indicate the end of the message, the complete display from the cursor position back to the cursor will be transmitted (all 1152 characters of the screen).

In summary, the sequence required to use page mode is:

1. Put the terminal in page mode with CTRL - B(STX),
2. Position the cursor on the screen where it is desired to start typing the text (usually "home" position, CTRL - L),
3. Type the desired message,

4. Edit the message by repositioning the cursor and over-typing,

5. Type a CTRL - W when the cursor is positioned at the end of the message,

6. Reposition the cursor to the start of the message,

7. Type CTRL - C(ETX) to transmit the message.

The SYNC IDLE feature does not function when operating in the page mode. Also, while the terminal is operating in page mode, the display is dedicated to the keyboard and therefore ignores any incoming received data.

4.5 End of line sequence

Normal BAUDOT operation requires transmission of the sequence "carriage return - line feed - letters" at the end of each line of text to assure that the following line starts correctly. This sequence is automatically generated by the terminal in the BAUDOT edit modes (line, word, and page modes). In any of the edit modes, operation of the RETURN key also triggers the line feed operation. In BAUDOT mode only, a LTRS code (11111) is always generated after a line feed code. Therefore, in the Baudot edit modes, operation of the RETURN key will cause the following character sequence to be generated: "carriage return - line feed - LTRS". When the terminal is used in continuous and Baudot modes, this sequence is automatically generated if more than 72 characters are typed in a line (automatic carriage return - line feed feature). However, if while in continuous mode, the operator types a RETURN before the 72nd character (a short line), he should also type the LINE FEED key to transmit the full sequence. As before, the line feed operation also causes the LTRS code to be transmitted.

The terminal functions in a similar manner when ASCII mode is used with the exception that the LTRS code does not exist in ASCII code and is therefore not generated after the line feed. In Morse mode (Version 3.X) the terminal generates local control operations at the end of each line.

4.6 Repeat key

Any character of the terminal may be repeated by holding the REPT key down while pressing the character key. A continuous string of this character will be produced for as long a time as the REPT key is held down.

4.7 Generation of Baudot LTRS and FIGS codes

In some Baudot communications systems, it is common to use a sequence of control and printing characters to provide control of various functions at the receive end. Such functions are generally decoded at the receiver by electronic or electromechanical "stunt boxes." Most such sequences require the generation of either LTRS or FIGS control codes, independent of whether the following character is a letter or figure. Such a sequence might be "FIGS - BLANK - H". To generate only the FIGS and LTRS codes, use the following control sequence:

FIGS: SHIFT - . (period)
LTRS: SHIFT - , (comma)

Since there are many more code combinations possible with the ASCII code, such special sequences are not generally required. However, in continuous mode, the keyboard will generate all standard ASCII codes as listed in appendix B.

4.8 Use of the programmable HERE IS message

The DS-3000 KSR contains a provision for a user programmable message. It can be transmitted at any time by depressing the HERE IS key. To program the message, type the CTRL - SHIFT - P key combination. Be careful to hold BOTH the CTRL and SHIFT keys down before pressing the P keytop. Any desired text of up to 127 characters (63 in Version 3.X) can now be written into the HERE IS memory by typing on the keyboard. When the complete message has been typed, depress the CTRL - SHIFT - P key combination again to end the programming step. The entire message may now be used at any time by pressing the HERE IS key. It may be inserted as part of the text in page mode, line mode, or word mode. The message will remain in storage for as long as power to the terminal is left ON. HOWEVER, the entire message is lost if the ac power to the terminal is switched off. The RUB OUT key will delete the previous typed character in the HERE IS message. RUB OUT of a CR or LF operation will not appear on the screen but it would actually occur in the memory buffer.

4.9 Test Message

If the key sequence CTRL - SHIFT - 0 is used (depress both CTRL and SHIFT keys before depressing the 0), the standard test message "THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG'S BACK 0123456789" can be transmitted. This message is particularly useful in testing Baudot data circuits since it includes all of the alpha-numeric characters. Initiating the test message will cause the KOS line to go to transmit state and the entire message will be transmitted. The test message may also be loaded into the page or line mode pre-composed text. The repeat key is inoperative in this mode.

4.10 Bell

If a bell code is received or the CTRL - G (BELL) sequence is typed, an audible tone burst is emitted by the terminal. The display section ignores bell codes and does not indicate or space when one is received.

4.11 Special connections and/or features

Special connections relating to power line voltage and frequency differing from 105-125 vac, 60 Hz are shown in Appendix A. The actual Baudot and ASCII codes generated by each key are shown in Appendix B.

If there are other special, non-standard, features supplied with a particular DS-3000 KSR, they will be described in a separate addendum to this manual.

5. SYSTEM DESCRIPTION

The circuitry of the DS-3000 KSR is contained on one large logic board, a keyswitch and encoder board, and smaller boards for power supply, input / output (I/O) interface, bell tone functions, and Morse interface (Version 3.X).

5.1 Central Processor Unit

A type 8080A silicon gate N-channel 8-bit microprocessor IC forms the "heart" of the terminal. The 8080A with its associated 8224 Clock Generator, 8228 System Controller, and 8T97B bus driver control all of the DS-3000 KSR operations. The bi-directional data bus, address bus, control signals such as I/O read-write and memory read-write, as well as master timing signals are combined into a 40 conductor Universal Processor Bus (UPB). All communications between the CPU and the peripherals (such as keyboard, USART, display, and memories) is transacted through the UPB. Since the 8080A CPU system is dynamic, many different commands for different devices are communicated on this bus. Therefore, accurate timing of all peripheral device commands and operations is very important. Although the terminal does not require use of hardware interrupts, provision is included in the CPU section for single-vectored interrupts if they should be required in future applications. The 40 conductor UPB is connected to a 40 pin connector on the board that is used for production testing of the system and could be used for future expansion of the terminal.

5.2 Program Memory

Up to eight type 3624-4 programmable read-only-memories (PROMs) or 2708 erasable programmable read-only-memories (EPROMs) can be installed in the unit to store the operating program subroutines. Normally, 5 - 3624-4s are used in the Version 2.X and 5 - 2708s are used in the Version 3.X. Typical subroutines stored in the program memory are: keyboard decoding, ASCII - Baudot code conversion, I/O control, speed-change routines, display management routines, and subroutines for each of the features listed previously. Use of the PROMs in sockets assures that the terminal can be up-dated in the future when new features and/or control functions are developed. The program memory interfaces directly to the UPB. The "QUICK BROWN FOX.." test message is also stored in the program memory.

5.3 Device Selector

Several peripheral devices, such as the keyboard, front panel switches, and indicators (including the bell) are connected to the CPU through the device selector section. The device selector provides continuous "polling" (testing for input signals) of the keyboard and front panel switches. When a key is depressed, a "ready flag" signal is generated that causes the device selector to signal the CPU that the keyboard should be read. As instructed by the control subroutine in the program memory, the CPU will then "jump" (or transfer) to the keyboard-read subroutine and read the code generated by the keyswitch depressed. The subroutine also tests to see if the keyboard data is for transmission or for terminal control (such as for a speed change). Data for transmission is then routed to the USART and display sections; control data causes a jump to another control subroutine. Timing for the keyboard scanning encoder is derived from the master clock signal generated in the 8224 of the CPU section.

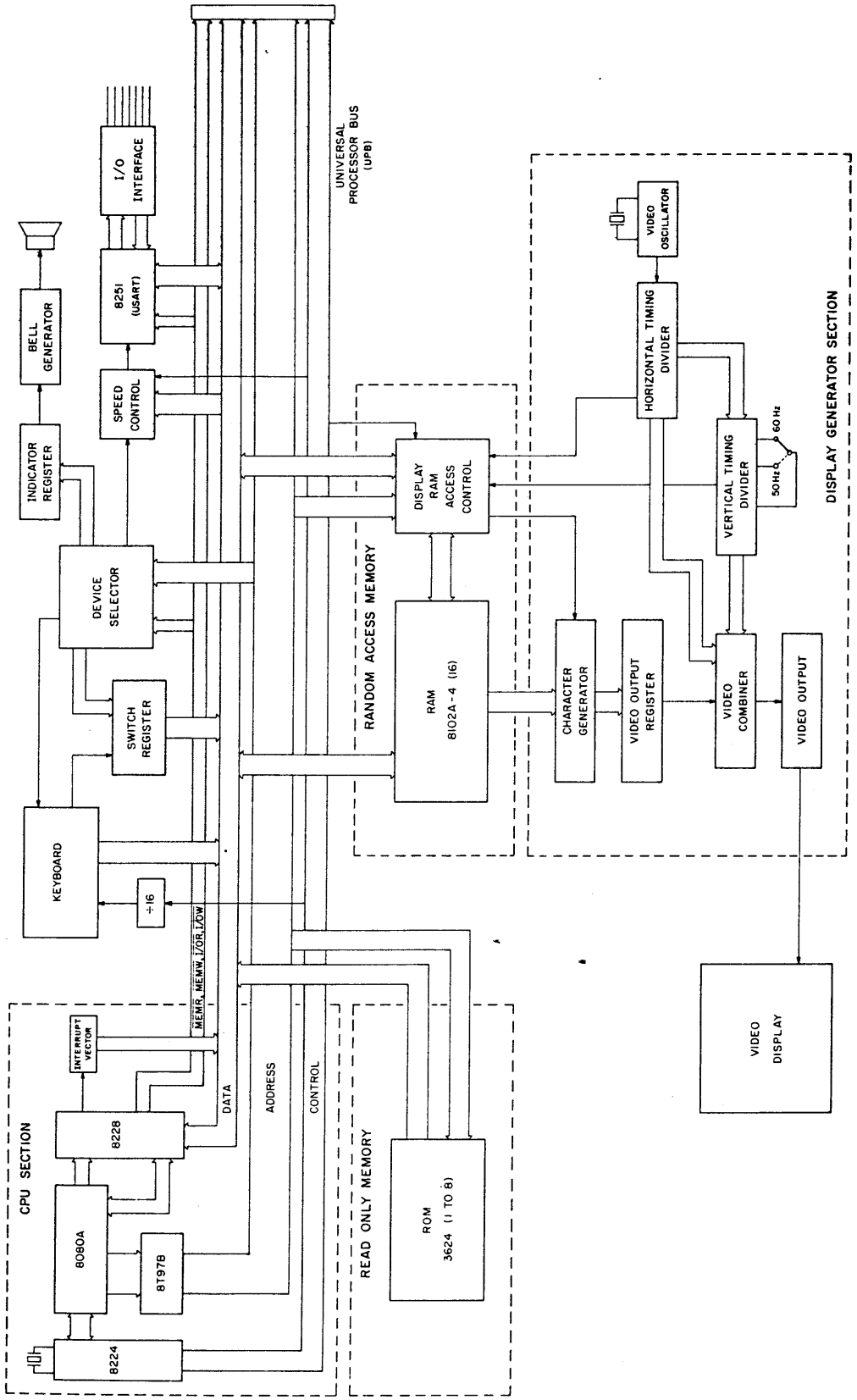


Figure 5.1 Block diagram of DS-3000 KSR terminal

The device selector also polls the front panel switches, generating the appropriate signal to the CPU whenever the status of any control switch changes. The switch register allows input of single bit instructions. Similarly, the indicator register allows output of single-bit instructions to drive indicators and the bell tone generator. Present versions of the DS-3000 KSR use the indicator register to drive only the bell tone generator. The function of both the switch and indicator registers is controlled by the device selector.

5.4 Speed control and USART

The device selector will also enable a programmable-divider system that determines the input and output data rates of the terminal. Up to 32 different I/O baud rates can be selected through bit patterns stored in a type 74S188 PROM. Present versions of the DS-3000 KSR have five Baudot rates and five ASCII rates programmed into the 74S188. However, other rates could be used by changing the 74S188 AND the corresponding speed-control subroutine in the program memory. A type 8251 Universal Synchronous/Asynchronous Receiver/Transmitter (USART) integrated circuit performs the serial-to-parallel conversion of received data (and vice-versa for transmitted data). The 8251 also determines the bit-length of a serial I/O word (5-unit Baudot or 8-unit ASCII), inserts start and stop bits, and provides control signals indicating I/O status to the CPU.

Input and output data from the USART is buffered to be compatible with EIA - RS-232C signal levels on the I/O interface board. Also contained on the I/O interface board are optical isolators for both receive and transmit sections for connection to current-loop data circuits. The keyboard-operated-switch (KOS) signal is also connected through the I/O interface board.

5.5 Random Access Memory

A total of 16 type 8102A-4 random access memory (RAM) static MOS integrated circuits are used for both display storage and "scratch-pad" (or temporary storage) memory requirements. Associated with the RAM is a series of control circuits, labeled "Display RAM Access Control" that "manages" access to the memory and prevents conflicts between use of the memory by the CPU and the display section. The RAM section provides a total storage capability of 16,384 bits, organized into 2048 bytes of 8-bits each. Use of the RAM is split approximately equally between the display and the CPU.

5.6 Display Section

As noted above, the display uses approximately one-half of the RAM section to store the screen information. All timing of the display video signal is generated in a 12.2727 MHz crystal oscillator which is then divided appropriately to the dot-rate, horizontal scan rate, and vertical scan rate. A type 3624 PROM is used in the vertical timing section to allow selection of either 50 or 60 Hz vertical scan rates (jumper selectable on circuit board - see Appendix A). Another 3624 PROM (or two if special character set is required) is connected to the RAM section, acting as a character generator to produce the bit pattern required for each character. The parallel data from the 3624 character generator is converted to serial output video in the 74166 video output register. The serial video is combined with vertical and horizontal sync and blanking signals in the video combiner section to produce the composite video to drive the display.

