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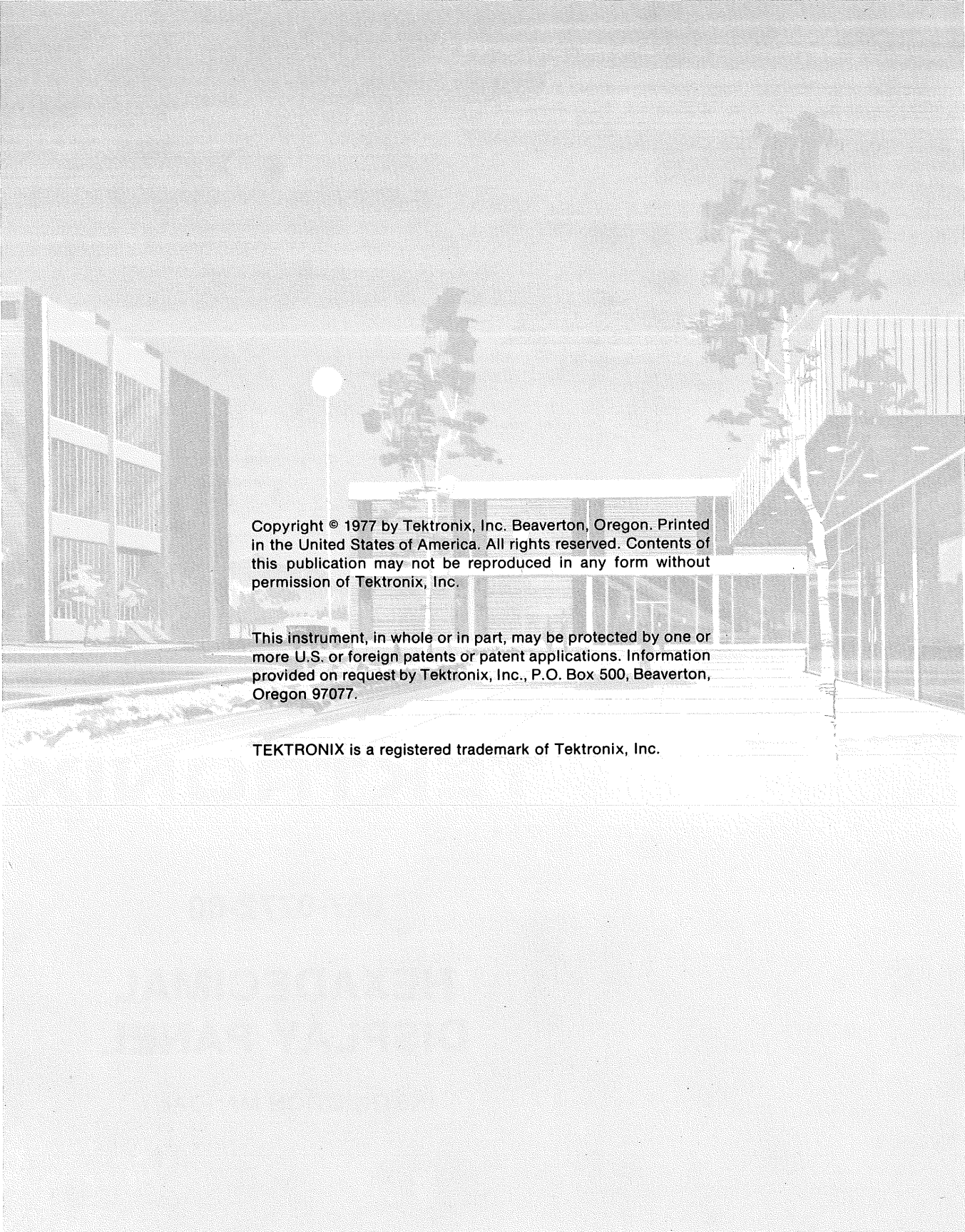
**HEXADECIMAL
DISPLAY PANEL**

INSTRUCTION MANUAL

Tektronix, Inc.
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WARNING

The remaining portion of this Table of Contents lists servicing instructions that expose personnel to hazardous voltages. These instructions are for qualified service personnel only.

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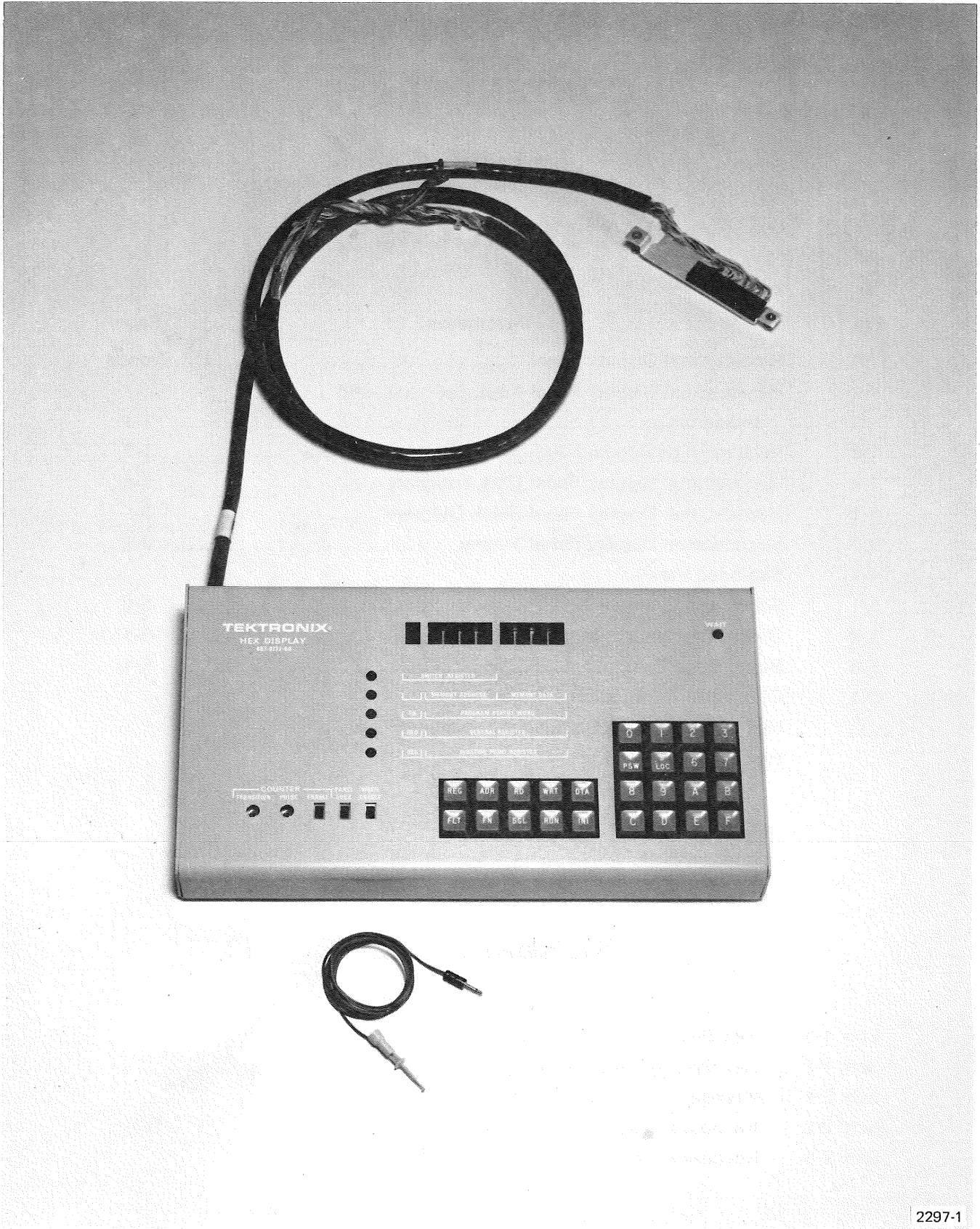
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SCHEMATICS

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Sch. 2-2	Keyboard: Status Register
Sch. 2-3	Keyboard: Switch Register



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Fig. 1-1. Hexadecimal Display Panel.

Section 1

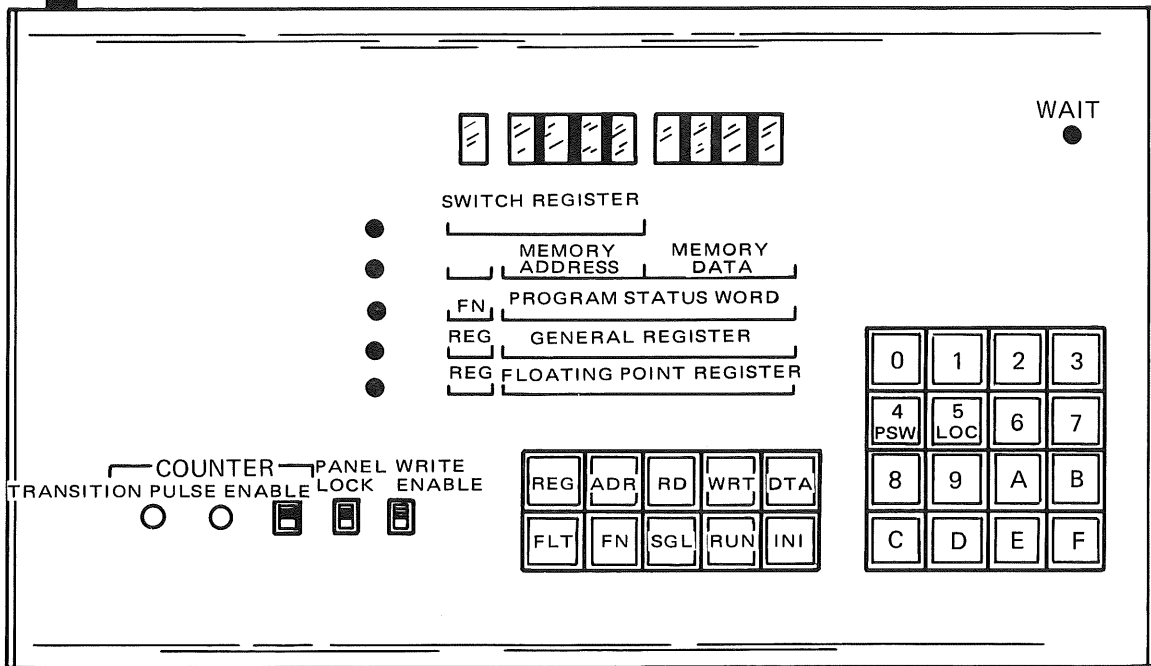
OPERATION

INTRODUCTION

The Hexadecimal Display Panel is an important programming aid for the 4080-Series Graphic System and is useful in helping to track down circuit problems wherever they may occur in the System. It is normally connected permanently to the Processor, so it can be called into use immediately whenever necessary. The Display Panel is a versatile device, with the ability to enter programs, monitor the execution of programs, and examine and alter the contents of memory. It also offers a built-in counter which is useful for a variety of purposes.

One of the most-used functions of the Hexadecimal Display Panel is in troubleshooting circuits. For example, the service technician can enter a program into the Display Panel that loops continuously, exercising the circuit area where a fault has occurred. This provides an opportunity to use test equipment to pinpoint the fault.

Figure 1-2 shows the keyboard of the Hexadecimal Display Panel. A detailed description of the functions of control keys and data-entry keys follows.



2297-2

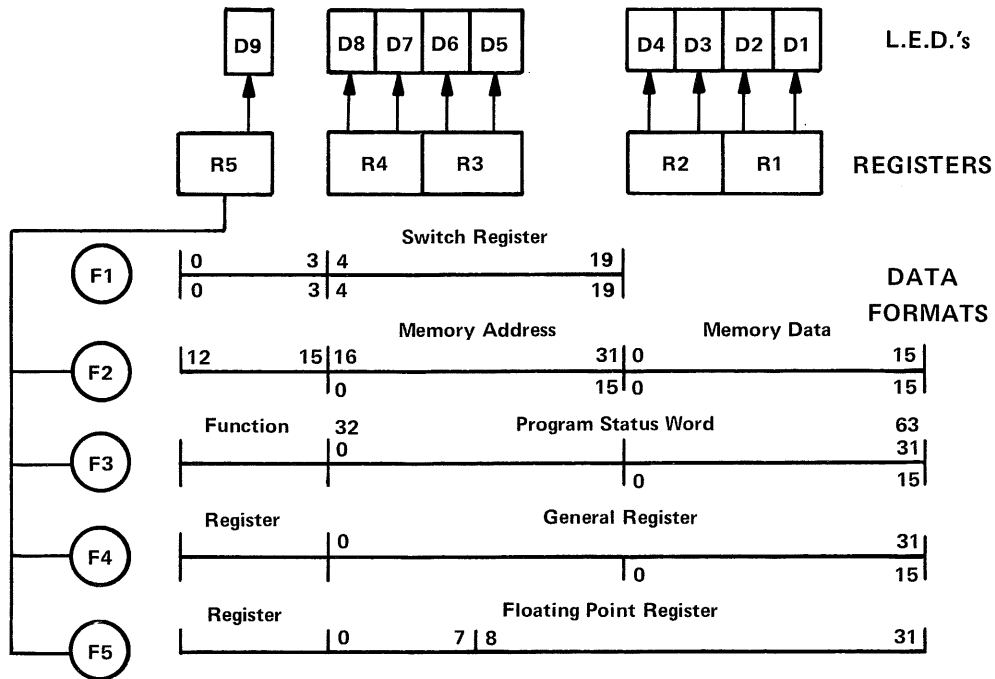
Fig. 1-2. Hexadecimal Display Panel Keys, Switches, and Indicators.

GENERAL DESCRIPTION

Display Registers and Indicators

Within the Hexadecimal Display Panel are five 8-byte registers, R1 through R5, which hold data output from the Processor, and a 20-bit Switch Register which holds data input from the Display Panel keyboard. As shown in Fig. 1-2, there are nine LED displays horizontally aligned across the top of the Display Panel. For purposes of description, these are numbered D1 through D9, reading from right to left. Just below and to the left of the LEDs are five vertically-aligned red indicator lights which describe the format of the display at any given time. These will be designated F1 through F5 reading downward for descriptive purposes. Figure 1-3 shows the relationship of data bits and address information to displays D1 through D9 and to Format indicators F1 through F5.

Each of the LED displays is directly related to an internal data register. As shown in Fig. 1-3, D1 and D2 display the contents of R1; D3 and D4 display R2 contents; D5 and D6 show what is contained in R3; D7 and D8 display the contents of R4. D9 displays the four least significant bits of R5. The four most significant bits of R5 control the lighting of format indicators F2 through F5. F1 is lighted when the 20-bit Switch Register is displayed on LEDs D5 through D9. The four lower format lamps can display data or are lighted individually to indicate the display status when the Switch Register is not displayed.



NOTE: Bit numbers below line apply to 16-bit Processors (as used in 4081)

2297-3

Fig. 1-3. Relationships Between Registers, L.E.D.'s and Data.

Referring again to Fig. 1-3, notice that the Switch Register also drives the LED displays through registers R3 and R4 and the four least significant bits of R5. When the Switch Register is being displayed, the Switch Register format lamp is on, as well as whichever format lamp (if any) was last lighted before the display of the Switch Register. When the Switch Register is no longer displayed, its format lamp goes out and the 20 most-significant bits of the LED display (D5 through D9) again show the contents of display registers R3 and R4 and the four least-significant bits of R5.

The WAIT indicator on the upper right corner of the display panel gives an immediate indication of Processor operations. If the Processor is halted, WAIT is illuminated; if a program is executing, WAIT is off.

Hexadecimal Character Set

The LED displays, which show the hexadecimal character set on the Display Panel, are 7-segment display elements, so the displayed characters are somewhat distinctive in appearance. The numerals 1 through 9 are readily recognizable (6=ξ) and are essentially unchanged from the printed form. The six alpha characters in the hexadecimal set appear as shown below:

A = *A* ; B = *b* ; C = *C* ; D = *d* ; E = *E* ; F = *F* .

Slide Switches and Jacks

At the lower left corner of the Display Panel are three slide switches labeled, from right to left, WRITE ENABLE, PANEL LOCK, and COUNTER ENABLE. Their functions are as follows:

- | | |
|-----------------------|--|
| WRITE ENABLE | A two-position slide switch. In the upper position, it enables the writing of data from the Hexadecimal Display Panel into system memory. In the lower position, WRITE ENABLE disables the WRT pushbutton control switch, to prevent accidental writes into system memory. |
| PANEL LOCK | Also a two-position slide switch. In the upper position, every other pushbutton, key, and switch on the Hexadecimal Display Panel is disabled. In the lower position, the pushbutton switches and Control keys and remaining slide switches are enabled. |
| COUNTER ENABLE | This two-position slide switch is effective only in its upper position. When it is in the upper position, the signals at the counter jacks can be used to increment a register. While the Counter is enabled, data can still be entered into the Switch Register. |

Counter Jacks

Two jacks are located to the left of the slide switches. These jacks can monitor TTL signals input from various signal sources. When COUNTER ENABLE is in the upper position, a count of pulses or transitions can be obtained. The jack labeled TRANSITION produces a count each time the TTL signal being monitored changes polarity; the PULSE jack registers only the negative-going portion of the signal, thus producing a count half that of the TRANSITION jack. The jacks accept standard sub-miniature phone plugs (Tektronix Part No. 134-0079-00). Counter capacity is 15 bits plus a sign bit. A count of zero in the Counter is represented hexadecimally as FFFF, while a full count is represented by 0000. The sign bit (most significant bit) of the counter corresponds to the logic level of the counter input signal at any given instant. The Hexadecimal Display Panel does not directly display data obtained from the Counter jacks. However, the contents of the Counter can be read by the Processor under program control while Counter ENABLE is in the up position.



