

H-79-0363B

5780 Series

Data Entry Devices

**SANDERS
COMPUTER
GRAPHICS**

**MODEL 5783 SERIES
ALPHANUMERIC AND
FUNCTION KEYBOARD**

**MODEL 5784 SERIES
LIGHTED ALPHANUMERIC
AND FUNCTION KEYBOARD**

TECHNICAL MANUAL

Information Products Division
Federal Systems Group



SANDERS

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TABLE OF CONTENTS

Section		Page
	LIST OF ILLUSTRATIONS	ii
	LIST OF TABLES	iii
1	GENERAL INFORMATION	1-1
	1.1 Introduction	1-1
	1.2 Equipment Description	1-1
	1.2.1 Physical Description	1-1
	1.2.2 Functional Description	1-2
2	OPERATION	2-1
	2.1 General	2-1
	2.2 Controls and Indicators	2-1
	2.2.1 Alphanumeric Keys	2-1
	2.2.2 Matrix Keys	2-2
	2.2.3 Function Keys	2-2
	2.2.4 Matrix Key and Function Key Lamps	2-2
	2.3 Operator Checkout Procedure	2-5
3	THEORY OF OPERATION	3-1
	3.1 Principles of Operation	3-1
	3.2 Detailed Operation	3-1
	3.2.1 Timing Generator	3-3
	3.2.2 X Strobe Generator	3-3
	3.2.3 Y Line Multiplexer	3-3
	3.2.4 Keystroke Detector	3-3
	3.2.5 Ram Logic	3-3
	3.2.6 Latch Logic	3-4
	3.2.7 PROM's	3-5
	3.2.8 Strobe and Repeat Logic	3-5
	3.2.9 UART and Timer	3-5
	3.2.10 Function Key and Matrix Key Lamps Circuit	3-6
	3.3 Principles of Operation	3-7
	3.4 Detailed Operation	3-7
	3.4.1 Timing Circuits	3-7
	3.4.2 X Strobe Generator	3-7
	3.4.3 Y Line Multiplexer	3-9
	3.4.4 Keystroke Detector	3-9

TABLE OF CONTENTS (Cont)

Section		Page
	3.4.5 Latches	3-9
	3.4.6 PROM's	3-9
	3.4.7 Line Driver	3-9
	3.4.8 Line Receiver	3-9
	3.4.9 Lamp-Lighting Circuit	3-10
	3.4.10 Audible Alarm Circuit	3-10
	3.4.11 Dip Switch	3-10
4	INSTALLATION	4-1
	4.1 Unpacking and Visual Inspection	4-1
	4.2 Equipment Location	4-1
	4.3 Cabling	4-1
	4.4 Power Turn-On/Turn-Off	4-2
	4.5 Operational Checkout	4-2
5	MAINTENANCE	5-1
	5.1 Maintenance Philosophy	5-1
	5.2 Preventive Maintenance	5-1
	5.3 Keyboard Tests	5-1
	5.3.1 General	5-1
	5.3.2 Procedure	5-2
	5.4 Keyboard Data Codes	5-3
	5.5 Interface Signals	5-3
	5.6 Additional Information	5-4
	5.6.1 Models 5783, 5784	5-4
	5.6.2 Models 5783A, 5784A	5-4
6	DRAWINGS	6-1
	6.1 Sanders Drawings	6-1
	6.2 Amkey Drawings, Models 5783, 5784	6-1
	6.3 Amkey Drawings, Models 5783A, 5784A	6-1
	6.4 Amkey Drawings, Models 5783B, 5784B	6-1

LIST OF ILLUSTRATIONS

Number	Title	Page
1-1	Model 5784 Keyboard	1-0
2-1	Keyboard Layout	2-1
2-2	Lamp Control Message Format	2-5
3-1	Models 5783, 5784 Block Diagram	3-2
3-2	Models 5783A, 5783B, 5784A, 5784B Block Diagram	3-8
5-1	Models 5783, 5784 Keyboard, Cover Removed	5-5
5-2	Model 5783A Keyboard, Cover Removed	5-6

LIST OF ILLUSTRATIONS (Cont)

Number	Title	Page
5-3	Model 5783A, Component Board and Keying Unit	5-7
5-4	Model 5783A Component Board	5-8
5-5	Model 5783A Keying Unit	5-9

LIST OF TABLES

Number	Title	Page
1-1	Principal Differences Between Keyboards	1-2
1-2	Keyboard Specifications	1-3
2-1	CTRL Functions	2-2
2-2	Key Codes	2-3
3-1	DIP Switch Functions	3-10
5-1	Interface Signals	5-3

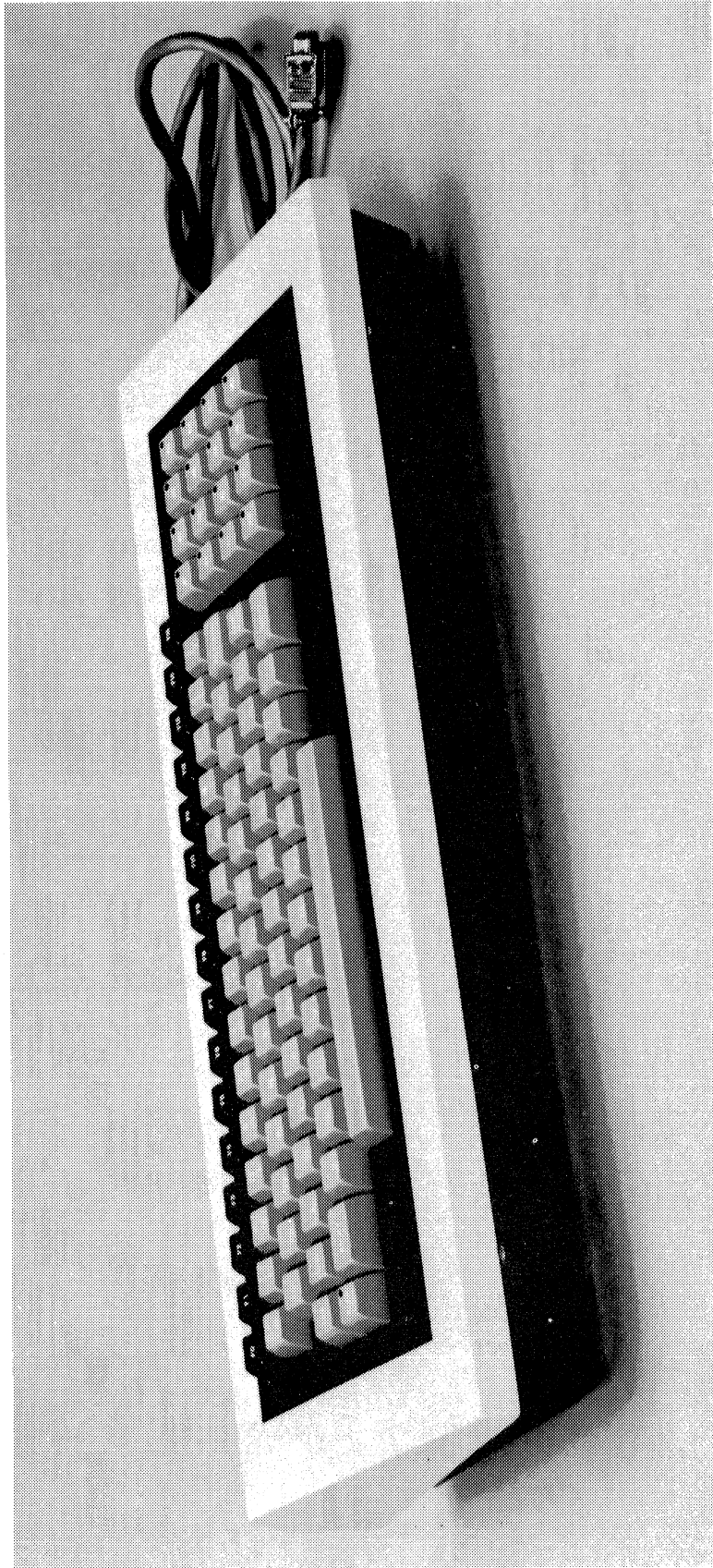


Figure 1-1. Model 5784 Keyboard

SECTION 1

GENERAL INFORMATION

1.1 INTRODUCTION

This manual describes the Model 5783 series of alphanumeric/function keyboards and the Model 5784 series of lighted alphanumeric/function keyboards. All keyboards are full ASCII data entry devices, used with the Sanders family of computer graphics display systems. This manual contains descriptive information, operation, theory, installation, and maintenance information.

The keyboard interfaces with a Sanders terminal controller. The terminal controller supplies power to the keyboard. Data goes from the keyboard to the terminal controller. In the case of the Model 5784 series only, lamp-lighting data goes from the terminal controller to the keyboard. In the case of the 5783B and 5784B only, the audible alarm control signal goes from the terminal controller to the keyboard.

All of these keyboards have the following features:

- 55 ASCII alphanumeric, symbol, and special purpose keys.
- 16 function keys at the right of the keyboard (lighted in the Model 5784 series).
- 16 function keys across the top of the keyboard (lighted in the Model 5784 series).
- Lighted CAPS LOCK key.
- Keystroke repeat function.

Table 1-1 describes the principal differences between the keyboards in each series. Figure 1-1 shows a typical keyboard.

1.2 EQUIPMENT DESCRIPTION

1.2.1 PHYSICAL DESCRIPTION

Each keyboard is self-contained in a cast aluminum housing, designed for desk top or similar use. Table 1-2 lists keyboard specifications.

The keyboard contains three separate key sets: a main block of 55 ASCII alphanumeric, symbol, and special purpose keys, a 4 x 4 matrix of 16 function keys to the right (the matrix keyboard), and a row of 16 function keys across the top (the function keyboard).

Table 1-1. Principal Differences Between Keyboards

Model (Part No)	Logic Type	Keyboard	LOCAL MODE Control	Audible Alarm	TTY Emulator
5783 (5977079P1)	Discrete RAM/ROM	Flat	No	No	No
5783A (5977079P2)	Microprocessor	Flat	Yes	No	Yes
5783B (5977079P3)	Microprocessor	Stepped	Yes	Yes	Yes
5784 (5978943P1)	Discrete RAM/ROM	Flat	No	No	No
5784A (5978943P2)	Microprocessor	Flat	Yes	No	Yes
5784B (5978943P3)	Microprocessor	Stepped	Yes	Yes	Yes

All keyboards have a lamp in the CAPS LOCK key. In addition, the Model 5784 series contains a lamp in each matrix key and function key.

The keyboard interfaces with the terminal controller through one of the terminal controller's serial interface ports. An adapter cable is required between the keyboard cable and the serial interface port connector. Refer to Section 4 for details. All power required to operate the keyboard is supplied by the terminal controller.

The Model 5783 series and 5784 series keyboards are commercial units built to Sanders' specifications. The units are supplied under manufacturer's warranty to Sanders and are not considered field-maintainable.

1.2.2 FUNCTIONAL DESCRIPTION

The keyboard communicates with the terminal controller through the multiport serial interface. Keyboard data is generated in the keyboard assembly as parallel character codes. Data transfer to the terminal controller is serial, RS-232C at 9600 baud.

The flow of keyboard data to the terminal controller is asynchronous from the terminal controller's point of view. The keyboard controls the timing of the data flow. The terminal controller firmware controls acceptance and use of the data.

The flow of lamp-lighting data to the keyboard is under resynchronized timing control of the Model 5784 series keyboard. See Section 3 for details.

All function, matrix, and alphanumeric keys are momentary-action switches. When pressed, each transmits a unique 8-bit code. Each key is so encoded that partially

Table 1-2. Keyboard Specifications

Parameter	Characteristic
Alphanumeric keys	55, momentary action, of which 50 are upper and lower case
Matrix keys	16, momentary action
Function keys	16, momentary action
Power	+5V, <u>+1%</u> , 750 mA max +15V, <u>+1%</u> , 50 mA max -15V, <u>+1%</u> , 50 mA max
Output levels	Logic low is 0.0 to +0.45V Logic high is +2.45 to +5.25V
Output signal characteristics	Serial, RS-232 compatible, negative true <ul style="list-style-type: none"> ● Rest = low ● Logic 1 = low ● Code = 10 bit (one start bit, eight data bits, one stop bit)
Maximum cable length (keyboard to terminal controller)	Model 5783 - 50 feet Model 5784 - 100 feet with external +5V power supply
Operating temperature range	+4°C to +49°C (40°F to 120°F)
Storage temperature range	-40°C to +60°C (-40°F to 140°F)
Humidity	5% to 95%, non-condensing
Storage pressure range	483 mm Hg to 813 mm Hg (19 to 32 inches Hg)
Dimensions	475 mm wide by 206 mm deep by 94 mm high (18.75 by 8.1 by 3.7 inches)
Weight	3.2 kg (7 lbs.)

pressing any combination of code generating keys cannot duplicate the code of another key. The keyboard has an N-key rollover feature. If you press two or more keys at a time, the key code for the first key pressed goes on the data lines. When you release the first key, the code for the second key pressed is present and stable on the data lines.

The keyboard has an internal repeat function on all encoded keys. If you hold a key down, the character repeats at a 10 Hz rate after a one second delay.

The codes generated by the alphanumeric and symbol keys are modified when the CTRL (control) key, the SHIFT key, or both the CTRL and SHIFT keys are pressed. See Section 2 for details.

When the CAPS LOCK key is pressed, a red lamp in the key cap lights and the alphanumeric keyboard becomes the equivalent of a teletypewriter keyboard.

Models 5783B and 5784B contain an audible alarm circuit, activated by receipt of octal code 007 (the TTY BELL signal) from the terminal controller. When activated, the audible alarm circuit produces a 1 kHz tone for 0.5 second at an amplitude of approximately 50 dBa.

Models 5783A, 5783B, 5784A, and 5784B contain a LOCAL MODE control circuit. When you press CONTROL, SHIFT, and RETURN all at the same time, a logic low appears at pin 15 of the keyboard connector. If the terminal controller is suitably configured, this LOCAL MODE signal switches the terminal controller to its LOCAL mode.

There are minor differences in the key code assignments between the models. See table 2-2 for details.

SECTION 2

OPERATION

2.1 GENERAL

The keyboard sends binary encoded character data to the terminal controller. Actual use of the data is under the control of the user's application program. Normally, the data is used to give the operator two-way interaction with the display and processing unit.

For the Model 5784 series, the terminal controller sends lamp-lighting data to the keyboard to light selected lamps on the function and matrix keys.

For the Models 5783B and 5784B, the terminal controller sends the 007 code that activates the audible alarm.

2.2 CONTROLS AND INDICATORS

Refer to figure 2-1 for the keyboard layout.



Figure 2-1. Keyboard Layout

2.2.1 ALPHANUMERIC KEYS

Operation of the 55-key alphanumeric key set is similar to that of a teletypewriter, except that 50 keys have both upper and lower case. The five keys that produce the same output code shifted and unshifted are RETURN, ESC (escape), RUB OUT, ___ (underscore), and SPACE.

To type lower case alphanumerics, be sure the CAPS LOCK key is released. Type the character without pressing either the SHIFT or the CTRL (control) keys.

To type upper case alphanumeric, press either of the two SHIFT keys plus the selected character. If you want to type a string of such characters, press the CAPS LOCK key, then the characters. Be sure to release the CAPS LOCK key at the end of the string.

The blank space bar at the bottom of the alphanumeric key set inserts spaces between displayed characters on the CRT.

The CTRL key overrides the normal alphanumeric functions and implements software control functions that are then accessed by the alphanumeric character keys. To use the CTRL function, press and hold the CTRL key, then type the selected character. Table 2-1 lists the alphanumeric keys and the control functions they invoke if the CTRL key is also pressed.