5.7 Keyswitch Circuit Board

The keyswitches and a scanning keyboard encoder IC (MM5740AAE/N) are constructed on a separate circuit board. The keyswitches are arranged in a standard 52-key ASCII arrangement. When possible, the keytops have been chosen to indicate the true function of each switch. However, some switches have more functions than labeling room permits and the operator should consult Figures 4.1 through 4.4 and Appendix B to determine all of the keyboard functions and output codes. The keyboard encoder features "N-key roll-over", permitting actuating of a new key before previous key(s) have been released. The data output from the keyboard is a modified form of the ASCII code plus control signals.

5.8 Bell Tone Circuit Board

A small circuit board attached to a speaker generates a short tone burst when signalled by the indicator register. The tone is generated whenever the bell code is received or transmitted. This board is used as the sidetone oscillator for Morse code (Version 3.X only).

5.9 I/O Interface Board

As discussed previously, the RS-232C interface buffers and optical isolators for current-loop circuits are constructed on a small circuit board mounted on the rear of the terminal. The KOS control transistor is also located on this board. The video output signal is also routed through the interface board.

5.10 Power Supply Board

The rectifiers, filter networks, and regulators to generate the +5 volts and ±12 volts required by the terminal are constructed on this small board to the rear of the cabinet. The transformer and regulator circuits have been designed to require no adjustment and to operate the terminal with line-voltage variations of 105 to 125 vac (210 to 250 vac when transformer connections are made accordingly - see Appendix A). The power supply functions for either 50 or 60 Hz power input.

5.11 Morse Code I/O Board (Version 3.X only)

This circuit board contains the pre-limiter filter, limiter, threshold, and detection circuitry. The data rate detection circuitry, keying circuitry, and all circuits necessary to interface with the 40 pin UPB cable and the bell tone board are also located on this board.

5.12 Maintenance

The operator should try to keep the terminal in a moderately clean environment and particularly avoid high-humidity or dust locations. The display section's high voltage power supply may be particularly susceptible to dust and humidity and should be cleaned frequently with a vacuum or forced air if operated in this type of environment. Normal operation in an office or home should result in years of trouble-free service. Should problems arise, please contact the customer relations department at the factory. It is NOT recommended that the user attempt to service the terminal.

6. DIAGRAMS

The circuit board layout and schematic diagrams are contained in this section. While every effort has been made to assure the accuracy of these drawings, individual units may vary slightly from the diagrams due to engineering improvements or parts availability. HAL Communications will attempt to periodically update these drawings, as well as make pertinent textual changes as time permits. However, HAL Communications reserves the right to make changes in specifications and circuitry without prior notice and without obligation to incorporate such changes in previously sold equipment. Any changes that seriously affect the performance or operating features of the DS-3000 will be explained in addendum pages supplied with this manual when the unit is shipped.

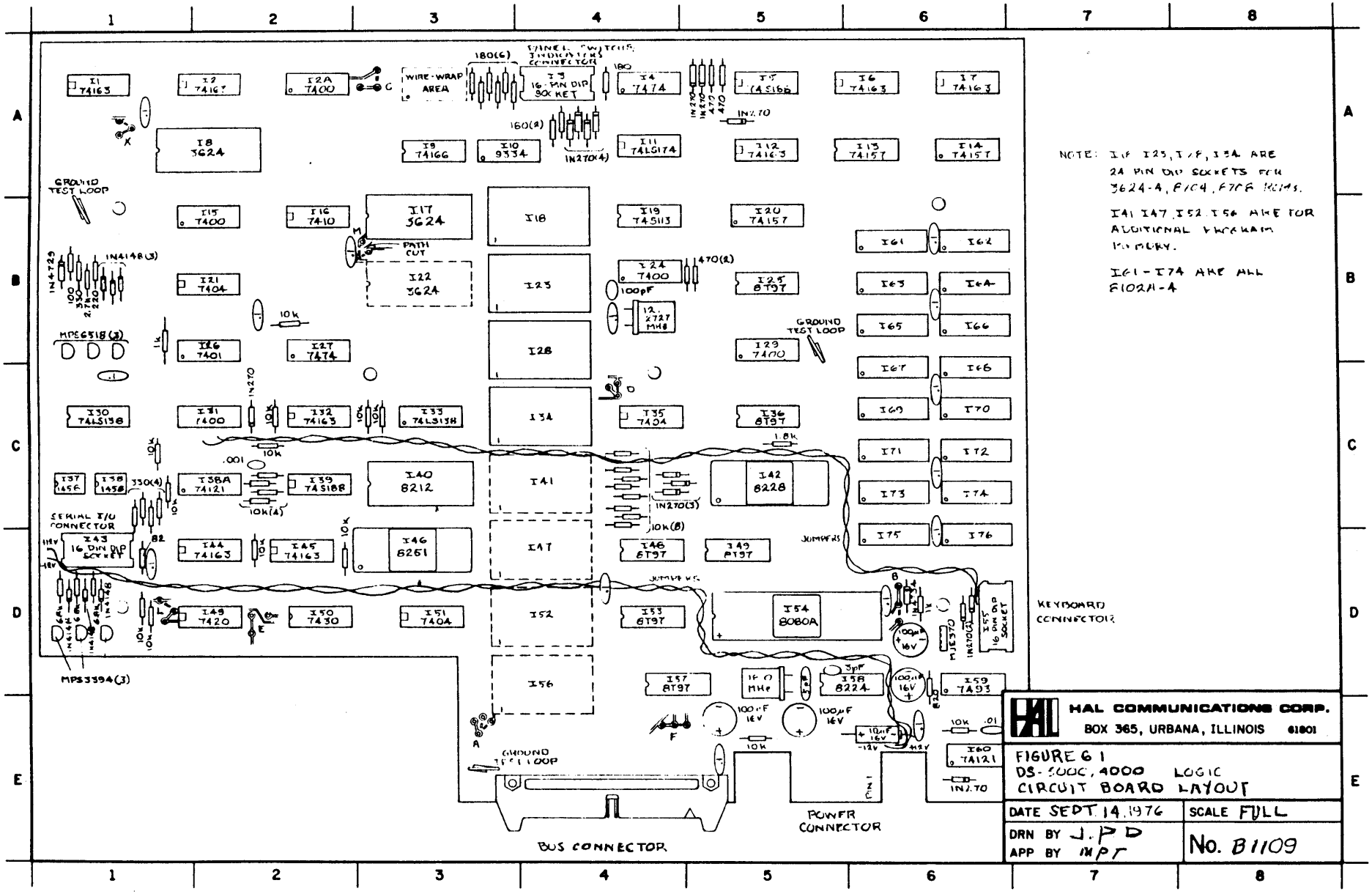

NOTE: I/F I25, I/F, I54 ARE 24 PIN DIP SOCKETS FOR 3624-4, F/C4, F/C8 ROMS.
I41 I47 I52 I56 ARE FOR ADDITIONAL PROGRAM MEMORY.
I61-I74 ARE ALL F102A-4
KEYBOARD CONNECTOR
POWER CONNECTOR
BUS CONNECTOR
GROUND TEST LOOP
SERIAL I/O CONNECTOR
JUMPERS
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FIGURE 6 1
DS-5000, 4000 LOGIC
CIRCUIT BOARD LAYOUT
DATE SEPT. 14, 1976
SCALE FULL
DRN BY J.P.D
APP BY MPT
No. B1109

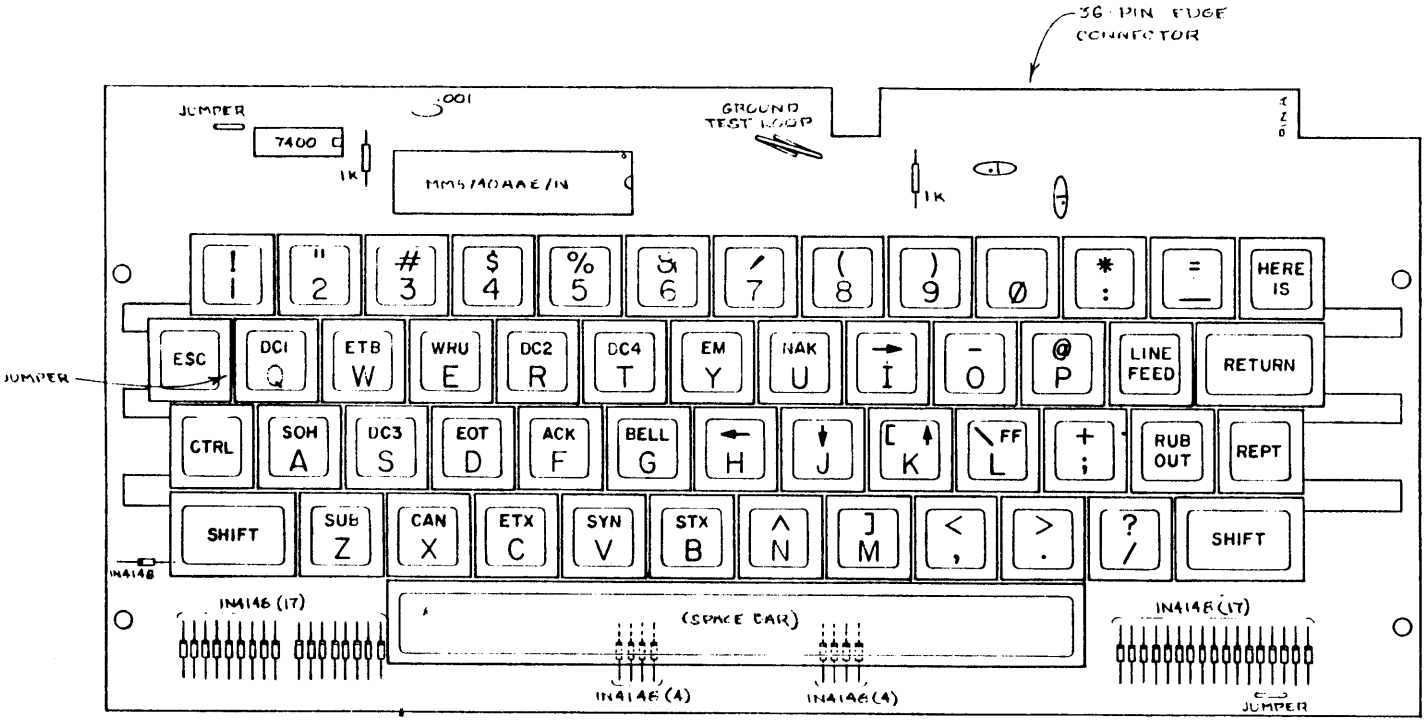

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FIGURE 6.2 DS-3000/4000 KEYSWITCH CIRCUIT BOARD LAYOUT	
DATE SEPT. 7, 1976	SCALE FULL
DRN BY J.P.D. APP BY M.T.	No. B110

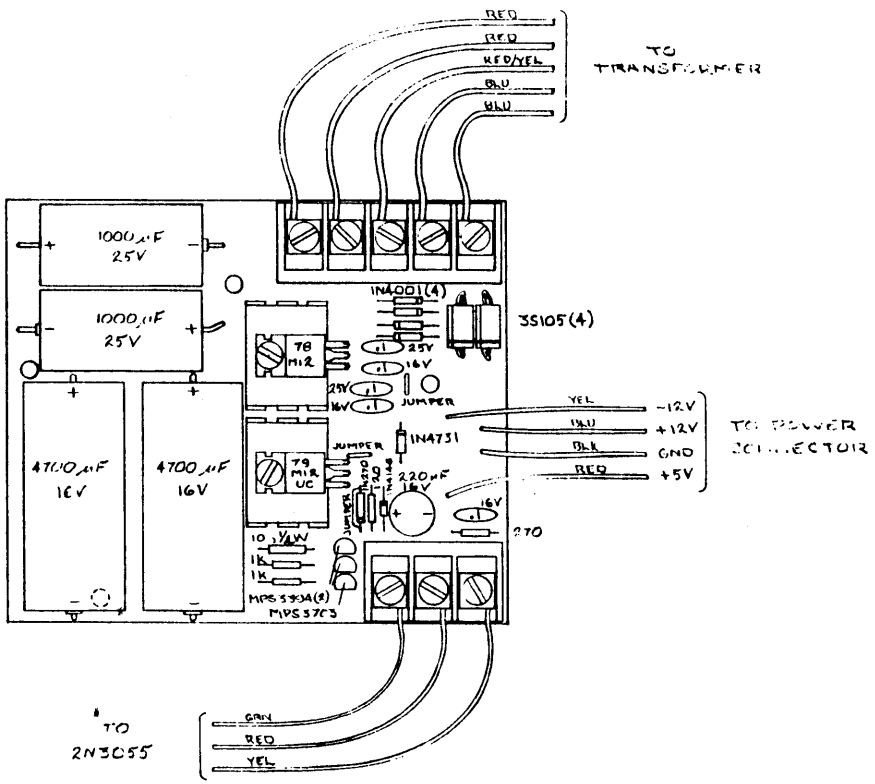

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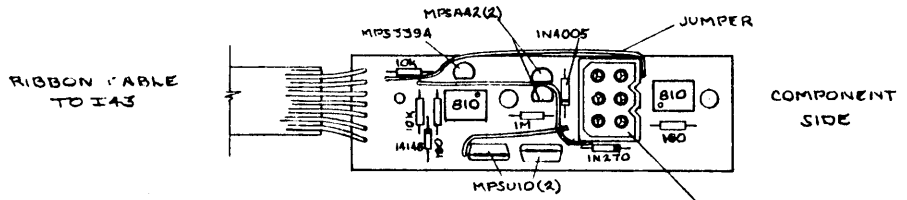
FIGURE 6.3 DS-3000/4000 POWER SUPPLY CIRCUIT BOARD LAYOUT	
DATE SEPT 7, 1976	SCALE FULL
DRN BY J P D. APP BY MPT	No. B1111