Signal levels in excess of TTL standards may damage the circuitry of the Hexadecimal Display Panel. Inserting a plug into a counter jack may ground the signal source. Be sure to insert the plug into the jack before connecting a test lead to the signal source.

Control Keys

The Control keys are enabled whenever the PANEL LOCK Switch is in the lower position.

DTA (data)

Pressing the DTA key clears the Switch Register and connects it to the five farthest-left LED display indicators, D5 through D9. When this occurs, the Switch Register Format Lamp F1 lights. From this point on, hexadecimal data can be entered into the Switch Register from the Hexadecimal keyboard. As each hexadecimal key is pressed, data shifts into the Switch Register from the right. If more than five hexadecimal digits are entered, data shifted out of the Switch Register is lost.

- ADR (address)** When the ADR key is pressed, the Processor reads the four least significant characters of the Switch Register and stores the contents in the location of the Processor's current Program Status Word (PSW). The PSW diagram Format Lamp F3 illuminates, and the LED display (D1 through D4) shows the current Location Counter value.
- RD (memory read)** The RD key causes the Processor to read data from the memory location specified by the Location Counter, and display the data in D1 through D4. At the same time, the Location Counter increments by a count of two and the revised memory address is displayed by the Memory Address indicators (D5 through D8).
- WRT (memory write)** When the WRT key is pressed, the data contained in the Switch Register is written into memory at the address specified by the Location Counter. The data written is displayed on the Memory Data indicators (D1 through D4). At the same time, the Location Counter increments by two and the updated memory location is displayed on the Memory Address indicators. When either RD or WRT is in operation the Mem ADRS/Mem Data Format Lamp F2 is lighted.
- REG (examine register)** The REG key causes the Hexadecimal Display Panel to interpret the next hexadecimal key pressed as a General Register number. The General Register number selected is displayed by D9, and the contents of that general register appear in display locations D1 through D4. At the same time, Reg/General Register Format Lamp F4 is lighted. Contents of a General Register cannot be modified from the Hexadecimal Display Panel.
- FLT (examine floating-point register)** Examines a Floating-Point Register if the Processor is so equipped. However, Floating-Point Registers in the 4081 System are allocated memory locations, and can be examined on the Hexadecimal Display Panel using the Memory Read key. Effectively, the FLT key performs the same functions as the REG key in this case.
- FN (function)** The FN key followed by any hexadecimal key n, causes the 4081 Processor to perform a function defined by one of the hexadecimal keys 0, 4, or 5 (described later in this section), or by one of the other hexadecimal keys as defined by the Processor's internal firmware. If the selected function number is undefined, the Processor halts and remains halted.

- SGL (single step)** The SGL key causes the Processor to execute one instruction and display the address of the next instruction to be executed. It then remains halted until SGL is pressed again. The effect is to allow execution of a program in memory one step at a time. At each step, the contents of the previously selected register (i.e., PSW or General Register) is displayed, along with the next address to be executed. The SGL key, when pressed, will halt a currently executing program.
- RUN (run)** The RUN key causes the Processor to begin program execution at the address indicated by the Location Counter. The WAIT indicator is extinguished while the program is executing.
- INI (initialize)** The INI key initializes the Processor micro-program. All device controllers on the system are reset, and the communication channels are cleared.

OPERATING INSTRUCTIONS

Defined Functions with FN key

When a specified hexadecimal key is pressed immediately after the FN key, a function, if defined, is performed. Pressing the FN key followed by a hexadecimal key without a function assignment will cause the Processor to halt and remain halted. The Processor's micro-program determines the particular function assigned to a hexadecimal key. The defined function keys are as follows:

- FN 0** **System Interrupt**
- This function generates an immediate interrupt to the Processor if bit 4 of the current PSW is set. The Processor searches location X'D2' in the interrupt service pointer table for the address of the Hexadecimal Panel service routine (if any) and executes the routine. If the interrupt is disabled by the PSW, the Processor ignores the request. These interrupts are not queued by the Processor.
- FN 4** **PSW Status**
- This function causes the PSW status halfword to be displayed.
- FN 5** **Location Counter**
- This function causes the Location Counter of the current PSW to be displayed.

Power Up and Power Fail

The Hexadecimal Display Panel, if permanently connected to the 4081 Processor, is automatically powered up when power is applied to the system. The state of the Hexadecimal Display Panel on Power Up depends upon several conditions. If the 4081 is equipped with the Power Fail Protection Option and the Processor detects a power failure, the micro-program senses the Hexadecimal Display Status. The present status of the Hexadecimal Display Panel is stored in main memory at a dedicated area by the micro-program. The current PSW, Location Counter, and programmable registers are saved in dedicated main memory locations, and the micro-program activates the System Clear Signal.

On power up, after the System Clear signal terminates, the Program Status Word, Location Counter, and programmable registers are restored from their main memory save locations. The status of the Hexadecimal Display Panel prior to the power failure is retrieved and interrogated by the micro-program.

If the Hexadecimal Display Panel was in Run mode at the time of the power failure, and if the Machine Malfunction Interrupt Enable bit of the PSW is set, a Machine Malfunction Interrupt is taken. If Machine Malfunction Interrupts are not enabled, the Processor enters the Run mode beginning at the instruction pointed to by the Location Counter.

If the Hexadecimal Display was not in Run mode at power failure, or if the 4081 does not have the Power Fail Option, the value of the Location Counter is output to the display registers, the WAIT lamp on the console is illuminated, and the Halt mode is entered.

Power Failure and operation of the Initialize key cannot be distinguished by the micro-program; so consider the possible effects carefully if you operate the Initialize key when the Machine Malfunction Interrupt is enabled. Be careful also in using the Hexadecimal Display Panel as an input device (testing Switch Register bits), because the Switch Register is also very volatile during Power Fail situations.

Addressing Memory Locations

Before reading from memory, writing into memory, or executing a program, it is first necessary to direct the Processor to the desired memory location. Thus, the procedure of addressing a memory location is preliminary to any of these operations. To select a particular memory address:

1. Press the DTA key. This clears the Switch Register and displays its contents (all zeros at this point) in D5 through D9.
2. Enter the desired 4-digit even address (MSD first) from the Hexadecimal keyboard. Odd-numbered addresses are changed to the next lowest even-numbered address. If a mistake is made, press DTA, and start over.
3. Press ADR. The Processor halts and copies the contents of the Switch Register (the address just entered) into the Location Counter field of the Program Status Word. The LED display (D1 through D4) then shows the new value of the Location Counter. The PSW Format Lamp, F3 is lighted.

Memory Read

To display the contents of a selected memory location, follow the procedure just described to direct the Processor to the desired memory location and display the Location Counter. Then press the Read (RD) key. The data read from memory will appear in D1 through D4 on the display with the most significant digit in D4, and the Location Counter will automatically increment by two to show the next memory location. To read from following memory locations in sequence, press RD each time a change is desired. The Location Counter will always show the **next** memory location, while the D1 through D4 LEDs will display the data read from system memory.

Memory Write

To write data from the Switch Register into memory, select the starting address as described in Addressing Memory Locations. After pressing ADR to display the Location Counter, again press DTA to clear and display the Switch Register. Enter the data to be written by pressing the appropriate Hexadecimal keys. Press WRT (Write). The display will show the data written in, and the Location Counter will be incremented to the next address location. To write data into following successive address locations, press DTA, enter the data, and press WRT each time. The Location Counter increments by two each time WRT is pressed. If you want to place the same data bits in each of a series of address locations, merely press WRT repeatedly after entering the data once.

General Register Display

To examine the contents of a General Register, press the REG key, and enter the register number from the Hexadecimal keyboard. The Processor halts, and the contents of the selected General Register are displayed. On processors equipped with selectable register sets, the General Register displayed is from the register set specified by the current Program Status Word. Contents of the General Register appear in the four right LED locations D1 through D4, with the General Register number shown in the far left LED location, D9. Register Format Lamp F4 is lighted.

Floating-Point Register Display

To examine the contents of a Floating-Point Register, press the FLT key, then enter the register number using the Hexadecimal keyboard. If the Processor has internal Floating-Point Registers, the selected register number is forced even and the Floating-Point Register is displayed. The Processor remains in Halt mode. The 4081 Processor does not have internal Floating-Point Registers, so with a 4081 System, the results of this operation are undefined. However, Floating-Point Registers in allocated system memory may be examined using the previously described Memory Read sequence.

Display and Modification of Program Status Word

Display of the Status Field and the Location Counter Field is accomplished on the Hexadecimal Display Panel through the use of the Function (FN) key and two defined functions. The Status Field, most significant half of the PSW, is displayed by pressing the FN key, followed by hexadecimal key 4. The Processor halts and the Status Field is displayed on LED indicators D1 through D4 (D1 through D8 on 32-bit processors). The PSW format lamp is lighted at the same time. D9 indicates the function selected. The Location Counter Field, the least significant half of the PSW, is displayed by pressing the FN key, followed by hexadecimal key 5. The Processor halts, and the Location Counter Field of the PSW is displayed in LEDs D1 through D4 (D1 through D8 on 32-bit processors). Again, the PSW format lamp is lighted, and D9 indicates function 5.

On 32-bit processors (not on the 4081 Processor), the 16 least significant bits (bits 16-31) of the Status Field can be modified by first pressing the DATA key, then entering the data from the Hexadecimal keyboard. The next step is to press the FN key, followed by hexadecimal key 1. The Processor halts and copies the 16 bits of the Switch Register in bits 16-31 of the PSW Status Field. The modified PSW Status Field is then displayed in LEDs D1 through D8 of the Hexadecimal Display Panel.

Program Execution

To begin execution of a program, select the program starting address using the method described earlier under Addressing Memory Locations, then press the RUN key. A program can be executed one step at a time by following the procedure just described in selecting the starting address (a register to be displayed may also be selected) then, instead of using the RUN key, press Single-Step (SGL) once for each instruction to be executed. After each pressing of SGL, one instruction is executed, the last selected register (PSW, LOC, General Register, etc.) is displayed, and the Processor halts.

Program Termination

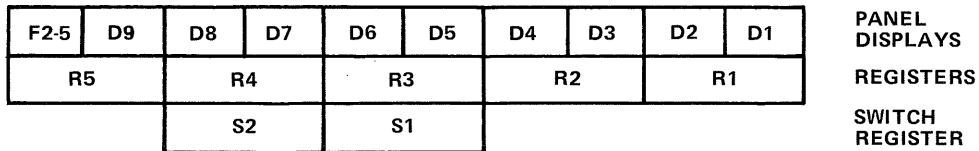
To manually halt the execution of a program, display any register, or press SGL. When SGL is pressed, the last selected register is displayed.

Panel Interrupt

An interrupt is generated from the Hexadecimal Display Panel by pressing FN, followed by hexadecimal key 0. If enabled by the current PSW, an interrupt from device number 1 is simulated. If no interrupt is enabled, the Processor ignores the request. Hexadecimal Display Panel interrupts are not queued. The Hexadecimal Display Panel interrupt feature allows the operator to inform a running program that some operator service or function is required. No acknowledgement of the interrupt is required of the running program. The address of the service routine for the Hexadecimal Panel should be stored at memory location X'D2' for the interrupt to be meaningful.

Data Format

A byte or halfword can be transferred to or from the display using a WD, WH, WDR, WHR, or RD, RH, RDR, or RHR instruction. Refer to Fig. 1-4 and the heading Input/Output Programming.



LOCATION OF DATA TRANSFERRED		
SUCCESSIVE INSTRUCTIONS EXECUTED (TOP TO BOTTOM)	NORMAL MODE	INCREMENTAL MODE
RD(R) RD(R) RD(R) RD(R)	S1 S1 S1 S1	S1 S2 S1 S2
RH(R)	S1, S2	S1, S2
RB(R)*	S1, S2, S1, S2	S1, S2, S1, S2
WD(R) WD(R) WD(R) WD(R) WD(R)	R1 (D1, D2) R1 (D1, D2) R1 (D1, D2) R1 (D1, D2) R1 (D1, D2)	R1 (D1, D2) R2 (D3, D4) R3 (D5, D6) R4 (D7, D8) R5 (D9, F2-5)
WH(R) WH(R) WH(R)	R1, R2 (D1 thru D4) R1, R2 (D1 thru D4) R1, F2 (D1 thru D4)	R1, R2 (D1 thru D4) R3, R4 (D5 thru D8) R5 (D9)†
WB(R) §	R1, R2, R3, R4, R5 (D1 thru D9 and F2-5)	R1, R2, R3, R4, R5 (D1 thru D9 and F2-5)

* Block length = 4 bytes

† Subsequent bytes output are lost until another Incremental Mode command byte resets the selection logic

§ Block length = 5 bytes

2297-4

Fig. 1-4. Hexadecimal Display Panel Data Transfers.

PROGRAMMING INSTRUCTIONS

Input/Output Programming

The Hexadecimal Display Panel is available to any running program as an I/O device with device address X'01'. The status and command bytes for the Hexadecimal Display are summarized in Table 1-1. The status byte indicates the mode of the Panel, and is of little interest to a running program, since it always indicates either Run mode or Hexadecimal Display Panel Interrupt (Function 0). The command byte selects Normal or Incremental mode; these modes control the sequence in which panel registers are used for data transfers. The selection logic that determines which Switch Register byte or data register byte to transfer is reset every time the Hexadecimal Display Panel is addressed when in Normal mode. When an Output Command Incremental mode is issued to the Hexadecimal Display Panel, the byte selection logic is initially reset. Read or Write instructions, which follow the Output Command instruction, transfer bytes as shown in Fig. 1-4. The fifth byte output in Incremental mode also clears the Counter Register.

Block I/O with the Hexadecimal Display Panel is only possible when the four least significant status bits are reset.

NOTE

After an initialize sequence, or after any manual Hexadecimal Display Panel operation that results in a display, the Display Device Controller is automatically placed in Normal mode.

The four most significant bits of the Switch Register are available only to the micro-program. These four bits are transferred as Bits 5, 6, 7, and 0 of the status when the Hexadecimal Display Panel status is Address (that is, the Display Status is X011XXXX).

Wait State

A running program can place the Processor in the Wait state by setting the Wait bit of the current PSW. The WAIT light in the upper right corner of the Panel illuminates to indicate the Wait state. The Processor can leave the Wait state and resume program execution in two ways:

1. An interrupt occurs, causing the Processor to jump to an interrupt service routine. When the routine restores the original Program Status Word, the Wait state is resumed.
2. The operator can press the RUN key, causing the Wait bit in the PSW and the WAIT lamp to be reset, and execution to resume at the address specified by LOC.

Switch Register

The Switch Register can be modified without interrupting the Processor, by pressing the DATA key. This causes the Switch Register to be cleared and displayed on the Hexadecimal Display Panel. Modification is then accomplished by entering the desired hexadecimal data.

