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Systems

PHILIPS

Field Support Manual
Keyboard P5020

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KEYBOARD

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Chapter 1: GENERAL DESCRIPTION

1.1. INTRODUCTION

The keyboard, shown in Figure 1-1, is a free-standing unit which is the main operator input device to the M3003 Word Processor System. Keyboard configurations are listed below.

CONFIGURATION	12NC NUMBER
English	5107 260 02901
French	5107 260 02911
Bilingual	5107 260 02921

A keyboard consists of a standard typewriter-like keyboard, plus there are several special function keys. The function of each key is explained in detail in the Operator's Reference Manual.

The main circuits of a keyboard are a microcomputer and a keyboard matrix. The matrix is continuously monitored by the microcomputer, which has serial links to and from the console. The data rate on the serial links is 9600 baud. A clock signal from the console is used to synchronize keyboard operations.

A keyboard can be connected directly to the console, or can be daisy chained with optional numeric keypads, as described in Paragraph 1.7. Numeric keypads are described in a separate manual.

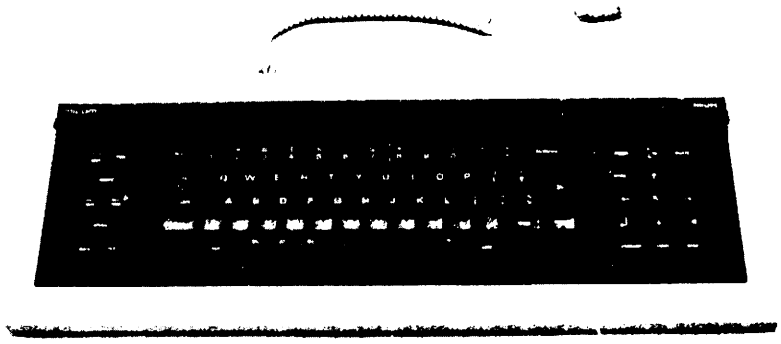


Figure 1-1 KEYBOARD

1.2. PHYSICAL DESCRIPTION

A keyboard measures 20.5 inches by 8.1 inches by 1.8 inches (52 mm x 21 mm x 5 mm) and weighs 5.5 pounds (2.5 kg). A keyboard consists of a keyboard PCB, keycaps, a housing, and a telephone-type cord. The keyboard PCB has three DIP switches which are used to select certain keys to have an auto-repeat function, as shown in Table 1.3. The only difference between the keyboards listed in Paragraph 1.1 is the keycaps.

1.3. TECHNICAL DATA

1.3.1. DIMENSIONS

Length: 20.5" (52 mm)
Width: 8.1" (21 mm)
Height: 1.8" (5 mm)

1.3.2. WEIGHT

5.5 pounds (2.5 kg)

1.3.3. ELECTRICAL REQUIREMENTS

Voltage: +5.0 Vdc ±0.25 Vdc
Current: 150 mA maximum

1.3.4. SERIAL LINKS

Bits per Character:	8
Stop Bits:	2
Parity:	None
Baud Rate (set by 16xCLK):	300-9600 Baud (See Table 1.1)

Table 1.1 CLOCK FREQUENCIES AND BAUD RATES

CLOCK FREQUENCY	BAUD RATE
4.8 kHz	300
9.6	600
19.2	1200
28.8	1800
32.0	2000
38.4	2400
57.6	3600
76.8	4800
115.2	7200
153.6	9600

1.3.5. ENVIRONMENTAL

Temperature

Operating:	0 to +40°C
Non-operating:	-40°C to +70°C

Humidity

Operating:	10 to 85% R.H.
Non-operating:	10 to 90% R.H.

1.4. INTERFACES

A keyboard interfaces with a console via a connector-equipped telephone-type cord. Connector pin assignments are listed in Table 1.2.

Table 1.2 CONNECTOR PIN ASSIGNMENTS

PIN NUMBER	SIGNAL
A3	+5 Vdc
B2	Ground
A2	TXDATA
B1	RXDATA
A1	16xCLK

1.5. AUTO-REPEAT FUNCTION

The keyboard PCB has three DIP switches that permit certain keys to be selected for the auto-repeat function. Auto-repeat keys, when held depressed for a

minimum of 0.25 second, will cause the key to repeat at a 20 Hz rate. Keys 47, 49, 52, 89, 107, 108, and 109 can be selected for auto-repeat, as shown in Table 1.3. For key positions, refer to the assembly drawing in Chapter 3.

Keys which are always auto-repeat (not selectable) are 54, 74, 76, 77, 93, 95, 101, 113, and 119. Key 111 is the repeat function key that can be used in conjunction with any coded key to perform a repeat function (20 Hz rate).

Table 1.3 AUTO-REPEAT SWITCHES

KEYS FOR AUTO-REPEAT	SWITCH SETTINGS		
	A	B	C
52, 108	Closed	Open	Open
47. 49, 107	Closed	Open	Closed
49, 108, 109	Open	Open	Closed
108, 109	Open	Closed	Open
89, 108	Open	Closed	Closed
All 7 Keys	Closed	Closed	Closed

1.6. APPLICATION NOTES

The keyboard is used with the M3003 Word Processor System, which is a self-contained desktop system consisting of a console, daisy wheel printer, keyboard, and optional numeric keypads.

1.7. INSTALLATION DATA

Set the switches for the optional auto-repeat keys, as detailed in Paragraph 1.5. To gain access to the auto-repeat switches the keyboard top cover must be removed. The top cover is secured with six Philips screws, accessible from the bottom of the keyboard.

The keyboard is equipped with a connector-equipped telephone-type cord for connection to the console. When the keyboard is used without the optional numeric keypads, the keyboard connects directly to a connector at the front bottom of the console. When the keyboard is used with the optional numeric keypads, the keyboard and keypads are connected in a daisy chain. The keyboard is at the end of the daisy chain and a numeric keypad connects to the console. There are two versions of the PCB used in the keyboard (see Figure 3-2). The version ' PCB has been superceded by the version 2 PCB.

Chapter 2: DETAILED DESCRIPTION

2.1. INTRODUCTION

This chapter is divided into two subsections, a block diagram description and a schematic diagram description.

In the following descriptions the active state of a signal is indicated as follows:

- Active high, no suffix (e.g., INT);
- Active low, L suffix (e.g., INT,L).

2.2. BLOCK DIAGRAM DESCRIPTION (Figure 2-2)

The main components of the keyboard are an MK3873 microcomputer chip, a keyboard matrix, and a CPU clock. The CPU clock provides the basic timing for the microcomputer. The keyboard matrix, consisting of the keys, is a standard 8x11 matrix arrangement, as shown in Figure 2-1. The microcomputer, by applying strobes in sequence to the input lines of the matrix and monitoring the output lines, can identify any key that is pressed. The scanning rate is approximately 6 msec. Thus, any key that is depressed momentarily or that is held depressed can be identified by the microcomputer. Note that only certain keys perform an auto-repeat function. The resistor network is used to pull down the normally open (keys off) microcomputer inputs.