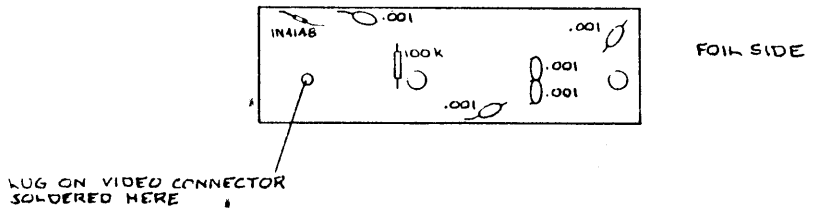


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FIGURE 6.A DS 3000 I/O INTERFACE CIRCUIT BOARD LAYOUT	
DATE SEPT. 3, 1976	SCALE FULL
DRN BY JPD APP BY MFT	No. B1112

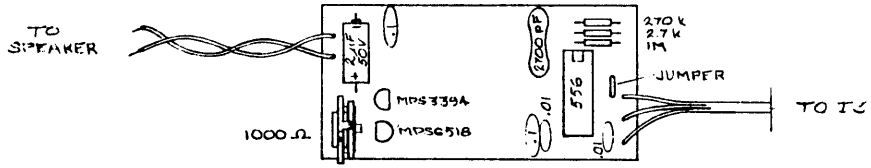

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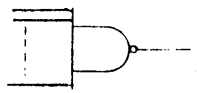
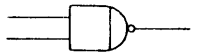
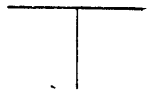
FIGURE 65 DS 3000/4000 BELL TONE CIRCUIT BOARD LAYOUT	
DATE SEPT. 5, 1976	SCALE FULL
DRN BY JP·D APP BY MPT	No. B1113



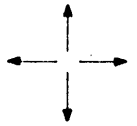
NAND
(OUTPUT=1 WHEN ANY INPUT=0)
7400, 7410, 7420
7430, 74S13



NAND
OPEN COLLECTOR
7401

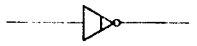


CONNECTION



+5V, -5V, +12V, -12V
CONNECTION

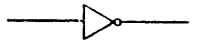
NOR
(OUTPUT=0 WHEN ANY INPUT=1)
7402



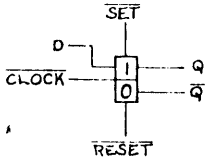
NOT
OPEN COLLECTOR
7405

NO CONNECTION

GROUND
CONNECTION
(0 VOLTS)



NOT
7404



7474

JUMPER
CONNECTION

BOARD
CONNECTION

———	$\overline{\text{INTREQ}}$ (C.14)	SIGNAL IS PART OF BUS AND APPEARS IN FIG. C.14
———	R/W UART C10-D4	SIGNAL ORIGINATES IN FIG. C.10, AREA D4
———	$\overline{\text{INCLINE}}$ (C.12)	SIGNAL GOES TO FIG. C.12

ALL RESISTORS ¼ WATT ± 5%

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FIGURE C.6
DS-3000, 4000
SCHEMATIC DIAGRAM CONVENTIONS

DATE MAR 30 1976	SCALE
DRN BY J.P.D.	No. 11209
APP BY MPT	

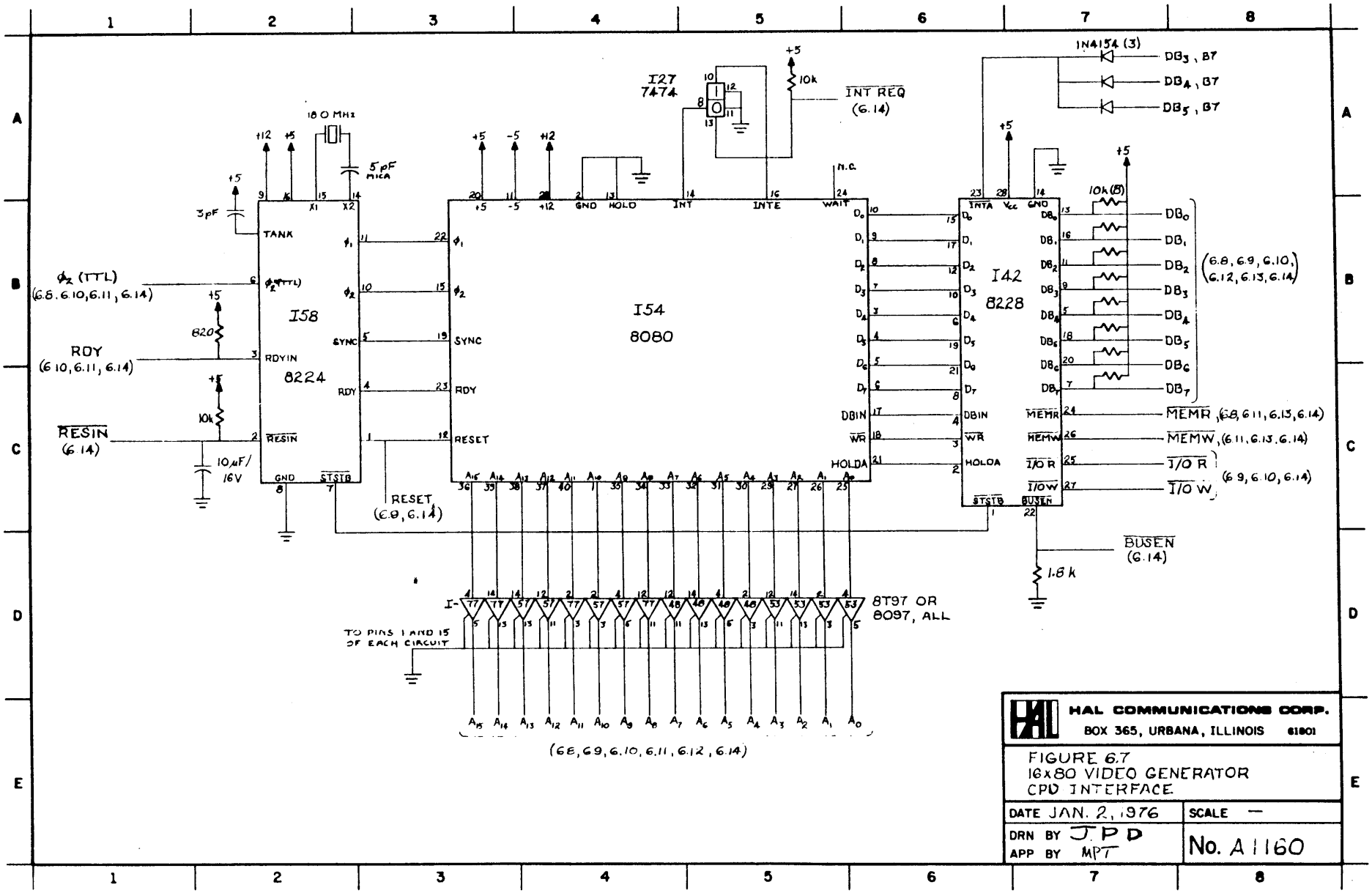

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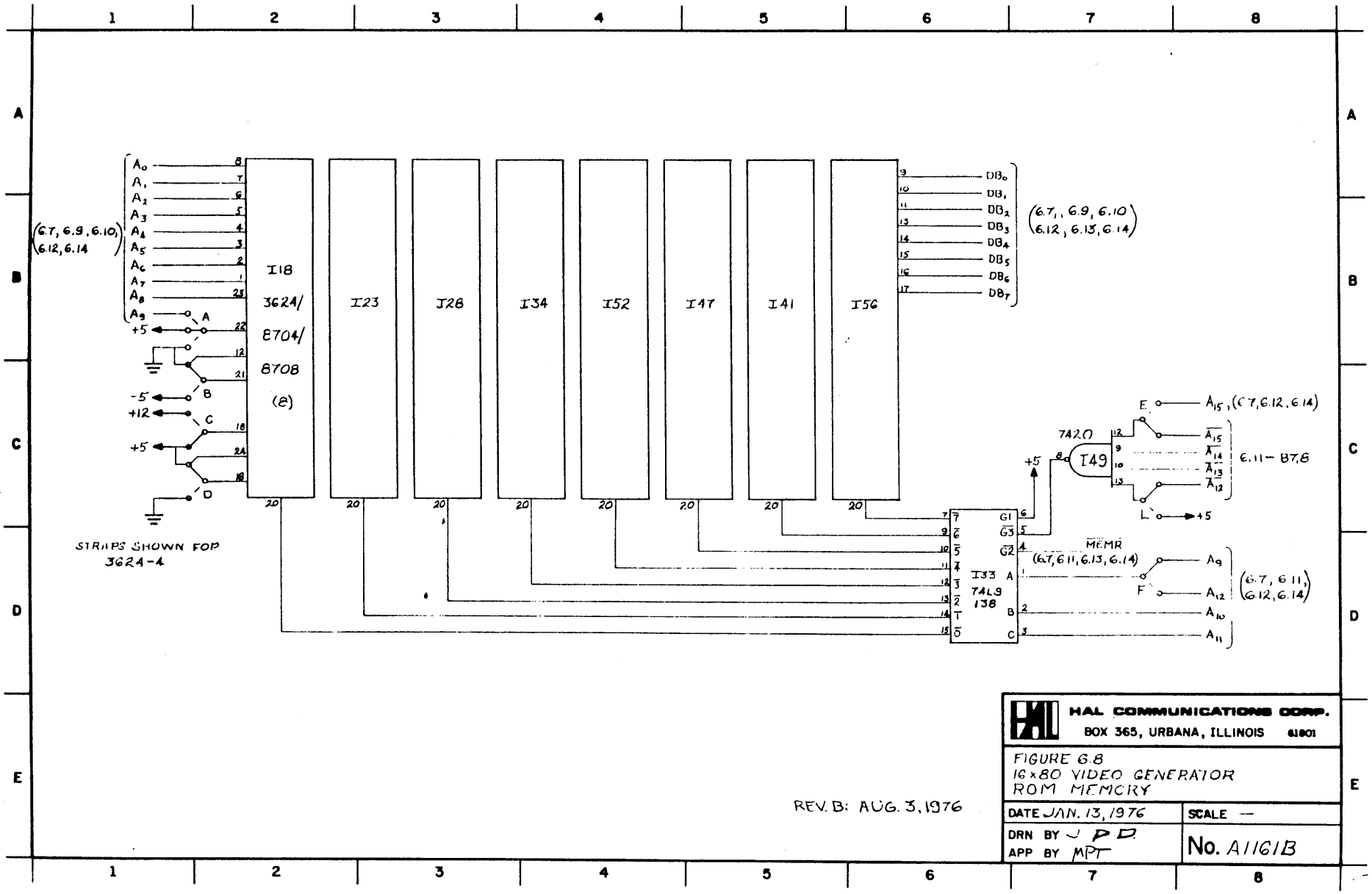
FIGURE 6.7
16x80 VIDEO GENERATOR
CPU INTERFACE