**Table 1-1
STATUS AND COMMAND BYTES**

		STATUS							
		0	1	2	3	4	5	6	7
Run		X	0	0	0	X	X	X	X
Memory write		X	0	0	1	X	X	X	X
Memory read		X	0	1	0	X	X	X	X
Address		X	0	1	1	X	X	X	X
Fixed Register		X	1	0	0	X	X	X	X
Floating Register	Function	X	1	0	1	X	X	X	X
		X	1	0	0	X	X	X	X
General Register	0	0	X	X	X	1	0	0	0
	1	1	X	X	X	1	0	0	0
	2	0	X	X	X	1	0	0	1
	3	1	X	X	X	1	0	0	1
	4	0	X	X	X	1	0	1	0
	5	1	X	X	X	1	0	1	0
	6	0	X	X	X	1	0	1	1
	7	1	X	X	X	1	0	1	1
	8	0	X	X	X	1	1	0	0
	9	1	X	X	X	1	1	0	0
	A	0	X	X	X	1	1	0	1
	B	1	X	X	X	1	1	0	1
	C	0	X	X	X	1	1	1	0
	D	1	X	X	X	1	1	1	0
General Register	E	0	X	X	X	1	1	1	1
	F	1	X	X	X	1	1	1	1
Function	0	0	X	X	X	0	0	0	0
	1	1	X	X	X	0	0	0	0
	2	0	X	X	X	0	0	0	1
	3	1	X	X	X	0	0	0	1
	4	0	X	X	X	0	0	1	0
	5	1	X	X	X	0	0	1	0
	6	0	X	X	X	0	0	1	1
	7	1	X	X	X	0	0	1	1
	8	0	X	X	X	0	1	0	0
	9	1	X	X	X	0	1	0	0
	A	0	X	X	X	0	1	0	1
	B	1	X	X	X	0	1	0	1
	C	0	X	X	X	0	1	1	0
	D	1	X	X	X	0	1	1	0
	E	0	X	X	X	0	1	1	1
Function	F	1	X	X	X	0	1	1	1

Single or Halt

Floating Register 0

2

4

6

8

A

C

Floating Register E

Panel Interrupt

PSW

LOC

		COMMAND							
		1	0	0	0	0	0	0	0
Normal		1	0	0	0	0	0	0	0
Incremental		0	1	0	0	0	0	0	0

1 = bit is set
0 = bit is reset
X = not specified

Programming Sequences

The Hexadecimal Display Panel has a device address of X'01'. It can be used to output up to five bytes of data to its display. The program sequence shown below outputs four bytes of data starting from the memory location BUF (Program sequences in the series which follow are shown in standard assembly language):

Instruction	Argument	
LIS	R1,1	Panel Address into R1
LHI	R3,X'40'	
OCR	R1,R3	Incremental mode
WD	R1,BUF	
WD	R1,BUF + 1	
WD	R1,BUF + 2	
WD	R1,BUF + 3	

After the four successive Write Data instructions shown above, the Hexadecimal Display Panel will display the data as indicated below:

D9	D8	D7	D6	D5	D4	D3	D2	D1	LED
R5	R4		R3		R2		R1		REGISTER
	(BUF+3)		(BUF+2)		(BUF+1)		(BUF)		BYTE

Note that the display shown above was created in Incremental mode. The program sequence which follows outputs one halfword of data with the Hexadecimal Display Panel in Normal mode:

Instruction	Argument	
LIS	R1,1	
LHI	R3,X'80'	
OCR	R1,R3	H.D.P. in Normal mode
WH	R1,BUF	

The Hexadecimal Display Panel will display the data as shown below:

D9	D8	D7	D6	D5	D4	D3	D2	D1	LED
R5	R4		R3		R2		R1		REGISTER
					(BUF+1)		(BUF)		BYTE

Note also that when a halfword of data is output to the Hexadecimal Display the most significant byte loads in register R1 and displays in D1 and D2, and the least significant byte loads in register R2 and displays in D3 and D4.

The Panel Switch Register. The Hexadecimal Display Panel's Switch Register can be read by using the read instructions shown below:

Instruction	Argument	
LIS	R1,1	(R1) contains Panel Address
LHI	R3,X'80'	(R3) = '80' = Normal mode
OCR	R1,R3	
RHR	R1,R4	Read 1 Halfword
EXBR	R4,R4	Exchange Bytes

At this time, Register 4 contains the 16 data bits from the Switch Register. It is necessary to exchange byte positions to align the most significant byte of the Switch Register with the most significant half of the Processor register.

NOTE

If more than five bytes are output to the Hexadecimal Display Panel in Incremental mode or with block transfers, the data is lost after five bytes. The Panel must then be initialized by sending a command byte to it before outputting any more data, if the data is to be displayed.

Sample Counter Program. The following is a program which demonstrates the use of the Hexadecimal Display Panel Counter.

```

1  * FILE HEXCNT
2  *
3  *THIS TEST EXERCISES THE COUNTER ON THE HEXADEXIMAL DISPLAY PANEL
4  *AND PRINTS THE RESULTS OF THE COUNT TO THE HEX DISPLAY.
5  *THE COUNTER IS ALLOWED TO COUNT FOR A PERIOD DETERMINED BY THE
6  *DELAY ROUTINE IN THE PROGRAM (DETERMINED BY THE PROCESSOR'S CLOCK).
7  *THEREFORE THE PROCESSOR CLOCK IS A GOOD INPUT SIGNAL SOURCE.
8  *THE FIFTH PIN DOWN ON THE CPU HI CARD YIELDS FFFF FOR
9  *THIS DELAY.
10 *
11 * !!! CAUTION !!! INSERTION OF THE PLUG INTO THE HEX PANEL
12 *JACK GROUNDS OUT THE PROBE.
13 *
14 *PUT THE PLUG INTO THE JACK
15 *BEFORE CONNECTING THE PROBE TO THE SIGNAL SOURCE.
16 *
17 START   LIS      1,1           HEX PANEL ADDRESS
18        LHI      8,X'0080'     NORMAL COMMAND BYTE
19        LHI      4,X'0040'     INCREMENT COMMAND BYTE
20 REPEAT  LIS      0,0           CLEAR DISPLAY REGISTER
21        OCR      1,8           NORMAL MODE
22        OCR      1,4           INCREMENTAL MODE
23        LIS      5,5           FOR 5 TIMES
24 SHOW   WDR      1,0           WRITE 00 TO HEX PANEL
25        SIS      5,1           CLEARS DISPLAY AND
26        BNZS     SHOW          RESETS COUNTER
27        LHI      7,X'1555'     COUNT PERIOD
28        OCR      1,8           NORMAL MODE
29        RHR      1,2           COUNTER INTO REG 2
30 DELAY1  SIS      7,1
31        BNES     DELAY1        DELAY FOR COUNTER TO CHANGE
32        RHR      1,3           NEW COUNT INTO R3
33        EXBR     3,3           TRUE COUNT IN REG 3 AND 2
34        EXBR     2,2           THE DIFFERENCE INTO R6
35        LHR      6,2           WRITE IT TO THE HEX PANEL
36        SHR      6,3
37        EXBR     6,6
38        WHR      1,6
39        EXBR     6,6
40        LIS      7,0
41 DELAY2  SIS      7,1
42        BNZS     DELAY2
43        B        REPEAT
44        END      START

```

0000'	2411	
0002'	C880	0080
0006'	C840	0040
000A'	2400	
000C'	9E18	
000E'	9E14	
0010'	2455	
0012'	9A10	
0014'	2751	
0016'	2032	
0018'	C870	1555
001C'	9E18	
001E'	9912	
0020'	2771	
0022'	2031	
0024'	9913	
0026'	9433	
0028'	9422	
002A'	0862	
002C'	0863	
002E'	9466	
0030'	9816	
0032'	9466	
0034'	2470	
0036'	2771	
0038'	2031	
003A'	4300	000A'
003E'		

Section 2

INSTALLATION

INTRODUCTION

The Hexadecimal Display Panel is an auxiliary device that is normally left connected to the system at all times, so that its usefulness as a programming or troubleshooting device is always immediately available. If the Panel is not already connected to your system when it is received from the factory, detailed connection instructions follow.

CONNECTION PROCEDURE

A 40-inch connecting cable, which is supplied with the Hexadecimal Display Panel, is to be connected to a Processor card at the front of the 4081 Card Cage. The two farthest-left cards in the card cage (slots J0700/1 and J0600/1) are the Processor cards. The Hexadecimal Display Panel cable connector is attached to Connector 3 at the upper edge of the farthest-left card, CPU-LO. The procedure for making the connection is as follows:

1. Remove the front and rear cover panels from the 4081 card cabinet.
2. Lead the Processor end of the connecting cable into the back of the 4081 cabinet and over the card cage, pulling it through far enough to allow connection at the CPU-LO card.
3. Two spade lugs are broken out of the connecting cable some distance from the end. The red spade connector is a +5 V supply, and it should be connected to the nearest +5 V supply lug on the rear of the 4081 backplane. The other spade lug is a ground connection. It should be attached to a ground lug on the backplane. There is also a metal clamp on the cable braid. This clamp should be attached to the internal bulkhead at the sidewall of the 4081 cabinet.
4. Connect the cable at the front of the card cage to the Processor card and secure it with the two attached screws.
5. Replace the front and rear cover panels on the card cabinet, allowing the cables to exit through the notch in the rear cover.

Section 3

CIRCUIT DESCRIPTION

INTRODUCTION

The following paragraphs explain the circuit action of the Hexadecimal Display Panel in a block format. While reading the description, refer to the block diagram of the circuitry, Fig. 3-1. Additional circuit details are provided in the Schematics section of this manual. Figure 3-2 illustrates the timing of data transfer signals between the Processor and Hexadecimal Display Panel. Signal names are defined at the end of this section.

BLOCK DESCRIPTION

Keyboard

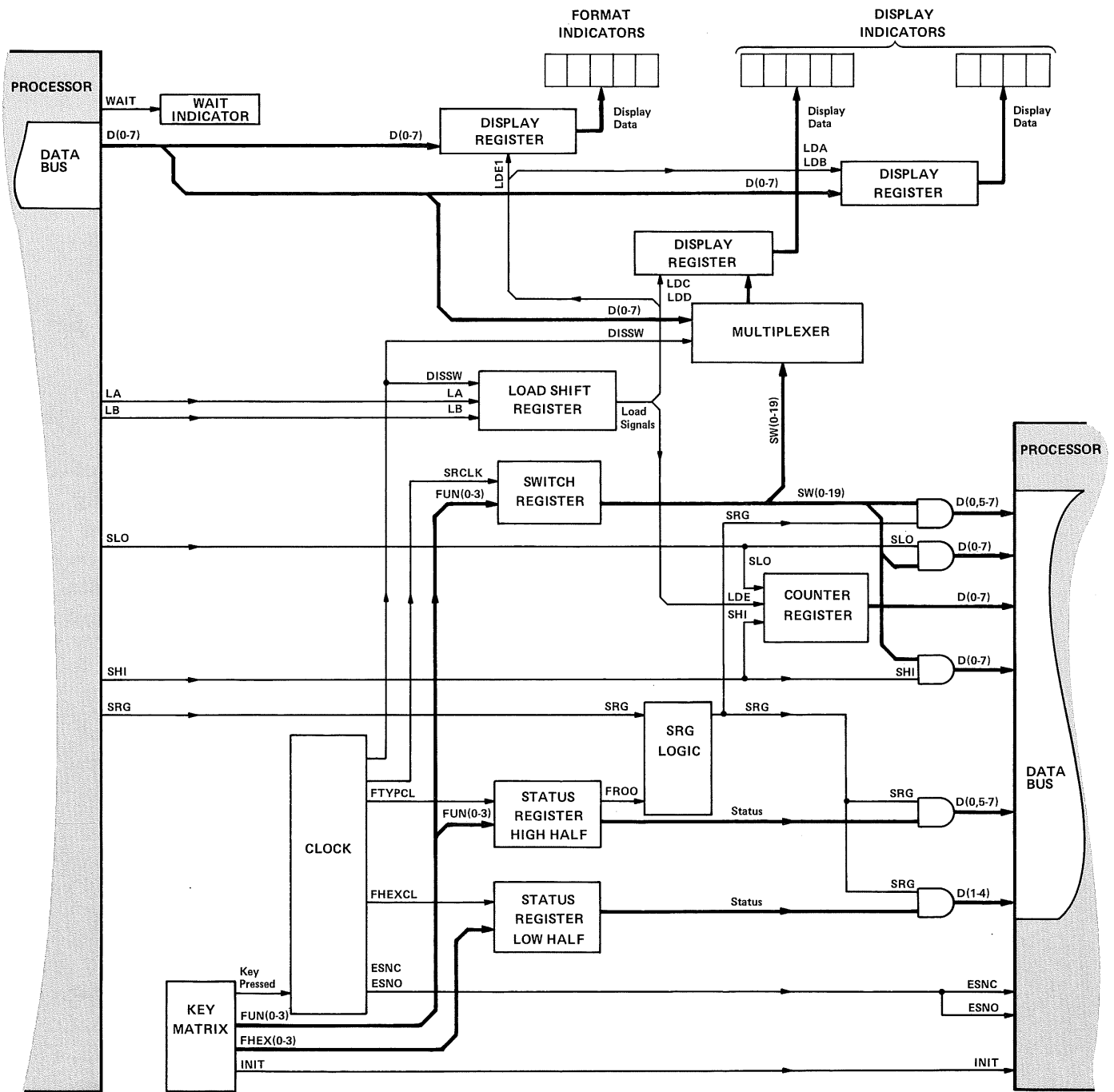
The Keyboard circuit board has 25 switches that are used to enter data to the Hexadecimal Display Panel logic, plus an Initialize (INI) key used to initialize the Processor. These normally open switches are encoded by diode logic to form HEX(0-3) (Hexadecimal key data) and FUN(0-3) (Function key data), plus additional control signals. The switches are designed to be low active. When a switch is pressed, the signal lines connected through the encoding diodes are pulled low, developing a four-bit pattern on the HEX or FUN bus lines. There is no keyboard rollover protection and if more than one key is simultaneously depressed, the result is unspecified.

The diode matrix is encoded to drive HEX(0-3) to the hexadecimal equivalent of any pressed key, 0 through F. HEX3 is the least significant bit of the generated keycode. Depressing any function key other than DTA causes FUN(0-3) to yield the codes specified by Table 3-1.

Table 3-1
FUNCTION KEY ENCODING FUN(0-3)

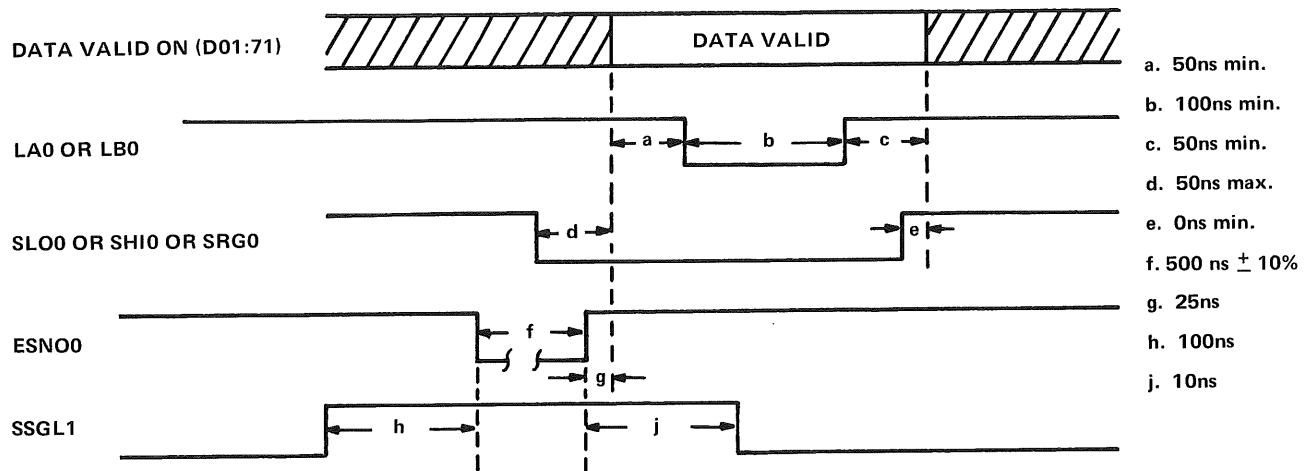
Key Depressed	FUN0	FUN1	FUN2	FUN3
SGL	0	1	1	1
RUN	1	1	1	1
WRT	1	1	0	1
RD	1	0	1	1
ADD	1	0	0	1
REG	0	1	1	0
FLT	0	1	0	0
FN	0	1	1	1

0 = low logic level, 1 = high logic level



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Fig. 3-1. Hexadecimal Display Panel Block Diagram.



2297-6

Fig. 3-2. Hexadecimal Display Panel Timing.

Clocking

Depressing a keyboard key other than DTA or INI generates one of three types of clock signals used by the Hexadecimal Display Panel logic. This is accomplished by using delay circuitry to block out contact bounce, which is caused by pressing a switch. After the delay, a short-duration clock pulse is paired with the signal from the still-activated key to produce the various clock signals.

Switch Register Clocks

The Switch Register is enabled for clocking by depressing the DTA key. Pressing the DTA key sets the Switch Register Enable signal (SRENB) true and produces DISSW (Display Switch Register). While DISSW is true, pressing any hexadecimal data key generates SRCLK (Switch Register Clock). This clock signal is disabled as soon as any function key is pressed.

Status Register Clocks

Two different clocks are used to load the Status Register. FTYPCL (Function Type Clock) is generated whenever any function key other than DTA is pressed. FTYPCL loads the current state of the FUN(0-3) bus into one half of the Status Register. The second clock, FHEXCL (Function Hex Clock), is generated whenever a hexadecimal key is pressed if the previously pressed key was FN, REG, or FLT. In this case, the hexadecimal input would be the register number or function number desired; FHEXCL clocks the state of HEX(0-3) into the second half of the Status Register.

Processor Intervention

Whenever a function key other than DTA, FN, REG, or FLT is depressed, or whenever a hexadecimal key is pressed following FN, REG, or FLT, the logic of the hex panel activates the signal ESNC (Execute) and its compliment ESNO. ESNC and ESNO interrupt the Processor to request response to the panel key(s) pressed. The Processor then retrieves the status of the hex panel, which is stored in the Status Register. According to its microcode, the Processor then performs the function as indexed by the contents of the Status Register.