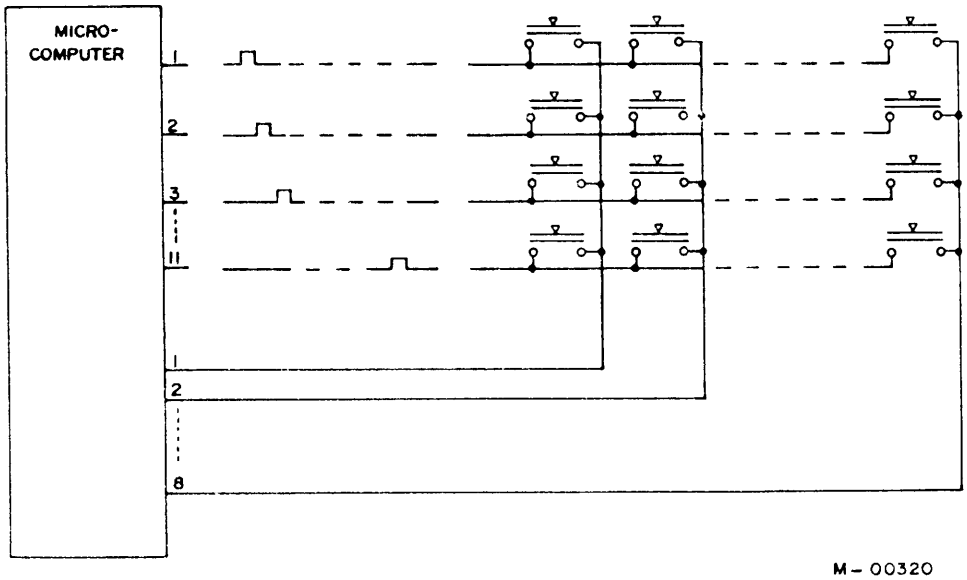


Figure 2-1 KEYBOARD SCANNING

The microcomputer contains a central processor, oscillator and clock circuits, '024 bytes of ROM for program storage, and 64 bytes of scratchpad RAM. The serial port consists of three lines; serial in, serial out, and clock (153.6 kHz or the 9600 baud transmission rate). These three lines connect to the console.

The main functions performed by the microcomputer are:

- Scan the keyboard and convert the data into a serial format;
- Transmit the serial data to the console. A serial data frame consists of eight data bits and two stop bits, with no parity;
- Decode control characters and generate the appropriate data and/or control signals, such as the Shift Lock internal signal which illuminates the LED on the LOCK key when the key is pressed.

he keyboard also has three DIP switches that permit certain keys to be selected for the auto-repeat function. Refer to Paragraph 1.5.

2.3. SCHEMATIC DIAGRAM DESCRIPTION

Refer to the schematic diagram provided in Chapter 3.

2.3.1. POWER

Power for the keyboard is provided by the console. The power, at connector pin A3, is +5.0V ±0.25V.

?.3.2. OSCILLATOR

A 2.5 MHz oscillator is formed by inverters U2-2 and U2-4, resistors R10 and R11, and capacitors C4 and C5. The oscillator starts automatically when power is first applied and produces a 2.5 MHz clock signal which is buffered by U2-6 and applied to the XTAL2 input of the microcomputer. This 2.5 MHz signal is used as a time base to control some internal operations of the microcomputer.

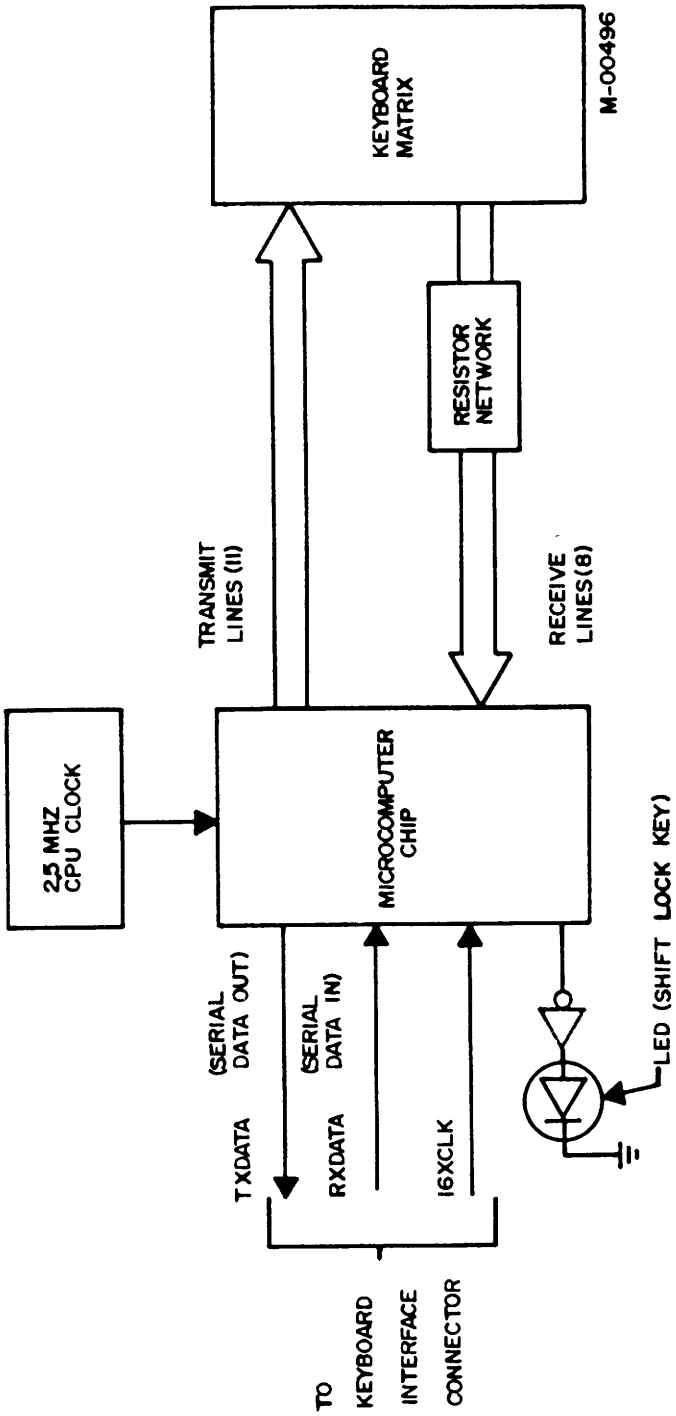


Figure 2-2 KEYBOARD BLOCK DIAGRAM

2.3.3. MICROCOMPUTER (Figure 2-3)

Microcomputer U1 is a complete 8-bit microcomputer. Inputs and outputs are shown in Table 2.1. The following is a brief description of the operation of the microcomputer. For a detailed description refer the MOSTEK Data Book.

The microcomputer contains 1024 bytes of ROM, 64 bytes of executable RAM, 64 bytes of scratchpad RAM, a programmable timer, a baud rate generator, 4 8-bit input/output ports, and serial input and output ports. Two clock inputs are used, a 2.5 MHz clock and the 16xCLK input. The 2.5 MHz clock is used as a time base to control internal operations and the 16xCLK input is used to synchronize data on the serial links (see Table 1.1).

The ROM contains the program and the executable RAM is used for program execution. The memory address registers (program counter, stack pointer, data counter, auxiliary data counter) are used for addressing. When a memory access is required, the appropriate address register is gated onto the memory address bus and the memory output is gated onto the main data bus.

The instruction register (IR) receives the OP-code of the instruction to be executed via the main data bus. The main control logic decodes the instruction and provides the necessary gating signals to the rest of the circuitry. The indirect scratchpad RAM is used to address the 64 bytes of scratchpad RAM, which is used for temporary storage.

When the ALU receives commands from the main control logic it performs the required mathematical or logical operation on the data received on the two input buses and provides the result on the result bus. The status of the result (carry, overflow, etc.), is applied to the status registers. The status registers also hold other status flags, such as interrupt control, I/O ports control, etc. The accumulator is the main register for data manipulation, with the result of ALU operations stored there.

The timer is an 8-bit down counter which is a software programmable counter which can be used as an internal timer, pulse width timer or event counter.