DATE JAN. 2, 1976	SCALE —
DRN BY JPD APP BY MPT	No. A1160



REV. B: AUG. 3, 1976

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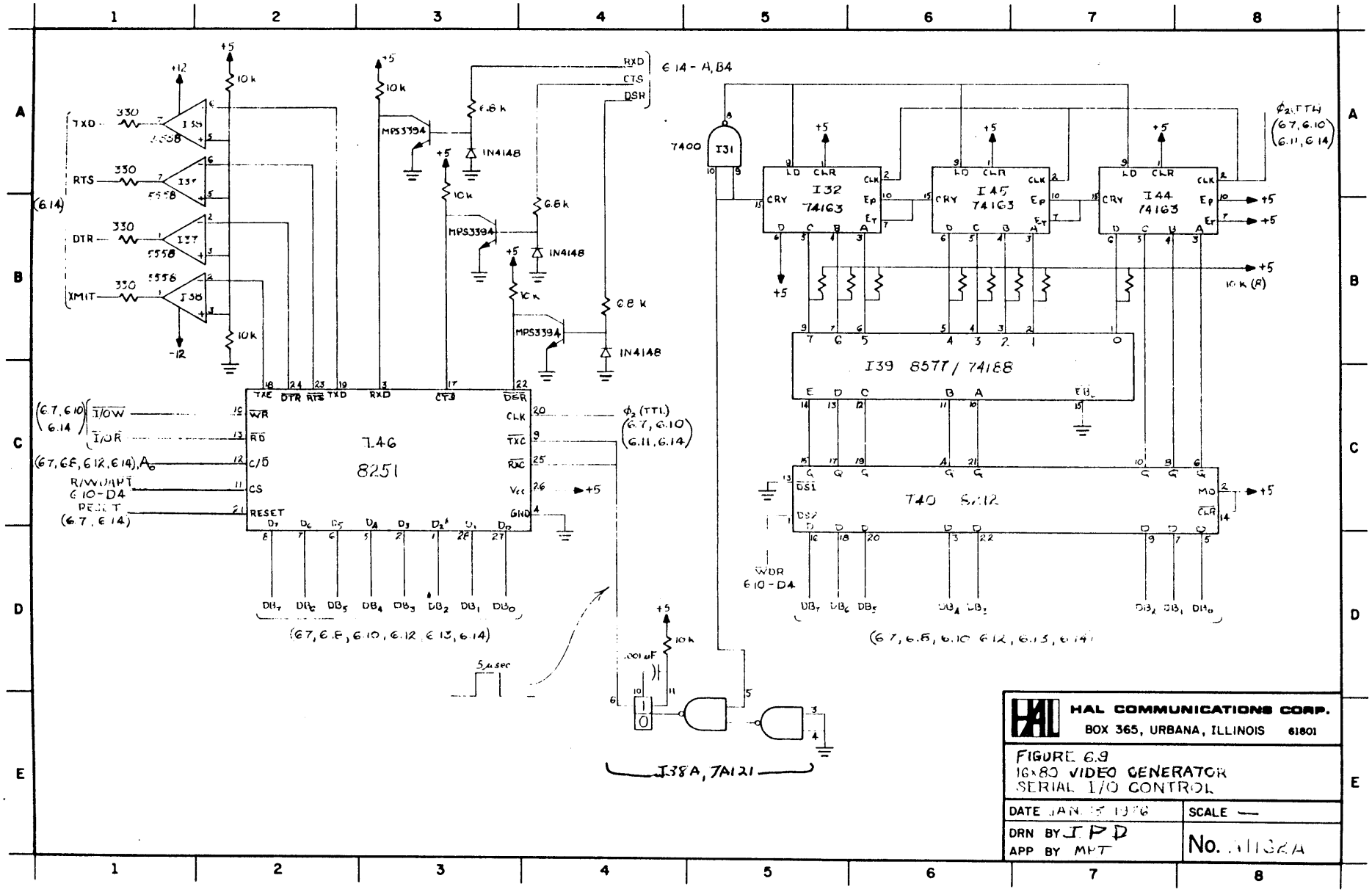
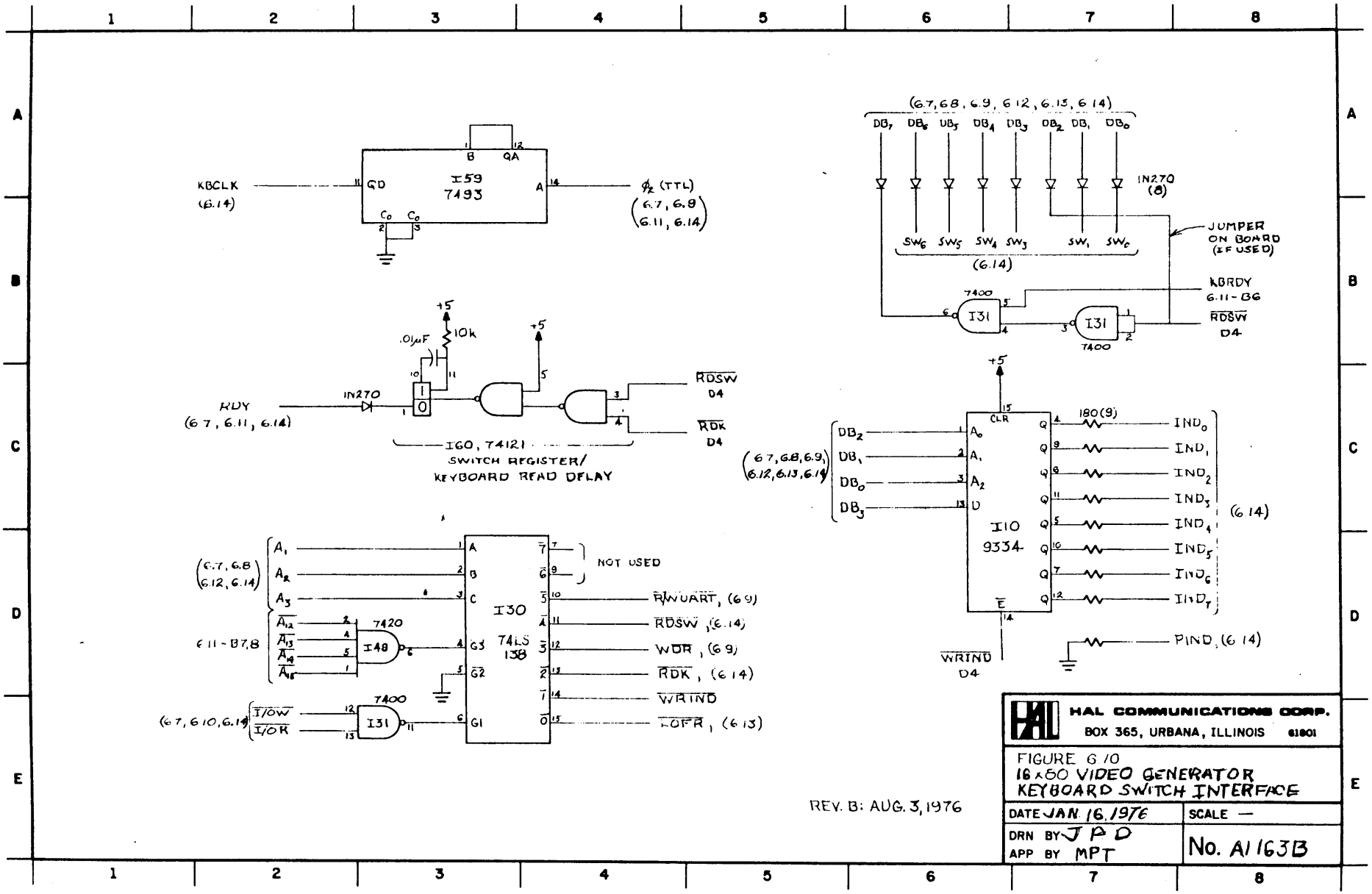
FIGURE 6.8
16×80 VIDEO GENERATOR
ROM MEMORY

DATE JAN. 13, 1976 | SCALE —
DRN BY J P D
APP BY MPT | No. A1161B



HAL COMMUNICATIONS CORP. BOX 365, URBANA, ILLINOIS 61801	
FIGURE 6.9 16×80 VIDEO GENERATOR SERIAL I/O CONTROL	
DATE JAN 15 1976	SCALE —
DRN BY JPD APP BY MPT	No. 1113-A