Switch Register Loading

The Switch Register is loaded with a hexadecimal character by each SRCLK pulse. Data enters into the least significant character position (SW16-19) and shifts left through the register on each clock pulse. The register is cleared by SDA (Switch Data Available) whenever the DTA key is pressed.

Status Register

The Status Register is loaded in two parts as described previously. One half is loaded from FUN(0-3) when any function key is pressed (the occurrence of FTYPCL). The least significant bit of this register is recirculated and gated when the RUN key is pressed. When SGL is pressed, the two least significant bits are recirculated through the Status Register. The produced status codes are given in Table 3-2. The second half of the Status Register is loaded from HEX(0-3) by the FHEXCL pulse. The Status Register is cleared by SCLR (System Clear) from the Processor. The contents of the Status Register are sent to the Processor by the control signal SRG (Status Register Gate).

Table 3-2
STATUS CODES

KEY	D1	D2	D3	D4	D5	D6	D7	D0
SGL	1	U	X	X	X	X	X	X
INI	U	U	U	U	U	U	0	U
RUN	0	0	0	X	X	X	X	X
WRT	0	0	1	U	U	U	U	U
RD	0	1	0	U	U	U	U	U
ADR	0	1	1	U	A ₁	A ₂	A ₃	A ₄
REG n	1	0	0	1	n ₁	n ₂	n ₃	n ₄
FLT n	1	0	1	1	n ₁	n ₂	n ₃	n ₄
FN n	1	0	0	0	n ₁	n ₂	n ₃	n ₄

A = Most significant hexadecimal digit of Switch Register,
 U = Unspecified,
 X = Unchanged,
 n = Hexadecimal digit associated with function.

Display Register Loading

The Panel's Display Register stores up to five bytes of data transmitted from the Processor. The outputs of the Display Register directly drive the seven-segment Display Indicators. Two control signals are transmitted from the Processor to direct the loading of each byte into the Display Register. LA (Load A) is a pulse that loads data available on bi-directional Data lines D(0-7) into the least significant byte of the Display Register. LA initializes the Load Shift Register to the state 1000, which is used to sequentially load subsequent bytes. The other control signal, LB (Load B) clocks the Load Shift Register with four pulses to gate data from D(0-7) into successive byte locations of the Display Register. Each LB pulse is gated by the state of the sequencing Load Shift Register to produce the load signals LDB, LDC, LDD, and LDE. LDE1 loads the Format Register.

When the DTA key is pressed, DISSW (Display Switch Register) forces the Display Register to be loaded from the Switch Register through the Multiplexer. DISSW enables the load signals LDC, LDD, and LDE, so that data is loaded only into the five most significant hexadecimal indicators.

Processor Inputs

When SRENB is true, data is gated to the Processor in response to control signals SHI (Switch Register High), SLO (Switch Register Low), or SRG (Status Register Gate). SHO gates the two least significant digits of the Switch Register onto the bi-directional data lines D(0-7). SHI gates the next two Switch Register digits onto D(0-7). SRG gates the most significant Switch Register character to the Processor if D1 is low. D1 is a result of the state of FROO (Function Register bit 0 Output). If D1 is high, SRG returns the hexadecimal portion of the Status Register to the Processor.

Counter

The Counter records the number of pulses or transitions fed into its input jacks on the panel. The Counter Register is clocked by each input signal, counting down from its cleared state X'FFFF'. The Counter Enable switch, when set to the UP position (SRENB is true), prevents the control signals SHI and SLO from sending Switch Register Data to the Processor. Instead, SHI and SLO enable the outputs of the Counter Register, gating the current count onto the D(0-7) lines to the Processor. While the Counter is enabled, data can be entered into the Switch Register from the keyboard; however, the Processor cannot access Switch Register Data unless a key is held down. The Counter Register is reset by LDE from the Processor.

Signal Descriptions

Table 3-3 provides a brief description of each signal mnemonic used in the schematics for the Hexadecimal Display Panel.

Table 3-3
SIGNAL DESCRIPTIONS

Mnemonic	Description
BIT(0-7)	Data Bits 0 through 7 to Display Register
D(0-7)	Data Bits 0 through 7 to/from Processor
DISSW	Display Switch controls Multiplexer for Switch Register data
ESNC	Execute Switch normally closed (requests Processor service)
ESNO	Execute Switch normally open (requests Processor service)
FTYPCL	Function Type Status Register Clock
FHEXCL	Hexadecimal data Status Register Clock
FR00	Function Register Bit 0 Output (part of Status Register)
FUN(0-3)	Encoded Functional key data to Status Register
HEX(0-3)	Encoded Hexadecimal key data to Status Register and Switch Register
INIT	Initialize Processor
LA	Load A from Processor initializes the Load Shift Register
LB	Load B controls loading of display registers by clocking the Load Shift Register
LDA, LDB, LDC, LDD, LDE	Load Display Register with bytes A, B, C, D, E (E is most significant hexadecimal digit of display)
LDE1	Loads Display Format Register and clears Counter Register
SCLR	System Clear signal from Processor initializes Status Registers

Table 3-3 (cont)
SIGNAL DESCRIPTIONS

Mnemonic	Description
SDA	Switch Data is activated when DTA key is pressed to clear Switch Register
SHI	Switch Register High byte signal gates data to Processor
SHIC	Send High Counter byte to Processor
SLO	Switch Register Low byte signal gates data to Processor
SLOC	Send Low Counter byte to Processor
SOR	SGL Or RUN key depressed
SRCLK	Switch Register Clock pulses for each hex key pressed
SRENB	Switch Register Enable signal allows transfer of data to Processor
SRG	Status Register Gate loads either low half of Status Register or most significant four bits of Switch Register onto data bus to Processor
SSGL	SGL Switch pressed
SSL	Single Step status signal
SW(00-19)	Switch Register data bits 00 through 19
WAIT	Wait light control line from Processor

Section 4 REPLACEABLE PARTS

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

SPECIAL NOTES AND SYMBOLS

- X000 Part first added at this serial number
- 00X Part removed after this serial number

FIGURE AND INDEX NUMBERS

Items in this section are referenced by figure and index numbers to the illustrations.

INDENTATION SYSTEM

This mechanical parts list is indented to indicate item relationships. Following is an example of the indentation system used in the description column.

```

1 2 3 4 5 Name & Description
Assembly and/or Component
Attaching parts for Assembly and/or Component
    --- * ---
Detail Part of Assembly and/or Component
Attaching parts for Detail Part
    --- * ---
Parts of Detail Part
Attaching parts for Parts of Detail Part
    --- * ---
    
```

Attaching Parts always appear in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation. The separation symbol --- * --- indicates the end of attaching parts.

Attaching parts must be purchased separately, unless otherwise specified.

ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

ABBREVIATIONS

"	INCH	ELCTR	ELECTRON	IN	INCH	SE	SINGLE END
#	NUMBER SIZE	ELEC	ELECTRICAL	INCAND	INCANDESCENT	SECT	SECTION
ACTR	ACTUATOR	ELCTLT	ELECTROLYTIC	INSUL	INSULATOR	SEMICOND	SEMICONDUCTOR
ADPTR	ADAPTER	ELEM	ELEMENT	INTL	INTERNAL	SHLD	SHIELD
ALIGN	ALIGNMENT	EPL	ELECTRICAL PARTS LIST	LPHLDR	LAMPHOLDER	SHLDR	SHOULDERED
AL	ALUMINUM	EQPT	EQUIPMENT	MACH	MACHINE	SKT	SOCKET
ASSEM	ASSEMBLED	EXT	EXTERNAL	MECH	MECHANICAL	SL	SLIDE
ASSY	ASSEMBLY	FIL	FILLISTER HEAD	MTG	MOUNTING	SLFLKG	SELF-LOCKING
ATTEN	ATTENUATOR	FLEX	FLEXIBLE	NIP	NIPPLE	SLVG	SLEEVING
AWG	AMERICAN WIRE GAGE	FLH	FLAT HEAD	NON WIRE	NOT WIRE WOUND	SPR	SPRING
BD	BOARD	FLTR	FILTER	OBD	ORDER BY DESCRIPTION	SO	SQUARE
BRKT	BRACKET	FR	FRAME or FRONT	OD	OUTSIDE DIAMETER	SST	STAINLESS STEEL
BRS	BRASS	FSTNR	FASTENER	OVH	OVAL HEAD	STL	STEEL
BRZ	BRONZE	FT	FOOT	PH BRZ	PHOSPHOR BRONZE	SW	SWITCH
BSHG	BUSHING	FXD	FIXED	PL	PLAIN or PLATE	T	TUBE
CAB	CABINET	GSKT	GASKET	PLSTC	PLASTIC	TERM	TERMINAL
CAP	CAPACITOR	HDL	HANDLE	PN	PART NUMBER	THD	THREAD
CER	CERAMIC	HEX	HEXAGON	PNH	PAN HEAD	THK	THICK
CHAS	CHASSIS	HEX HD	HEXAGONAL HEAD	PWR	POWER	TNSN	TENSION
CKT	CIRCUIT	HEX SOC	HEXAGONAL SOCKET	RCPT	RECEPTACLE	TPG	TAPPING
COMP	COMPOSITION	HLCPS	HELICAL COMPRESSION	RES	RESISTOR	TRH	TRUSS HEAD
CONN	CONNECTOR	HLEXT	HELICAL EXTENSION	RGD	RIGID	V	VOLTAGE
COV	COVER	HV	HIGH VOLTAGE	RLF	RELIEF	VAR	VARIABLE
CPLG	COUPLING	IC	INTEGRATED CIRCUIT	RTNR	RETAINER	W/	WITH
CRT	CATHODE RAY TUBE	ID	INSIDE DIAMETER	SCH	SOCKET HEAD	WSHR	WASHER
DEG	DEGREE	IDENT	IDENTIFICATION	SCOPE	OSCILLOSCOPE	XFMR	TRANSFORMER
DWR	DRAWER	IMPLR	IMPELLER	SCR	SCREW	XSTR	TRANSISTOR

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
00779	AMP, INC.	P O BOX 3608	HARRISBURG, PA 17105
01121	ALLEN-BRADLEY COMPANY	1201 2ND STREET SOUTH	MILWAUKEE, WI 53204
01295	TEXAS INSTRUMENTS, INC., SEMICONDUCTOR GROUP	P O BOX 5012, 13500 N CENTRAL EXPRESSWAY	DALLAS, TX 75222
07263	FAIRCHILD SEMICONDUCTOR. A DIV. OF FAIRCHILD CAMERA AND INSTRUMENT CORP.	464 ELLIS STREET	MOUNTAIN VIEW, CA 94042
07910	TELEDYNE SEMICONDUCTOR	12515 CHADRON AVE.	HAWTHORNE, CA 90250
08505	E-Z HOOK, DIV. OF TEKTEST, INC.	P O BOX 450, 114 E ST. JOSEPH	ARCADIA, CA 91006
10389	CHICAGO SWITCH, INC.	2035 WABANSIA AVE.	CHICAGO, IL 60647
12360	ALBANY PRODUCTS CO., DIV. OF PNEUMO DYNAMICS CORPORATION	145 WOODWARD AVENUE	SOUTH NORWALK, CT 06586
22526	BERG ELECTRONICS, INC.	YOUK EXPRESSWAY	NEW CUMBERLAND, PA 17070
26066	MINNESOTA MINING AND MFG. CO., INDUSTRIAL TAPE DIV.	3M CENTER	ST. PAUL, MN 55101
27014	NATIONAL SEMICONDUCTOR CORP.	2900 SEMICONDUCTOR DR.	SANTA CLARA, CA 95051
27233	HI-TEK, CORP.	2220 S. ANNE ST.	SANTA ANNA, CA 92704
50522	MONSANTO CO., ELECTRONIC SPECIAL PRODUCTS	3400 HILLVIEW AVENUE	PALO ALTO, CA 94304
56289	SPRAGUE ELECTRIC CO.		NORTH ADAMS, MA 01247
59730	THOMAS AND BETTS COMPANY	36 BUTLER ST.	ELIZABETH, NJ 07207
70485	ATLANTIC INDIA RUBBER WORKS, INC.	571 W. POLK ST.	CHICAGO, IL 60607
72982	ERIE TECHNOLOGICAL PRODUCTS, INC.	644 W. 12TH ST.	ERIE, PA 16512
73138	BECKMAN INSTRUMENTS, INC., HELIPOT DIV.	2500 HARBOR BLVD.	FULLERTON, CA 92634
78189	ILLINOIS TOOL WORKS, INC. SHAKEPROOF DIVISION	ST. CHARLES ROAD	ELGIN, IL 60120
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
82389	SWITCHCRAFT, INC.	5555 N. ELSTON AVE.	CHICAGO, IL 60630
83385	CENTRAL SCREW CO.	2530 CRESCENT DR.	BROADVIEW, IL 60153
90201	MALLORY CAPACITOR CO., DIV. OF P. R. MALLORY AND CO., INC.	3029 E WASHINGTON STREET	INDIANAPOLIS, IN 46206
95987	WECKESSER CO., INC.	P O BOX 372 4444 WEST IRVING PARK RD.	CHICAGO, IL 60641

Electrical

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A1	670-4291-00			CKT BOARD ASSY:HEXIDECIMAL DISPLAY	80009	670-4291-00
A2	670-4465-00			CKT BOARD ASSY:KEYBOARD	80009	670-4465-00
A1 CKT BOARD ASSY:HEX DISPLAY						
C105	283-0026-00			CAP.,FXD,CER DI:0.2UF,+80-20%,25V	56289	274C3
C125	283-0026-00			CAP.,FXD,CER DI:0.2UF,+80-20%,25V	56289	274C3
C145	283-0026-00			CAP.,FXD,CER DI:0.2UF,+80-20%,25V	56289	274C3
C171	283-0026-00			CAP.,FXD,CER DI:0.2UF,+80-20%,25V	56289	274C3
C251	283-0026-00			CAP.,FXD,CER DI:0.2UF,+80-20%,25V	56289	274C3
C305	283-0026-00			CAP.,FXD,CER DI:0.2UF,+80-20%,25V	56289	274C3
C325	283-0026-00			CAP.,FXD,CER DI:0.2UF,+80-20%,25V	56289	274C3
DS28	150-1011-01			LAMP,LED RDOUT:RED,SINGLE DIGIT	07263	FND357
DS35	150-1011-01			LAMP,LED RDOUT:RED,SINGLE DIGIT	07263	FND357
DS41	150-1011-01			LAMP,LED RDOUT:RED,SINGLE DIGIT	07263	FND357
DS45	150-1011-01			LAMP,LED RDOUT:RED,SINGLE DIGIT	07263	FND357
DS48	150-1011-01			LAMP,LED RDOUT:RED,SINGLE DIGIT	07263	FND357
DS51	150-1011-01			LAMP,LED RDOUT:RED,SINGLE DIGIT	07263	FND357
DS53	150-1011-01			LAMP,LED RDOUT:RED,SINGLE DIGIT	07263	FND357
DS55	150-1011-01			LAMP,LED RDOUT:RED,SINGLE DIGIT	07263	FND357
DS58	150-1011-01			LAMP,LED RDOUT:RED,SINGLE DIGIT	07263	FND357
DS93	150-1014-00			LAMP,LED:RED,50MA	50522	MU5054-1
DS120	150-1014-00			LAMP,LED:RED,50MA	50522	MU5054-1
DS123	150-1014-00			LAMP,LED:RED,50MA	50522	MU5054-1
DS220	150-1014-00			LAMP,LED:RED,50MA	50522	MU5054-1
DS223	150-1014-00			LAMP,LED:RED,50MA	50522	MU5054-1
DS320	150-1014-00			LAMP,LED:RED,50MA	50522	MU5054-1
R91	315-0220-00			RES.,FXD,CMPSN:22 OHM,5%,0.25W	01121	CB2205
R113	315-0220-00			RES.,FXD,CMPSN:22 OHM,5%,0.25W	01121	CB2205
R114	315-0220-00			RES.,FXD,CMPSN:22 OHM,5%,0.25W	01121	CB2205
R216	315-0220-00			RES.,FXD,CMPSN:22 OHM,5%,0.25W	01121	CB2205
R250	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R313	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
R314	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
S411	260-0960-01			SWITCH,SLIDE:0.5A,120VDC,CKT BD MT	10389	23-021-043
S415	260-0960-01			SWITCH,SLIDE:0.5A,120VDC,CKT BD MT	10389	23-021-043
S421	260-0960-01			SWITCH,SLIDE:0.5A,120VDC,CKT BD MT	10389	23-021-043
U105	156-0145-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN7438N
U111	156-0145-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN7438N
U115	156-0617-00			MICROCIRCUIT,DI:DUAL 4 BIT BIN COUNTER	01295	SN74393N
U125	156-0493-00			MICROCIRCUIT,DI:BCD TO 7 SEG DEC/DRIVER	07263	9368DC
U131	156-0493-00			MICROCIRCUIT,DI:BCD TO 7 SEG DEC/DRIVER	07263	9368DC
U141	156-0493-00			MICROCIRCUIT,DI:BCD TO 7 SEG DEC/DRIVER	07263	9368DC
U145	156-0493-00			MICROCIRCUIT,DI:BCD TO 7 SEG DEC/DRIVER	07263	9368DC
U151	156-0493-00			MICROCIRCUIT,DI:BCD TO 7 SEG DEC/DRIVER	07263	9368DC
U155	156-0493-00			MICROCIRCUIT,DI:BCD TO 7 SEG DEC/DRIVER	07263	9368DC
U161	156-0493-00			MICROCIRCUIT,DI:BCD TO 7 SEG DEC/DRIVER	07263	9368DC
U171	156-0125-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN74157N
U181	156-0125-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN74157N