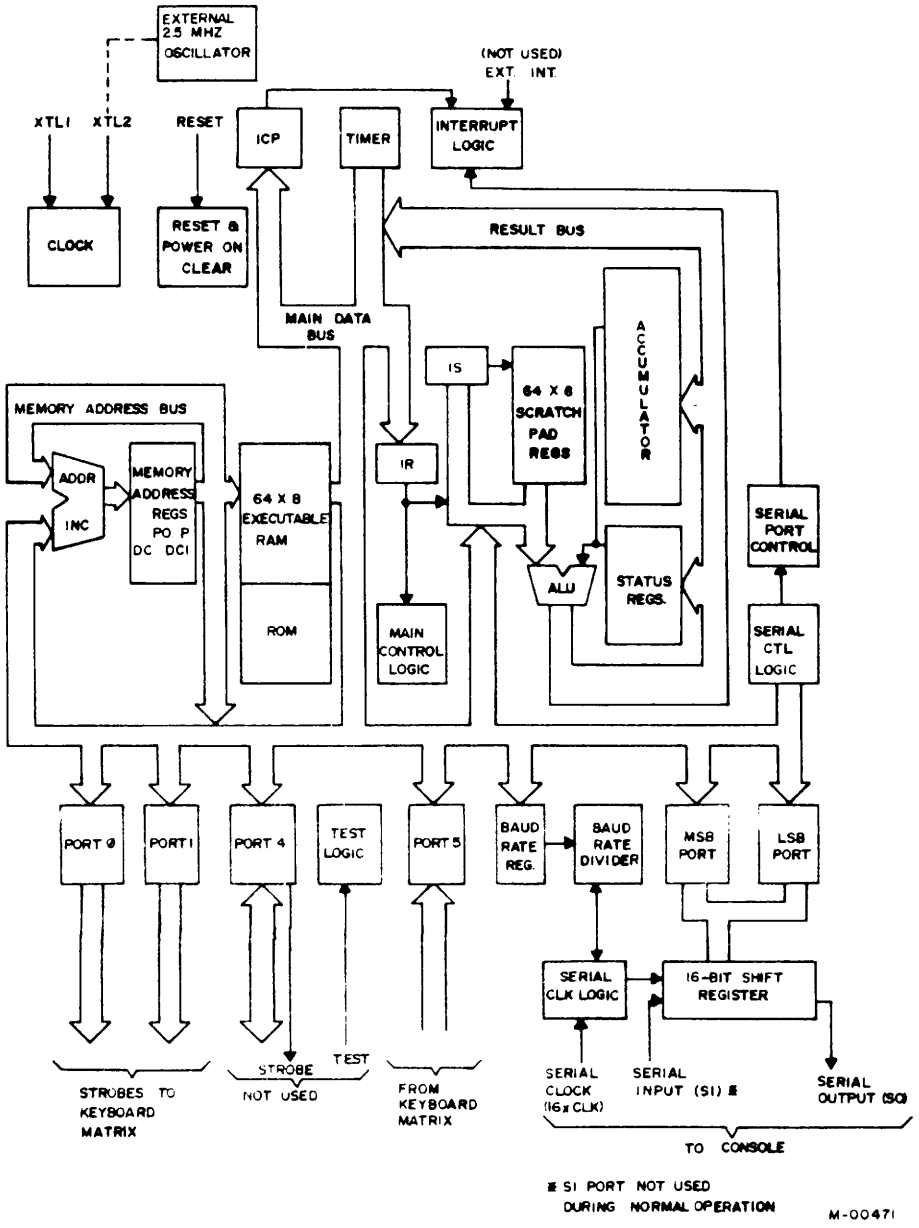


Figure 2-3 MICROCOMPUTER BLOCK DIAGRAM

There are 4 8-bit bidirectional ports. Ports 0 and 1 are used as output ports to provide the 11 strobe pulses to the keyboard matrix. Port 5 is used as an input port, and is used to scan the 8 return lines from the keyboard matrix. Thus, by monitoring the return lines for the presence of a strobe, indicating a key has been depressed, the microcomputer can identify keys as they are depressed. The scanning rate is approximately 6 msec. See Figure 2-1.

There are two serial ports, IN and OUT, which are the serial data links from and to the console. Associated with the serial ports is the serial clock input from the console (16xCLK). The 16xCLK input is used to synchronize data transfer and set the baud rate (see Table 1.1).

The serial port control logic controls the two ports to the 16-bit shift register. Each of the two ports is eight bits wide and has holding registers for data to/from the shift register (each port has a receive and transmit holding register). Data transfers between the holding registers and the shift register are performed at end-of-word time, under software control. Data transfer on the serial links consists of blocks of data with eight bits per character, two stop bits, with no parity (Figure 2-4). The transfer rate is set by 16xCLK (Table 1.1).

Data on the receive link from the console is conditioned by receiver U2-8 before being applied to the microcomputer, and data from the microcomputer is conditioned by transmitter U2-10 before being applied to the transmit link to the console.

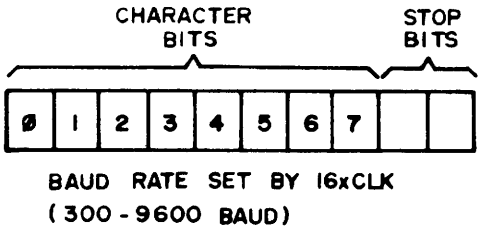
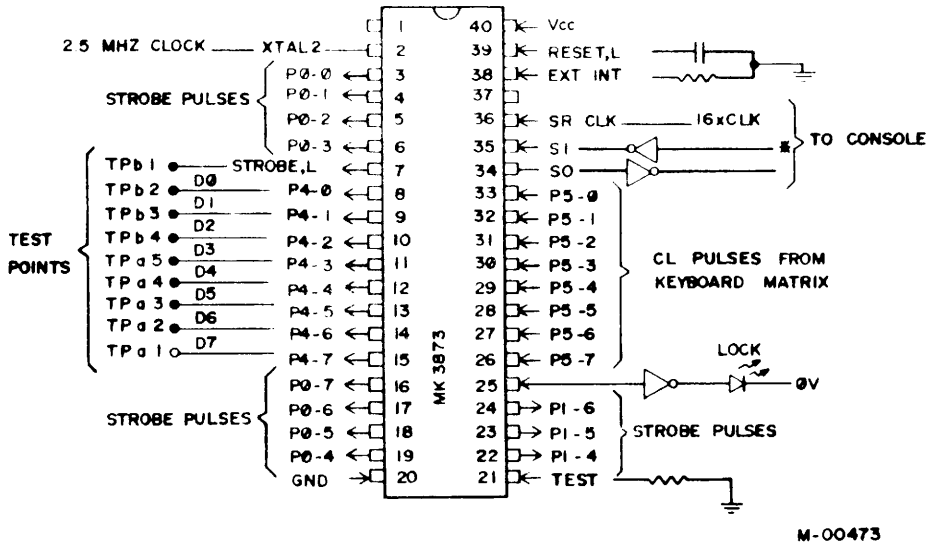


Figure 2-4 SERIAL DATA LINKS FORMAT

Table 2.1 MICROCOMPUTER CONNECTIONS



1. * SI PORT NOT USED DURING NORMAL OPERATION.

2. TEST POINTS ARE ON VERSION 1 OF KEYBOARD ONLY.

SIGNAL	DESCRIPTION
XTAL 2 (Crystal 2)	Input. A 2.5 MHz time base signal used to control some internal operations.
P0-0 to P0-7 (Port 0) P1-4 to P1-6 (Port 1)	Output, active high. 1' strobe pulses to the keyboard matrix.
STROBE	Output, active low. A single pulse which is present after valid data is present on the P4-0 to P4-7 pins during an output instruction.
P4-0 to P4-7 (Port 4)	Output, active high. 8 data bits from internal data bus. Active during an output instruction.
GND (Ground)	Ground connection to chip.
Vcc	+5V connection to chip.
RESET,L	When pulled low the microcomputer will reset. When allowed to go high the microcomputer will begin program execution at 000H. Not used in this application.