REV. B: AUG. 3, 1976

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FIGURE 6.10
16 x 60 VIDEO GENERATOR
KEYBOARD SWITCH INTERFACE

DATE JAN. 16, 1976	SCALE —
DRN BY JPD APP BY MPT	No. A1163B

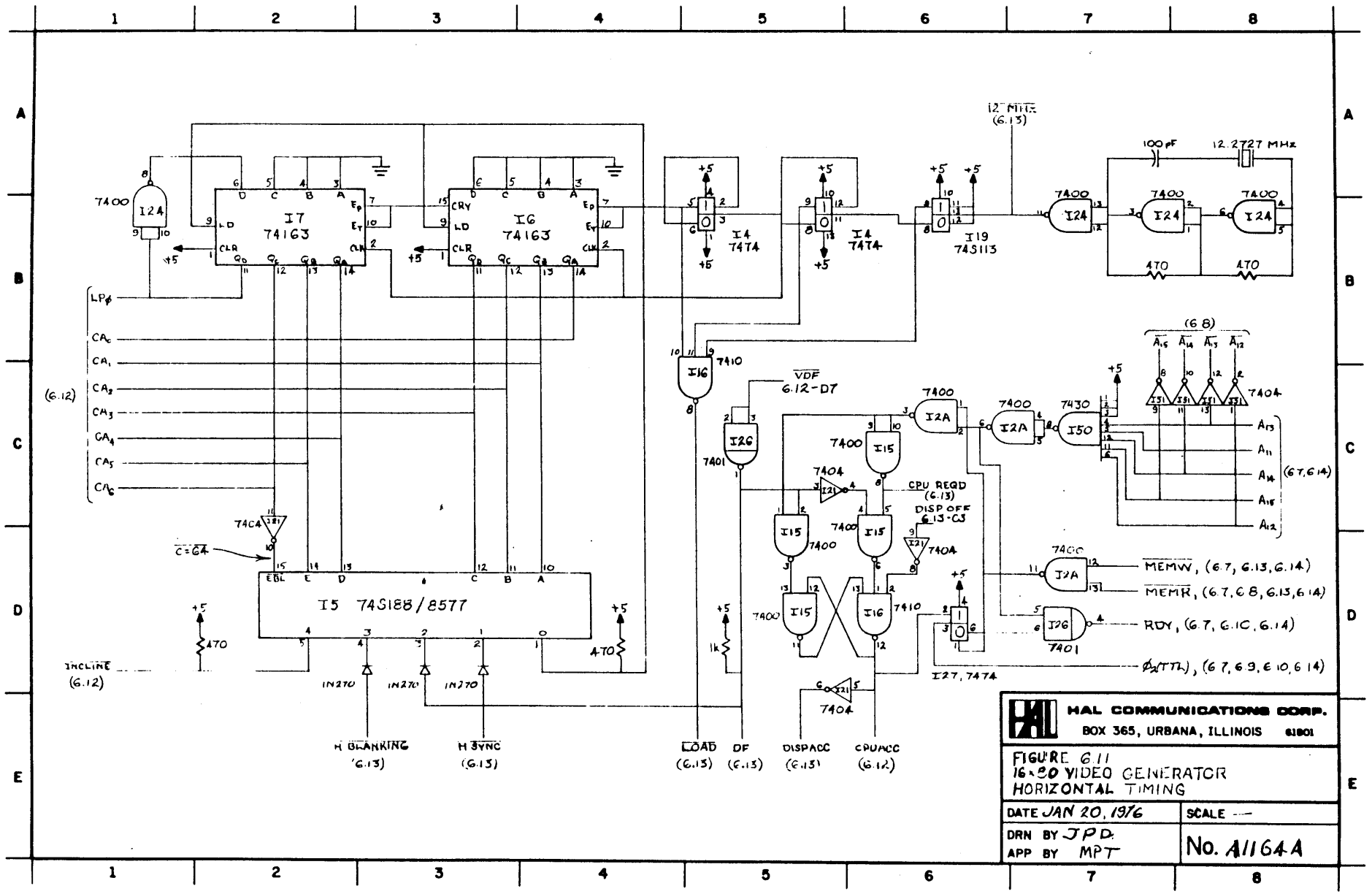

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FIGURE 6.11
16×30 VIDEO GENERATOR
HORIZONTAL TIMING

DATE JAN 20, 1976 | SCALE —
DRN BY JPD
APP BY MPT
No. A1164A

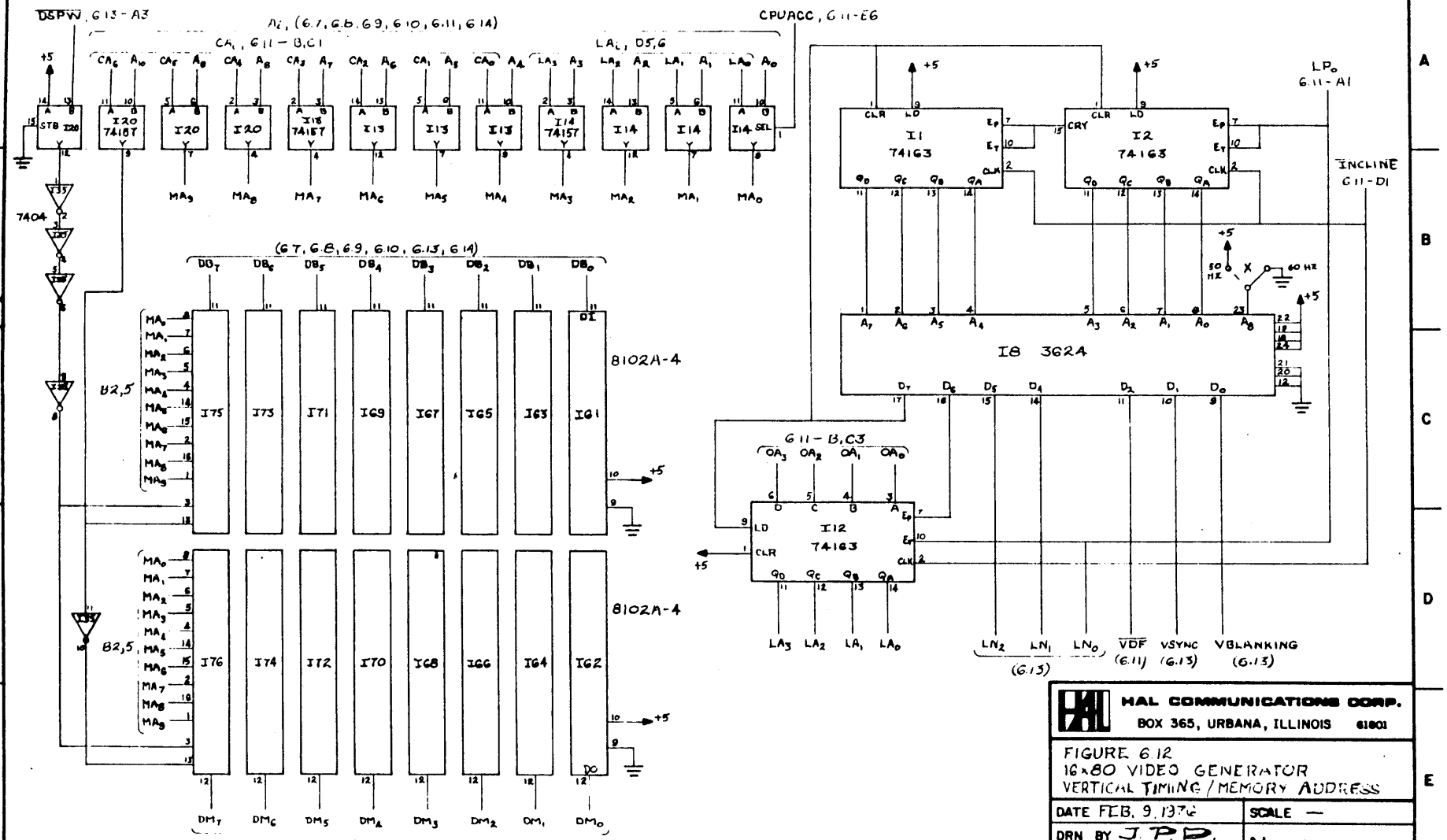

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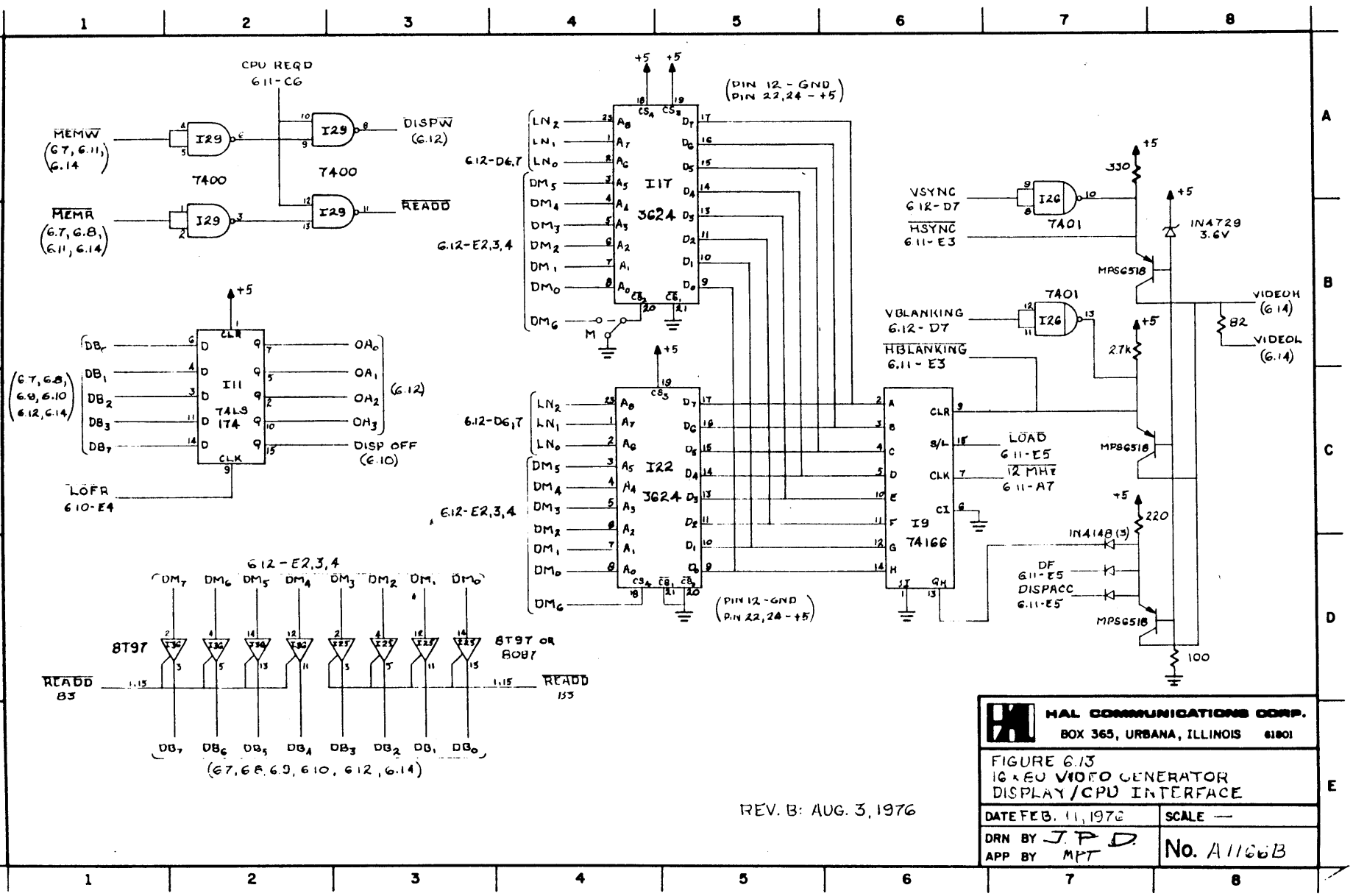
FIGURE 6.12
16×80 VIDEO GENERATOR
VERTICAL TIMING / MEMORY ADDRESS

DATE FEB. 9, 1976 | SCALE —
DRN BY J.P.D. | No. A1165A
APP BY MPT



REV. B: AUG. 3, 1976

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FIGURE 6.13
IGEN VIDEO GENERATOR
DISPLAY/CPU INTERFACE

DATE FEB. 11, 1976	SCALE —
DRN BY J.P.D.	No. A1166B
APP BY MPT	

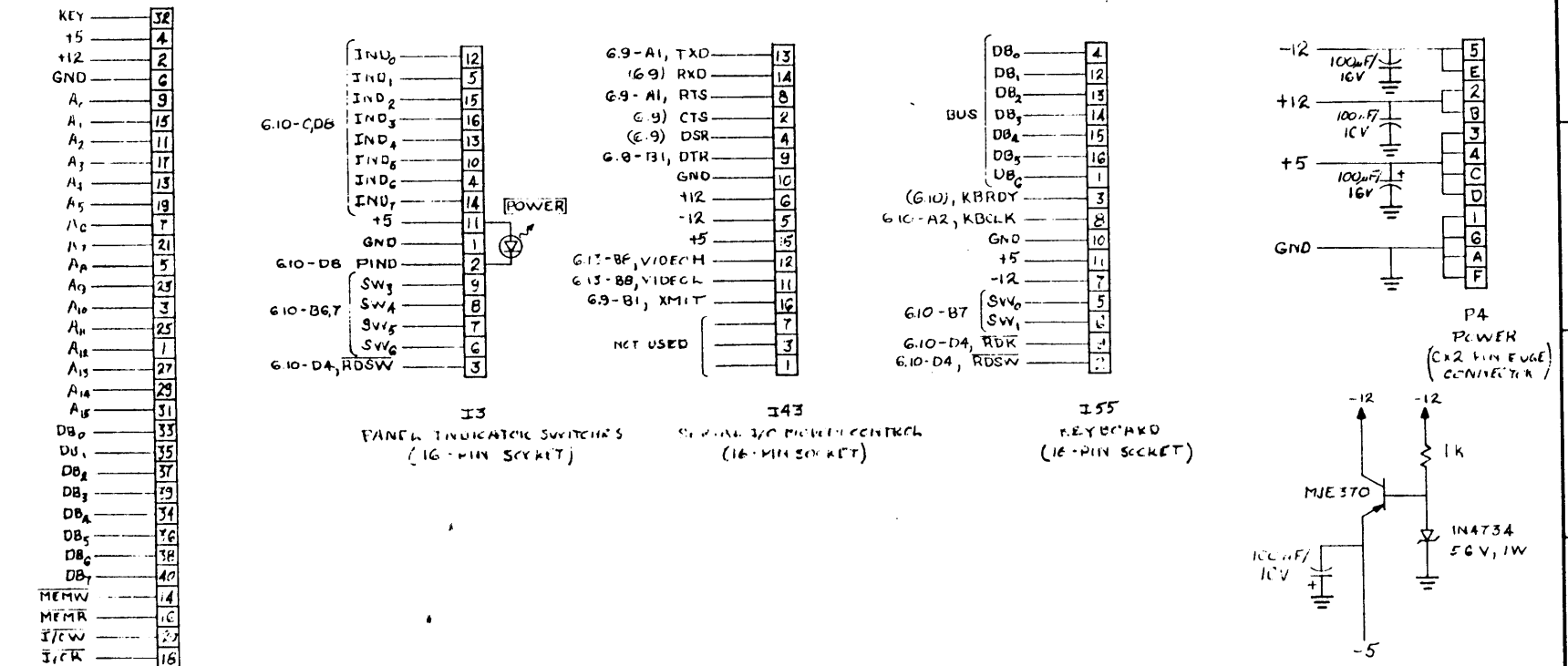

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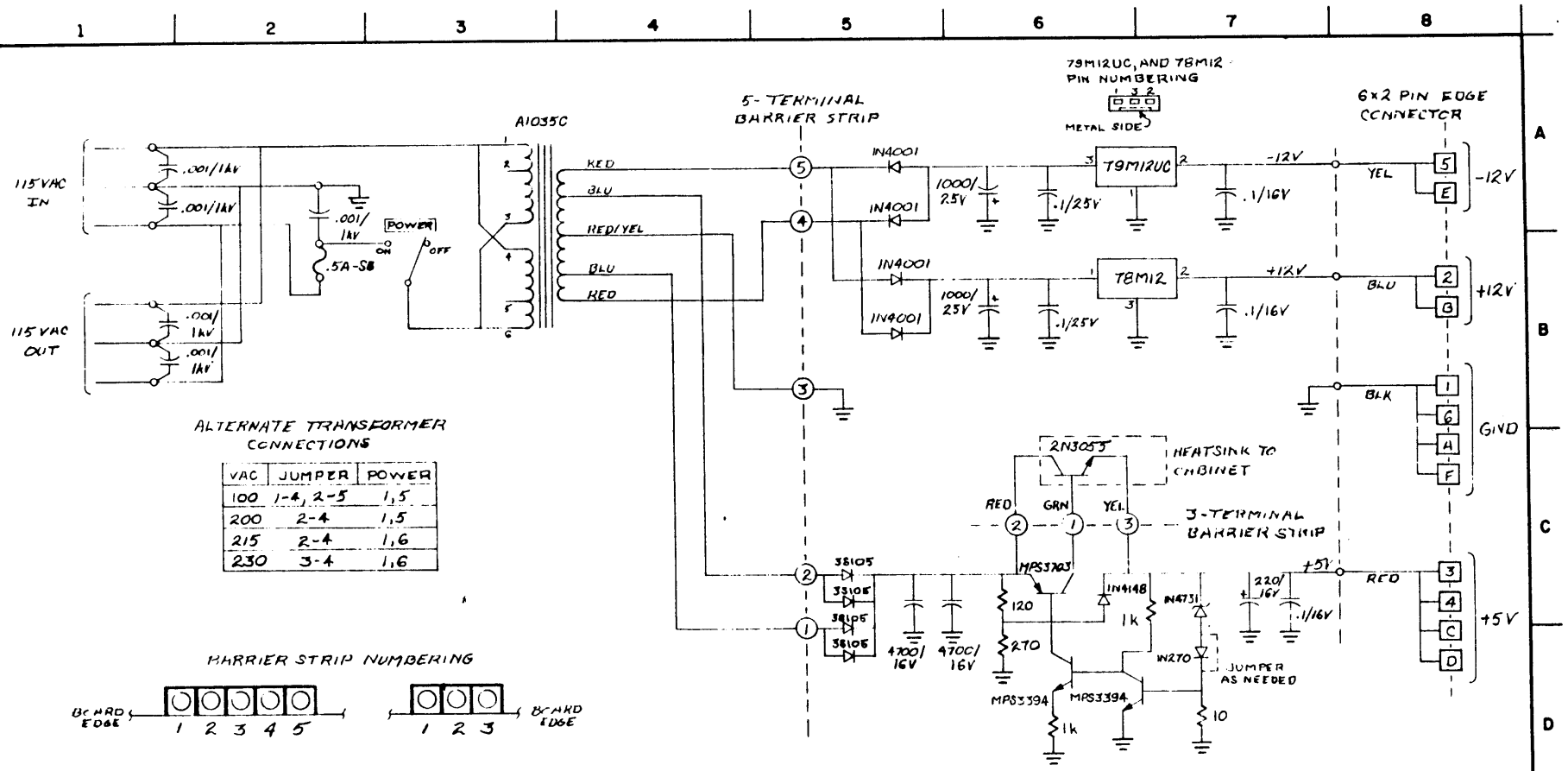
FIGURE 6.14
IOS50 VIDEO GENERATOR
CONNECTOR DEFINITIONS