Table 2-1. CTRL Functions

Key Label	Control Function	Key Label	Control Function
A	SOH (start of heading)	N	SO (shift out)
B	STX (start of text)	O	SI (shift in)
C	ETX (end of text)	P	DLE (data link escape)
D	EOT (end of transmission)	Q	DC1 (device control 1)
E	ENQ (inquiry)	R	DC2 (device control 2)
F	ACK (acknowledge)	S	DC3 (device control 3)
G	BEL (bell)	T	DC4 (device control 4)
H	BS (backspace)	U	NAK (negative acknowledge)
I	HT (horizontal tab)	V	SYN (synchronous idle)
J	LF (line feed)	W	ETB (end of transmission block)
K	VT (vertical tab)	X	CAN (cancel)
L	FF (form feed)	Y	EM (end of medium)
M	CR (carriage return)	Z	SUB (substitute)

Pressing a key, with or without the SHIFT and CTRL functions, generates a certain code that corresponds to an upper case character, a lower case character, a symbol, or a control function. How those codes are actually used in a system is determined by the application program. Table 2-2 lists the key codes.

2.2.2 MATRIX KEYS

The 16-key (4 x 4) matrix key set located to the right of the alphanumeric key set can be assigned optional functions at the discretion of the user.

2.2.3 FUNCTION KEYS

The 16-key in-line function key set is located above the alphanumeric keyboard. Special functions can be assigned to each key at the option of the user.

2.2.4 MATRIX KEY AND FUNCTION KEY LAMPS (MODEL 5784 series only)

The 32 lamps in the matrix and function key sets are controlled by the terminal controller. The terminal controller turns these lamps on or off by sending a 5-byte message as shown in figure 2-2.

Table 2-2. Key Codes

Unshifted ASCII Character	Unshifted	Shifted	Control	Shift and Control
M0	000	000	000	000
M1	001	001	001	001
M2	002	002	002	002
M3	003	003	003	003
M4	004	004	004	004
M5	005	005	005	005
M6	006	006	006	006
M7	007	007	007	007
M8	010	010	010	010
M9	011	011	011	011
M10	012	012	012	012
M11	013	013	013	013
M12	014	014	014	014
M13	015	015	015	015
M14	016	016	016	016
M15	017	017	017	017
F0	020	020	020	020
F1	021	021	021	021
F2	022	022	022	022
F3	023	023	023	023
F4	024	024	024	024
F5	025	025	025	025
F6	026	026	026	026
F7	027	027	027	027
F8	030	030	030	030
F9	031	031	031	031
F10	032	032	032	032
F11	033	033	033	033
F12	034	034	034	034
F13	035	035	035	035
F14	036	036	036	036
F15	037	037	037	037
LF	212	232	232	232
RETURN	215	215	215	215
ESC	233	233	233	233
RUBOUT	377	377	377	377
BACKSPACE	210	230	230	230
SPACE (bar)	240	240	240	240
TAB	211	231	231	231
,	254	274 (<)	254	254
-	255	275 (=)	255	255
.	256	276 (>)	256	256

Table 2-2. Key Codes (Cont)

Unshifted ASCII Character	Unshifted	Shifted	Control	Shift and Control
/	257	277 (?)	257	257
0	260	260	260	260
1	261	241 (!)	261	261
2	262	242 (")	262	262
3	263	243 (#)	263	263
4	264	244 (\$)	264	264
5	265	245 (%)	265	265
6	266	246 (&)	266	266
7	267	247 (')	267	267
8	270	250 ((270	270
9	271	251 ())	271	271
:	272	252 (*)	272	272
;	273	253 (+)	273	273
\	333	373 (f)	233	233
]	334	374 (:)	234	234
[335	375 (}	235	235
^	336	376 (~)	236	236
_	337	337	237	237
@	300	340 (^)	200	200
A	341 (a)	301	201	201
B	342 (b)	302	202	202
C	343 (c)	303	203	203
D	344 (d)	304	204	204
E	345 (e)	305	205	205
F	346 (f)	306	206	206
G	347 (g)	307	207	207
H	350 (h)	310	210	210
I	351 (i)	311	211	211
J	352 (j)	312	212	212
K	353 (k)	313	<u>P1*</u> 233 <u>P2/P3*</u> 213	233
L	354 (l)	314	234 214	234
M	355 (m)	315	235 215	235
N	356 (n)	316	236 216	236
O	357 (o)	317	237 217	237
P	360 (p)	320	<u>220</u> <u>220</u>	200
Q	361 (q)	321	221	221
R	362 (r)	322	222	222
S	363 (s)	323	223	223
T	364 (t)	324	224	224
U	365 (u)	325	225	225
V	366 (v)	326	226	226
W	367 (w)	327	227	227
X	370 (x)	330	230	230
Y	371 (y)	331	231	231
Z	372 (z)	332	232	232

*P-condition is indicated on Sanders nameplate at rear of keyboard.

Table 2-2. Key Codes (Cont)

NOTES:

1. CAPS LOCK is a separate mode. SHIFT mode overrides CAPS LOCK. Only the alphabet characters A to Z are affected by CAPS LOCK.

2. Shifted graphics characters are shown in parentheses in the Shifted column where applicable. Unshifted alphabet characters are shown in parentheses in the Unshifted column.

When the keyboard is initialized (power up), all matrix and function key lamps are initialized OFF.

If the keyboard detects a sync byte followed by no data bytes, the keyboard waits one second, then resets and waits for another sync byte. Any number of matrix and function key lamps can be turned on or off in a single lamp control message.

2.3 OPERATOR CHECKOUT PROCEDURE

Refer to the keyboard tests in Section 5.

	MSB							LSB
Sync byte (224_8)	1	0	0	1	0	1	0	0
Data byte 1	F7	F6	F5	F4	F3	F2	F1	F0
Data byte 2	F15	F14	F13	F12	F11	F10	F9	F8
Data byte 3	M7	M6	M5	M4	M3	M2	M1	M0
Data byte 4	M15	M14	M13	M12	M11	M10	M9	M8

Figure 2-2. Lamp Control Message Format

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SECTION 3

THEORY OF OPERATION

Part 1 of this section applies to Models 5783 and 5784. Part 2 applies to Models 5783A, 5783B, 5784A, and 5784B.

PART 1

MODELS 5783, 5784

3.1 PRINCIPLES OF OPERATION

Refer to figure 3-1. The keyboard consists of a matrix of 128 intersections (16 X lines crossing 8 Y lines). Each X line is activated, one line at a time, by a series of 32 pulses from the timing generator. The Y line multiplexer advances one count after scanning eight X lines. A complete scan cycle ends after every combination of 16 X lines and 8 Y lines has been scanned.

When you press a key, you are increasing the capacitance between one X line and one Y line (one intersection). The increased capacitance couples the burst of 32 pulses through the Y line multiplexer to the keystroke detector.

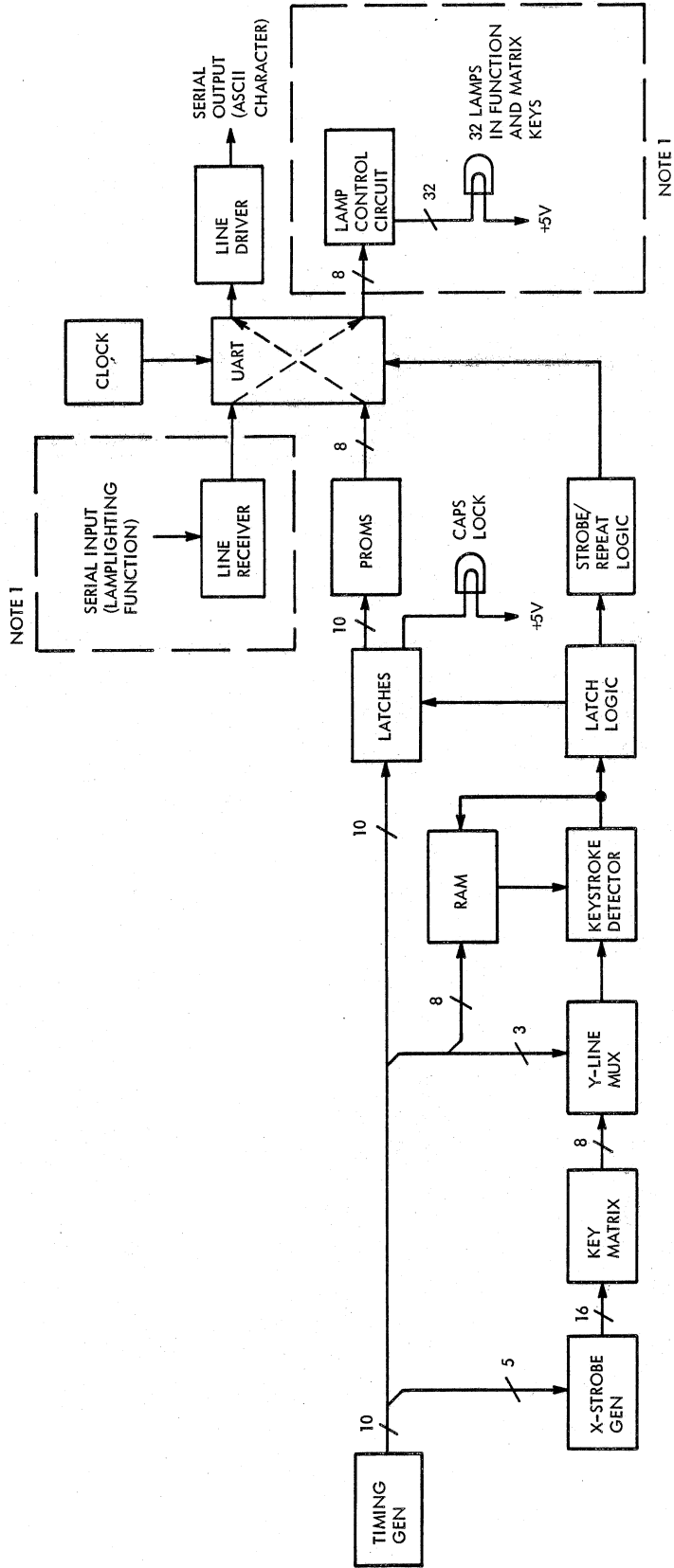
The keystroke detector converts the 32 short pulses to a single pulse that latches the timing signal states into the RAM (random access memory) and PROM's (programmable read-only memories). Each timing signal state is the equivalent of a unique character or control key. The condition is put into the RAM to prevent unwanted repetitions of a keystroke (the X and Y lines scan faster than you would normally press and release a key). The PROM's produce an 8-bit output that is the ASCII equivalent of the key you pressed.

The UART (universal asynchronous receiver-transmitter) converts the eight parallel data bits to a serial string, adds a start bit, and sends the 9-bit serial string to the terminal controller. A separate adjustable clock controls the UART transfer rate (nominally 9600 baud). The output circuits provide the 9-bit serial string at various levels and polarities. The stop bit is implied. There is at least a 2-bit space between consecutive characters.

In the Model 5784 only, the lamp-lighting message from the terminal controller turns on or turns off any of the lamps in the 16 function keys and the 16 matrix keys. The keyboard operator has no control over this function.

3.2 DETAILED OPERATION

Refer to Amkey drawing 200-2031 in Section 6 of this manual.



NOTE:
1. MODEL 5784 ONLY.

H-79-0363-001

Figure 3-1. Models 5783, 5784 Block Diagram

3.2.1 TIMING GENERATOR

The timing generator consists of clock generator Z2D, Z2E, Z2F; binary counter Z13; and various inverters and gates.

The clock generator produces a square wave with a frequency of 900 kHz. The binary counter produces submultiples of this frequency. The Q13 output is a square wave at 110 Hz. Gates Z5B, Z15A, and Z15B produce a high pulse every 70 us.

3.2.2 X STROBE GENERATOR

BCD-to-decimal decoders Z4 and Z3 form the X strobe generator. For each combination of input timing signals, one and only one X-output line goes low. Gating the Q1 and Q13 outputs together at the D input of each decoder produces the 32 pulses on the line selected by the other three inputs. The alternating inputs at D causes the decoder to alternate between legal and illegal states.

Inverter Z5F lets decoder Z3 operate when Z4 is disabled and lets decoder Z4 operate when Z3 is disabled.

Each X line goes to a certain group of keys on the keyboard.

3.2.3 Y LINE MULTIPLEXER

When you press a key, the 32 pulses on the selected X line are coupled to a Y line. The Y lines are sequentially selected by Y line multiplexer Z7 in response to the timing signals applied to its A, B, C inputs. A complete set of eight X lines (from one X-strobe generator) occurs every time the Y line multiplexer advances by one. The output of the multiplexer is high for a no-signal condition. When the pulses are present on a Y line, the Y line multiplexer passes them to the keystroke detector.

3.2.4 KEYSTROKE DETECTOR

The keystroke detector consists of phase detector/integrator Z8, operational amplifier Z16, inverters Z6C and Z20B and flip-flop Z26B. The phase detector reference signal (from Z6C) is at the same frequency as the 32 pulses. When the 32 pulses appear at the output of the Y line multiplexer, the output of Z20B is a positive pulse of 70 us duration every time that intersection is scanned. The intersection is normally scanned several times while you hold the key down.

The output of Z20B is applied to the data input of flip-flop Z26B, which is clocked every 70 us by the output of Z15B in the timing generator. When a keystroke is detected, the Q output of flip-flop Z26B is high for 70 us, when it is clocked again.

3.2.5 RAM LOGIC

The function of the RAM logic is to assure that a keystroke registers only once, regardless of how many times the intersection is scanned while you hold the key down. (See paragraph 3.2.8 for repeat logic).

RAM Z12 is enabled every 70 us at the address established by timing signals Q7 through Q13. If the RAM is empty at the address corresponding to the key you pressed, the output of flip-flop Z26B loads the RAM. When the RAM is loaded, its output is applied as the data input to flip-flop Z26A. Flip-flop Z26A is also clocked every 70 us, but it is clocked 8 us earlier than flip-flop Z26B, through Z20F. The Q output of flip-flop Z26A, inverted by Z20D, disables operational amplifier Z16 for the duration of the scan.

If the RAM is loaded at an address and you have released the key, the RAM clears that address.

3.2.6 LATCH LOGIC

The latch logic consists of latches Z10, Z11, and Z9 plus various gates and inverters.

Latches Z10 and Z11 are enabled to hold the timing signal inputs when the output of Z24B goes high. Z24B goes high when the following conditions are met: key is down and RAM address is clear (gates Z32A and Z32B enabled), and X strobe is not X15 (gate Z32C enabled through Z2C and Z20C). When these conditions exist, latches Z10 and Z11 pass their seven latched outputs to address the PROM's.

Latch Z9 is enabled to pass a single input signal to one of three output lines only when the X strobe is at X15. (When the strobe is at X15, gate Z15C and inverter Z20A enable the latch; RAM output through Z20E is the data input; and the three timing inputs select the enabled line). If the key is down, the input from Z20E is low and is passed to one of the three output lines selected by the Y line timing as follows:

$$X15, Y5 = \overline{\text{CAPS LOCK}}$$

$$X15, Y6 = \overline{\text{SHIFT}}$$

$$X15, Y7 = \overline{\text{CONTROL}}$$

The $\overline{\text{CAPS LOCK}}$ signal, inverted by Z24A, clocks flip-flop Z23B, making the Q output low. The low Q output of Z23B lights the red indicator in the CAPS LOCK key. The low Q output of Z23B also disables Z17A, priming Z17B. If $\overline{\text{CONTROL}}$ is not active, the output of Z17B goes low.