Table 2.1 MICROCOMPUTER CONNECTIONS (Cont'd)

SIGNAL	DESCRIPTION
EXT INT (External Interrupt)	Input. Not used in this application. Used for factory testing only.
SRCLK (Serial Clock)	Input. Clock rate (16xCLK) which sets the baud rate. See Table 1.1.
SI (Serial In)	Serial data from console.
SO (Serial Out)	Serial data to console.
P5-0 to P5-7 (Port 5)	Input, active high. Clock pulses from keyboard matrix (when keys are operated).
P1-7,L (Port 1)	Output, active low. Illuminates the LED on the LOCK key (shift lock function).
TEST	Input. Not used in this application. Used for factory testing only.

2.3.4. KEYBOARD MATRIX

The keyboard matrix consists of 81 keys and 3 DIP switches divided into 11 groups, with each group consisting of a maximum of 8 keys. Connections to the keys are in the form of an 11x8 matrix. All keys in a particular group receive one row strobe (RS) pulse, identified on the schematic as RS0 to RS10. The other contact of each switch in a group is connected to a separate column (CL) line, and the 8 column lines are connected to input port 5 of the microcomputer. As each strobe is applied to a group of switches, the microcomputer scans the 8 CL lines to check for a pulse. For the complete keyboard to be scanned, the microcomputer puts out 11 row strobe pulses in sequence and makes 11 scans of the 8 column lines. Thus, the microcomputer can identify any key that is pressed. The character encoding for each key is shown in Table 2.3 and key numbering is shown in Figure 3-2.

Key 111 is the repeat function key. If pressed at the time any coded key is depressed, it causes the coded key to repeat at a 20 Hz rate.

Auto-repeat keys, when held depressed and held for a minimum of 0.25 second, will cause the key to repeat at a 20 Hz rate. Keys that always have the auto-repeat feature are 54, 74, 76, 77, 93, 95, 101, 113, and 119. There is a group of 3 DIP switches (A,B,C) which can be used to enable the auto-repeat function on selected keys. These keys are 47, 49, 52, 89, 107, 108, and 109. The switch settings to enable key combinations are shown in Table 2.2.

Table 2.2 AUTO-REPEAT SWITCHES

KEYS FOR AUTO-REPEAT	SWITCH SETTINGS		
	A	B	C
52, 108	Closed	Open	Open
47, 49, 107	Closed	Open	Closed
49, 108, 109	Open	Open	Closed
108, 109	Open	Closed	Open
89, 108	Open	Closed	Closed
All 7 Keys	Closed	Closed	Closed

Keys 98 and 110 are the shift function keys. When depressed, the entry of the coded keys will cause the selection of the code to change, as shown in Table 2.3.

Key 78 is the lock function key. This key is alternate action and, when depressed, causes the microcomputer to provide a low output on U1-25 to illuminate the LED on the lock key. When on, this key performs the same function as the shift key. The key can be unlocked by pressing the lock key a second time or by depressing either of the shift keys.

Keys 117 and 121, when depressed while a coded key is pressed, will cause data bit 7 of the output word to be "0" (ground potential).

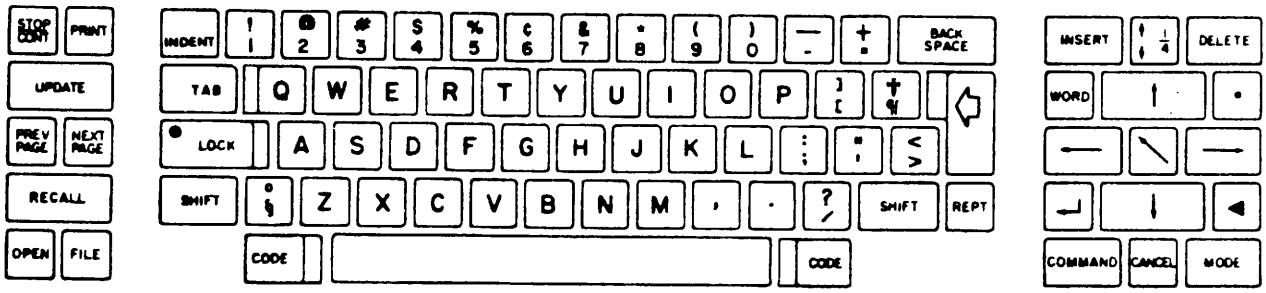
Keys 58, 76 and 96 generate outputs with data bit 7 of the output word being a "0" (ground potential). For all other keys data bit 7 will be a "1" (high).

Table 2.3 CHARACTER ENCODING

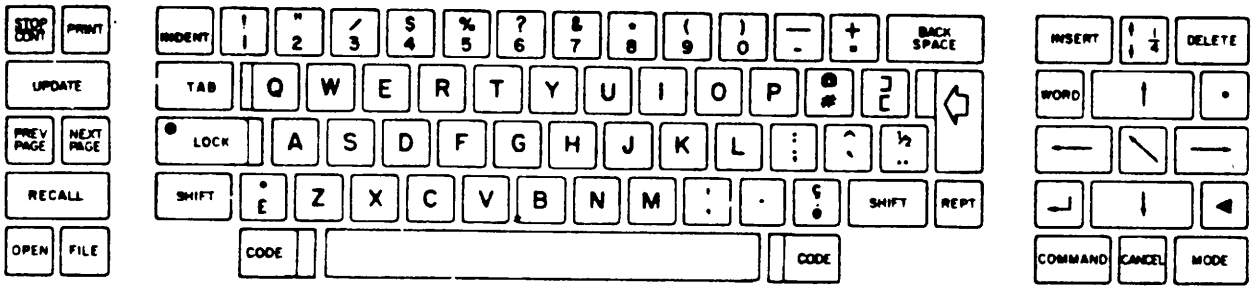
KEY NO.	HEX CODE		KEY NO.	HEX CODE		KEY NO.	HEX CODE	
	SHIFT	UN-SHIFT		SHIFT	UN-SHIFT		SHIFT	UN-SHIFT
39	8B	8B	67	D5	F5	96	01	01
40	85	85	68	C9	E9	97	81	81
41	95	96	69	CF	EF	99	DC	98
42	A1	B1	70	DO	FO	100	DA	FA
43	CO	B2	71	DD	DB	101	D8	F8
44	A3	B3	72	8E	8F	102	C3	E3
45	A4	B4	73	90	90	103	D6	F6
46	A5	B5	74	9C	9C	104	C2	E2
47	DE	B6	75	91	91	105	CE	EE
48	A6	B7	76	04	04	106	CD	ED
49	AA	B8	77	84	84	107	87	AC
50	A8	B9	79	E0	E0	108	8A	AE
51	A9	BO	80	C1	E1	109	BF	AF
52	DF	AD	81	D3	F3	112	92	92
53	AB	BD	82	C4	E4	113	9D	9D
54	88	88	83	C6	E6	114	93	93
55	8C	8C	84	C7	E7	115	82	82
56	94	94	85	C8	E8	116	80	80
57	86	86	86	CA	EA	119	A0	A0
58	03	03	87	CB	EB	122	97	97
59	83	83	88	CC	EC	123	99	99
60	89	89	89	BA	BB	124	9A	9A
61	D1	F1	90	A2	A7			

Refer to Figure 3-2 for Key Positions.