Replaceable Parts—067-0772-00

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
U191	156-0125-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN74157N
U205	156-0617-00			MICROCIRCUIT,DI:DUAL 4 BIT BIN COUNTER	01295	SN74393N
U211	156-0145-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN7438N
U215	156-0145-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN7438N
U231	156-0125-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN74157N
U245	156-0125-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN74157N
U255	156-0493-00			MICROCIRCUIT,DI:BCD TO 7 SEG DEC/DRIVER	07263	9368DC
U261	156-0493-00			MICROCIRCUIT,DI:BCD TO 7 SEG DEC/DRIVER	07263	9368DC
U305	156-0462-00			MICROCIRCUIT,LI:HEX SCHMITT TRIG,TTL	01295	SN7414N
U311	156-0221-00			MICROCIRCUIT,DI:QUAD LATCH	01295	SN74175N
U315	156-0093-00			MICROCIRCUIT,DI:HEX. INVERTER	01295	SN7416N
U325	156-0062-00			MICROCIRCUIT,DI:QUAD 2-INPUT EXCL-OR GATE	80009	156-0062-00

A2 CKT BOARD ASSY:KEYBOARD

C69	283-0026-00			CAP.,FXD,CER DI:0.2UF,+80-20%,25V	56289	274C3
C83	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N075Z5U0103M
C87	281-0523-00			CAP.,FXD,CER DI:100PF,+/-20PF,500V	72982	301-000U2M0101M
C97	290-0524-00			CAP.,FXD,ELCTL:4.7UF,20%,10V	90201	TDC475M010EL
C117	283-0026-00			CAP.,FXD,CER DI:0.2UF,+80-20%,25V	56289	274C3
C143	283-0026-00			CAP.,FXD,CER DI:0.2UF,+80-20%,25V	56289	274C3
C185	283-0026-00			CAP.,FXD,CER DI:0.2UF,+80-20%,25V	56289	274C3
C217	283-0026-00			CAP.,FXD,CER DI:0.2UF,+80-20%,25V	56289	274C3
C253	283-0026-00			CAP.,FXD,CER DI:0.2UF,+80-20%,25V	56289	274C3
C323	283-0026-00			CAP.,FXD,CER DI:0.2UF,+80-20%,25V	56289	274C3
C355	283-0026-00			CAP.,FXD,CER DI:0.2UF,+80-20%,25V	56289	274C3
C356	283-0026-00			CAP.,FXD,CER DI:0.2UF,+80-20%,25V	56289	274C3
C357	283-0026-00			CAP.,FXD,CER DI:0.2UF,+80-20%,25V	56289	274C3
C358	283-0026-00			CAP.,FXD,CER DI:0.2UF,+80-20%,25V	56289	274C3
C359	283-0026-00			CAP.,FXD,CER DI:0.2UF,+80-20%,25V	56289	274C3
C360	283-0026-00			CAP.,FXD,CER DI:0.2UF,+80-20%,25V	56289	274C3
C361	283-0026-00			CAP.,FXD,CER DI:0.2UF,+80-20%,25V	56289	274C3
C362	283-0026-00			CAP.,FXD,CER DI:0.2UF,+80-20%,25V	56289	274C3
C363	283-0026-00			CAP.,FXD,CER DI:0.2UF,+80-20%,25V	56289	274C3
CR93	152-0141-02			SEMICONV DEVICE:SILICON,30V,150MA	07910	1N4152
CR265	152-0141-02			SEMICONV DEVICE:SILICON,30V,150MA	07910	1N4152
CR266	152-0141-02			SEMICONV DEVICE:SILICON,30V,150MA	07910	1N4152
CR267	152-0141-02			SEMICONV DEVICE:SILICON,30V,150MA	07910	1N4152
CR268	152-0141-02			SEMICONV DEVICE:SILICON,30V,150MA	07910	1N4152
CR269	152-0141-02			SEMICONV DEVICE:SILICON,30V,150MA	07910	1N4152
CR270	152-0141-02			SEMICONV DEVICE:SILICON,30V,150MA	07910	1N4152
CR271	152-0141-02			SEMICONV DEVICE:SILICON,30V,150MA	07910	1N4152
CR273	152-0141-02			SEMICONV DEVICE:SILICON,30V,150MA	07910	1N4152
CR274	152-0141-02			SEMICONV DEVICE:SILICON,30V,150MA	07910	1N4152
CR275	152-0141-02			SEMICONV DEVICE:SILICON,30V,150MA	07910	1N4152
CR277	152-0141-02			SEMICONV DEVICE:SILICON,30V,150MA	07910	1N4152
CR278	152-0141-02			SEMICONV DEVICE:SILICON,30V,150MA	07910	1N4152
CR279	152-0141-02			SEMICONV DEVICE:SILICON,30V,150MA	07910	1N4152
CR280	152-0141-02			SEMICONV DEVICE:SILICON,30V,150MA	07910	1N4152
CR281	152-0141-02			SEMICONV DEVICE:SILICON,30V,150MA	07910	1N4152

Replaceable Parts—067-0772-00

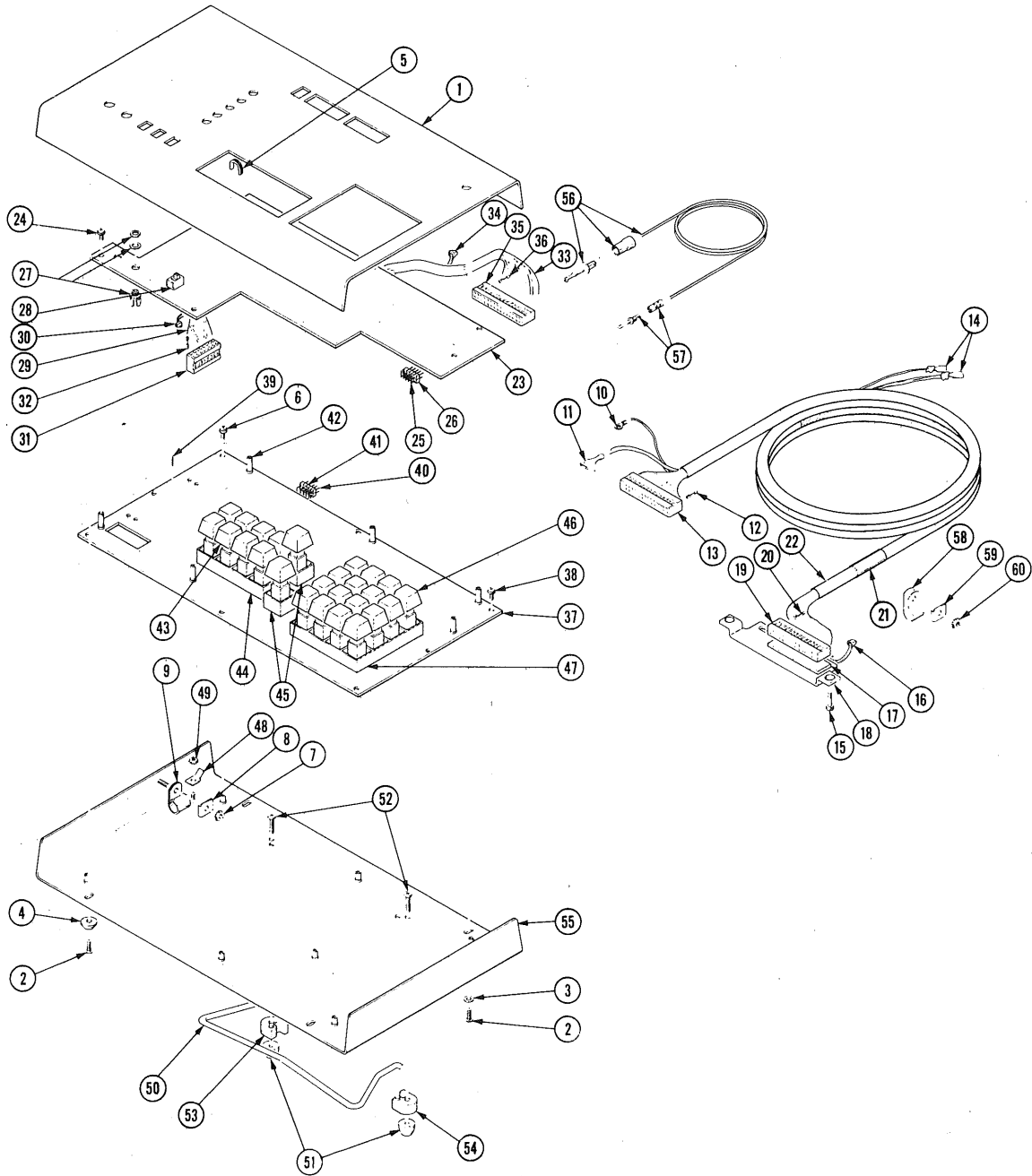
Ckt No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
CR282	152-0141-02		SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR283	152-0141-02		SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR285	152-0141-02		SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR286	152-0141-02		SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR288	152-0141-02		SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR290	152-0141-02		SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR291	152-0141-02		SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR292	152-0141-02		SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR292	152-0141-02		SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR331	152-0141-02		SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR333	152-0141-02		SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR335	152-0141-02		SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR337	152-0141-02		SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR339	152-0141-02		SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR341	152-0141-02		SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR343	152-0141-02		SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR345	152-0141-02		SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR347	152-0141-02		SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR349	152-0141-02		SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR351	152-0141-02		SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR353	152-0141-02		SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR365	152-0141-02		SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR366	152-0141-02		SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR367	152-0141-02		SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR466	152-0141-02		SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
R85	315-0103-00		RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R95	315-0103-00		RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R113	315-0221-00		RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
R114	315-0221-00		RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
R165	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R209	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
S271	260-1854-00		SWITCH MDL,PUSH:4 BTN X 4 ROWS,W/BLK KEYCAPS	27233	DS1234-4X4
S274					
S277					
S279					
S283					
S285					
S291					
S295					
S335	260-1853-00		SWITCH MDL,PUSH:2 BTN X 4 ROWS,W/BLK KEYCAPS	27233	DS1234-2X4
S345					
S355					
S361					
S365					
S371	260-1834-00		SWITCH.PUSH:SPST,W/BLANK PUSH BUTTON	27233	DS1234-1X1
S377					
S383					
S391					
S435					
S445					
S455					
S461					

¹Furnished as a unit.

Replaceable Parts—067-0772-00

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
S465	260-1834-00			SWITCH,PUSH:SPST,W/BLANK PUSH BUTTON	27233	DS1234-1X1
S471	260-1834-00					
S477						
S483						
S491						
U61	156-0129-00			MICROCIRCUIT,DI:QUAD 2-INPUT GATE	01295	SN7408N
U65	156-0041-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	27014	DM7474N
U71	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U81	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U91	156-0172-00			MICROCIRCUIT,DI:DUAL RETRIG MONOSTABLE MV	80009	156-0172-00
U111	156-0462-00			MICROCIRCUIT,LI:HEX SCHMITT TRIG,TTL	01295	SN7414N
U115	156-0221-00			MICROCIRCUIT,DI:QUAD LATCH	01295	SN74175N
U121	156-0221-00			MICROCIRCUIT,DI:QUAD LATCH	01295	SN74175N
U125	156-0221-00			MICROCIRCUIT,DI:QUAD LATCH	01295	SN74175N
U131	156-0221-00			MICROCIRCUIT,DI:QUAD LATCH	01295	SN74175N
U141	156-0221-00			MICROCIRCUIT,DI:QUAD LATCH	01295	SN74175N
U151	156-0120-00			MICROCIRCUIT,DI:SINGLE 4-BIT R/L SHIFT REG	01295	SN7495AN
U161	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U171	156-0047-00			MICROCIRCUIT,DI:TPL 3-INPUT POS NAND GATE	80009	156-0047-00
U181	156-0129-00			MICROCIRCUIT,DI:QUAD 2-INPUT GATE	01295	SN7408N
U191	156-0058-00			MICROCIRCUIT,DI:HEX. INVERTER	01295	SN7404N
U211	156-0043-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NOR GATE	80009	156-0043-00
U215	156-0145-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN7438N
U221	156-0145-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN7438N
U225	156-0145-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN7438N
U231	156-0145-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN7438N
U241	156-0145-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN7438N
U251	307-0349-00			RES.,FXD,FILM:13 RES. NTWK,1K OHM,2%,0.125W	73138	899-1-R1K
U261	307-0349-00			RES.,FXD,FILM:13 RES. NTWK,1K OHM,2%,0.125W	73138	899-1-R1K
U265	156-0034-00			MICROCIRCUIT,DI:DUAL 4-INPUT NAND GATE	80009	156-0034-00
U311	156-0129-00			MICROCIRCUIT,DI:QUAD 2-INPUT GATE	01295	SN7408N
U315	156-0145-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN7438N
U321	156-0145-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	01295	SN7438N
U325	156-0037-00			MICROCIRCUIT,DI:2-INPUT +AND/OR/INVERT GATE	80009	156-0037-00
U415	156-0221-00			MICROCIRCUIT,DI:QUAD LATCH	01295	SN74175N
U421	156-0221-00			MICROCIRCUIT,DI:QUAD LATCH	01295	SN74175N

¹Furnished as a unit, with S271-S295, S371-S391 and S471-S491.



Mechanical

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscnt	Qty						Name & Description	Mfr Code	Mfr Part Number
					1	2	3	4	5			
-1	386-3471-00			1						PANEL, TOP: (ATTACHING PARTS)	80009	386-3471-00
-2	211-0071-00			4						SCREW, MACHINE: 4-40 X 0.375 INCH, TRH, STL	83385	OBD
-3	210-1001-00			2						WASHER, FLAT: 0.119 ID X 0.375" OD, BRS	12360	OBD
-4	348-0037-00			2						FOOT: RUBBER	70485	1059
-5	348-0115-00			2						GROMMET, PLASTIC: U-SHP, 0.548 X 0.462 INCH	80009	348-0115-00