The high \overline{Q} output of Z23B primes gate Z17C. If $\overline{\text{SHIFT}}$ is not active, the output of Z17C goes low, forcing the output of Z17D high. When you press CAPS LOCK, the output of Z17B goes low and the output of Z17D goes high.

The $\overline{\text{SHIFT}}$ signal, when active, disables both gates Z17A and Z17C, priming gates Z17B and Z17D. If $\overline{\text{CONTROL}}$ is not active, the outputs of Z17B and Z17D are both low.

The $\overline{\text{CONTROL}}$ signal, when active, disables both gates Z17B and Z17D, making both their outputs high.

The $\overline{\text{CONTROL}}$ signal overrides the $\overline{\text{SHIFT}}$ signal, which in turn overrides the $\overline{\text{CAPS LOCK}}$ signal.

The outputs of Z17B and Z17D go to PROM's Z18 and Z19.

3.2.7 PROM'S

PROM's Z18 and Z19 each produce four bits of the 8-bit output code as a function of their nine inputs (address). Seven of the address inputs are the latched timing signals; the other two come from Z17B and Z17D. The outputs of the PROM's go to the UART.

3.2.8 STROBE AND REPEAT LOGIC

The strobe and repeat logic circuit consists of flip-flops Z1A, Z1B, and Z30A; counter Z31; and various inverters and gates. The strobe and repeat logic circuit has two functions: to generate a strobe for every keystroke and to generate additional strobes that let a character be repeated intentionally.

When the repeat function is not active, a low key-down signal from Z24C is gated through Z25B and inverters Z24E, Z36E, and Z36D to the UART.

The repeat function works as follows: Gate Z15D is enabled when the RAM address is loaded and X strobe is not X15. Under these conditions, the output of gate Z15D goes high, priming gate Z25A. Z25A is enabled by the output of Z15B; the low output of Z25A presets flip-flop Z1A. The Q output of Z1A goes high, making the D input of Z1B high.

The next pulse from Z5D (one pulse every 9 ms) clocks Z1B and through inverter Z2A clears Z1A. The high Q output of Z1B primes gate Z32D. Z32D is enabled by the output of Z24C (which is high in repeat mode because flip-flop Z26B clears). The low output of Z32D clears flip-flop Z30A and resets counter Z31.

Counter Z31 counts the 220 Hz (period 4545 us) pulses from the Q12 output of binary counter Z13. The V04 output of Z31 occurs approximately 10 times per second; the V06 output occurs approximately every half second, and the V07 output occurs approximately once per second.

The V06 and V07 outputs are gated in Z25C to clock flip-flop Z30A. This establishes the initial delay before the repeat action starts. When the Q output of flip-flop Z30A goes high, it lets gate Z25D pass the 10 Hz output of counter Z31 to gate Z25B. Gate Z25B is primed by the output of Z24C, sending the 10 Hz strobe signal to the UART through inverters Z24E, Z36E, and Z36D.

3.2.9 UART AND TIMER

Timer Z50 is an adjustable clock that normally operates at a frequency of 153.6 kHz (period of 6.51 us). Potentiometer R18 lets the frequency be adjusted through a range of approximately 151.5 to 156.25 kHz. The timer output is the clock signal to the UART for both transmitting and receiving.

The UART (Z51), in the transmit mode, receives as parallel inputs the eight bits of ASCII character data from the PROM's. On receipt of a low-going strobe from the strobe logic circuit, the UART adds a start bit and clocks the data out through line driver Z43 as a 9-bit serial word. The stop bit is implied.

When the repeat function is active, the strobe logic generates additional strobes after the initial one second delay. Because the outputs of the PROM's do not change, the additional strobes cause the UART to transmit additional words, consisting of the same eight bits plus the start bit.

3.2.10 FUNCTION KEY AND MATRIX KEY LAMPS CIRCUIT

NOTE

This paragraph applies to the Model 5784 only. The circuit card of the Model 5783 is depopulated to delete this function.

The lamp-lighting message from the terminal controller consists of five 8-bit bytes and enters the UART through line receiver Z44. The bits are resynchronized in the UART by the timing signals from timer Z50.

Initially, gates Z47 and Z48 are primed by +5V, but all the RB outputs of the UART are low; therefore, the inputs to latches Z21, Z22, Z27, Z28, Z34, Z35, Z40, and Z41 are all low. The latch outputs are high and the lamps are initialized off.

Gates Z38 and Z39 form an address decoder that recognizes the first byte of a lamp-lighting message. The serial data enters the UART through line receiver Z44 and appears at outputs RB1 (LSB) through RB8 (MSB). The first byte passes through gates Z47 and Z48 without inversion and goes to the address decoder. If the first byte is (MSB) 1 0 0 1 0 1 0 0 (LSB), the output of Z39 (at pin 6) goes high. The high from Z39-6 is thrice inverted and clears counter Z45. Thereafter, the counter counts the number of times the DR (data ready) line of the UART goes high.

When the second byte arrives, the parallel data is applied through gate Z47 and Z48 to the latches. The high DR signal, inverted by Z29E, clocks counter Z45 and inhibits the reset line. The counter output goes to decoder Z46, which in turn enables gate Z49A. The high output of Z49A, inverted by Z42A, enables latches Z21 and Z22. The result is that the contents of the first data byte sets lamps LED 1 through LED 8 in function switches F0 through F7.

At the same time, the second byte starts the timer circuit consisting of Z29F and Z33B. This circuit generates a delay just long enough to let the data settle on the latch lines, then generates a low pulse that clears the UART's DR line and disables the latch that was just set, storing the lamp-lighting information.

The third, fourth, and fifth bytes of the lamp-lighting message function in a similar manner, latching the data into the remaining pairs of latches. The third byte latches the data for function switches F8 through F15 into latches Z27, Z28. The fourth byte latches the data for matrix switches M0 through M7 into latches Z34, Z35, and the fifth byte latches the data for matrix switches M8 through M15 into latches Z40, Z41.

When the fifth byte is decoded by Z46, the high output of Z46, inverted by Z29B, Z37A, and Z29C, resets counter Z45.

If a header byte is received but is not followed by data bytes, pin 1 of Z46 goes high, charging C21. After approximately 1 second, C21 runs down and resets counter Z45.

PART 2

MODELS 5783A, 5783B, 5784A, 5784B

3.3 PRINCIPLES OF OPERATION

Refer to figure 3-2. The keyboard consists of a matrix of 128 intersections, 8 X lines crossing 16 Y lines. Each X line is activated, one line at a time, by a series of approximately 100 pulses from the X strobe generator. The Y line multiplexer advances one count after scanning eight X lines. A complete scan cycle ends after every combination of 8 X lines and 16 Y lines has been scanned.

When you press a key, you are increasing the capacitance between one X line and one Y line (one intersection). The increased capacitance couples the burst of 100 pulses through the Y line multiplexer to the keystroke detector.

The keystroke detector converts the 100 short pulses to a single pulse that activates microprocessor Z12. The microprocessor latches the timing signal states into latches Z8, Z11. These signals become PROM addresses. The microprocessor then reads the PROM's and passes the resulting data through the line driver to the terminal controller. The PROM output is an 8-bit ASCII equivalent of the key you pressed. The microprocessor converts the eight parallel bits to a serial string and adds the start and stop bits.

Serial data from the terminal controller enters the keyboard through a line receiver. Microprocessor Z23 latches the incoming data into latches Z19, Z22. These signals become PROM addresses. The microprocessor then reads the PROM's and passes the resulting data either to the shift registers to turn on the LEDs in the function keys, or to turn on the audible alarm.

3.4 DETAILED OPERATION

Refer to Amkey drawings 200-3271 and 200-3581 in Section 6 of this manual.

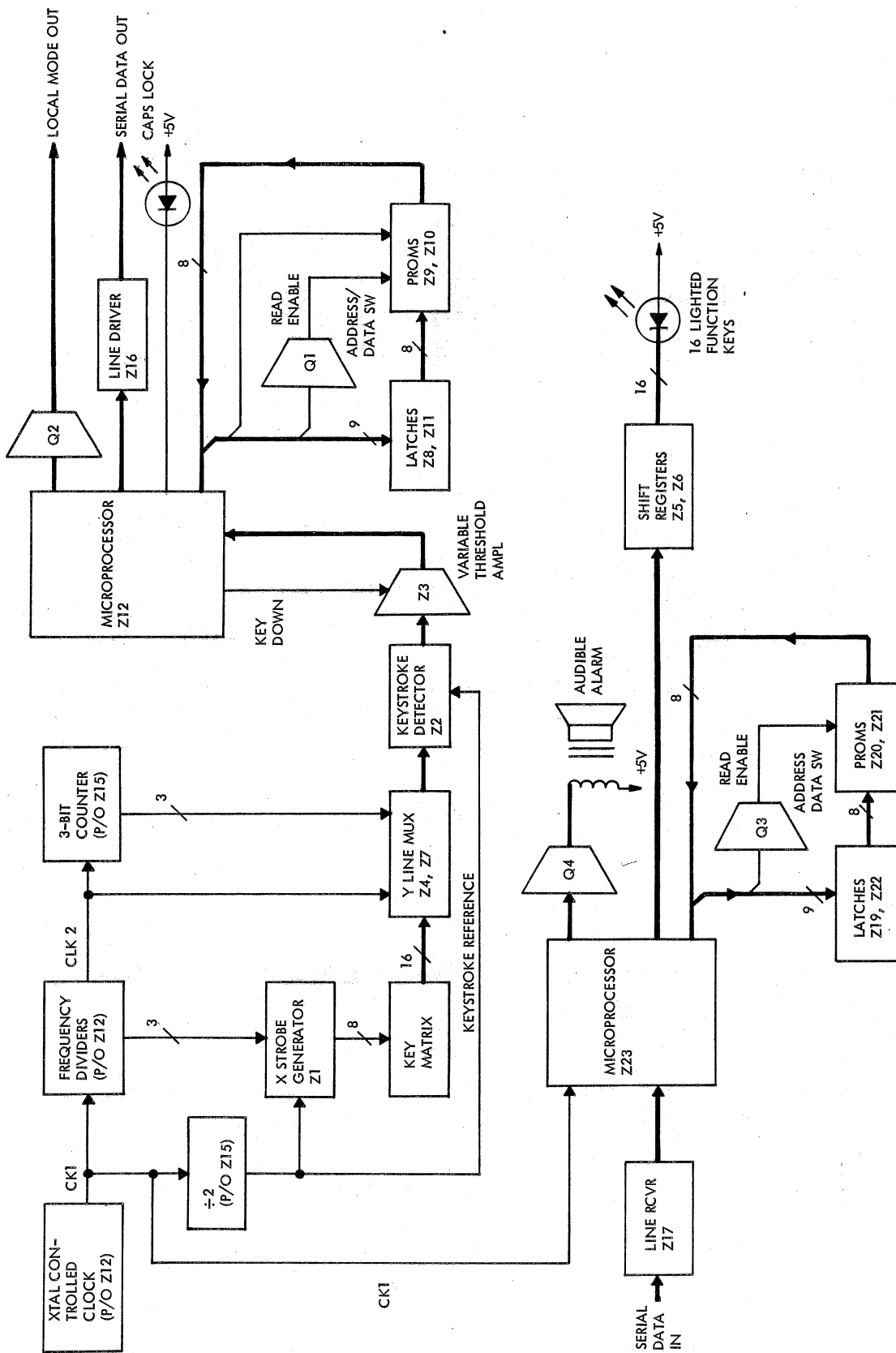
3.4.1 TIMING CIRCUITS

The timing circuits consist of crystal Y1, parts of microprocessor Z12, and frequency counter Z15. Frequency CK1 is 3.58 MHz (period of approximately 280 ns). The frequency at Z15-5 is 1.79 MHz; other frequencies are as follows:

Z12-30	6538 Hz (CLK2)
Z15-9	3269 Hz
Z15-2	1635 Hz
Z15-12	817 Hz
Z12-40	332 Hz
Z12-39	222 Hz
Z12-38	111 Hz

3.4.2 X STROBE GENERATOR

BCD-to-decimal decoder Z1 is the X strobe generator. For each combination of input timing signals, one and only one X-output lines goes low. The alternating signal at Z1-12 causes the decoder to alternate between legal and illegal states,



H-79-0965-002

Figure 3-2. Models 5783A, 5783B, 5784A, 5784B Block Diagram

thus producing the pulse burst on the line that is selected by the other three inputs. Each X line output goes to a certain group of keys on the keyboard.

3.4.3 Y LINE MULTIPLEXER

When you press a key, the pulses on the selected X line are coupled to a Y line. The Y lines are sequentially selected by Y line multiplexers Z4, Z7 in response to the timing signals applied to their inputs. A complete set of eight X lines occurs every time the Y line multiplexer advances by one. The output of the multiplexers (pin 3) is high for a no-signal condition. When the pulses are present on a Y line, the Y line multiplexer passes them to the keystroke detector.

Inverter Z14 lets each multiplexer operate in turn.

3.4.4 KEYSTROKE DETECTOR

Z2 is the keystroke detector. The reference signal from Z15 is at the same frequency as the pulses in the burst. When the pulses appear at the output of the Y line multiplexer, the output of Z2 is a single positive pulse every time that intersection is scanned. The intersection is normally scanned several times while you hold the key down.

Variable threshold amplifier Z3 functions with the keystroke detector to assure that a keystroke registers only once, regardless of how many times the intersection is scanned while you hold the key down. After you have pressed a key, microprocessor Z12 lowers the threshold setting of Z3, effectively disabling it until you press a different key or press the same key a second time.

3.4.5 LATCHES

Z8 and Z11 form an 8-bit latch. The latch is enabled to hold the output of the microprocessor (1P0 through 1P7) when the address signal is high. Microprocessor Z12 outputs 1P0 through 1P7 correspond to timing signal states when the key down signal is detected. The latch outputs go to address the PROM's.

3.4.6 PROM'S

Z9 and Z10 form a 512 by 8-bit PROM. Each chip produces four bits of the 8-bit output code as a function of nine inputs (eight from the latches, one from the microprocessor). When the address signal from microprocessor Z12 goes low, the PROM outputs are accepted as microprocessor inputs on lines 1P0 through 1P7.

Transistor switch Q1 produces the PROM read enable signal.

3.4.7 LINE DRIVER

Z16 accepts the serial data output of microprocessor Z12 and drives the cable to the terminal controller.

3.4.8 LINE RECEIVER

Z17 accepts the serial data input from the terminal controller and passes it to microprocessor Z23.

3.4.9 LAMP-LIGHTING CIRCUIT

Microprocessor Z23 is clocked by the CK1 signal from the timing circuits. When it detects a lamp-lighting instruction from the terminal controller, the microprocessor passes the message to the 8-bit latch Z19, Z22. Microprocessor Z23 outputs 1P0 through 1P7 correspond to the data contained in the lamp-lighting message. The latch outputs go to address PROM's Z20, Z21.

Z20 and Z21 form a 256 by 8-bit PROM. Each chip produces four bits of the 8-bit output code as a function of the eight inputs from the latches. When the address signal from microprocessor Z23 goes low, the PROM outputs are accepted as microprocessor inputs on lines 1P0 through 1P7.

In response to the PROM outputs, microprocessor Z23 controls the lighting of the LEDs in the matrix and function keys.

The lamp-lighting circuit is not used in Models 5783A, 5783B.

3.4.10 AUDIBLE ALARM CIRCUIT

The audible alarm circuit is used only in Models 5783B, 5784B.

When microprocessor Z23 recognizes the input command 007g (TTY BELL), it generates a 1 kHz tone for 0.5 second. Amplifier Q4 couples this signal to the loudspeaker so that the alarm is audible at approximately 50 dBa.

3.4.11 DIP SWITCH

The DIP switch is used only in Models 5783B and 5784B.