DATE FEB. 11, 1976	SCALE —
DRN BY J. P. D.	No. A1167A
APP BY MPT	



VAC	JUMPER	POWER
100	1-4, 2-5	1,5
200	2-4	1,5
215	2-4	1,6
230	3-4	1,6

NOTE: ACCEPTABLE SUBSTITUTES ARE
- MPS3702, MPS6518 FOR MPS3703
- MPS3395, MPS6514 FOR MPS3394

REV. A: AUG. 3, 1976

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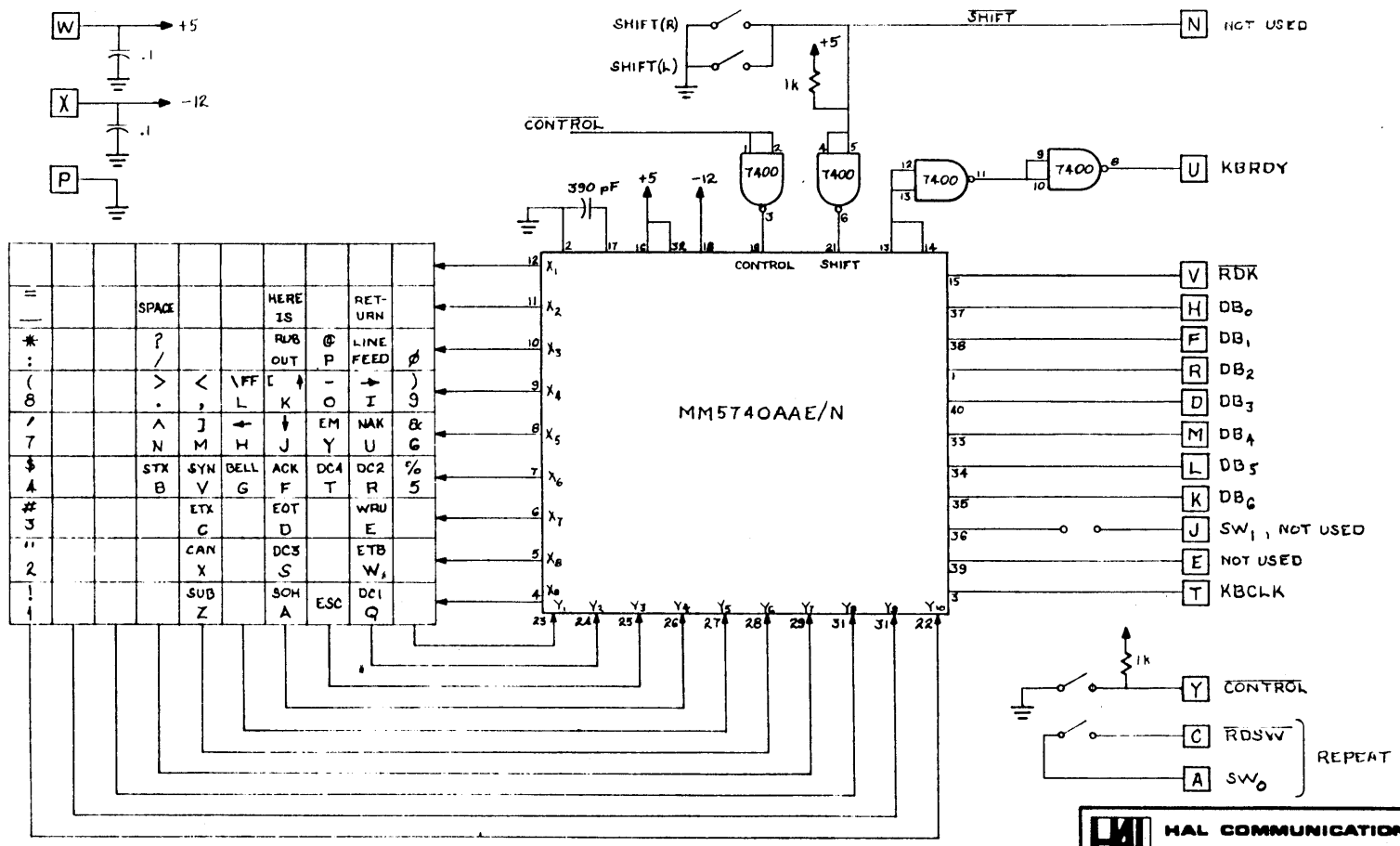
FIGURE 6.15
DS-3000/4000 KSR/RO
POWER SUPPLY

DATE MAR. 15, 1976 | SCALE —
DRN BY J.P.D.
APP BY MPT
No. A1206A



NOTE 1. ALL KEYSWITCHES IN ABOVE MATRIX ARE:

X_i — IN4146 — SPST — Y_i

EXCEPT !, ", #, =, AND HERE IS WHICH ARE

X_i — SPST — Y_i

BLANK POSITIONS ARE NOT USED

REV. A: MAR. 15, 1977

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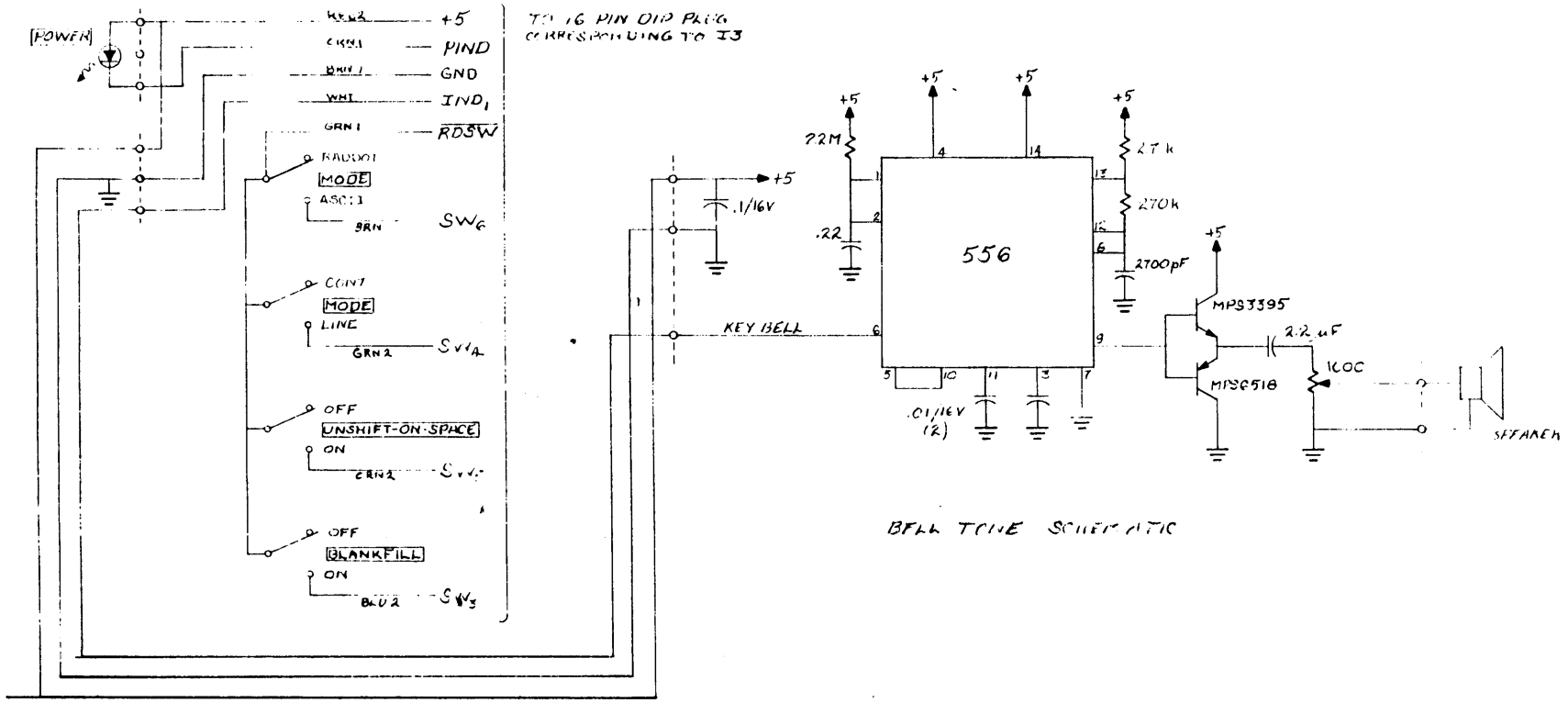
FIGURE 6.16
DS-3000/4000
KEYBOARD ENCODER

DATE MAR. 15, 1976 | SCALE —

DRN BY J.P.D
APP BY MPT

No. A1200A



BELL TONE SCHEMATIC

FRONT PANEL SWITCH SCHEMATIC

NOTE: SWITCHES SHOWN FOR DS-3000 VER. 2.X
FOR DS-3000 VER 1X, DELETE "BAUDOT/ASCII" SWITCH
FOR DS-4000 VER 1X, DELETE "BAUDOT/ASCII", "UNSHIFT-ON-SPACE" AND "BLANKFILL" SWITCHES

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FIGURE 6.17
BELL TONE AND FRONT PANEL SCHEMATICS

DATE MAR. 8 1976 | SCALE —
DRN BY J.P.D
APP BY MPT
No. 11198

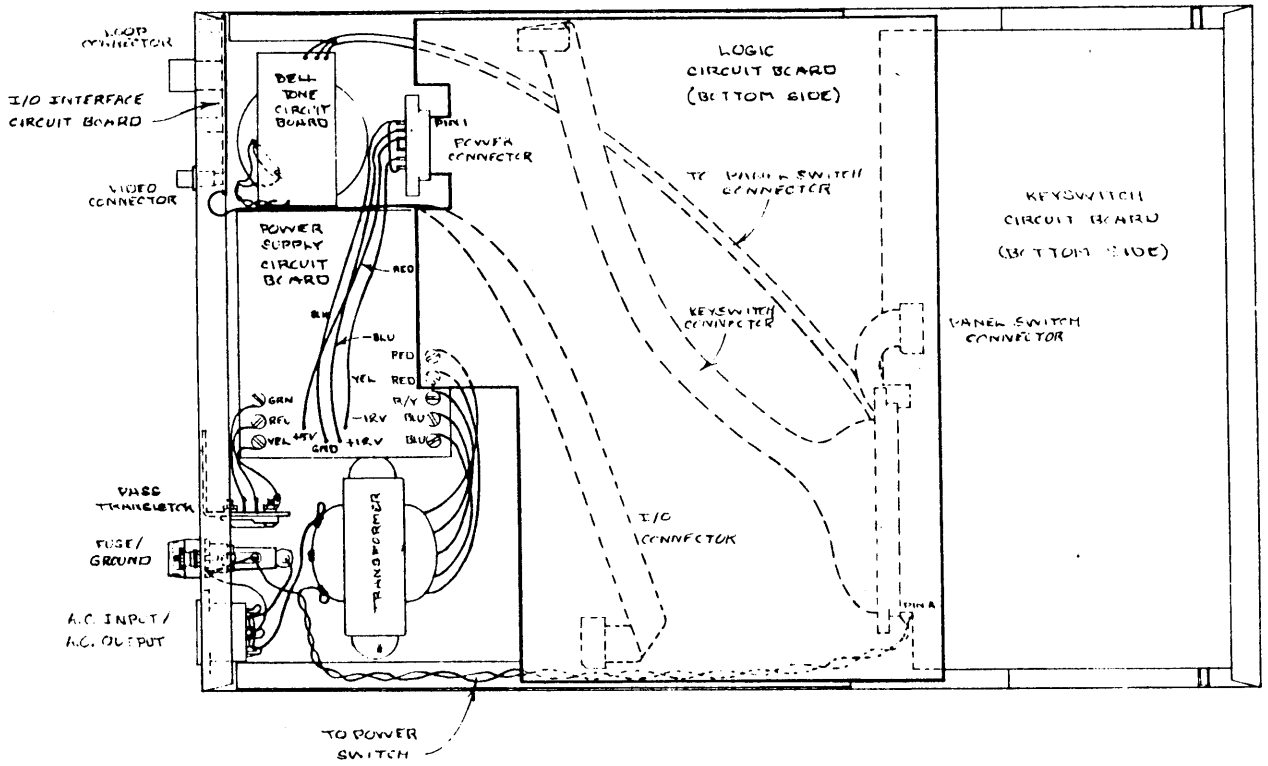

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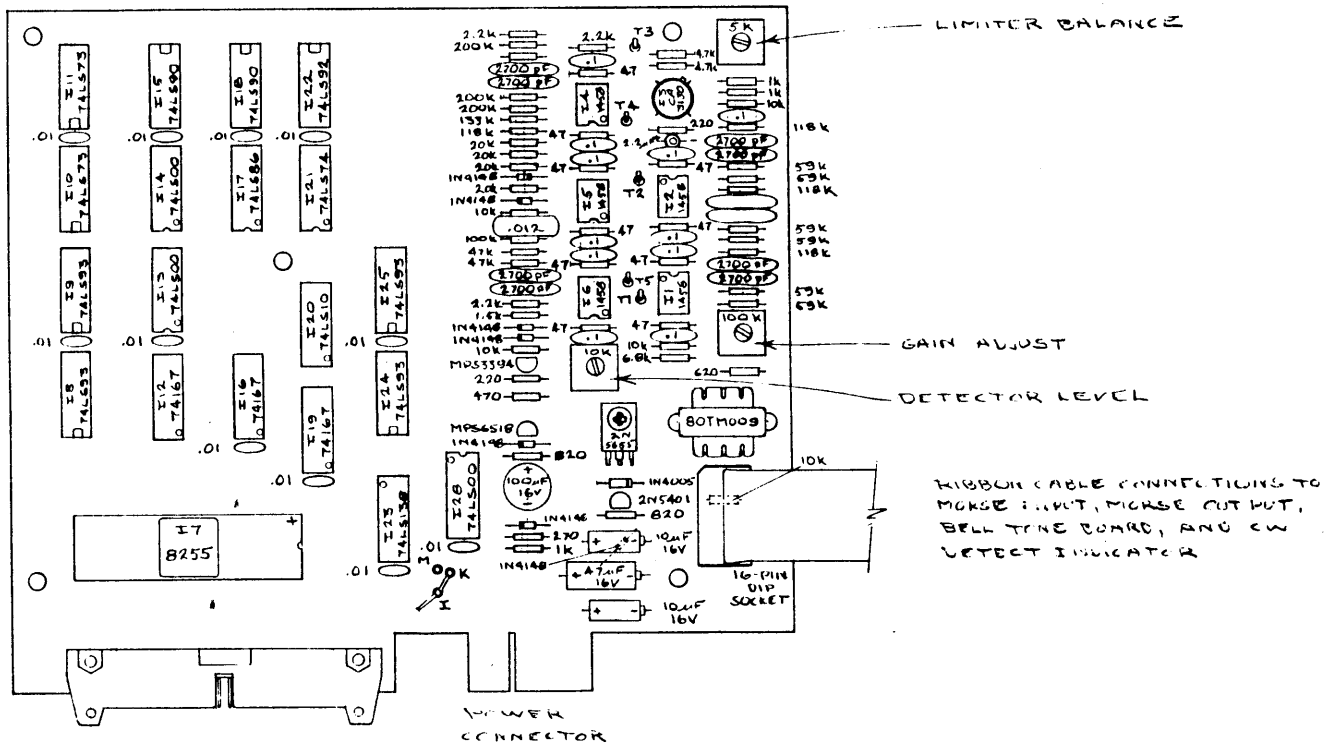
FIGURE E18
DS-3000, 4000
CABINET WIRING