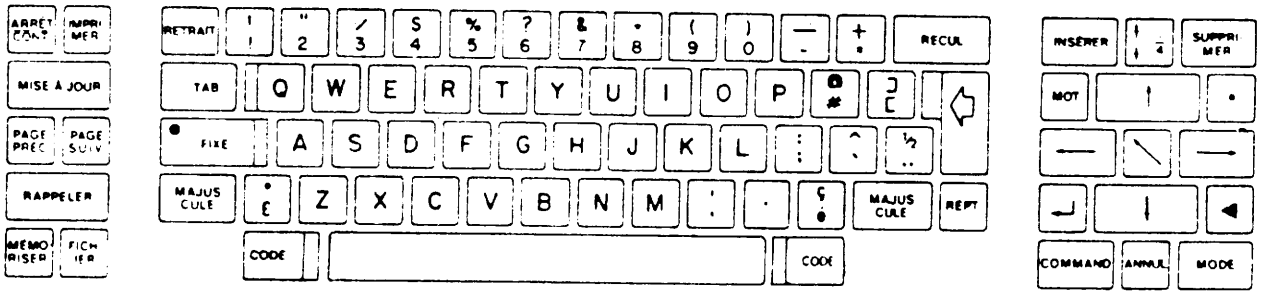
Chapter 3: DRAWINGS



a. English Keytops



b. Bilingual Keytops



c. French Keytops

Figure 3-1 KEYTOP LAYOUTS

REFER TO TABLE 2.3 FOR KEY ENCODING.

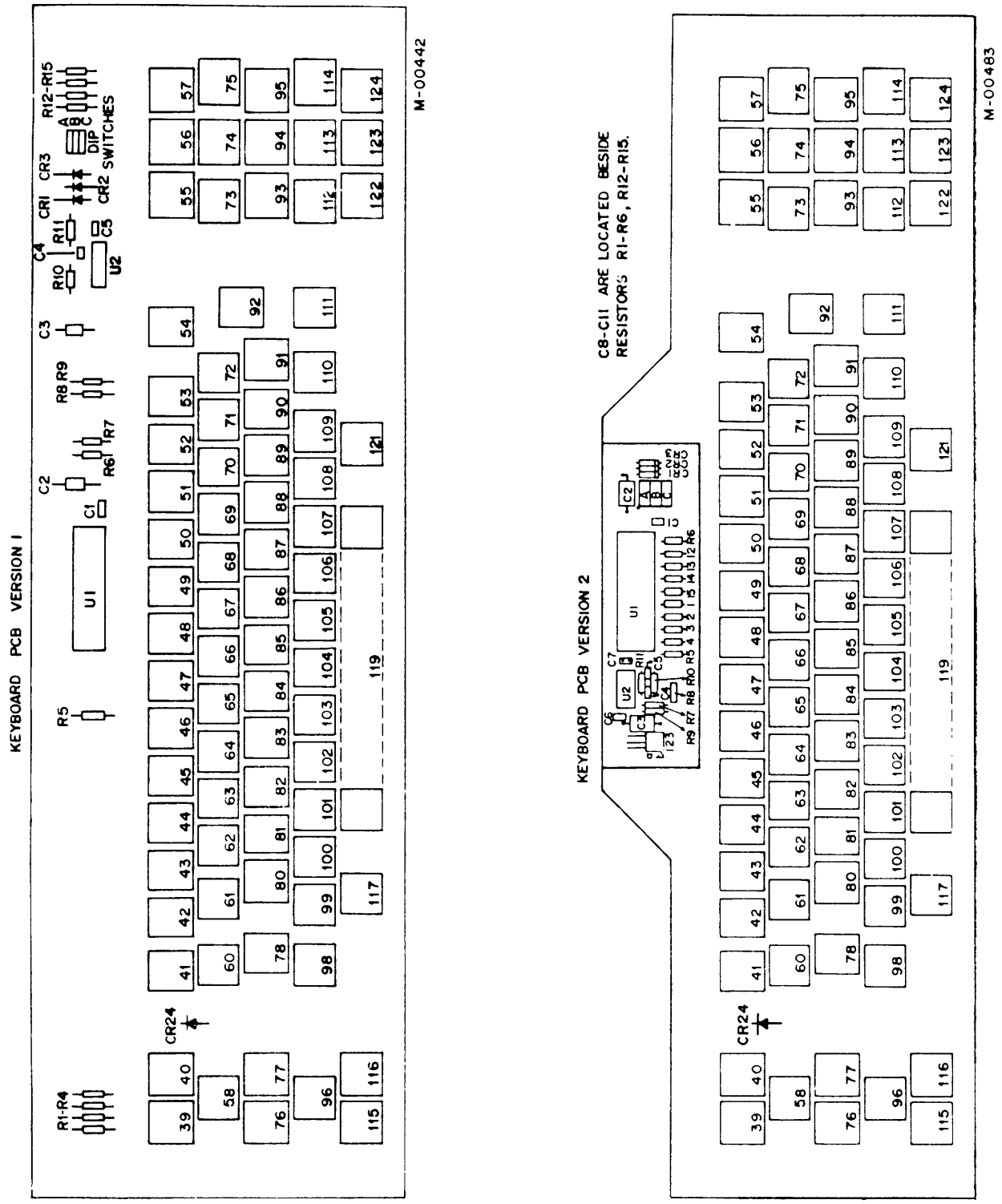
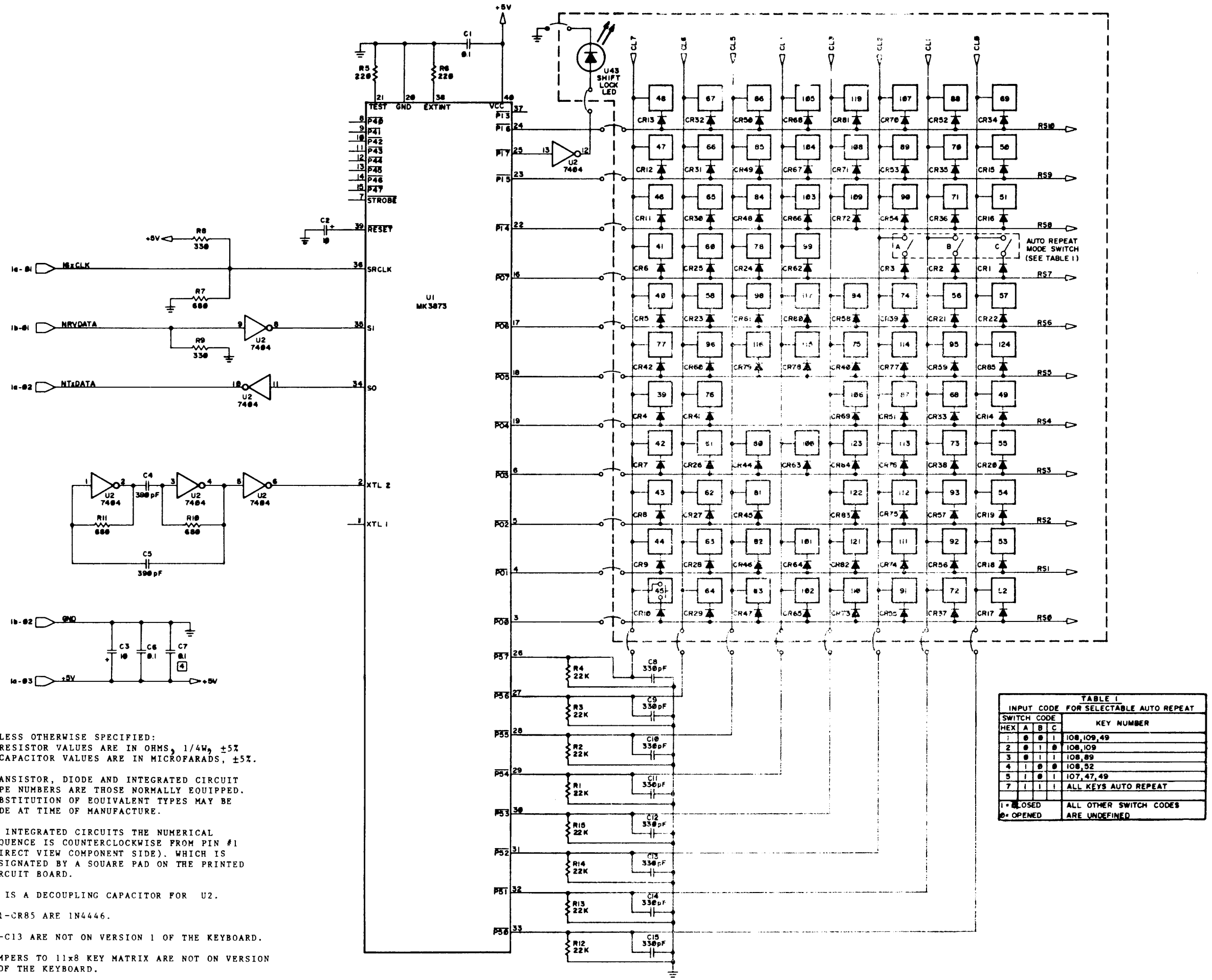