Replaceable Parts—067-0772-00

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
	012-0701-00		1		CABLE,INTCON:37.5" LONG,TEST UNIT/4081 (ATTACHING PARTS)	80009	012-0701-00
-6	211-0116-00		1		SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH BRS	83385	OBD
-7	210-0457-00		1		NUT,PLAIN,EXT W:6-32 X 0.312 INCH,STL	83385	OBD
-8	210-0863-00		1		WSHR,LOOP CLAMP:FOR 0.50" WIDE CLAMP,STL	95987	C191
-9	343-0013-00		1		CLAMP,LOOP:0.375 INCH DIA	95987	3-8-6B
- - - - *							
-10	210-0287-00		1		CABLE ASSY INCLUDES: TERMINAL,LUG:	80009	210-0287-00
-11	131-1563-00		1		CONTACT,ELEC:FOR 0.25 TAB,W/BUE INS	00779	61198-1
-12	131-0707-00		26		CONTACT,ELEC:0.48"L,22-26 AWG WIRE	22526	47439
-13	352-0437-01		1		HLD,TERM CONN:2-15 FEM,0.15 X 0.15 CTR W/MK	22526	NA
-14	131-1216-00		2		CONTACT,ELEC:CRIMP MT W/BUE INS	00779	42332-2
-15	213-0313-00		2		THUMBSREW:4-40 X 0.45 INCH,KNURLED	80009	213-0313-00
-16	343-0549-00		5		STRAP,TIEDOWN:0.091 W X 3.62 INCH LONG	59730	TY23M
-17	253-0218-00		RL		TAPE,PRESS.SENS:0.375 W X 1.5" L,DBL SIDED	26066	4016
-18	407-1770-00		1		BRACKET,CONN:15 PIN	80009	407-1770-00
-19	352-0437-00		1		HLD,TERM CONN:2-15 FEMALE,0.15 X 0.15 CTR	22526	65057-017
-20	131-0707-00		30		CONTACT,ELEC:0.48"L,22-26 AWG WIRE	22526	47439
-21	334-2819-00		2		SLEEVE,MKR CA:012-0701-00	80009	334-2819-00
	343-0549-00		3		STRAP,TIEDOWN:0.091 W X 3.62 INCH LONG	59730	TY23M
-22	175-1419-00		FT		CABLE,SP,ELEC:12.0 FEET LONG	80009	175-1419-00
-23	-----		1		CKT BOARD ASSY:HEX DISPLAY (SEE A1 EPL) (ATTACHING PARTS)		
-24	211-0116-00		6		SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH BRS	83385	OBD
- - - - *							
-25	131-1806-00		1		CONTACT ASSY,EL:31,0.025 SQ,0.15 CTR,0.39L	22526	65595-131
-26	131-1807-00		1		CONTACT ASSY,EL:31,0.025 SQ,0.15 CTR,0.54L	22526	65603-131
-27	131-0407-00		2		JACK,TELEPHONE:2 COND OPEN OR SGL CLOSED	82389	TR-2A
-28	-----		2		SW,SLIDE:CNTR/PNL LK/WRT(SEE S411/415/421 EPL)		
	198-3217-00		1		WIRE SET,ELEC:	80009	198-3217-00
-29	-----		1		CABLE ASSY:J3/J1,2.5 INCH LONG		
-30	343-0549-00		1		STRAP,TIEDOWN:0.091 W X 3.62 INCH LONG	59730	TY23M
-31	352-0435-01		2		HLD,TERM CONN:2-8 FEM,0.15 X 0.15 CRT,W/MK	22526	NA
-32	131-0707-00		30		CONTACT,ELEC:0.48"L,22-26 AWG WIRE	22526	47439
-33	-----		1		CABLE ASSY:J75/J25,8.0 INCHES LONG		
-34	343-0549-00		2		STRAP,TIEDOWN:0.091 W X 3.62 INCH LONG	59730	TY23M
-35	352-0437-01		2		HLD,TERM CONN:2-15 FEM,0.15 X 0.15 CTR,W/MK	22526	NA
-36	131-0707-00		58		CONTACT,ELEC:0.48"L,22-26 AWG WIRE	22526	47439
-37	-----		1		CKT BOARD ASSY:KEYBOARD (SEE A2 EPL) (ATTACHING PARTS)		
-38	211-0116-00		6		SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH BRS	83385	OBD
- - - - *							
-39	-----		-		CKT BOARD ASSY INCLUDES:		
-40	131-0608-00		45		CONTACT,ELEC:0.365 INCH LONG	22526	47357
-41	131-1806-00		1		CONTACT ASSY,EL:31,0.025 SQ,0.15 CTR,0.39L	22526	65595-131
-42	131-1807-00		1		CONTACT ASSY,EL:31,0.025 SQ,0.15 CTR,0.54L	22526	65603-131
-43	129-0266-00		6		POST,ELEC-MECH:0.515 L X 0.219 OD,0.219 BRS	80009	129-0266-00
	366-1709-10		1		PUSH BUTTON:GRAY,--REG	80009	366-1709-10
	366-1709-09		1		PUSH BUTTON:GRAY,--ADR	80009	366-1709-09
	366-1709-08		1		PUSH BUTTON:GRAY,--RD	80009	366-1709-08
	366-1709-07		1		PUSH BUTTON:GRAY,--WRT	80009	366-1709-07
	366-1709-06		1		PUSH BUTTON:GRAY,--DT	80009	366-1709-06
	366-1709-05		1		PUSH BUTTON:GRAY,--FLT	80009	366-1709-05
	366-1709-04		1		PUSH BUTTON:GRAY,--FN	80009	366-1709-04
	366-1709-03		1		PUSH BUTTON:GRAY,--SGL	80009	366-1709-03
	366-1709-02		1		PUSH BUTTON:GRAY,--RUN	80009	366-1709-02
	366-1709-01		1		PUSH BUTTON:GRAY,--INI	80009	366-1709-01
-44	-----		2		SW,PUSH:(SEE S335,S345,S355,S361 EPL)		
	-----		-		SW,PUSH:(SEE S435,S445,S455,S461 EPL)		
-45	-----		2		SW,PUSH:(SEE S365/S465 EPL)		

Replaceable Parts—067-0772-00

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1	2	3	4	5	Name & Description	Mfr Code	Mfr Part Number
-46	366-1709-26			1	.					PUSH BUTTON:GRAY,--0	80009	366-1709-26
	366-1709-25			1	.					PUSH BUTTON:GRAY,--1	80009	366-1709-25
	366-1709-24			1	.					PUSH BUTTON:GRAY,--2	80009	366-1709-24
	366-1709-23			1	.					PUSH BUTTON:GRAY,--3	80009	366-1709-23
	366-1709-22			1	.					PUSH BUTTON:GRAY,--4 PSW	80009	366-1709-22
	366-1709-21			1	.					PUSH BUTTON:GRAY,--5 LOG	80009	366-1709-21
	366-1709-20			1	.					PUSH BUTTON:GRAY,--6	80009	366-1709-20
	366-1709-19			1	.					PUSH BUTTON:GRAY,--7	80009	366-1709-19
	366-1709-18			1	.					PUSH BUTTON:GRAY,--8	80009	366-1709-18
	366-1709-17			1	.					PUSH BUTTON:GRAY,--9	80009	366-1709-17
	366-1709-16			1	.					PUSH BUTTON:GRAY,--A	80009	366-1709-16
	366-1709-15			1	.					PUSH BUTTON:GRAY,--B	80009	366-1709-15
	366-1709-14			1	.					PUSH BUTTON:GRAY,--C	80009	366-1709-14
	366-1709-13			1	.					PUSH BUTTON:GRAY,--D	80009	366-1709-13
	366-1709-12			1	.					PUSH BUTTON:GRAY,--E	80009	366-1709-12
	366-1709-11			1	.					PUSH BUTTON:GRAY,--F	80009	366-1709-11
-47	-----			1	.					SW,PUSH:(SEE S271-295/S371-391/S471-491 EPL)		
-48	131-1191-00			1						CONTACT,ELEC:FOR 0.25 INCH WD CONN (ATTACHING PARTS)	00779	42822-2
-49	210-0586-00			1						NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL - - - * - - -	78189	OBD
-50	348-0348-00			1						STAND,ELEC EQPT:	83385	OBD
-51	348-0187-00			2						FOOT,CABINET:0.780 X 1.650 INCH LONG (ATTACHING PARTS FOR EACH)	80009	348-0187-00
-52	211-0551-00			1						SCREW,MACHINE:6-32 X 0.562 INCH,PNH STL - - - * - - -	83385	OBD
-53	348-0026-00			1						HINGE BLOCK,STA:LEFT	80009	348-0026-00
-54	348-0027-00			1						HINGE BLOCK,STA:RIGHT	80009	348-0027-00
-55	390-0504-00			1						CAB. BOT,TSTEQ:	80009	390-0504-00
	012-0713-00			1						LEAD TEST:TEL PLUG 1 END/HOOK TIP OTHER,48" L	80009	012-0713-00
-56	134-0079-00			1						PLUG,TELEPHONE:	82389	850
-57	344-0298-00			1						CLIP,ELECTRICAL:HOOK,TYPE	08505	213 X M-48
-58	343-0659-00			1						CLAMP,LOOP:0.375 DIA,STEEL		
-59	210-0863-00			1						WSHR,LOOP CLAMP:FOR 0.50" WIDE CLAMP,STL	95987	C191
-60	210-0457-00			1						NUT,PLAIN,EXT W:6-32 X 0.312 INCH,STL	83385	OBD

ACCESSORIES

	070-2297-00			1						MANUAL,TECH:INSERT	80009	070-2297-00
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Section 5

SCHEMATICS

SCHEMATIC DRAWING CONVENTIONS

Symbols used on the diagrams are based on ANSI Standard Y32.2—1975. Logic symbols are based on ANSI Y32.16—1975. Logic symbols depict the performed logic function and may differ from the manufacturer's data. The following explanations and accompanying schematic example (Fig. 5-1) show typical usage of symbols and their meaning.

1. TRUE HIGH And TRUE LOW Signals

Signal names on the schematics are followed by—1 or—0 to show active logic levels. A TRUE HIGH signal is indicated by—1, and a TRUE LOW signal is indicated by—0. CPU signals omit the hyphen before the 1 or 0.

SIGNAL—1 = TRUE HIGH, or SIGNAL1 = TRUE HIGH

SIGNAL—0 = TRUE LOW, or SIGNAL0 = TRUE LOW

2. Cross-References

Schematic cross-references (from/to information) are included on the schematics. The "from" reference indicates the signal "source," and the "to" reference lists all loads where the signal is used. All from/to information is enclosed in parentheses.

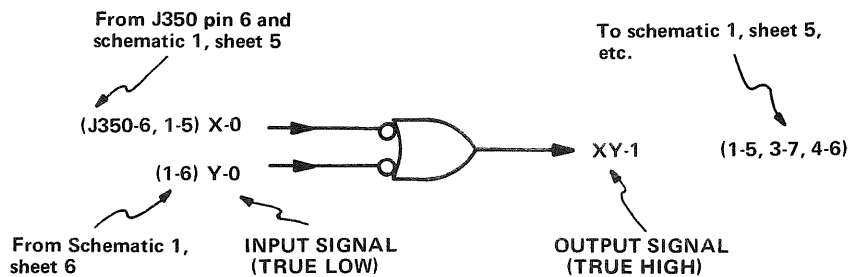


Fig. 5-2. Cross Reference Example.

3. Board Edge Information

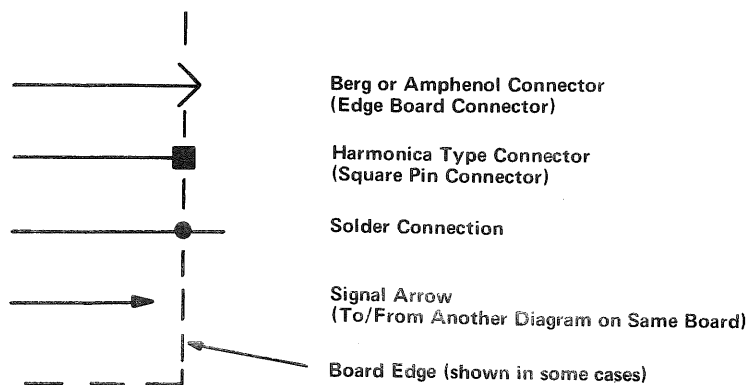


Fig. 5-3. Board Edge Example.

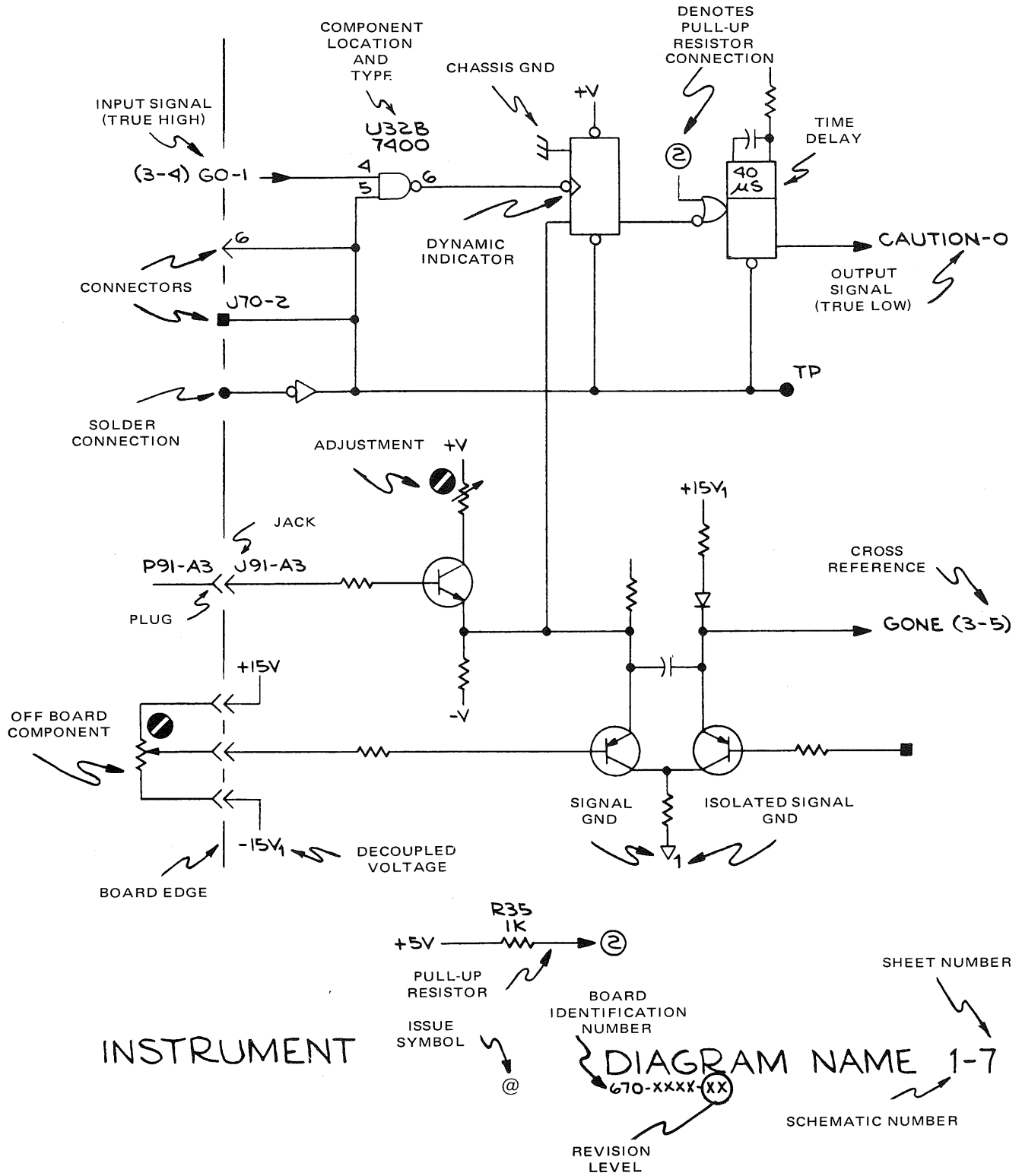
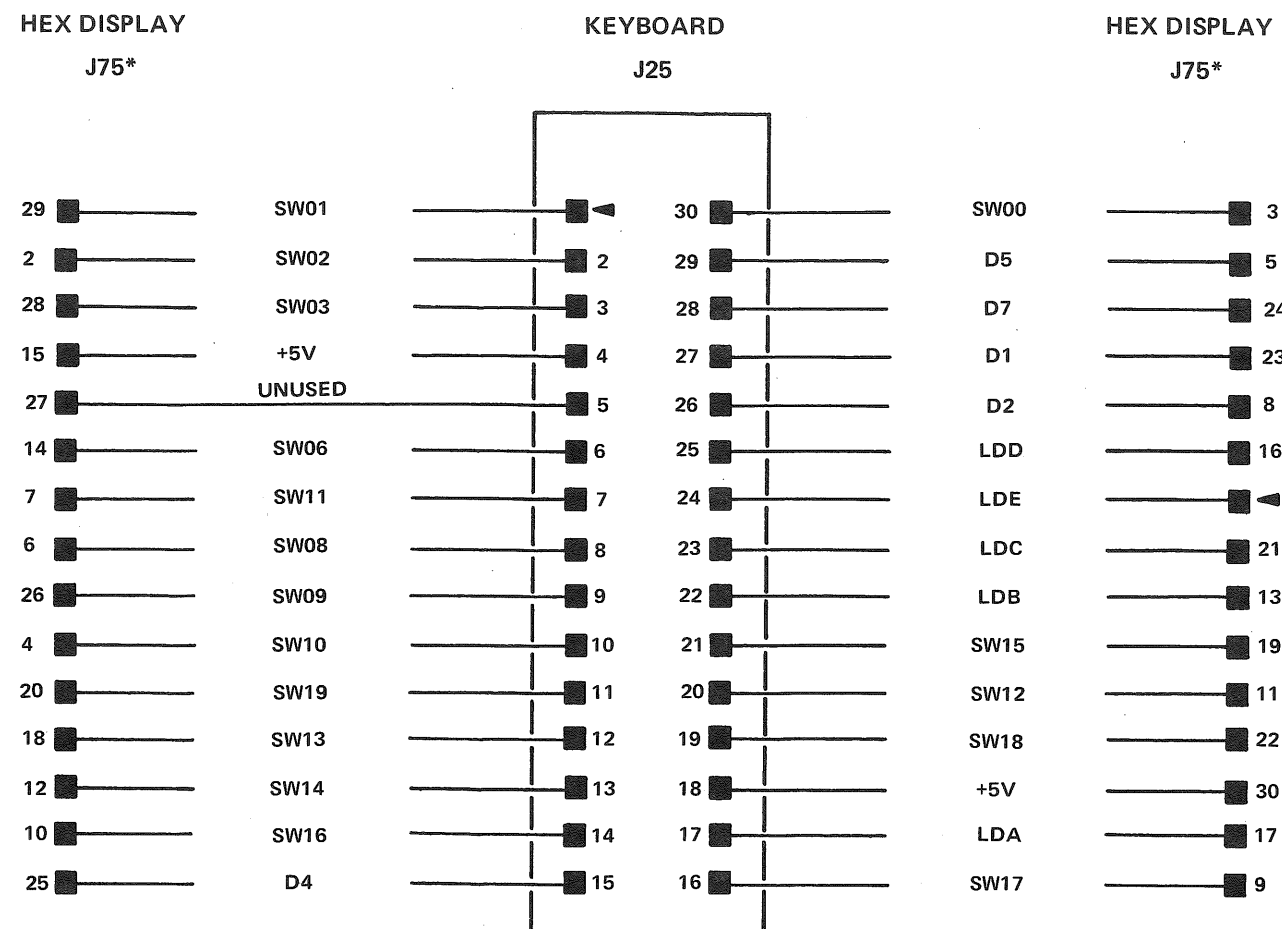
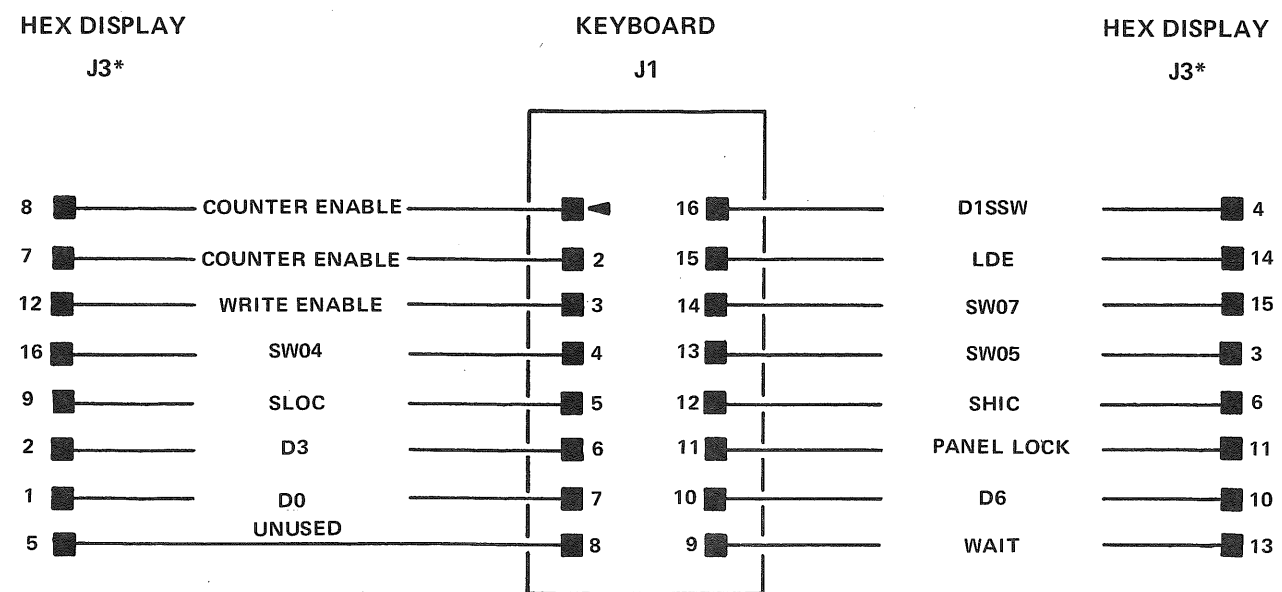