DATE SEPT. 16, 1976
SCALE HALF
DRN BY JDD
APP BY MPT
No. B1114



REV. A, JAN 20, 1978
800 ME MODIFICATION
SER. NO > 435

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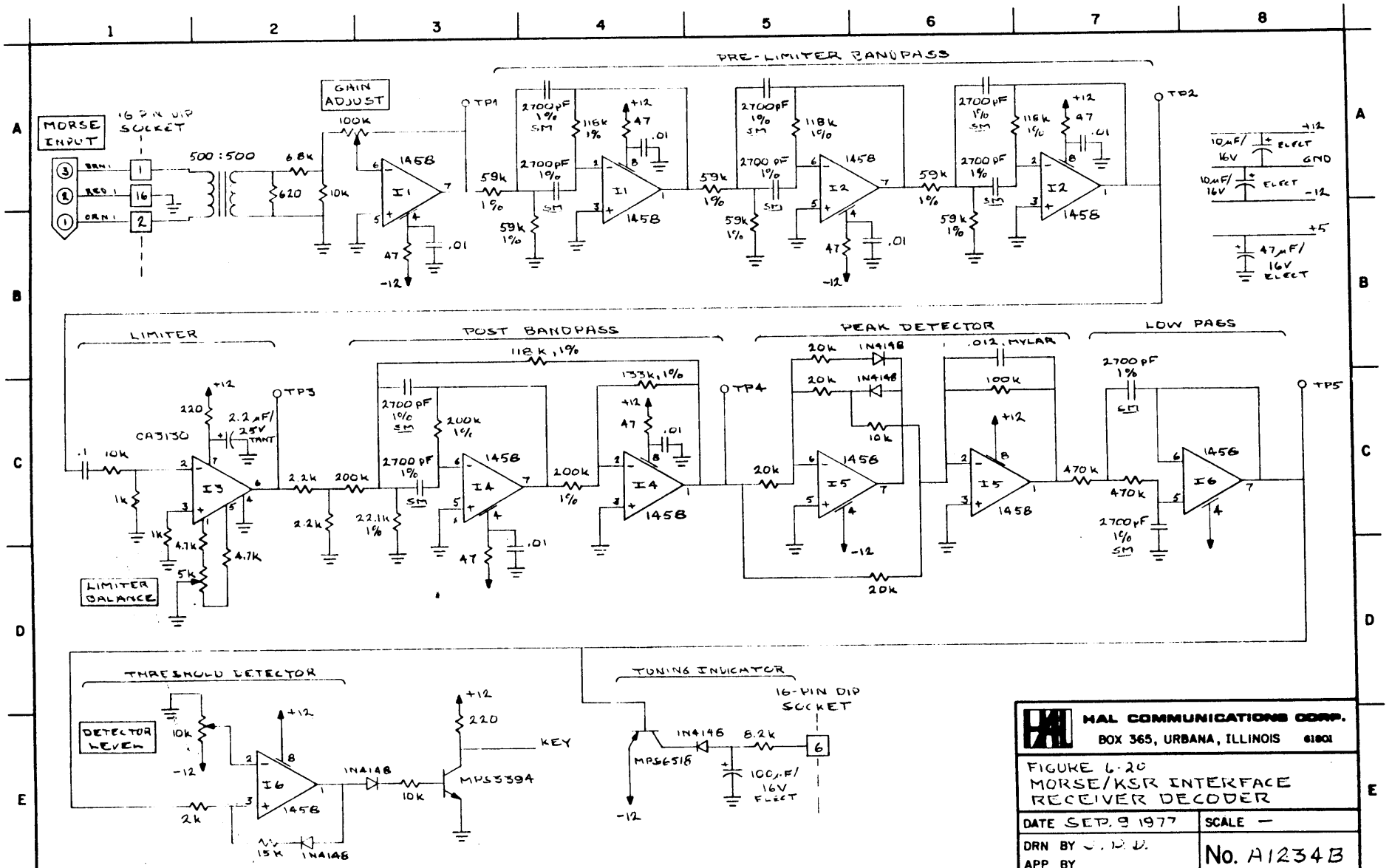
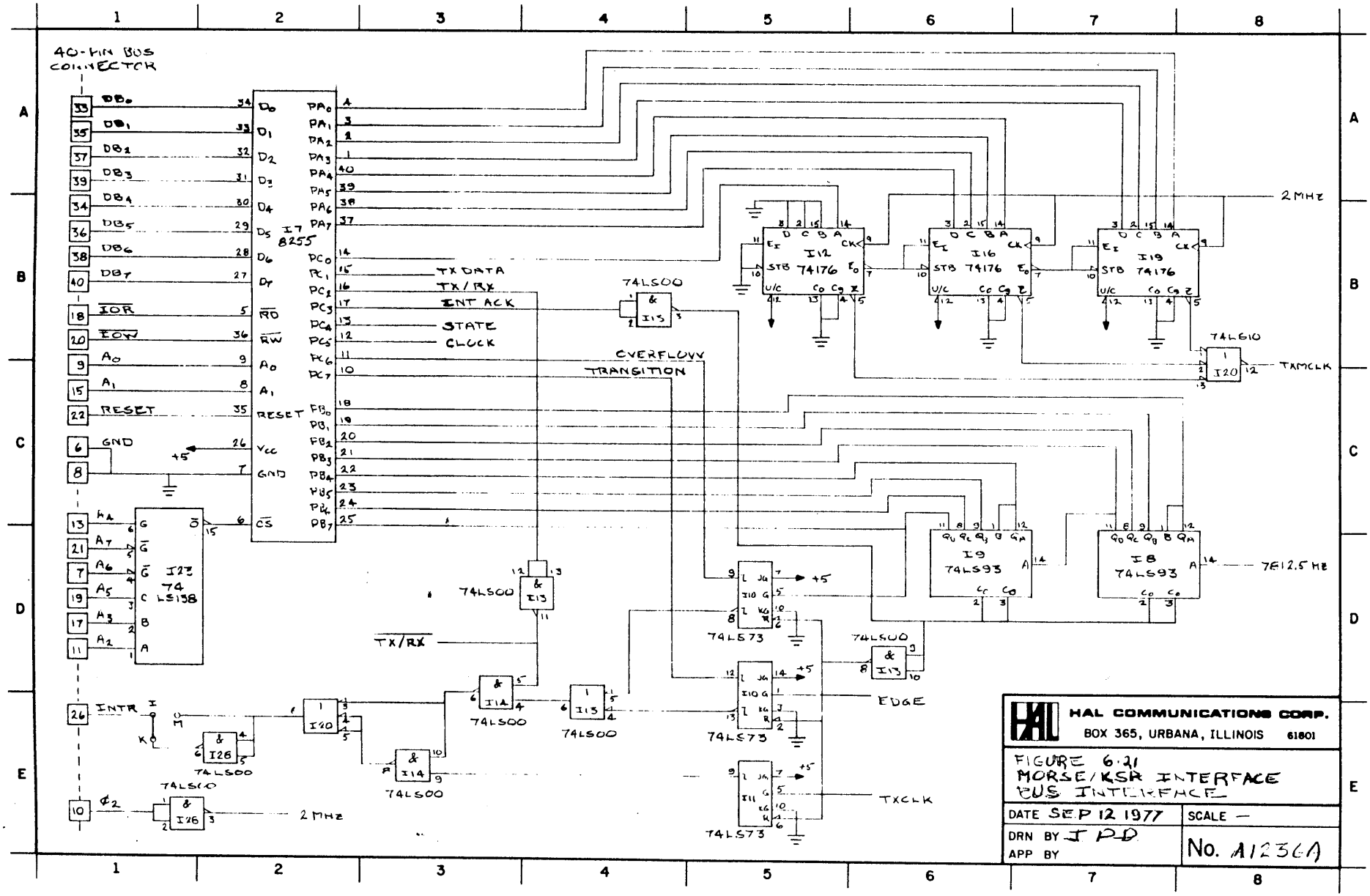
FIGURE 6.14 MORSE/KSR INTERFACE BOARD PARTS PLACEMENT	
DATE SEP 14 1977	SCALE FULL
DRN BY JPD APP BY	No. P1166


PRE-LIMITER BANDPASS
MORSE INPUT
16 PIN DIP SOCKET
GAIN ADJUST
500 : 500
620
6.8k
10k
100k
1458
TP1
TP2
2700pF 1%
118k 1%
59k 1%
47
.01
-12
+12
10µF/ 16V ELECT
GND
+5
47µF/ 16V ELECT
LIMITER
POST BANDPASS
PEAK DETECTOR
LOW PASS
CA3130
2.2µF/ 25V TANT
220
.1
1k
4.7k
5k
LIMITER BALANCE
TP3
TP4
TP5
2.2k
200k
118k, 1%
133k, 1%
22.1k 1%
20k
IN4148
.012, MYLAR
100k
10k
470k
THRESHOLD DETECTOR
DETECTOR LEVEL
15k
IN4148
MPS5394
KEY
TUNING INDICATOR
16-PIN DIP SOCKET
MPS6518
8.2k
100µF/ 16V ELECT
HAL COMMUNICATIONS CORP.
BOX 365, URBANA, ILLINOIS 61801
FIGURE 6-20
MORSE/KSR INTERFACE
RECEIVER DECODER
DATE SEP. 9 1977
SCALE —
DRN BY
APP BY
No. A1234B


40-PIN BUS CONNECTOR
DB0
DB1
DB2
DB3
DB4
DB5
DB6
DB7
IOR
IOW
A0
A1
RESET
GND
+5
I7 8255
PA0
PA1
PA2
PA3
PA4
PA5
PA6
PA7
PC0
PC1
PC2
PC3
PC4
PC5
PC6
PC7
PB0
PB1
PB2
PB3
PB4
PB5
PB6
PB7
RD
WR
Vcc
GND
CS
TX DATA
TX/RX
INT ACK
STATE
CLOCK
OVERFLOW
TRANSITION
I12 74176
I16 74176
I19 74176
2 MHz
TAMCLK
I20 74LS10
I9 74LS93
I8 74LS93
7812.5 Hz
I23 74 LS138
74LS00
I13
74LS73
I10
I11
EDGE
TXCLK
INTR
I26
I20
I14
I1A
I15
I17
Φ2
HAL COMMUNICATIONS CORP.
BOX 365, URBANA, ILLINOIS 61801
FIGURE 6-21
MORSE/KSR INTERFACE
BUS INTERFACE
DATE SEP 12 1977
SCALE —
DRN BY J PD
APP BY
No. A1236A

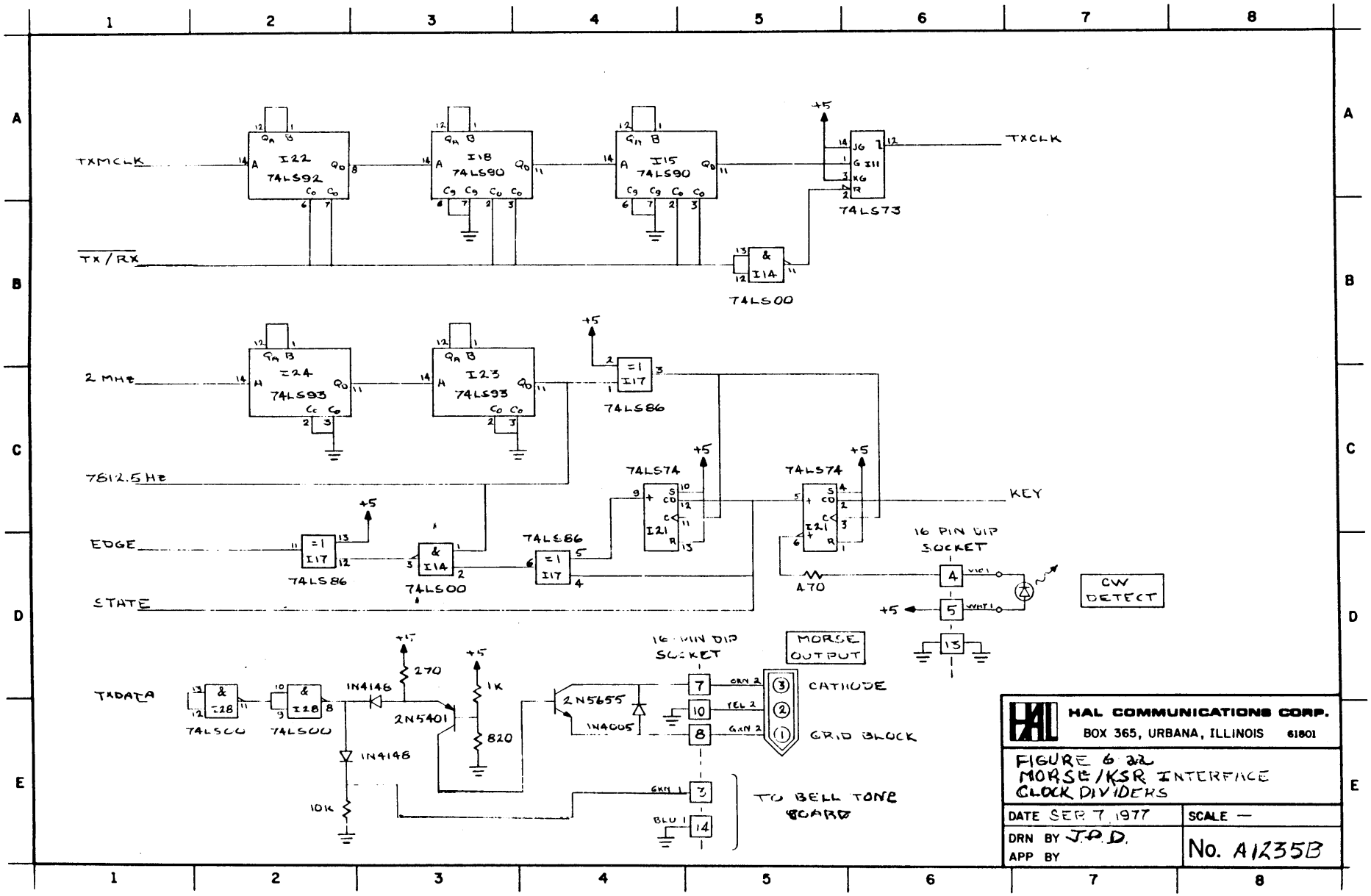


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FIGURE 6 32
MORSE/KSR INTERFACE
CLOCK DIVIDERS

DATE SEP 7 1977 | SCALE —
DRN BY J.P.D.
APP BY
No. A1235B

7. APPENDICES

This section contains detailed instructions for changing the power line frequency and voltage, tables of the data codes used in the DS-3000 KSR, and a short form operator instruction card. When a DS-3000 KSR has been factory modified to include special features, these modifications will be discussed in additional appendices.