Figure 3-2 PCB LAYOUT



NOTES

1. UNLESS OTHERWISE SPECIFIED:
   RESISTOR VALUES ARE IN OHMS, 1/4W, ±5%
   CAPACITOR VALUES ARE IN MICROFARADS, ±5%.
2. TRANSISTOR, DIODE AND INTEGRATED CIRCUIT TYPE NUMBERS ARE THOSE NORMALLY EQUIPPED. SUBSTITUTION OF EQUIVALENT TYPES MAY BE MADE AT TIME OF MANUFACTURE.
3. ON INTEGRATED CIRCUITS THE NUMERICAL SEQUENCE IS COUNTERCLOCKWISE FROM PIN #1 (DIRECT VIEW COMPONENT SIDE). WHICH IS DESIGNATED BY A SQUARE PAD ON THE PRINTED CIRCUIT BOARD.
4. C7 IS A DECOUPLING CAPACITOR FOR U2.
5. CR1-CR85 ARE 1N4446.
6. C8-C13 ARE NOT ON VERSION 1 OF THE KEYBOARD.
7. JUMPERS TO 11x8 KEY MATRIX ARE NOT ON VERSION 1 OF THE KEYBOARD.

DRAWING N° 5107 299 90351

TABLE I
INPUT CODE FOR SELECTABLE AUTO REPEAT

SWITCH CODE				KEY NUMBER
HEX	A	B	C	
1	0	0	1	108,109,49
2	0	1	0	108,109
3	0	1	1	108,89
4	1	0	0	108,52
5	1	0	1	107,47,49
7	1	1	1	ALL KEYS AUTO REPEAT
1 = CLOSED 0 = OPENED				ALL OTHER SWITCH CODES ARE UNDEFINED

Figure 3-3 KEYBOARD SCHEMATIC

Chapter 4: PARTS LISTS

4.1. GENERAL

This chapter provides parts lists for replaceable parts of a keyboard.

Table 4.1 KEYBOARD (Figure 4-1)

ITEM	12NC PART NUMBER	DESCRIPTION
	See Table 1.1	Keyboard (complete)
1	5107 299 90021	Keyboard Base Assembly
2	5107 200 12281	Keyboard Overlay
3	2522 004 02022	Screw, M3 x 4
4	2522 004 02031	Screw, M3 x 20
5	5107 200 12721	Keyboard Top
6	2522 004 02024	Screw, M3 x 6
7	5107 200 12441	Keyboard Logo Strip
8	5112 291 68171	Keyboard PCB (English)
	5112 291 68181	Keyboard PCB (Bilingual)
	5112 291 68261	Keyboard PCB (French)

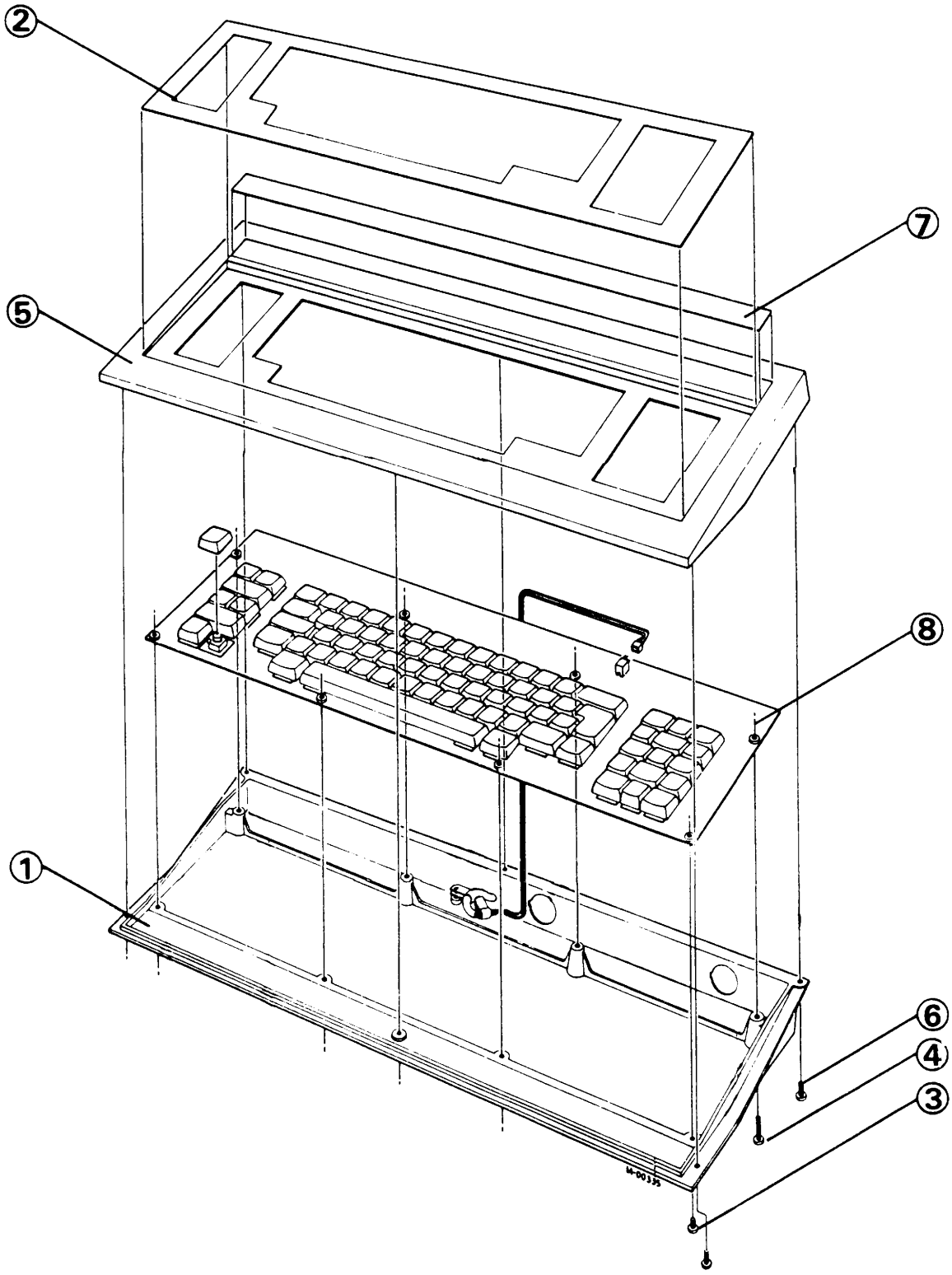


Figure 4-1 KEYBOARD

Table 4.2 KEYBOARD BASE ASSEMBLY (Figure 4-2)