The DIP switch is located on the underside of the component board, adjacent to the Cannon connector. The switch has eight sections, of which only four are used. Table 3-1 lists and identifies DIP switch functions.

Table 3-1. DIP Switch Functions

SWITCH SECTION	ON	OFF
8 (code set select)	Selects P2/P3 code set	Selects P1 code set
7 (auto repeat)	Repeat enabled	Repeat disabled
1 (click)	Click disabled	Click enabled
4 (alarm)	Alarm enabled	Alarm disabled

SECTION 4

INSTALLATION

4.1 UNPACKING AND VISUAL INSPECTION

Before unpacking the equipment, inspect the shipping container for evidence of damage. If damage exists, immediately notify the carrier and Sanders Associates, Inc.

Visually inspect the keyboard exterior for signs of damage. Examine the connector for bent pins.

4.2 EQUIPMENT LOCATION

The keyboard assembly may be operated on any convenient flat surface (desk, table, etc.) within 50 cable feet (15.24 meters) of the terminal controller. The cable delivered with the keyboard is 72 ± 2 inches (183 ± 5 cm) long.

For the Model 5784 series, the keyboard may be operated at distances up to 100 feet from the terminal controller if a separate +5V power supply (Acopian 5EB200 or equivalent) is provided. The power supply mounts on the accessory panel (data entry device panel) of the associated display indicator or monitor. The power supply +15V input comes from the terminal controller. Its +5V output goes to the keyboard through the keyboard connector on the accessory or data entry service panel.

4.3 CABLING

The connector on the end of the keyboard cable is type DAC-15P with hood. You need an adapter cable to accommodate this connector and to connect to either the multiport serial interface in the terminal controller or to the connector on the display interconnect panel, accessory panel, or data entry device panel.

If the keyboard is to connect directly to a GRAPHIC 7 or GRAPHIC 8 terminal controller, connect cable part no. 1089765 from the keyboard cable connector to port 3 or port 7 (J4) on the multiport serial interface card.

If the keyboard is to be operated in conjunction with a GRAPHIC 7 or GRAPHIC 8 display interconnect panel, connect cable part no. 1088738 from the keyboard cable connector to the appropriate connector on the display interconnect panel.

If the keyboard is to be operated in conjunction with a GRAPHIC X pedestal, connect cable part no. 1088738 from the keyboard cable connector to the appropriate connector on the pedestal.

4.4 POWER TURN-ON/TURN-OFF

There is no power on/off procedure associated with the keyboard. Power is applied to the keyboard when the keyboard is connected to the terminal controller and the terminal controller is energized.

4.5 OPERATIONAL CHECKOUT

Check the keyboard operational status by operating it as part of the overall system. Refer to the keyboard tests in Section 5.

SECTION 5

MAINTENANCE

5.1 MAINTENANCE PHILOSOPHY

The overall maintenance approach is based on the keyboard test (paragraph 5.3). The keyboard is an off-the-shelf item and is not field repairable. Maintenance is limited to preventive maintenance and fault isolation to the keyboard assembly level.

5.2 PREVENTIVE MAINTENANCE

Preventive maintenance for the keyboard assembly is limited to external cleaning. Periodically clean the keys and all other external surfaces with a soft, dry cloth. Use a slightly moistened cloth for stubborn stains. Use a vacuum cleaner to suck dust through openings in the keyboard case.

5.3 KEYBOARD TESTS

Perform the keyboard tests with the terminal controller in LOCAL mode.

5.3.1 GENERAL

This test operates in the display verification level of the LOCAL mode. When any key is pressed, except RETURN key or CTRL plus M, an output indication appears in a small rectangular box at the right side of the display. The indications in this small box are as follows:

a. Either an A1 or an A2 is displayed in the upper right corner of the box, depending on the serial interface port the keyboard is connected to.

NOTE

If characters other than A1 or A2 appear, the keyboard is probably connected to the wrong port.

b. When an alphanumeric or symbol key is pressed (shifted or unshifted), the corresponding character is displayed in the upper left corner of the box. (Alphabetic characters are upper case only.)

c. When a key is pressed on the alphanumeric, function, or matrix keyboards, the corresponding octal code generated by the key appears in the lower left corner of the box. Similarly, when a special purpose key is pressed, or when the SHIFT or CTRL keys are pressed in conjunction with an alphanumeric or symbol key, the corresponding octal code appears in the lower left corner of the box.

NOTE

Pressing the RETURN key or CTRL plus M causes the terminal controller to execute the monitor level. To return to the display verification test pattern, type T followed by RETURN.

5.3.2 PROCEDURE

- a. On terminal controller, press LOC or LOCAL pushbutton.

NOTE

If your keyboard is an "A" or "B" model and if your terminal controller is so configured, you can get to the verification test pattern by pressing CTRL and SHIFT and RETURN at the same time.

- b. Observe verification test pattern on display.

c. Press keyboard keys one at a time. Observe that the key output is displayed in the small rectangular box on the display. Refer to table 2-2 for the correct output associated with each key.

d. To test the repeat function, you must put the terminal controller in teletype emulator mode, half duplex. Press the keys SHIFT and Y, RETURN, then F0. When you press the F0 key, the screen clears except for the terminal controller identifier at the top (G7, G8, Gx), followed by an F or an H. The F stands for full duplex, the H for half duplex. Every time you press the F1 key, the mode changes from either half to full duplex or from full duplex to half duplex.

e. Now anything you type appears on the display and you can test the repeat function. Use the LF (line feed) key to start a new line. Line feed can also repeat, dropping your next line farther down the page.

f. To return to the LOCAL mode, again press the LOC or LOCAL pushbutton. If your keyboard is an "A" or "B" model and your terminal controller is so configured, you can get to the verification test pattern by pressing CTRL and SHIFT and RETURN at the same time.

- g. To test the audible alarm;

- (1) Press RETURN key.
- (2) Type the following:

3000/112737

/ 7

/176526

/ 0

- (3) Press RETURN key.
- (4) Type: 3000G
- (5) Press RETURN key. Audible alarm should beep.

5.4 KEYBOARD DATA CODES

Except as specified below, each key on the keyboard generates its own unique 8-bit code to the terminal controller. Table 2-2 lists the codes generated by each key.

The SHIFT, CTRL, and CAPS LOCK keys do not generate a code. They modify the codes of the alphanumeric keys. Refer to table 2-1 for the control functions of the alphanumeric keys.

5.5 INTERFACE SIGNALS

Table 5-1 lists the signals present at the pins of the keyboard connector. The connector is a type DAC-15P with hood; the keyboard cable is Belden type 9516 or Alpha type 5341, consisting of six twisted pairs shielded. (Some early units of the Models 5783 and 5784 have cables of Belden type 8747.)

Table 5-1. Interface Signals

Signal	Twisted Pair	Pin No.	Function
RDA-	1	1	Serial data from keyboard (<i>Brown</i>)
RRTN	1	9	Return
XMT-	2	11	Serial data to keyboard (<i>Black</i>)
XRTN	2	4	Return
+5VDC	3, 4	13, 14	+5V power
+15VDC	5	10	+15V power
-15VDC	5	2	-15V power
Signal ground	3, 4	6, 7	Power return
Chassis ground	6	8	Chassis (safety) ground
LOCAL	6	15	LOCAL MODE signal (on "A" and "B" models only)

5.6 ADDITIONAL INFORMATION

NOTE

The following information is included for reference only. Sanders Associates, Inc., assumes no responsibility for keyboards that have been repaired or modified by the user.

5.6.1 MODELS 5783, 5784

The bottom cover of the keyboard assembly is attached by four Phillips-head screws and washers. Figure 5-1 shows the keyboard assembly with bottom cover removed. The cable connector attaches to the card connector with two captive screws. The printed circuit card attaches to the keyboard assembly with four Phillips-head screws, secured with Glyptol. Refer to Amkey drawing 200-3034 in Section 6 for identification and location of components on the card.

On the component side of this card is a 28-pin connector that mates with the larger printed circuit card. This connector carries the X line strobes to the larger printed circuit card and carries the Y line returns to the component card. There are no components on the larger printed circuit card.

There is one adjustment on the component card: potentiometer R18 adjusts the clock rate of timer Z50. This adjustment is set at the factory for a frequency of 153.6 kHz (a period of 6.51 us). The nominal range of adjustment is from 151.6 kHz to 156.25 kHz (periods of 6.6 to 6.4 us). Refer to drawing 200-3034, sheet 2, the top right corner, for the location of this potentiometer.

5.6.2 MODELS 5783A, 5784A

The bottom cover of the keyboard assembly is attached by four Phillips-head screws and washers. Figure 5-2 shows the keyboard assembly with bottom cover removed. The cable connector attaches to the card connector with two captive screws. A ground lead from the cable connector is fastened under the adjacent mounting screw for the keying unit. A cable clamp is attached by another keying unit mounting screw.

To separate the keying unit and component board together from the top cover, remove four Phillips-head screws, lock washers, and flat washers. At the same time separate the ground wire and the cable clamp from the keying unit.

To separate the component board from the keying unit:

- a. Loosen two screws and separate the cable connector from its mating connector on the component board.
- b. Remove fourteen 2-56 Phillips-head screws and carefully lift component board away from keying unit. See figures 5-3 through 5-5.

Reassembly is the reverse of disassembly.

Refer to Amkey drawings 200-3274 and 200-3584 for identification and location of components.

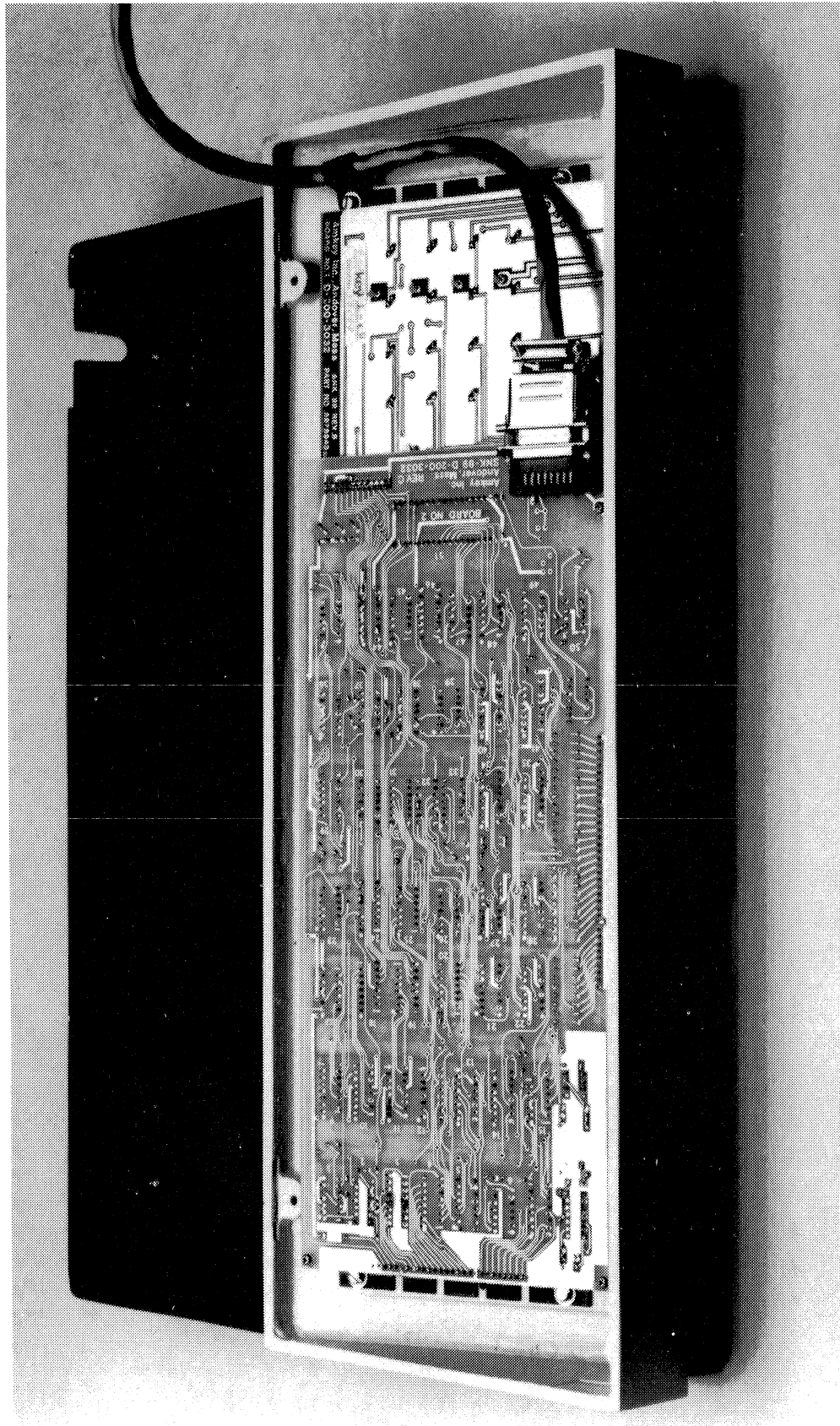
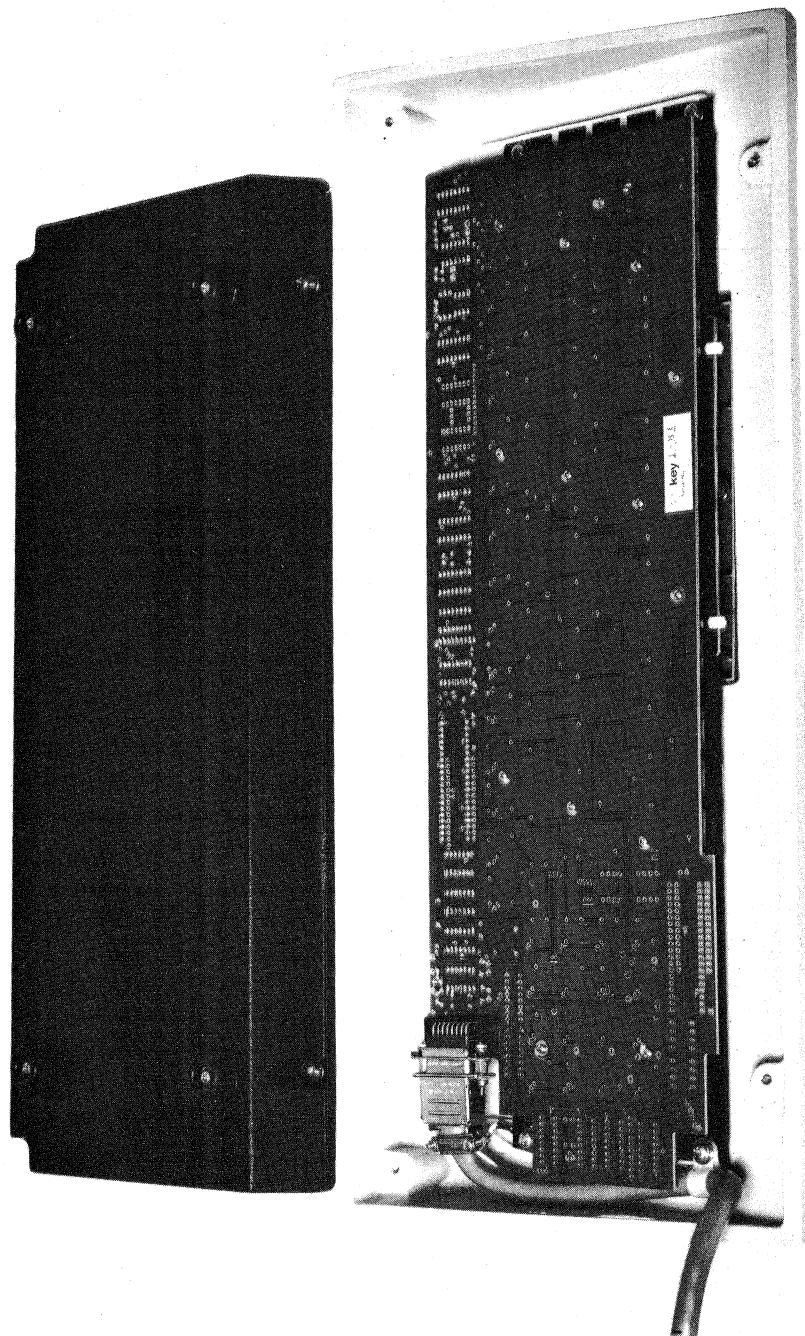
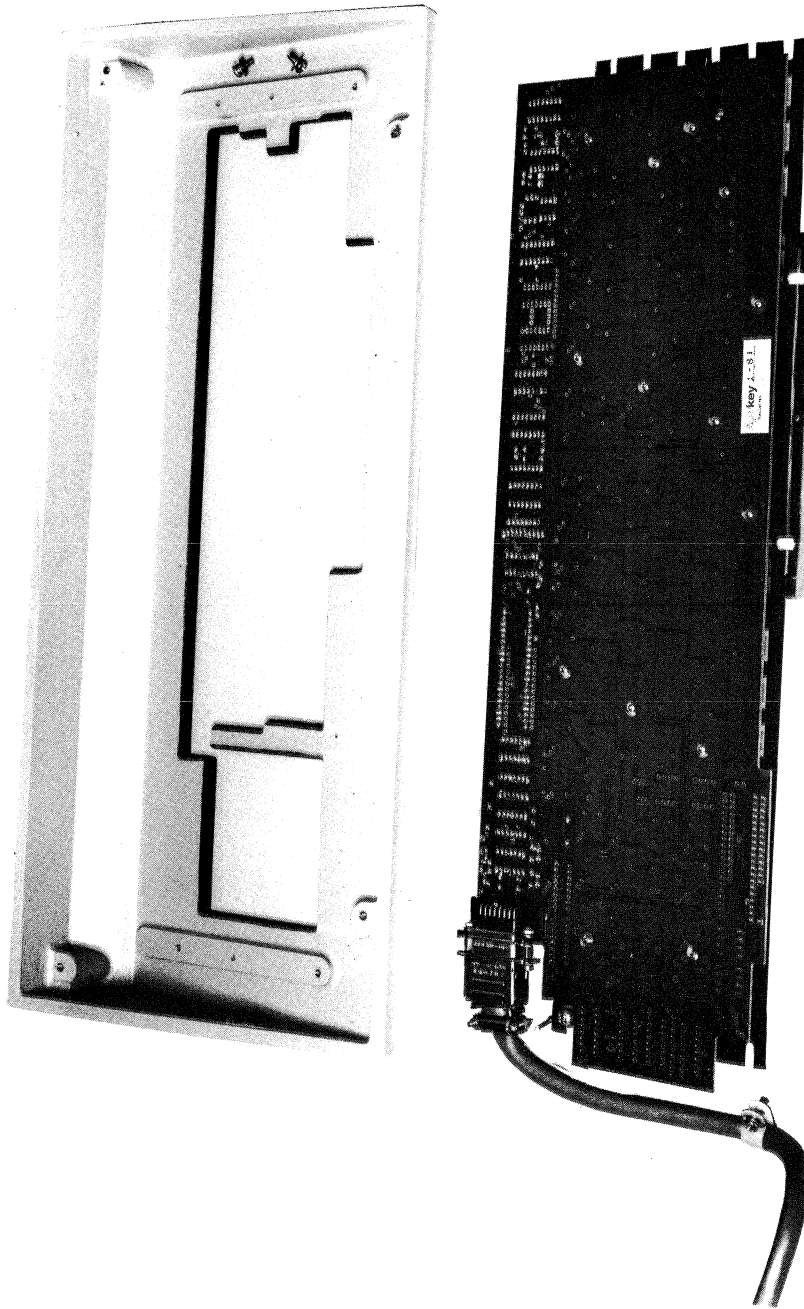