APPENDIX A

POWER LINE VOLTAGE AND FREQUENCY CHANGES

Voltage

The DS-3000 KSR can be connected for operation from either 95 to 125 VAC or 190 to 250 VAC power lines. The AC power supplies of the display and keyboard sections are separate and it is therefore necessary to change both sections. In addition, provision is included in each section to compensate for lower than the normal 120 / 240 VAC U.S. standard power voltage.

Keyboard Section

Power transformer primary winding taps must be changed to accommodate the various power line voltage possibilities. Refer to Figure A.1, A.2, and A.3 for the following discussion.

110 to 125 VAC

The DS-3000 KSR is normally factory-wired for this connection unless the unit was 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 A.1 (a).

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 A.1 (b). 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 A.2 (a). 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 A.2 (b) 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.

When the terminal has been factory wired for 95 to 125 VAC operation, a power cord with the standard 3-prong plug is supplied. NOTE: Changing the power voltage into the keyboard section also changes the power voltage supplied on the A.C. socket.

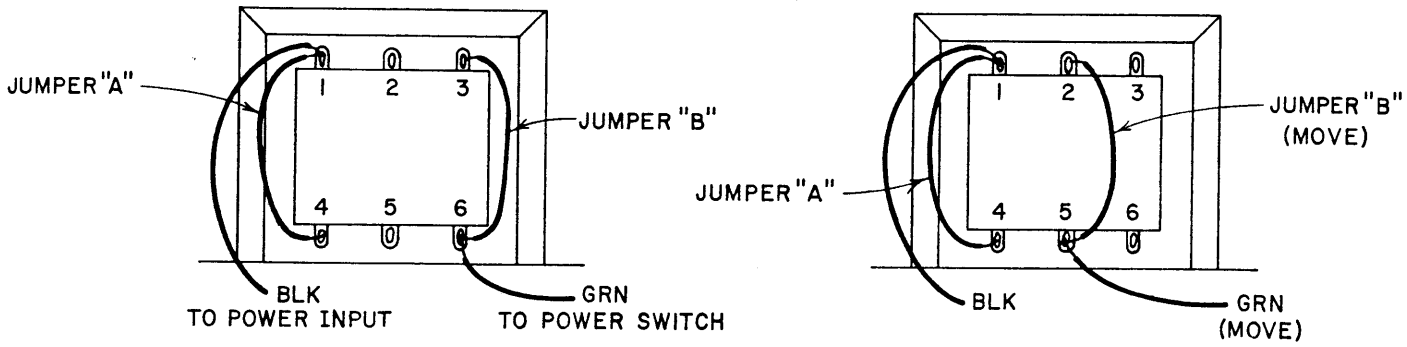
Power Frequency Changes

The power supplies of both the keyboard and display sections work equally well for power line frequencies of 50 or 60 Hz. However, it is desirable to change the vertical sync frequency to correspond to the power frequency used. Therefore, a jumper location is provided on the large logic circuit board to allow changing of the vertical timing divider for either 50 or 60 Hz operation. Refer to Figure A.4 (a) to determine the general location of the jumper involved. DS-3000 KSR terminals sold to domestic (U.S.A.) customers are usually provided with the jumper location indicated in Figure A.5(b). Export units, when specified by the customer, can be connected as in Figure A.4(c) for 50 Hz operation. If the 50 Hz option has been factory-installed, it will be indicated on a tag on the rear panel. If it is necessary to convert a previous 60 Hz unit to operation with 50 Hz, refer to Figure A.4(c), cut the printed-circuit path indicated with a sharp tool, and insert the wire jumper where shown. Conversely, to convert a 50 Hz unit to 60 Hz, move the wire jumper to correspond to the original pc path (shown in Figure A.4(b)).

****

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

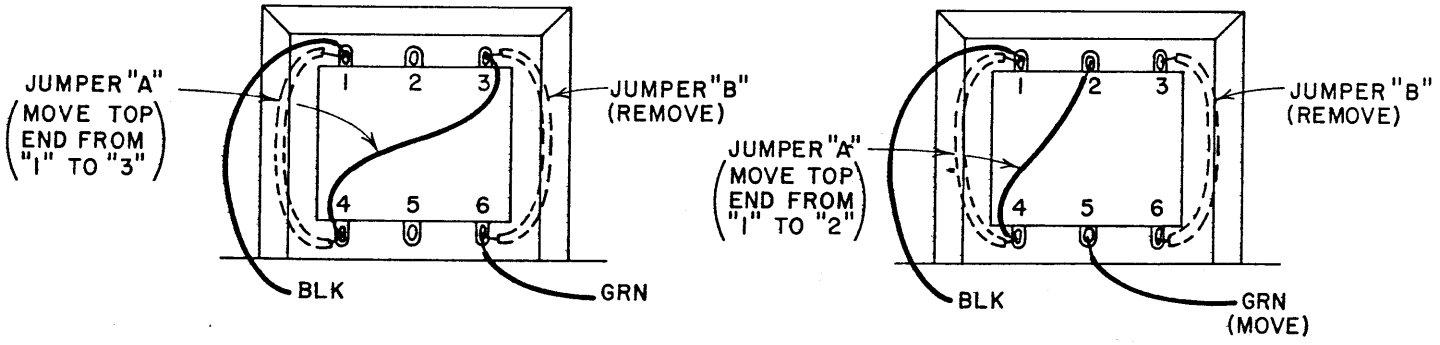
****



(a) 110 - 125 VAC Connection (Standard)

(b) 95 - 110 VAC Connection

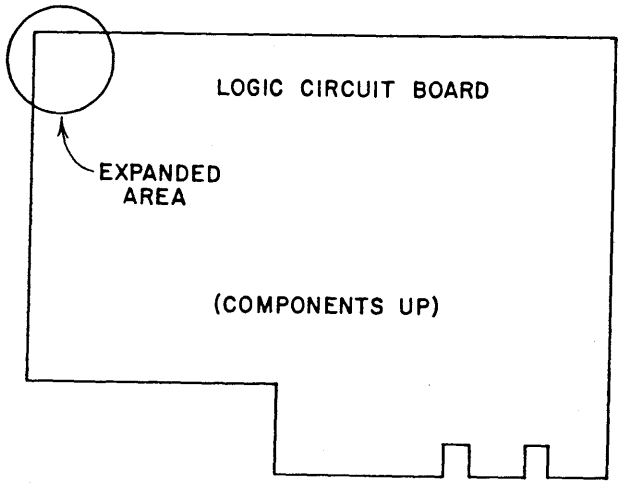
Figure A.1 95 - 125 VAC Power Transformer Connections



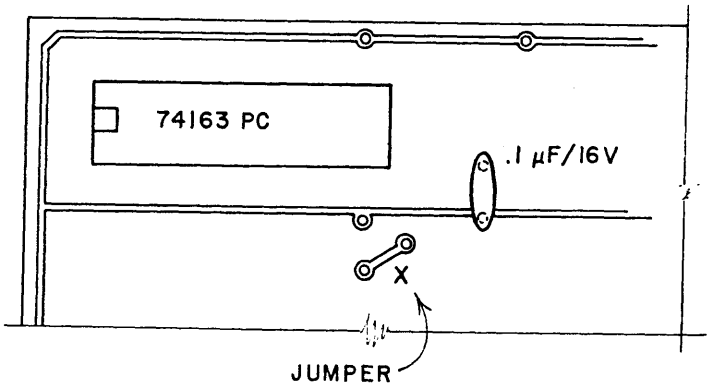
(a) 220 - 250 VAC Connection

(b) 190 - 220 VAC Connection

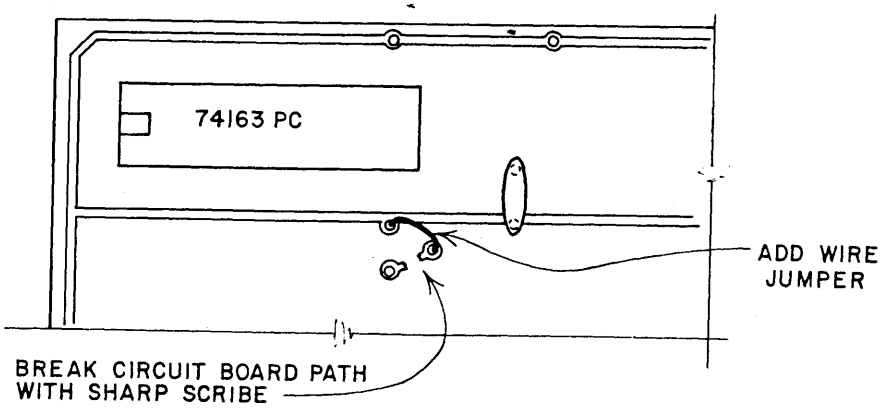
Figure A.2 190 - 250 VAC Power Transformer Connections



(a) Location of 50 - 60 Hz jumper



(b) Normal jumper location for 60 Hz



(c) Jumper change for 50 Hz

Figure A.3 50 - 60 Hz Jumper Placement

APPENDIX B

INPUT / OUTPUT DATA CODES

The codes generated or received by the DS-3000 KSR in general correspond to "standard" forms of the 5-unit Baudot code and the 8-unit ASCII code (version 2.X only). The codes used by the terminal are given below in Tables B.1 and B.2. Special units may differ from these codes slightly; if so, the differences will be outlined in the appendix corresponding to the special unit.

TABLE B.1 Baudot Code Used in DS-3000

Bit Number 5 4 3 2 1	Case	
	Letters	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:

1 = mark
0 = space

LF denotes line feed
CR denotes carriage return

The order of transmission is bit 1 to bit 5. A start bit (logical "0") precedes bit 1 and 1 to 2 stop bits (logical "1") follow bit 5.

Figures case H is the STOP character in Military Standard Baudot Code. The # character is used by the HAL Visual Display System to indicate the STOP code.

TABLE B.2 ASCII Code and Character Set

			b_7	0	0	0	0	1	1	1	1
			b_6	0	0	1	1	0	0	1	1
			b_5	0	1	0	1	0	1	0	1
b_4	b_3	b_2	b_1								
0	0	0	0	NUL	DLE	SPACE	Ø	@	P	`	p
0	0	0	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	STX	DC2	"	2	B	R	b	r
0	0	1	1	ETX	DC3	#	3	C	S	c	s
0	1	0	0	EOT	DC4	$	4	D	T	d	t
0	1	0	1	WRU	NAK	%	5	E	U	e	u
0	1	1	0	ACK	SYN	&	6	F	V	f	v
0	1	1	1	BEL	ETB	'	7	G	W	g	w
1	0	0	0	BS	CAN	(	8	H	X	h	x
1	0	0	1	HT	EM	)	9	I	Y	i	y
1	0	1	0	LF	SUB	*	:	J	Z	j	z
1	0	1	1	VT	ESC	+	;	K	[	k	{
1	1	0	0	FF	FS	,	<	L	\	l	¦
1	1	0	1	RTN	GS	-	=	M	]	m	}
1	1	1	0	SO	RS	.	>	N	^	n	~
1	1	1	1	SI	US	/	?	O	_	o	RUB OUT

ACK = acknowledge
BEL = bell
BS = backspace (←)
CAN = cancel
RTN = carriage return (RETURN)
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 transmission
ESC = escape
ETB = end of transmission block
ETX = end of text
FF = form feed ("home")
FS = file separator
GS = group separator
HT = horizontal tabulation (→)
LF = line feed (↓)
NAK = negative acknowledge
NUL = null
RS = record separator
RUB OUT = delete (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 tabulation (↑)
WRU = enquiry (ENQ)

Table B.3: Morse Codes

Character	Code
A	· –
B	– · · ·
C	– · – ·
D	– · ·
E	·
F	· · – ·
G	– – ·
H	· · · ·
I	· ·
J	· – – –
K	– · –
L	· – · ·
M	– –
N	– ·
O	– – –
P	· – – ·
Q	– – · –
R	· – ·
S	· · ·
T	–
U	· · –
V	· · · –
W	· – –
X	– · · –
Y	– · – –
Z	– – · ·

Character	Code
Ø	– – – – –
1	· – – – –
2	· · – – –
3	· · · – –
4	· · · · –
5	· · · · ·
6	– · · · ·
7	– – · · ·
8	– – – · ·
9	– – – – ·
"	· – · · – ·
.	· – · – · –
(	– · – – · –
)	– · – – · –
:	– – – · · ·
;	– · – · – ·
,	– – · · – –
/	– · · – ·
-	– · · · · –
'	· – – – – ·
?	· · – – · ·
$\overline{AS}$	· – · · ·
$\overline{SK}$	· · · – · –
$\overline{BT}$	– · · · –
$\overline{AR}$	· – · – ·
$\overline{KN}$	– · – – ·
ERROR	· · · · · · · ·