Fig. 5-1. Schematic Example.

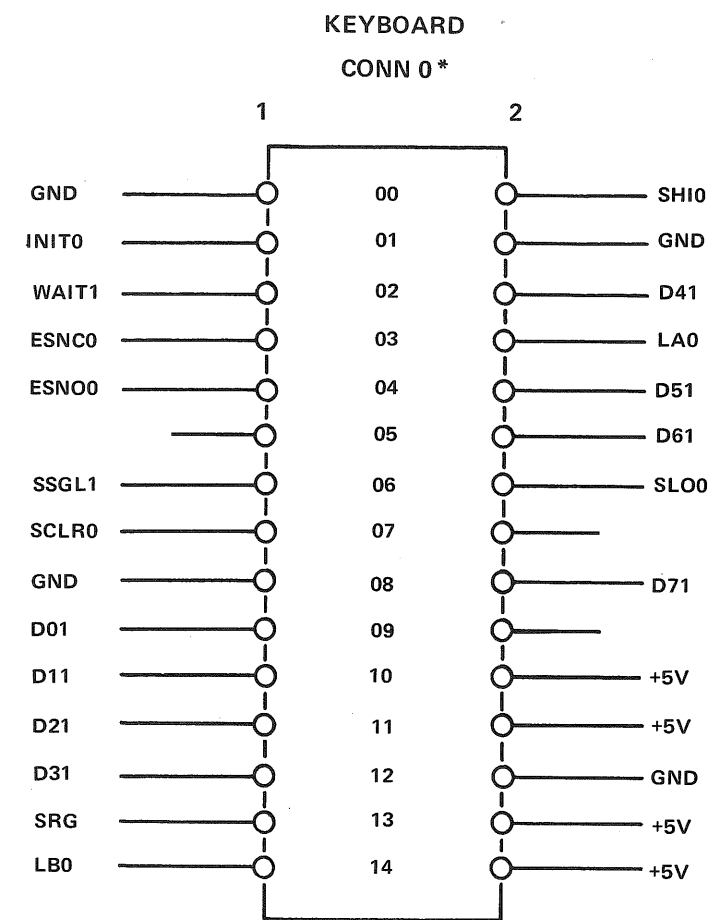


* J75 has same pin arrangement as J25



* J3 has same pin arrangement as J1

2297-7

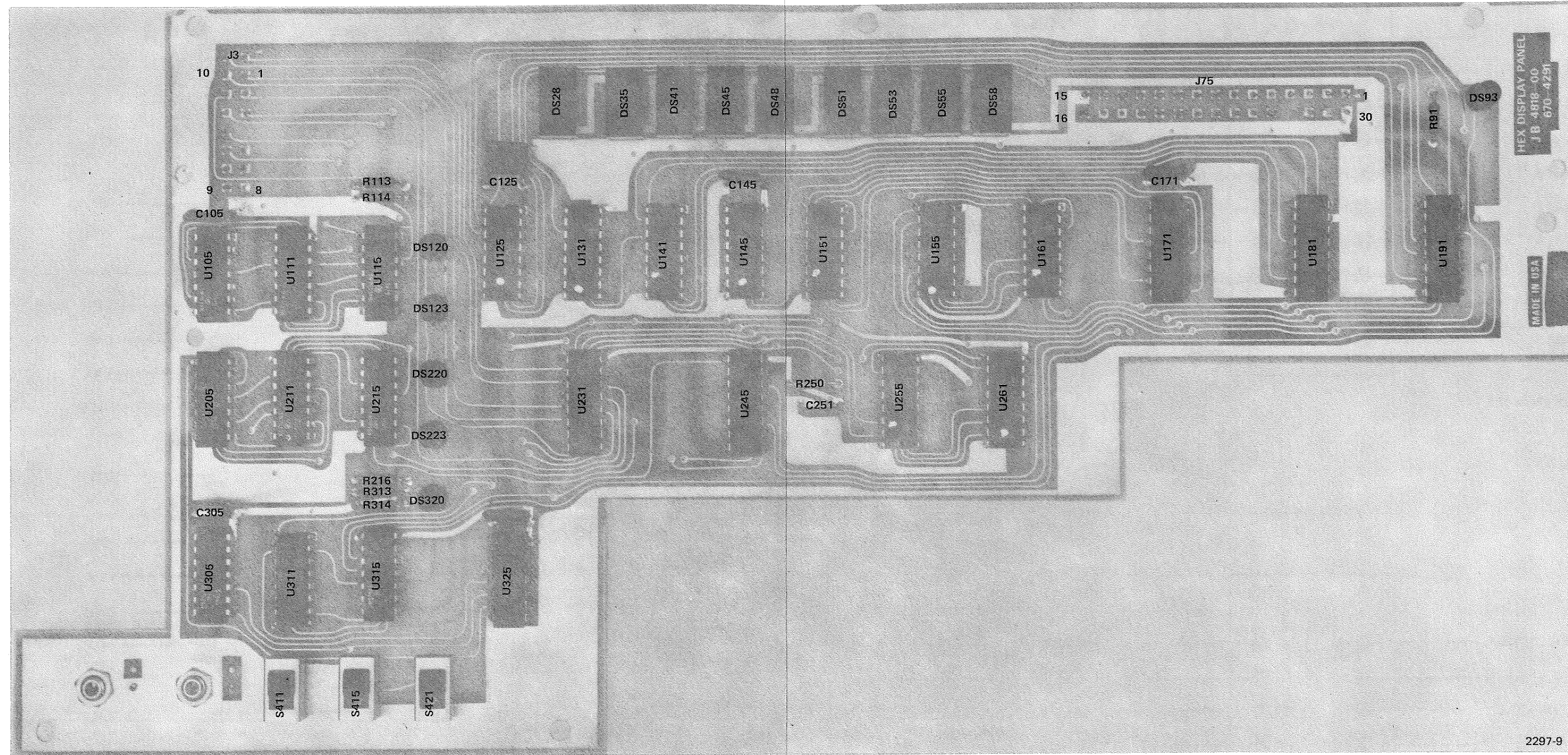


*The cable from the Processor attaches to Connector 0

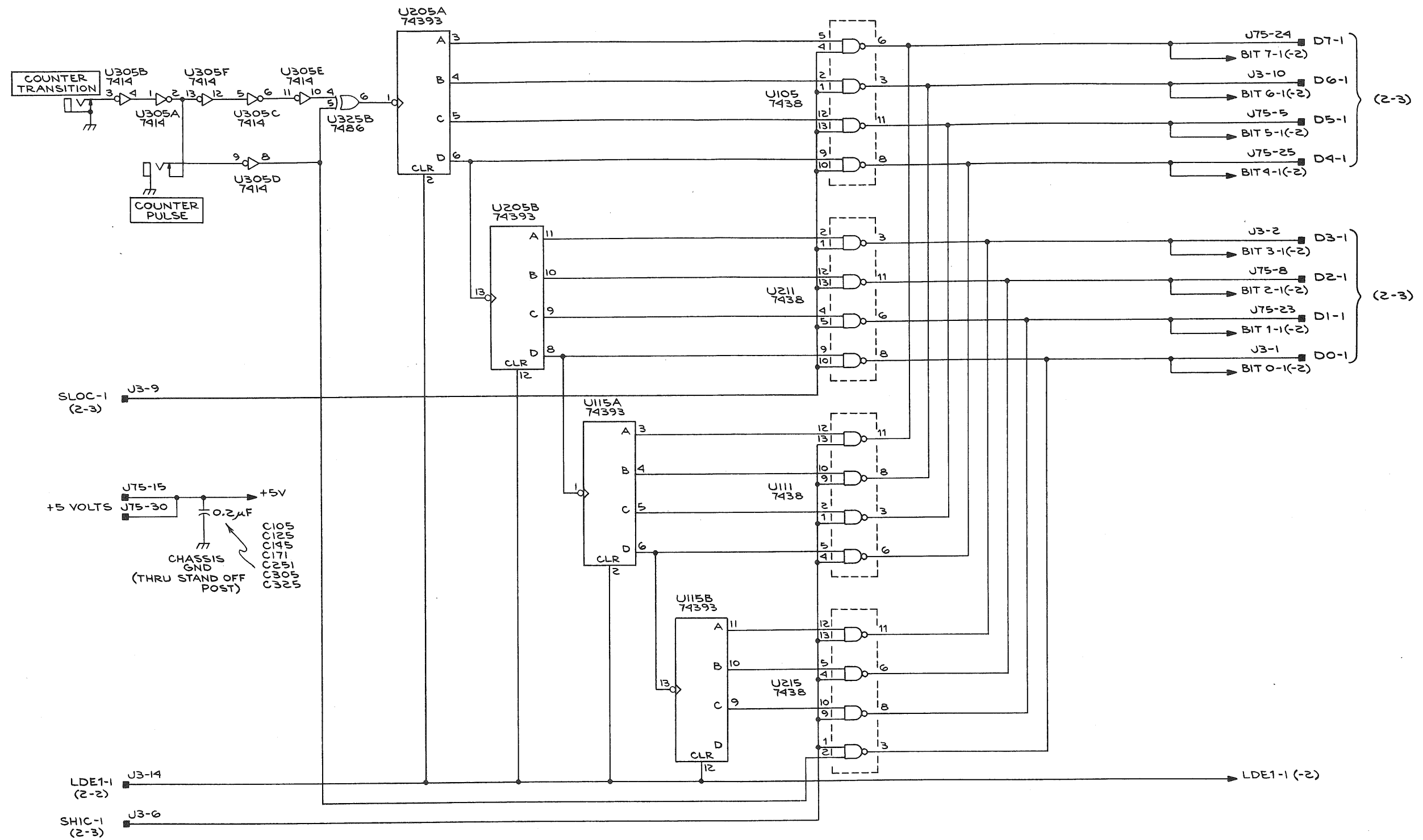
2297-8

Fig. 5-4. Connector Information.

HEX DISPLAY



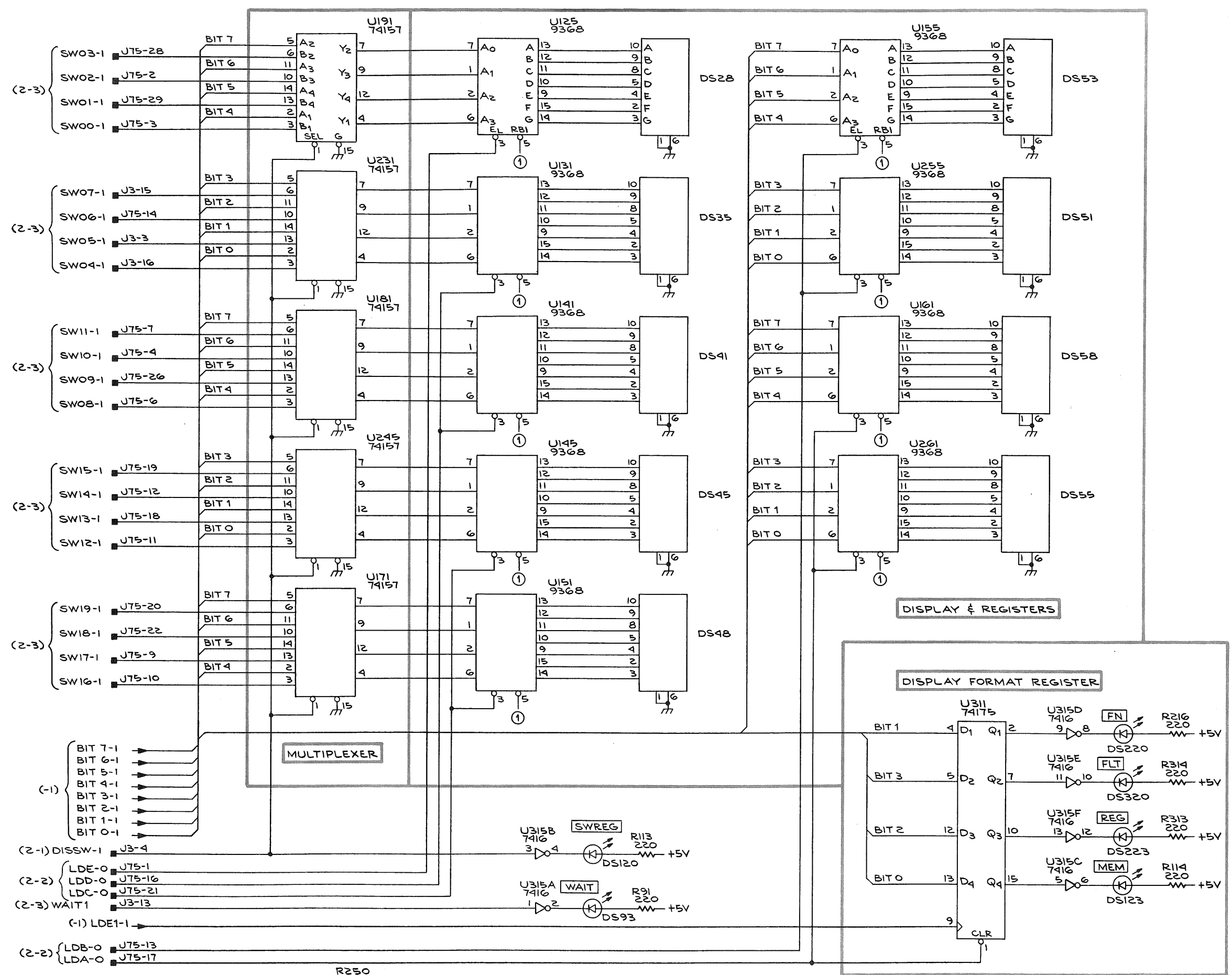
Hex Display Board Component Location.