ITEM	12NC PART NUMBER	DESCRIPTION
	5107 299 90021	Keyboard Base Assembly (complete)
1	5107 200 12531	Keyboard Base
2	5107 299 90253	Cable Assembly
3	5107 200 12071	Foot Pad
4	5107 259 91961	Connector, 8-Position
5	2422 015 09329	Hole Plug, HEYCO DP-750 #2683
6	2422 034 10803	Polarizing Key, BERG #65307-001
7	5107 025 01641	Clamp, TINNERMAN #63052A-4
8	2522 004 02024	Screw, M3 x 6
9	2522 613 03005	Lockwasher, M3
10	2422 015 09512	Hole Plug, HEYCO DP-625 #2663

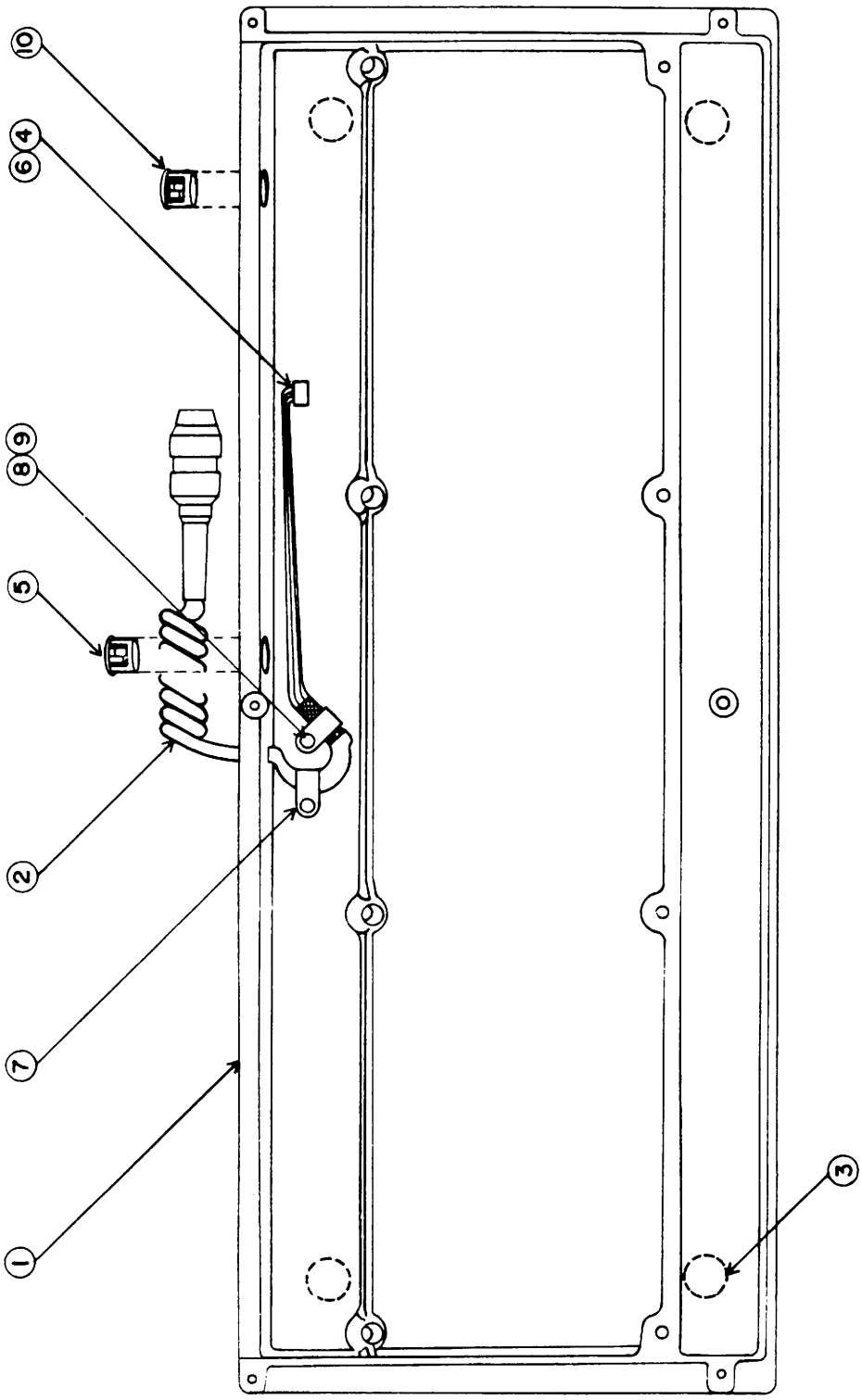


Figure 4-2 KEYBOARD BASE ASSEMBLY

Table 4.3 KEYBOARD PCB (Figure 4-3)

ITEM	12NC PART NUMBER	DESCRIPTION
	See Table 4.1	Keyboard PCB (complete)
C1	2022 552 00524	Capacitor, 0.1 uF, 25V
C2	2222 015 28109	Capacitor, 10 uF, 63V
C3	2222 015 28109	Capacitor, 10 uf, 63V
C4	2222 630 05391	Capacitor, 390 pF
C5	2222 630 05391	Capacitor, 390 pF
C6	T.B.S.	Capacitor, 0.1 uF, 10V
C7	T.B.S.	Capacitor, 0.1 uF, 10V
C8-15	T.B.S.	Capacitor, 330 pF
CR1-85	9331 126 60112	Diode, IN4446
R1	2322 151 52213	Resistor, 22K, 1/4W, ±5%
R2	2332 151 52213	Resistor, 22K, 1/4W, ±5%
R3	2322 151 52213	Resistor, 22K, 1/4W, ±5%
R4	2322 151 52213	Resistor, 22K, 1/4W, ±5%
R5	2322 151 52211	Resistor, 220 Ohm, 1/4W, ±5%
R6	2322 151 52211	Resistor, 220 Ohm, 1/4W, ±5%
R7	2322 151 56811	Resistor, 680 Ohm, 1/4W, ±5%
R8	2322 151 53321	Resistor, 330 Ohm, 1/4W, ±5%
R9	2322 151 53321	Resistor, 330 Ohm, 1/4W, ±5%
R10	2322 151 56811	Resistor, 680 Ohm, 1/4W, ±5%
R11	2322 151 56811	Resistor, 680 Ohm, 1/4W, ±5%
R12	2322 151 52213	Resistor, 22K, 1/4W, ±5%
R13	2322 151 52213	Resistor, 22K, 1/4W, ±5%
R14	2322 151 52213	Resistor, 22K, 1/4W, ±5%
R15	2322 151 52213	Resistor, 22K, 1/4W, ±5%
U1	5112 209 18251	IC, MK3873 Microcomputer
U2	9331 398 50772	IC, SN7402N Hex Inverters
U43	9334 855 50682	Shift Lock LED
	5112 291 43293	Keyswitch, Normal Spring
	5112 291 42913	Keyswitch, Special Spring
	5112 211 62801	LED Socket
	5112 209 04731	5-position Header
	2422 126 00067	Auto-Repeat Switches A,B,C
	5112 211 51183	Snap-in Bearing (large keys)
	5112 211 50581	Transverse Guides
	5112 211 77201	Transverse Guide (Space Bar)
	0312 019 08001	Jumper Wires