Figure 5-1. Models 5783, 5784 Keyboard, Cover Removed



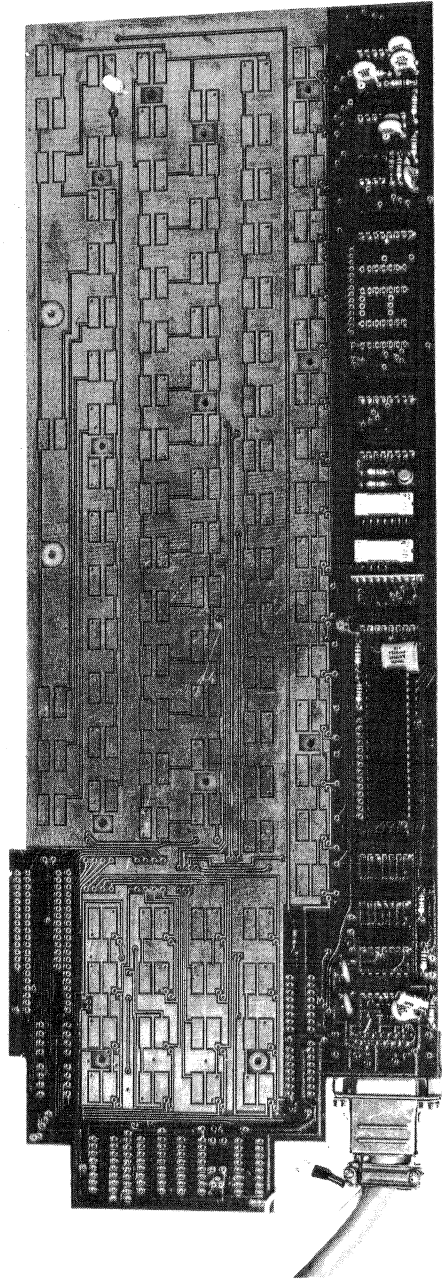
NEG 81-0786-006
H-79-0363-004

Figure 5-2. Model 5783A Keyboard, Cover Removed



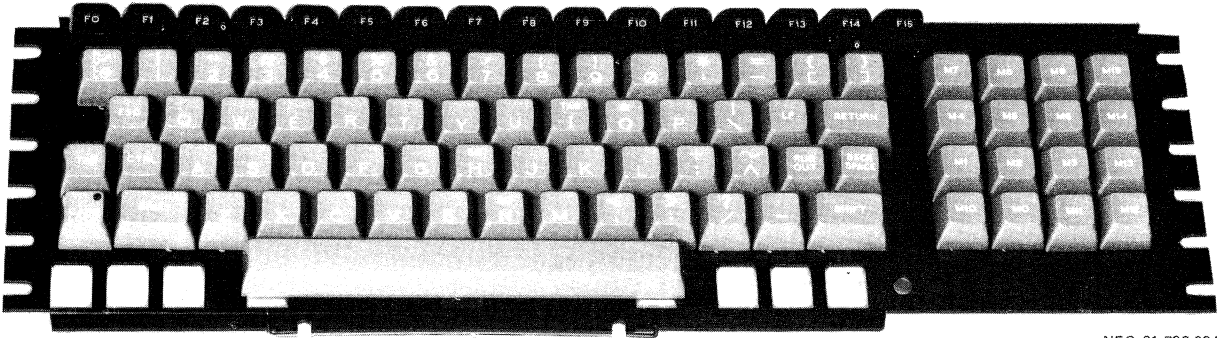
NEG 81-0798-001
H-79-0363-005

Figure 5-3. - Model 5783A, Component Board and Keying Unit



NEG 81-796-003
H-79-0363-006

Figure 5-4. Model 5783A Component Board



NEG 81-796-004



NEG 81-796-005
H-79-0363-007

Figure 5-5. Model 5783A Keying Unit



SECTION 6

DRAWINGS

6.1 SANDERS DRAWINGS

Outline Drawing Keyboard Assembly 5977078

6.2 AMKEY DRAWINGS, MODELS 5783, 5784

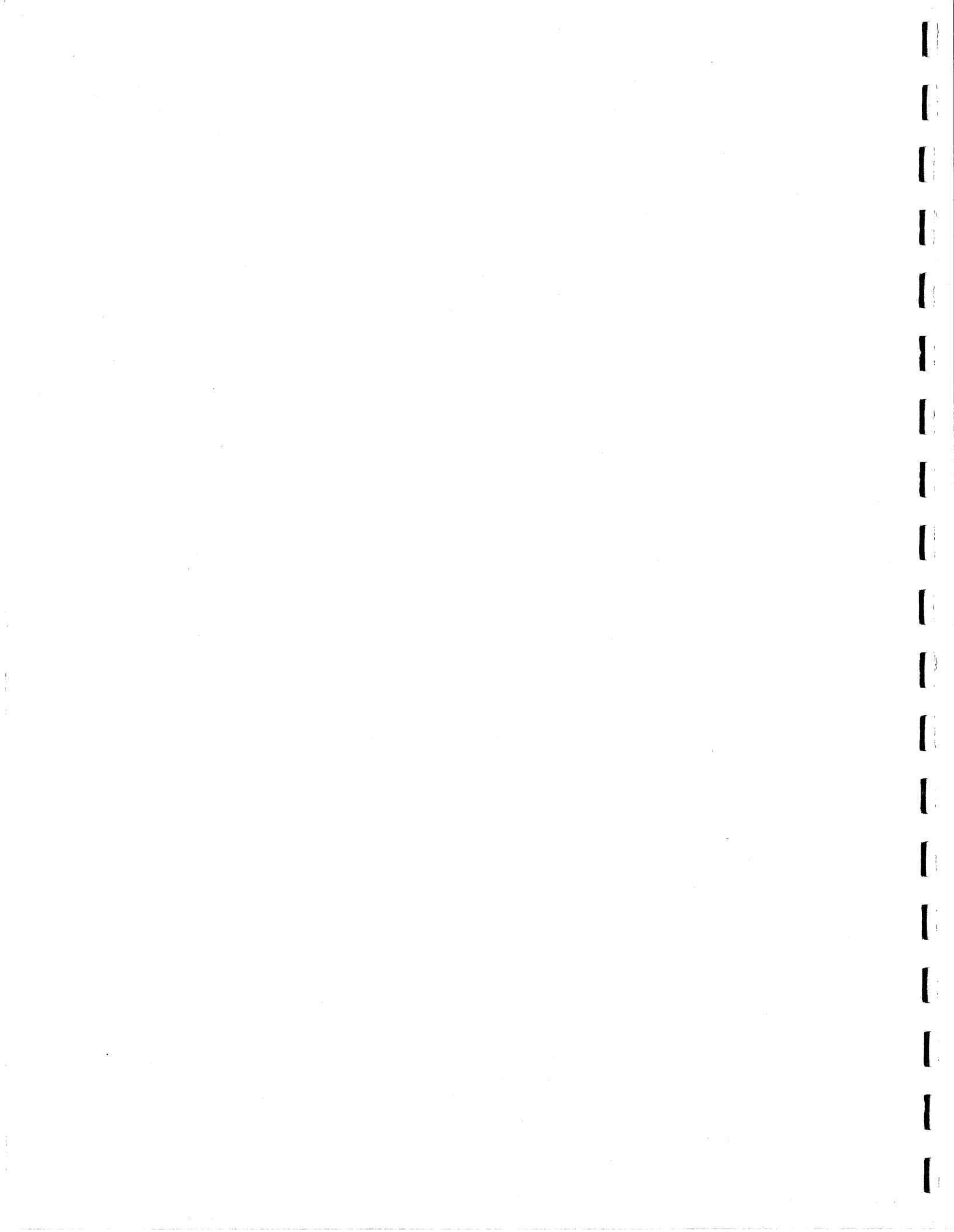
Schematic SNK-89 LED 200-3031
Assembly SNK-89 LED Board No. 1 200-3034 Sheet 1
Assembly SNK-89 LED Board No. 2 200-3034 Sheet 2

6.3 AMKEY DRAWINGS, MODELS 5783A, 5784A

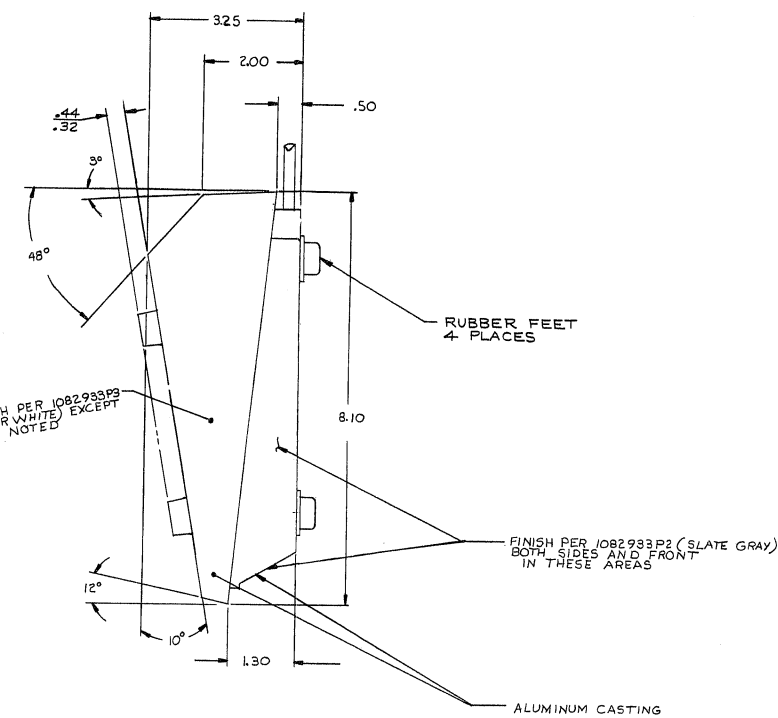
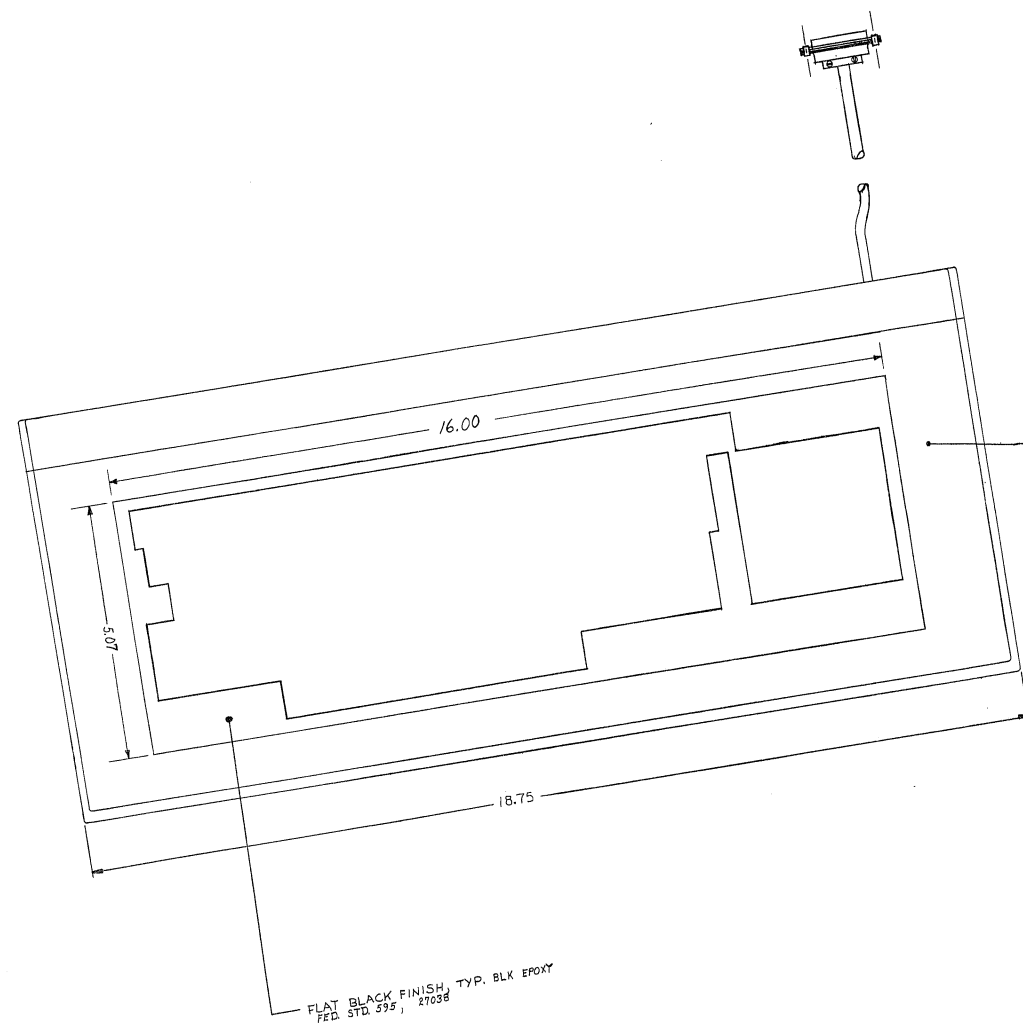
Schematic MPNK-89 200-3271
Assembly MPNK-89 (LED Version) 200-3274-1
Assembly MPNK-89 (Non-LED Version) 200-3274-2
Code Spec MPNK-89 200-3270-2