067-0772-00

HEX DISPLAY
670-4291-00 COUNTER REGISTER 1-1

COUNTER REGISTER

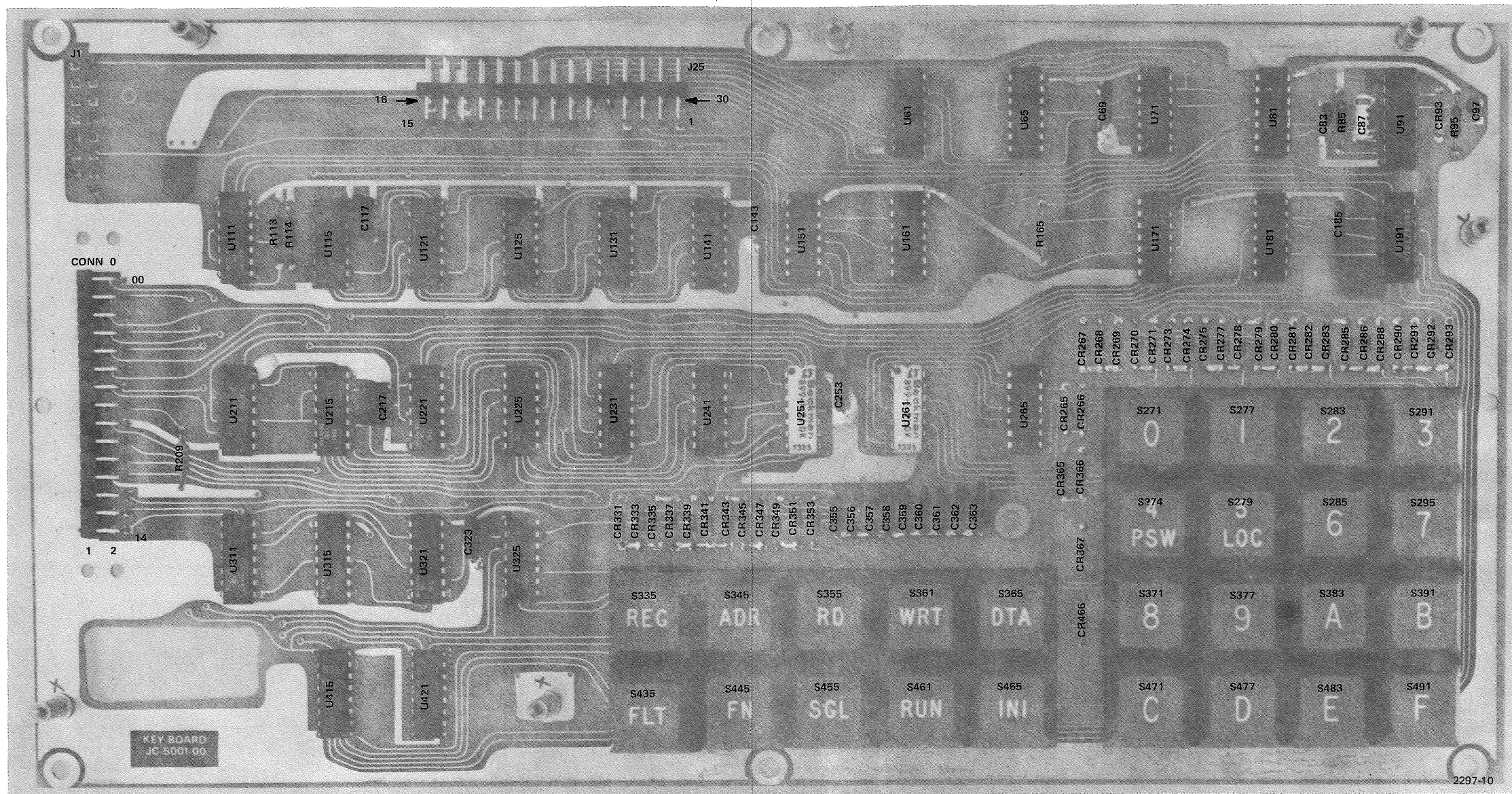


067-0772-00

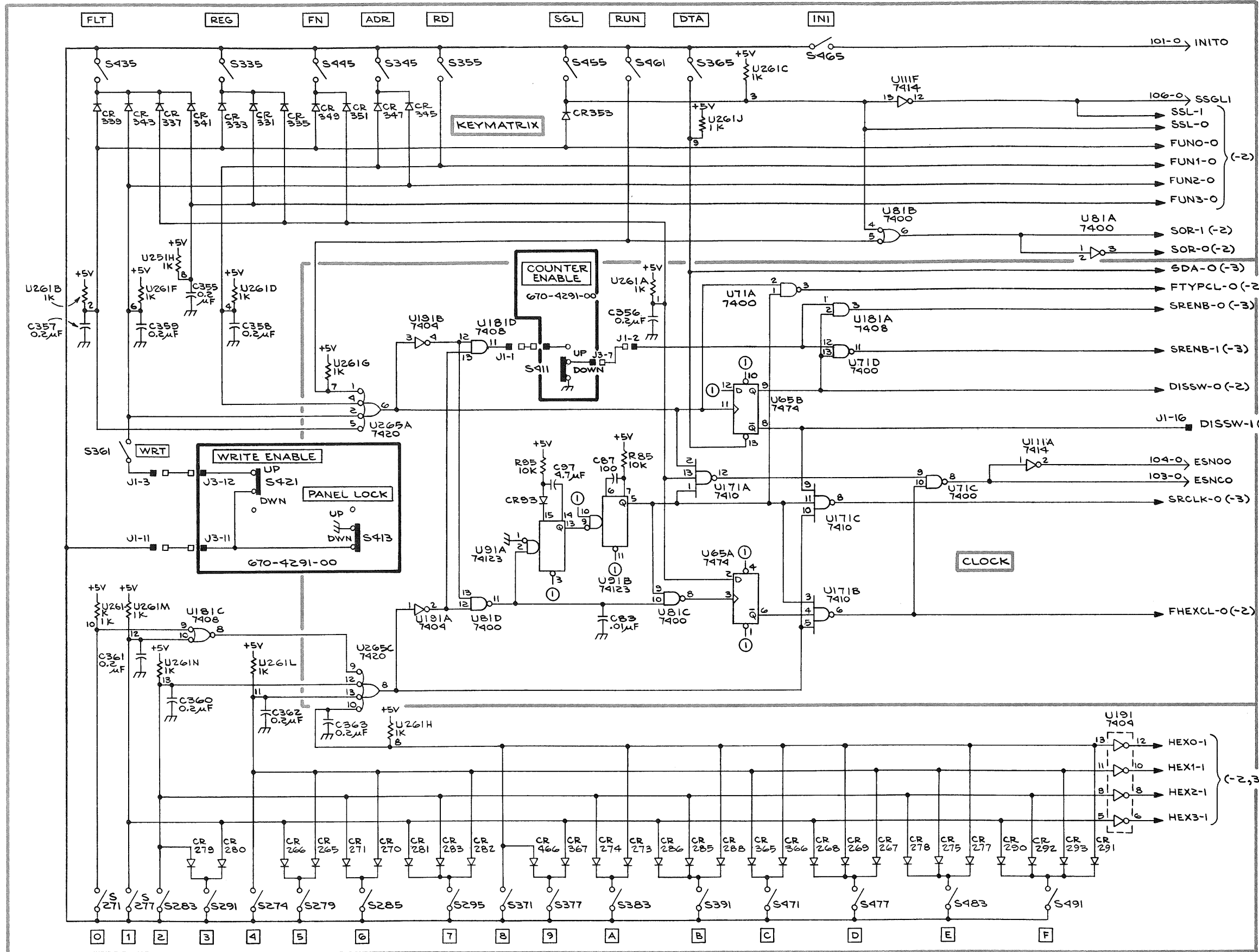
+5V — R250
1K — ①

HEX DISPLAY 1-2
DISPLAY REGISTERS

DISPLAY REGISTERS



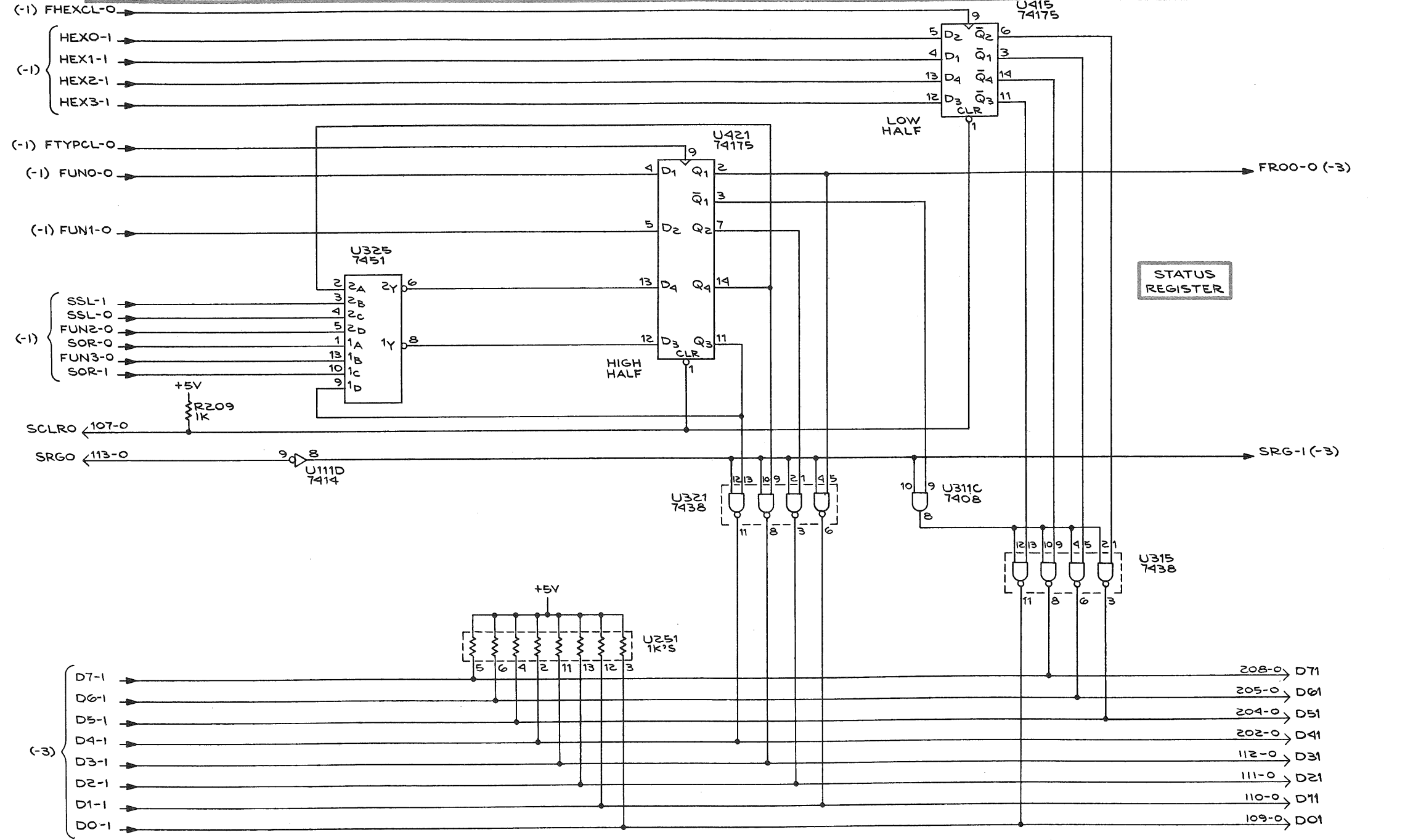
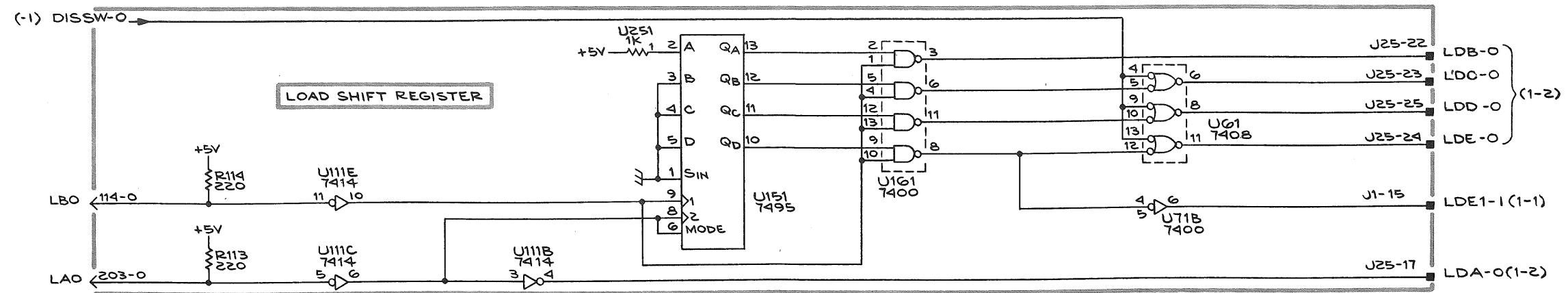
Hex Keyboard Component Locations.



067-0772-00

KEYBOARD
670-4465-00 KEYMATRIX & CLOCK 2-1

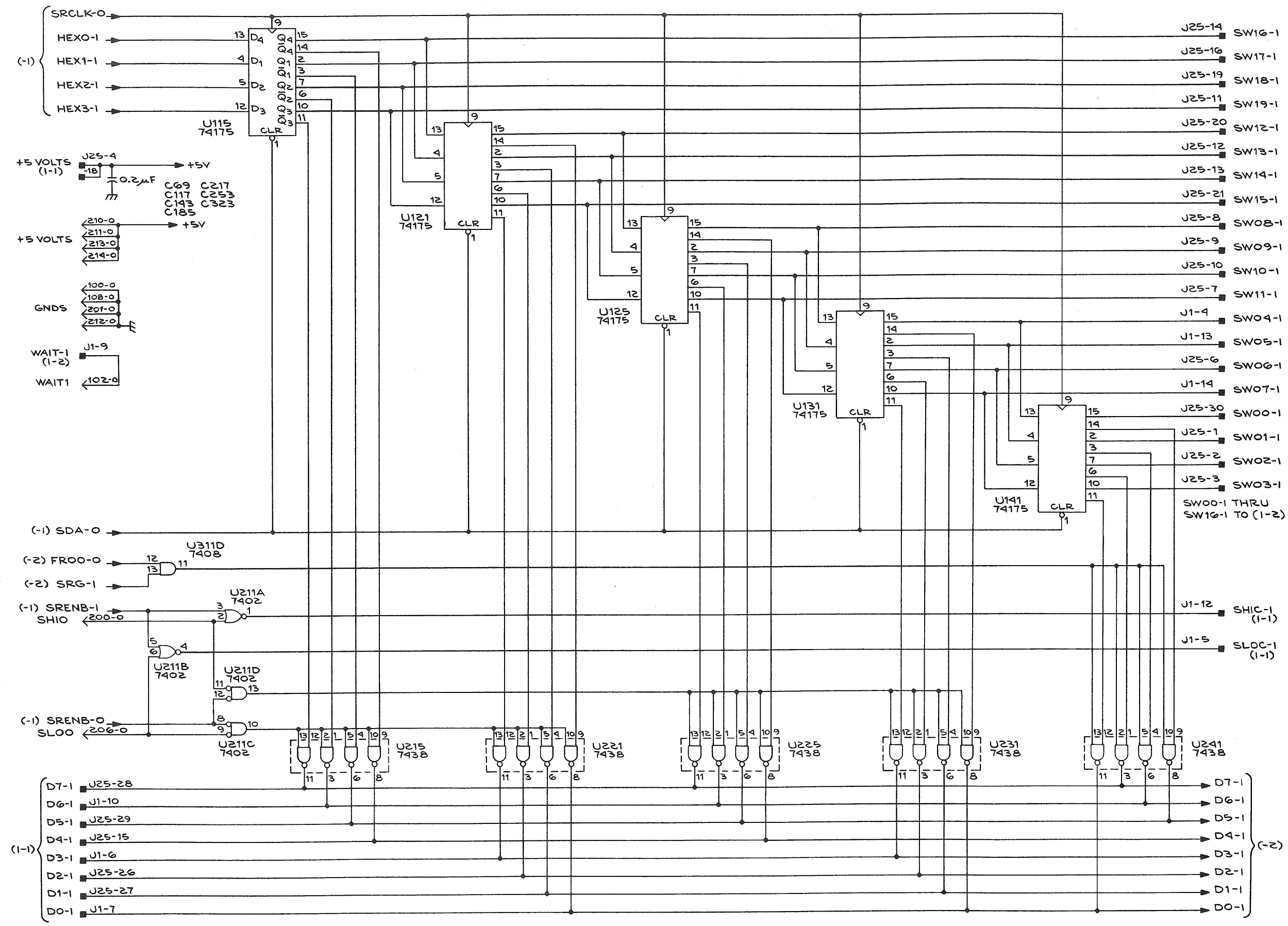




STATUS REGISTER

067-0772-00

670-4465-00 KEYBOARD STATUS REGISTER 2-2



067-0772-00

KEYBOARD SWITCH REGISTER

2-3

SWITCH REGISTER