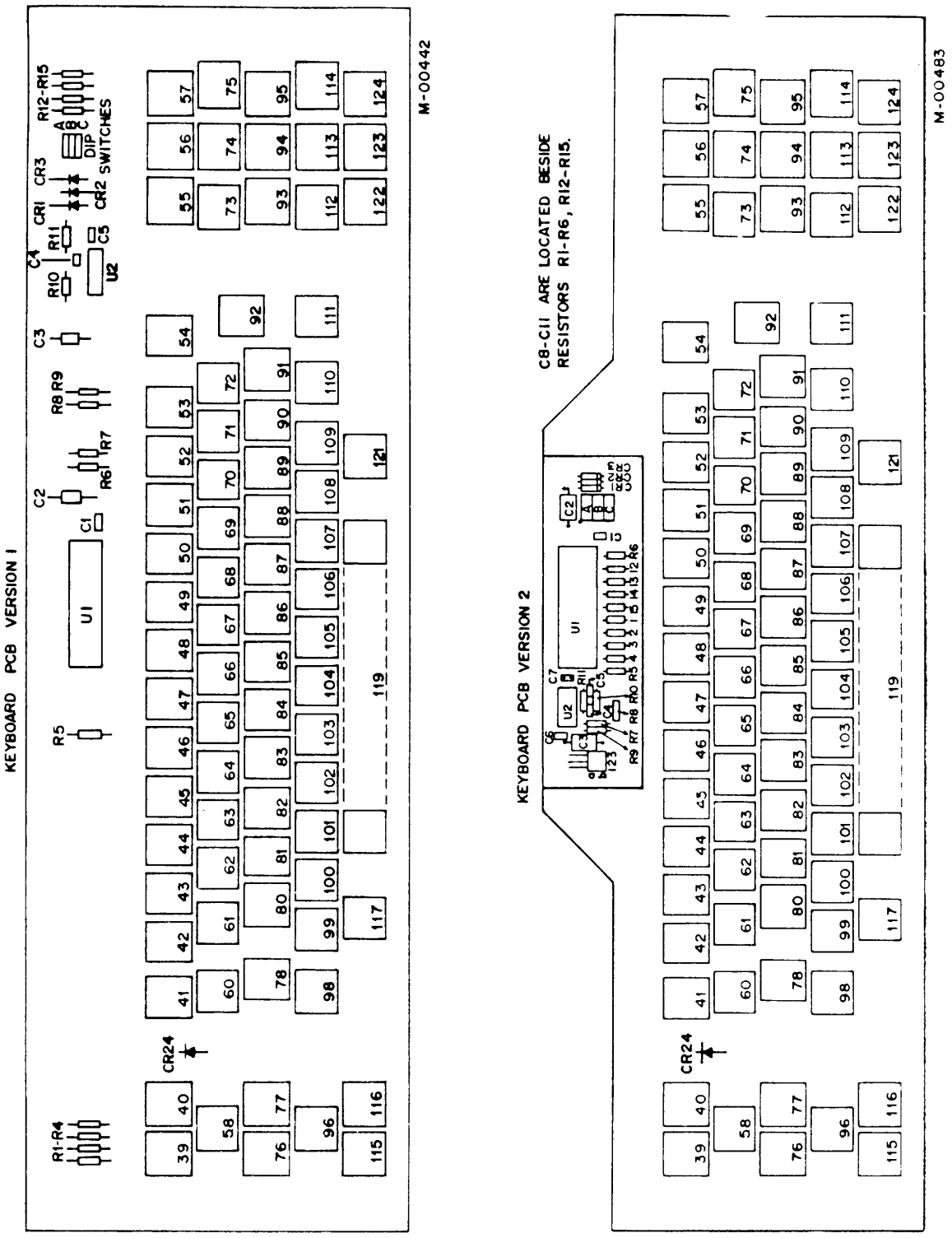
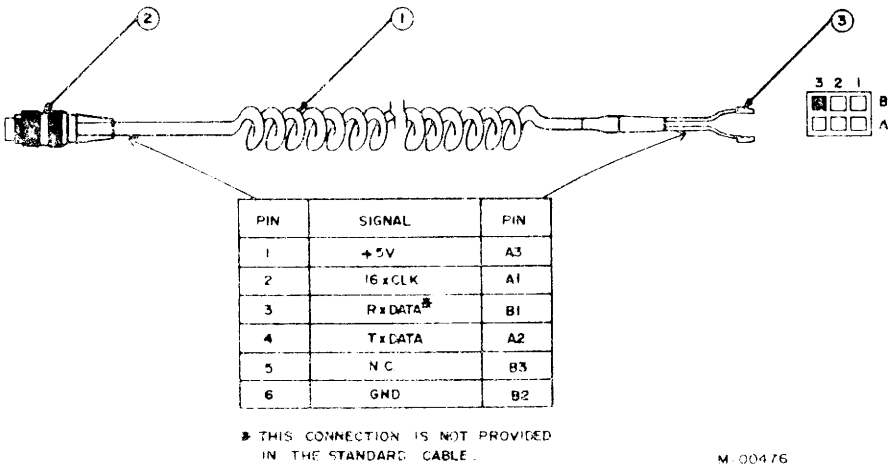


Figure 4-3 KEYBOARD PCB

Table 4.4 CABLE ASSEMBLY (Figure 4-4)

ITEM	12NC PART NUMBER	DESCRIPTION
	5107 299 90253	Cable Assembly (complete)
1	5107 200 12462	Flex Coiled Cord
2	5107 259 95051	Connector, 6-Position, Male
3	5107 259 94931	Terminal



PIN	SIGNAL	PIN
1	+5V	A3
2	16xCLK	A1
3	RxDATA*	B1
4	TxDATA	A2
5	N C	B3
6	GND	B2

* THIS CONNECTION IS NOT PROVIDED IN THE STANDARD CABLE.

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Figure 4-4 CABLE ASSEMBLY

Chapter 5: TROUBLESHOOTING & REPAIR

5.1. GENERAL

This chapter provides troubleshooting and repair instructions for the keyboard. The troubleshooting procedures apply when a keyboard is connected to a console.

5.2. TOOLS AND MATERIAL REQUIRED

- Standard Tool Kit
- WP Diskette
- Functional Field Test Program Diskette
- Oscilloscope

5.3. TROUBLESHOOTING

These procedures apply when the troubleshooting will be performed with the keyboard attached to a console. All functions of the console must be operational.

Troubleshooting should be performed in the following sequence:

- Power check;
- Clock check;
- Troubleshooting of the defective circuitry.

Reference must be made to the assembly drawing and schematic diagram, which are located in Chapter 3.

5.3.1. POWER CHECK

The keyboard receives +5V from the console. Check that the voltage on the positive (+) end of C3 is +5.0 Vdc $\pm$10%.

5.3.2. CLOCK CHECK

The keyboard receives a 16xCLK signal from the console. The clock signal synchronizes keyboard operations and sets the baud rate on the serial links (see Table 1.1 for clock frequencies).

- Check the 16xCLK rate at U1 pin 36.

5.3.3. FAULT ISOLATION

Faults are isolated using the Keyboard Data Test of the Functional Field Test Program, which is currently being developed. Details on how to use the test will be provided when the diskette is available.

When a fault has been isolated, troubleshoot the defective circuit as described in Paragraph 5.3.4.

5.3.4. CIRCUIT TROUBLESHOOTING

Once the fault has been isolated to a functional block of circuitry, the component at fault must be isolated using conventional troubleshooting methods. In order to troubleshoot individual circuits, Field Support Personnel must be completely familiar with the circuit theory described in Chapter 2. The PCB schematic diagram is included in Chapter 3 and pertinent waveforms are given in Chapter 2.

5.4. REPAIR

5.4.1. REPAIR PRECAUTIONS

When repairing the keyboard the following precautions must be observed.

- Never repair the keyboard with power applied;
- When soldering, use only a soldering iron which has a properly grounded soldering tip. A soldering iron which has AC on the soldering tip will cause extensive damage to IC's;
- Only use a low-wattage soldering iron;
- A soldering iron must not be held in contact with the PCB solder point any longer than necessary. Excess heat can damage the IC's. Use a "solder sucker" to remove melted solder;
- Perform a visual inspection of all repairs. After soldering, check for solder shorts between pins and tracks adjacent to the repair. Check for cold solder joints.

5.4.2. POST-REPAIR TESTING

After a keyboard has been repaired, it should be checked for proper operation by running the Keyboard Data Test of the Functional Field Test Program and then by loading the WP Program and checking for correct operation.