6.4 AMKEY DRAWINGS, MODELS 5783B, 5784B

Key Layout MPNK-89-1 200-3580-1
(Sanders P/N 5978943P3)
Key Layout MPNK-89-1 200-3580-2
(Sanders P/N 5977079P3)
Schematic MPNK-89-1 LED 200-3581
Assembly MPNK-89-1 200-3584-1
Assembly MPNK-89-1 (Non-LED Version) 200-3584-2



REVISIONS		DATE	APPROVED
ZONE	DESCRIPTION		
1-	REL FOR PRODUCTION	12/87	LL



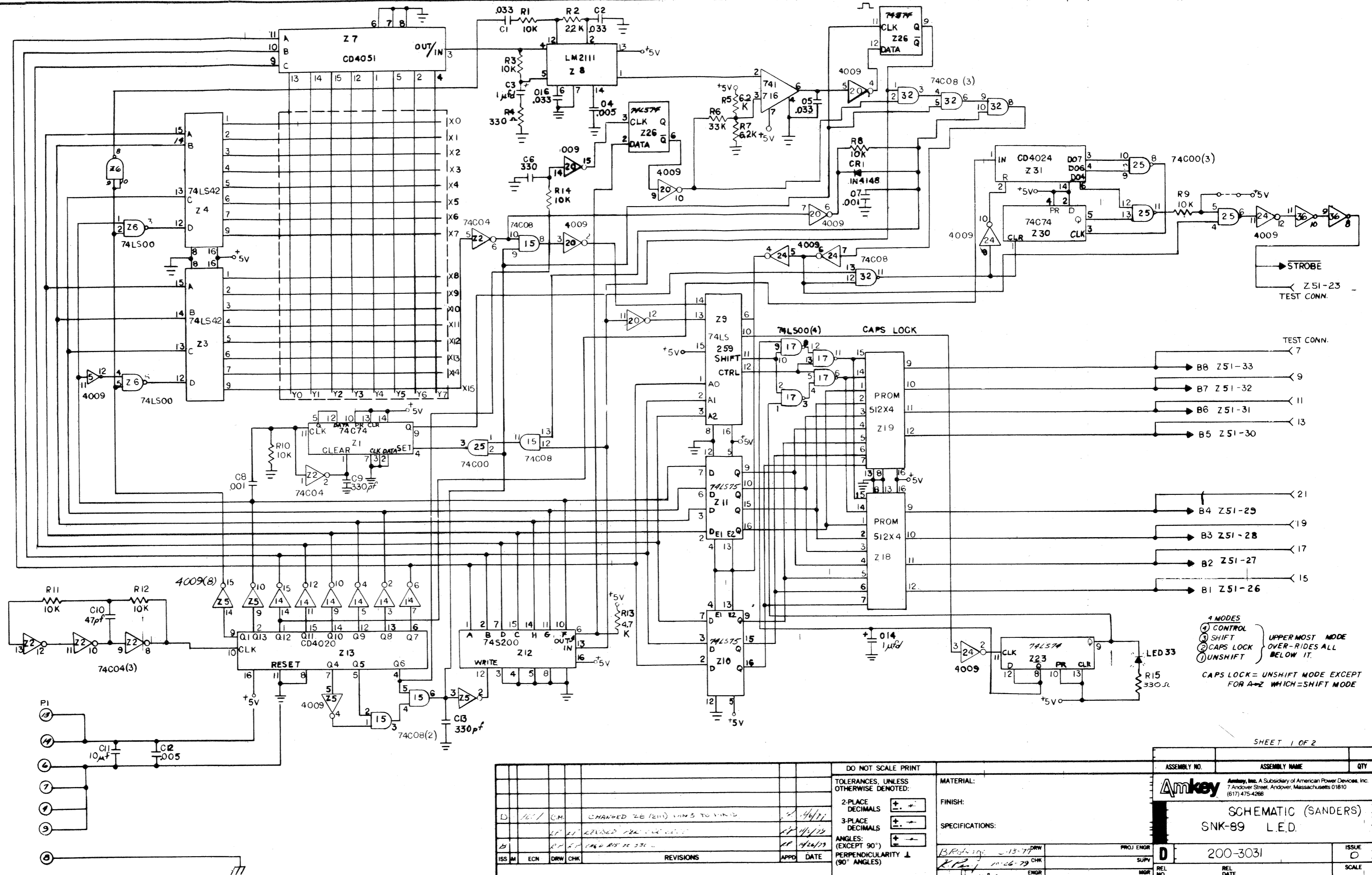
1. SHOP TOLERANCES AND DRAWING INTERPRETATION WITHIN 815002 SUPPLEMENT THIS DRAWING.
NOTES

REV	DATE	DESCRIPTION	BY	CHKD
1	12/87	REL FOR PRODUCTION	LL	

QTY	PER	ASSY	ITEM	SIZE	PART OR IDENTIFYING NO.	DESCRIPTION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES	DATE 12/10/87	DATE 5 SEP 77
XX DECIMAL	XXX DECIMAL	
= .03	= .001	
ANGLES		
= 2°		

5977079	GRA-7	PRODUCTION	DATE 9/10/87	DATE 9/10/87
NEXT ASSY	USED ON	CHANGE BY	CODE IDENT. NO.	DWG. NO.
			E 94117	5977078



4 MODES
 ① CONTROL
 ② SHIFT
 ③ CAPS LOCK
 ④ UNSHIFT

UPPER MOST MODE
 OVER-RIDES ALL
 BELOW IT.

CAPS LOCK = UNSHIFT MODE EXCEPT
 FOR A-Z WHICH = SHIFT MODE

ISS	NO	ECN	DRW	CHK	REVISIONS	APPR	DATE
D	101	CM			CHANGED Z6 (211) VIMS TO VIMD		11/11/77
B	101	CM			REVISED PARTS LIST		11/11/77
					REVISED PARTS LIST		11/11/77

DO NOT SCALE PRINT

TOLERANCES, UNLESS OTHERWISE DENOTED:

2-PLACE DECIMALS ± .01

3-PLACE DECIMALS ± .001

ANGLES: (EXCEPT 90°) ± .1°

PERPENDICULARITY ⊥ (90° ANGLES)

MATERIAL:

FINISH:

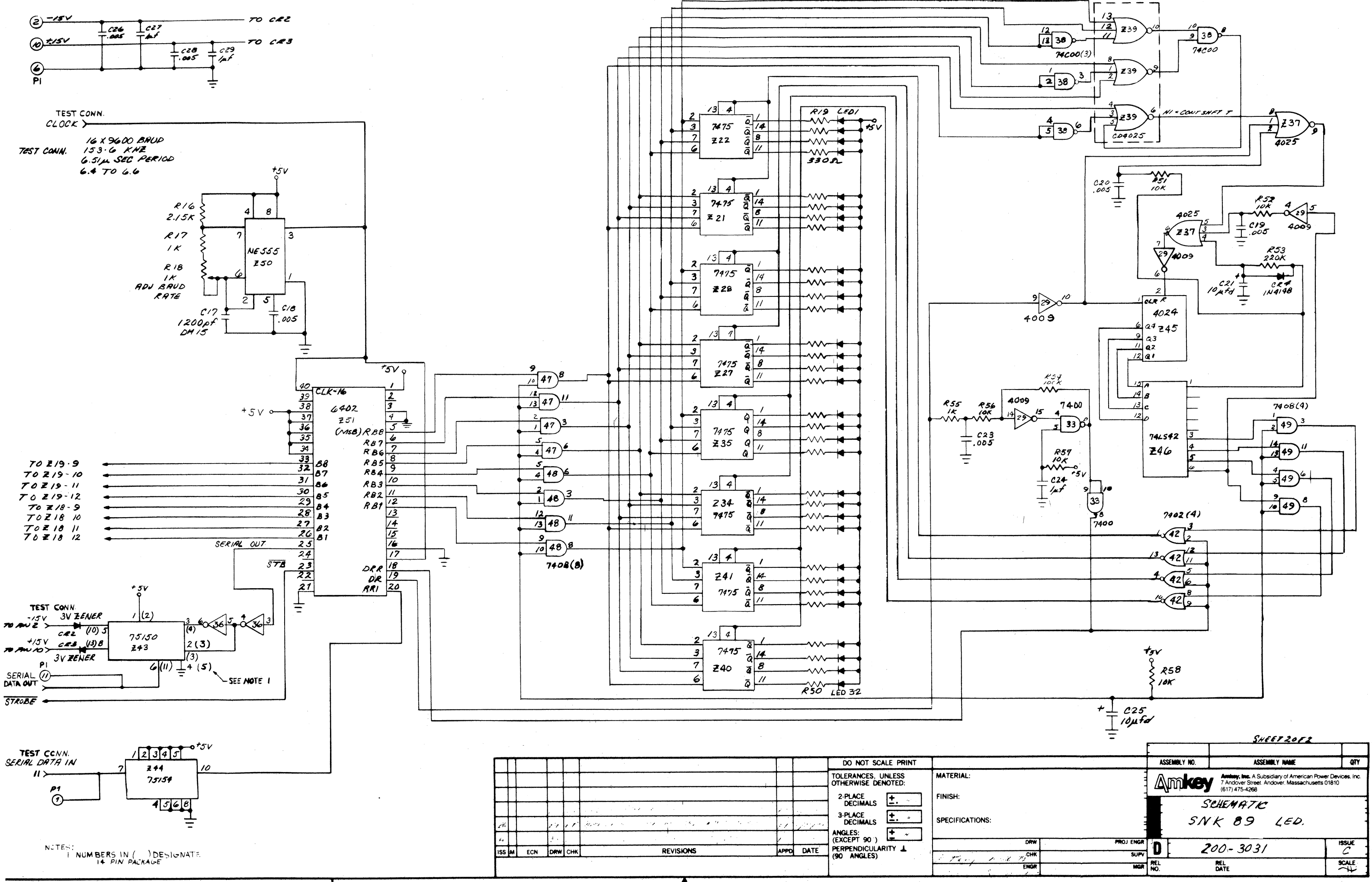
SPECIFICATIONS:

B. Roberts 11-13-77 DRW

Z. Sanders 11-26-77 CHK

11-26-77 ENGR

ASSEMBLY NO.	ASSEMBLY NAME	QTY
	Amkey Inc. A Subsidiary of American Power Devices, Inc. 7 Andover Street, Andover, Massachusetts 01810 (617) 475-4268	
	SCHMATIC (SANDERS)	
	SNK-89 L.E.D.	
REL NO.	REL DATE	SCALE
D		
200-3031		



TEST CONN. CLOCK
 TEST CONN. 16 X 9600 BAUD
 153.6 KHZ
 6.51μ SEC PERIOD
 6.4 TO 6.6

TO Z19-9
 TO Z19-10
 TO Z19-11
 TO Z19-12
 TO Z18-9
 TO Z18-10
 TO Z18-11
 TO Z18-12

TEST CONN. -15V 3V ZENER
 TO ANZ TO CR2 (10) 5
 +15V CR3 (13) 8
 TO ANZ TO CR3 (13) 8
 P1
 SERIAL DATA OUT
 STROBE

TEST CONN. SERIAL DATA IN
 P1

NOTES:
 1. NUMBERS IN () DESIGNATE 14 PIN PACKAGE

ISS	ECN	DRW	CHK	REVISIONS	APPD	DATE

DO NOT SCALE PRINT
 TOLERANCES, UNLESS OTHERWISE DENOTED:
 2-PLACE DECIMALS ±
 3-PLACE DECIMALS ±
 ANGLES: (EXCEPT 90°) ±
 PERPENDICULARITY ⊥ (90° ANGLES)

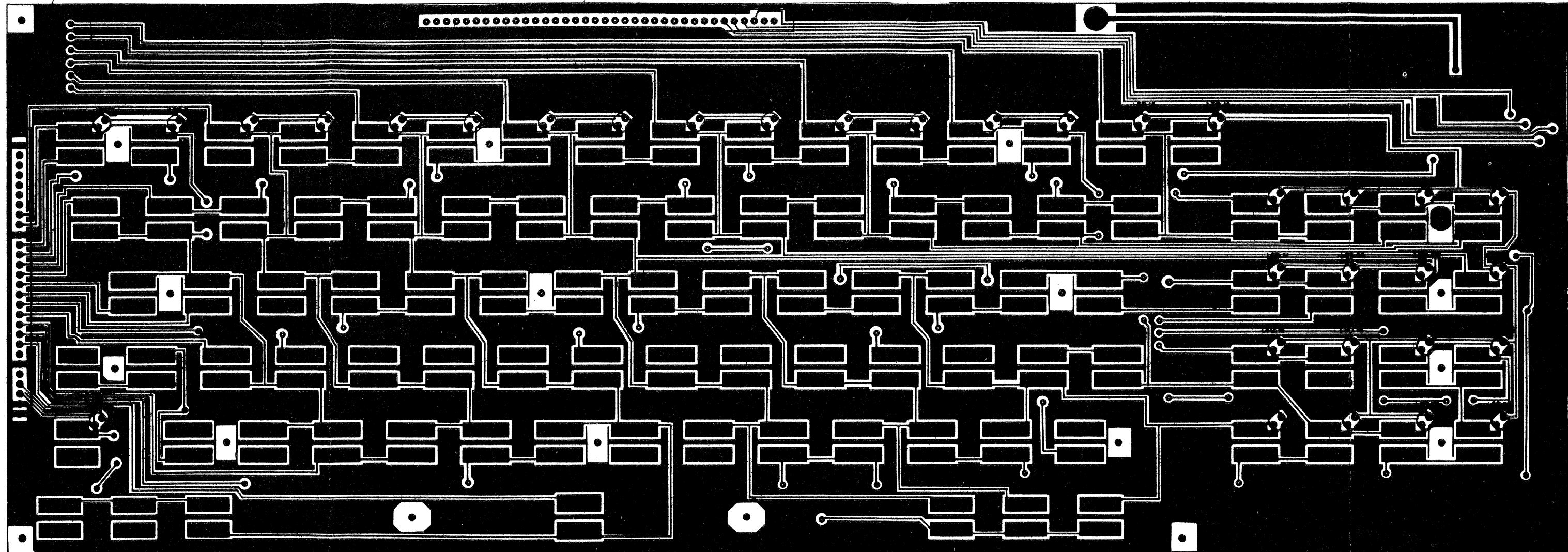
MATERIAL:
 FINISH:
 SPECIFICATIONS:

SHEET 2 OF 2

ASSEMBLY NO.	ASSEMBLY NAME	QTY
SCHEMATIC SNK 89 LED.		
DRW	PROJ ENGR	ISSUE
CHK	SUPV	C
ENGR	MGR	SCALE
REL NO.	REL DATE	REL DATE
200-3031		

CONNECTOR 28 PIN FEMALE
A.P. PRODUCTS
MOUNTED ON BOTTOM OF P.C. BOARD

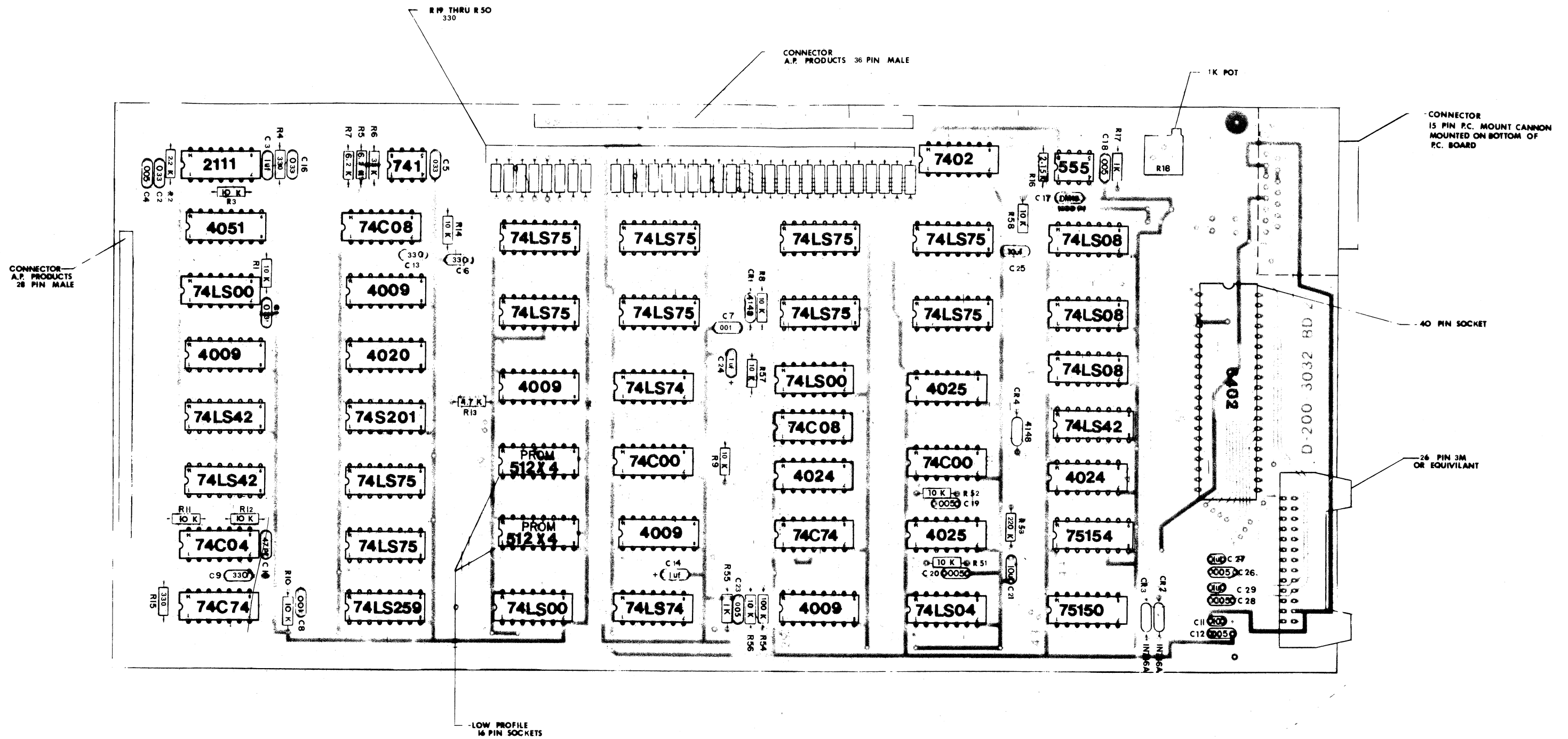
CONNECTOR 36 PIN FEMALE
A.P. PRODUCTS
MOUNTED ON BOTTOM OF P.C. BOARD



SNK89 1042

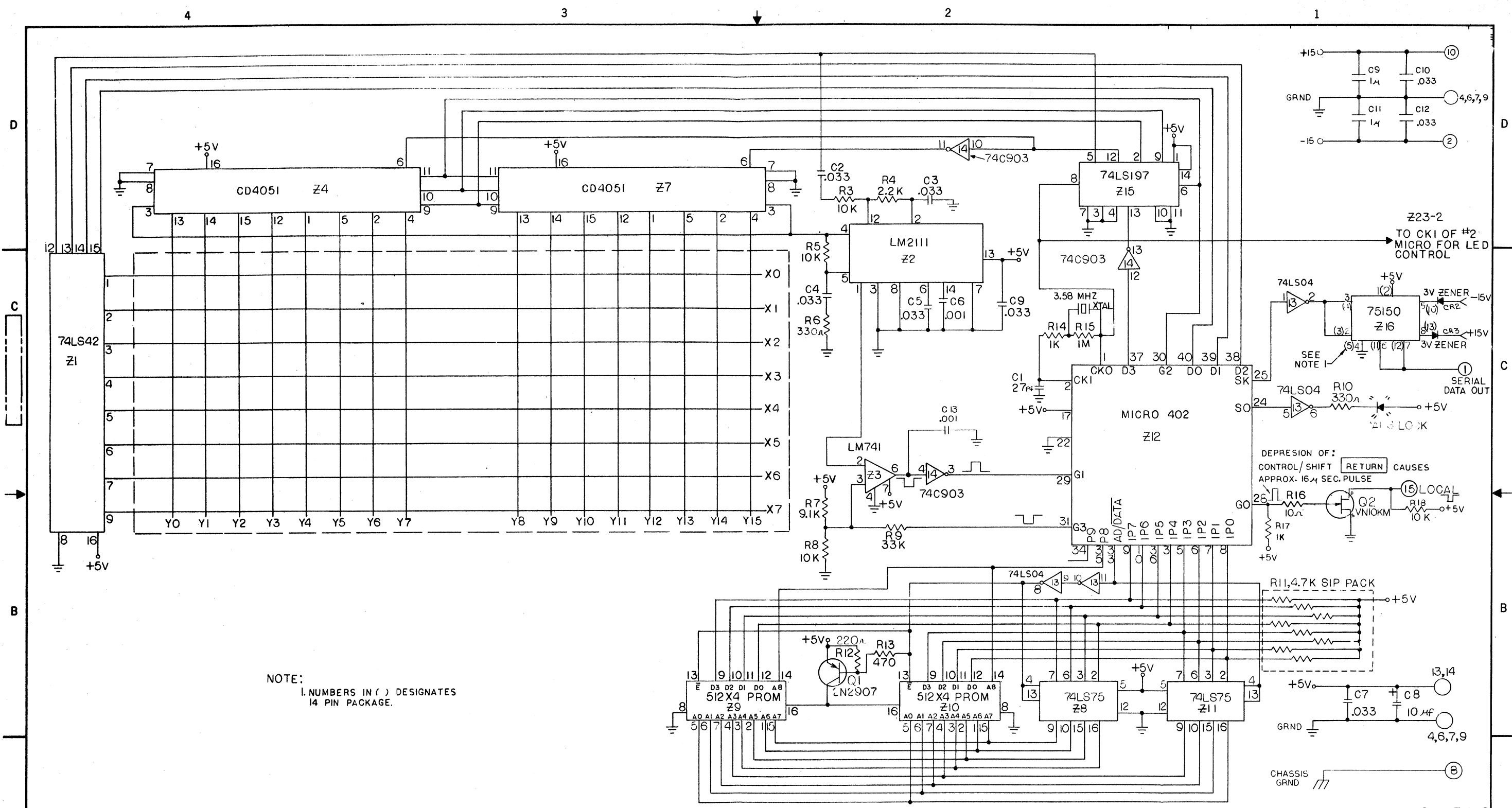
Amkey Amkey, Inc. A Subsidiary of American Power Devices, Inc.
7 Andover Street, Andover, Massachusetts 01810
(617) 475-4268

DO NOT SCALE PRINT TOLERANCES, UNLESS OTHERWISE DENOTED: 2-PLACE DECIMALS: ± .01 3-PLACE DECIMALS: ± .001 ANGLES: (EXCEPT 90°) ± .1° PERPENDICULARITY: ± .1 (90° ANGLES)	MATERIAL:	ASSEMBLY		ISSUE
	FINISH:	SNK89 LED BOARD NO. 1		SCALE
SPECIFICATIONS:	D D200-3034		REL. NO.	REL. DATE
	DESIGNER	DATE	REL. NO.	REL. DATE
	CHKD	DATE	REL. NO.	REL. DATE
	ENGR	DATE	REL. NO.	REL. DATE



SHEET 2 of 2

MATERIAL:		Amkey Amkey, Inc. A Subsidiary of American Power Devices, Inc. 7 Andover Street, Andover, Massachusetts 01810 (617) 475-4268	
FINISH:		ASSEMBLY BOARD 2 SNK-89-LED.	
SPECIFICATION:		D 200-3034	
DRW	PROJ ENGR	REL NO.	REL DATE
CHK	SUPV		
ENGR	MGR		SCALE



NOTE:
1. NUMBERS IN () DESIGNATES
14 PIN PACKAGE.

ISS	M	ECN	DRW	CHK	REVISIONS	APPD	DATE

DO NOT SCALE PRINT
TOLERANCES, UNLESS OTHERWISE DENOTED:
2-PLACE DECIMALS ±.
3-PLACE DECIMALS ±.
ANGLES: (EXCEPT 90°) ±.
PERPENDICULARITY ⊥ (90° ANGLES)

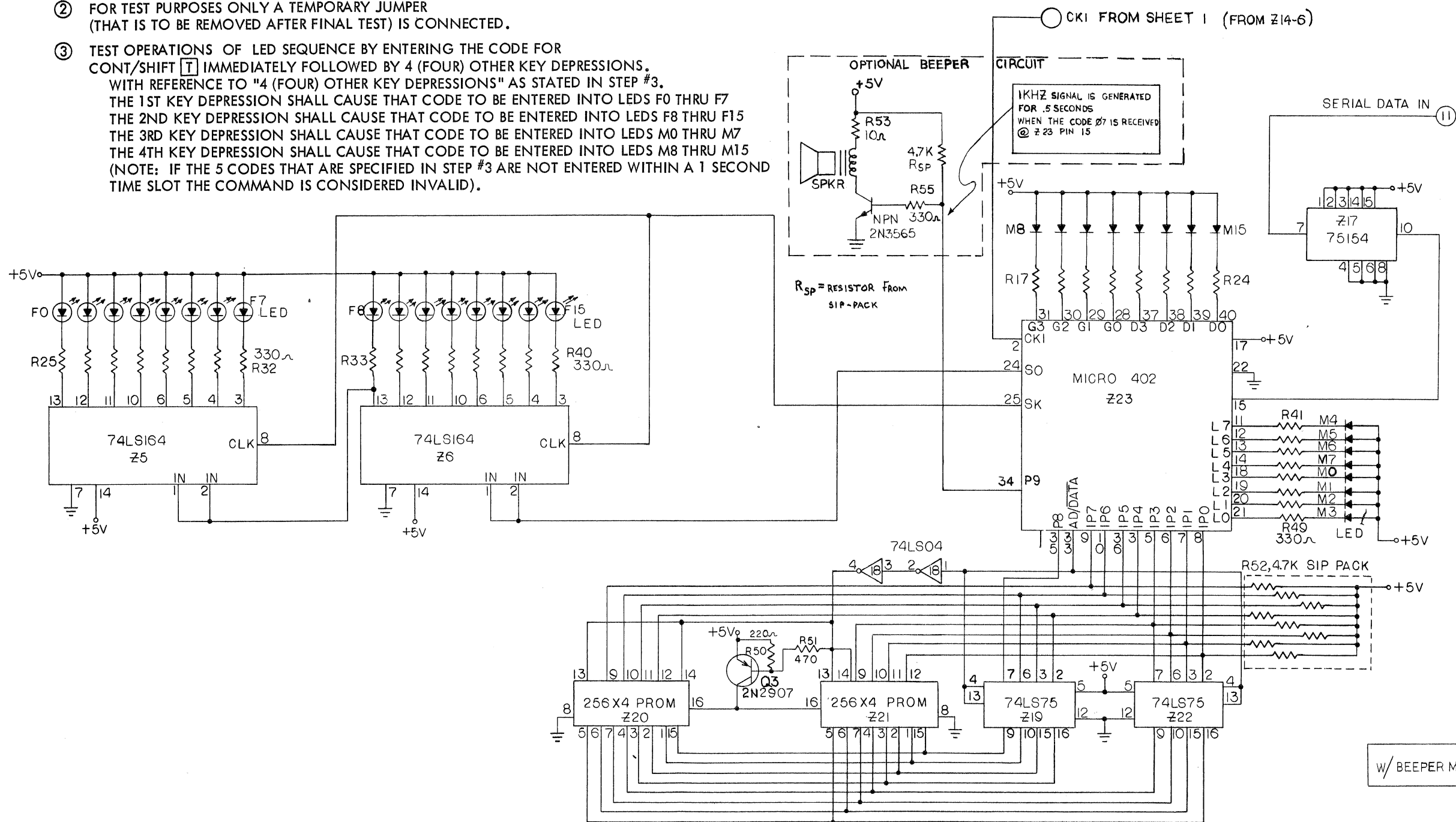
MATERIAL:
FINISH:
SPECIFICATIONS:
77 Collins Drive
PROJ ENGR
SUPV
ENGR
MGR

ASSEMBLY NO.	ASSEMBLY NAME	QTY
Amkey Amkey, Inc. A Subsidiary of American Power Devices, Inc. 7 Andover Street, Andover, Massachusetts 01810 (617) 475-4268		
SCHEMATIC (SANDERS) MPNK-89		
200-3271-1	REL DATE	ISSUE F
		SCALE

DRAWING 40-107-3825

LED TEST SEQUENCE

- ① BOARD POWERS UP WITH ALL LEDS OFF.
- ② FOR TEST PURPOSES ONLY A TEMPORARY JUMPER (THAT IS TO BE REMOVED AFTER FINAL TEST) IS CONNECTED.
- ③ TEST OPERATIONS OF LED SEQUENCE BY ENTERING THE CODE FOR CONT/SHIFT [T] IMMEDIATELY FOLLOWED BY 4 (FOUR) OTHER KEY DEPRESSIONS. WITH REFERENCE TO "4 (FOUR) OTHER KEY DEPRESSIONS" AS STATED IN STEP #3. THE 1ST KEY DEPRESSION SHALL CAUSE THAT CODE TO BE ENTERED INTO LEDS F0 THRU F7 THE 2ND KEY DEPRESSION SHALL CAUSE THAT CODE TO BE ENTERED INTO LEDS F8 THRU F15 THE 3RD KEY DEPRESSION SHALL CAUSE THAT CODE TO BE ENTERED INTO LEDS M0 THRU M7 THE 4TH KEY DEPRESSION SHALL CAUSE THAT CODE TO BE ENTERED INTO LEDS M8 THRU M15 (NOTE: IF THE 5 CODES THAT ARE SPECIFIED IN STEP #3 ARE NOT ENTERED WITHIN A 1 SECOND TIME SLOT THE COMMAND IS CONSIDERED INVALID).



W/ BEEPER MODIFICATION

DO NOT SCALE PRINT		ASSEMBLY NO.		ASSEMBLY NAME		QTY	
TOLERANCES, UNLESS OTHERWISE DENOTED:		MATERIAL:		FINISH:		SPECIFICATIONS:	
2-PLACE DECIMALS ±		MATERIAL:		FINISH:		SPECIFICATIONS:	
3-PLACE DECIMALS ±		MATERIAL:		FINISH:		SPECIFICATIONS:	
ANGLES: (EXCEPT 90°) ±		MATERIAL:		FINISH:		SPECIFICATIONS:	
PERPENDICULARITY ⊥ (90° ANGLES)		MATERIAL:		FINISH:		SPECIFICATIONS:	
ISS	ECN	DRW	CHK	REVISIONS	APPD	DATE	
				M. Collins Motter		DRW	PROJ ENGR
						CHK	SUPV
						ENGR	MGR
						REL NO.	REL DATE
						SCALE	

Amkey, Inc. A Subsidiary of American Power Devices, Inc.
7 Andover Street, Andover, Massachusetts 01810
(617) 475-4268

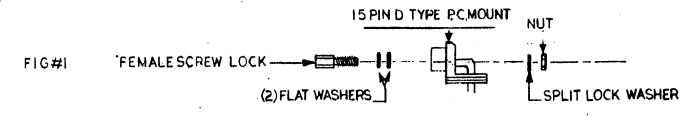
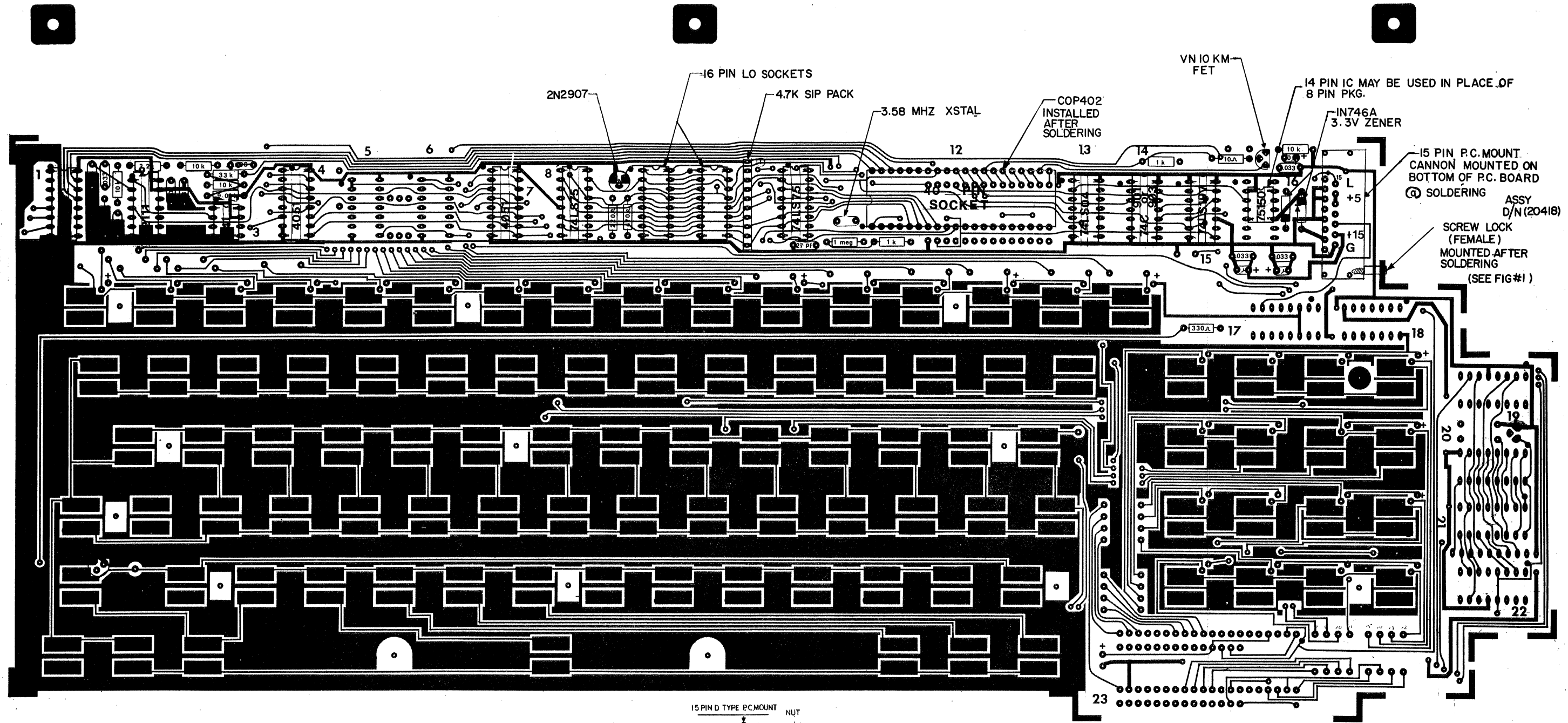
Amkey

SCHEMATIC (SANDERS)
MPNK-89

200-3271-2

ISSUE E

DRAWING 40-107-2026



DRAWING 40-107 30225-2

ISS	M	ECN	DRW	CHK	REVISIONS	APPD	DATE
C		1431			Z12 Socket polarity corrected		4-17-81
B		1412			socket polarity changed Z12		4-10-81
A		1368	LD		UPDATED ADDED INFO		

DO NOT SCALE PRINT

TOLERANCES, UNLESS OTHERWISE DENOTED:

2-PLACE DECIMALS $\pm .$

3-PLACE DECIMALS $\pm .$

ANGLES: (EXCEPT 90°) \perp

PERPENDICULARITY \perp (90° ANGLES)

ASSEMBLY NO.	ASSEMBLY NAME	QTY
Amkey	Amkey, Inc. A Subsidiary of American Power Devices, Inc. 7 Andover Street, Andover, Massachusetts 01810 (617) 475-4288	
ASSEMBLY (NON LED VERSION) MPNK 89 (SANDERS)		
D	200-3274-2	ISSUE C
REL NO.	REL DATE	SCALE

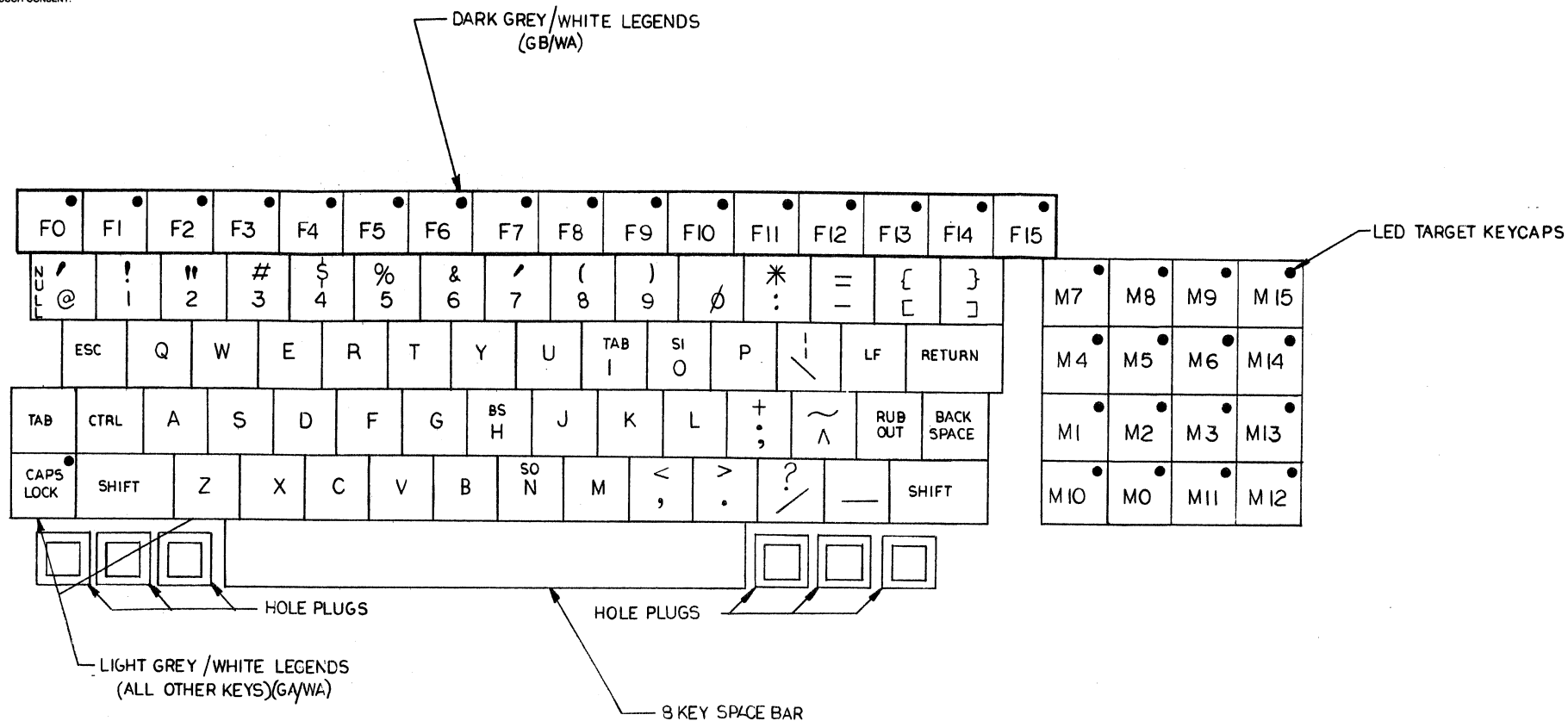
4

3

2

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ISS	REV	DATE	REVISIONS	APP'D	DATE



NORMAL KEYCAPS
 STRAIGHT SHAFTS P/N 100-0091-1
 0017 SPRINGS P/N 100-0038 *
 GREY SPONGES P/N 300-2001
 O ADAPTERS P/N 100-0152 *

* LED KEYCAPS
 0016 SPRINGS
 NO ADAPTER INSTALLED

SANDERS P/N-597843-P3

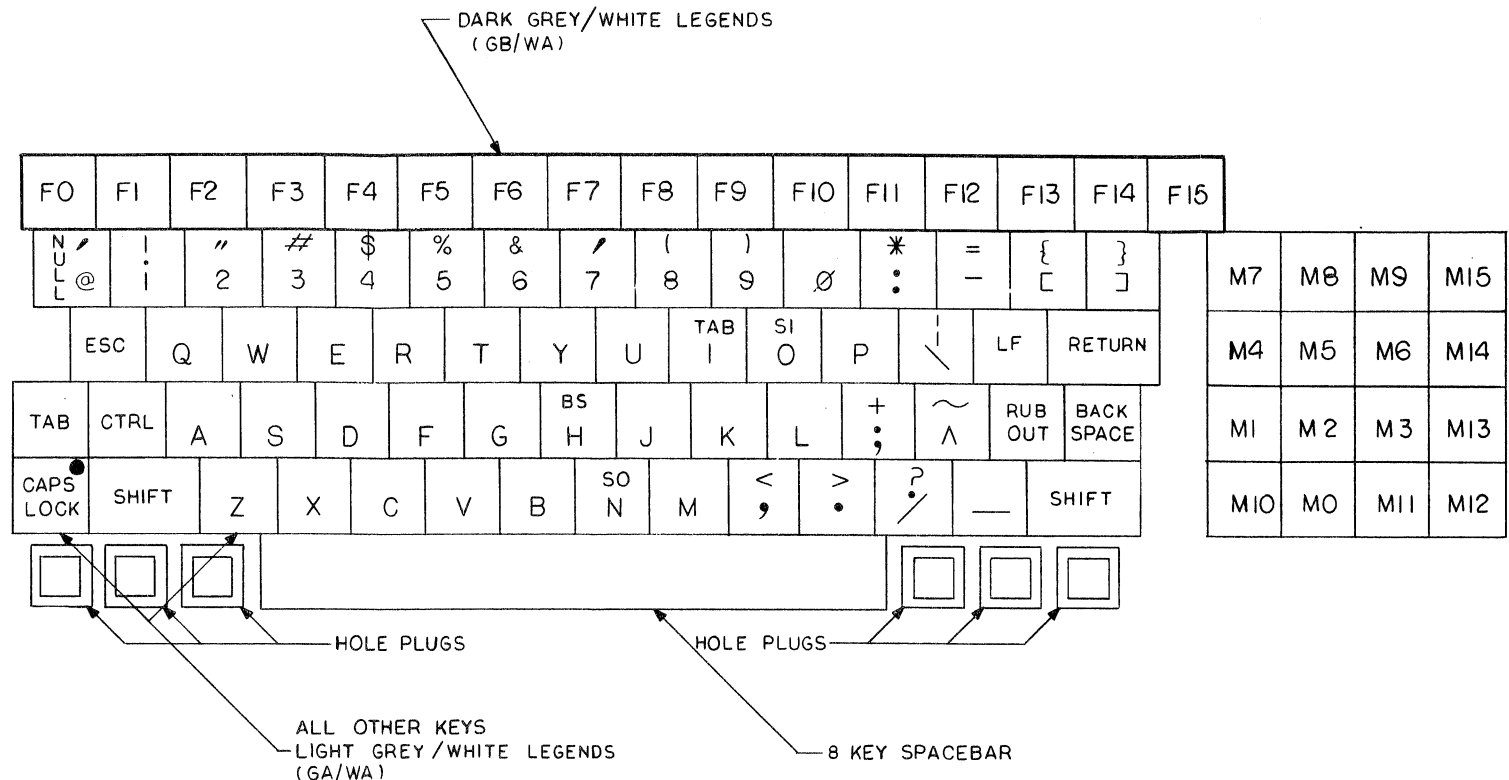
DO NOT SCALE PRINT	
TOLERANCES, UNLESS OTHERWISE DENOTED:	MATERIAL:
2-PLACE DECIMALS <input type="checkbox"/> ±	FINISH:
3-PLACE DECIMALS <input type="checkbox"/> ±	SPECIFICATIONS:
ANGLES: (EXCEPT 90°) <input type="checkbox"/> ±	L.A.JONCAS DRW
PERPENDICULARITY <input type="checkbox"/> ⊥ (90° ANGLES)	CHK
	ENGR
	PROJ ENGR
	SUPV
	MGR

LED VERSION		QTY
ASSEMBLY NO.	ASSEMBLY NAME	
Amkey, Inc. A Subsidiary of American Power Devices, Inc. 220 Balladvale St. Wilmington, Massachusetts 01887 (617) 658-7800		
KEY LAYOUT MPNK-89-1		
C	200-3580-1	ISSUE
REL NO.	REL DATE	SCALE

AMKEY, INC., WILMINGTON, MA 01887

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ISS	CHK	DATE	REV	DATE



NOTE: ON LED KEYCAPS THERE ARE NO ADAPTERS AND 0016 SPRINGS

- NOTES:
- NORMAL KEYCAPS
 - STRAIGHT SHAFTS P/N 100-0091-1
 - 0017 SPRINGS P/N 100-0038
 - GREY SPONGES P/N 300-2001
 - 0" ADAPTERS P/N 100-0152

SANDERS
MPNK-89-1

SANDERS P/N 5977079-P3

NON-LED VERSION		
ASSEMBLY NO.	ASSEMBLY NAME	QTY

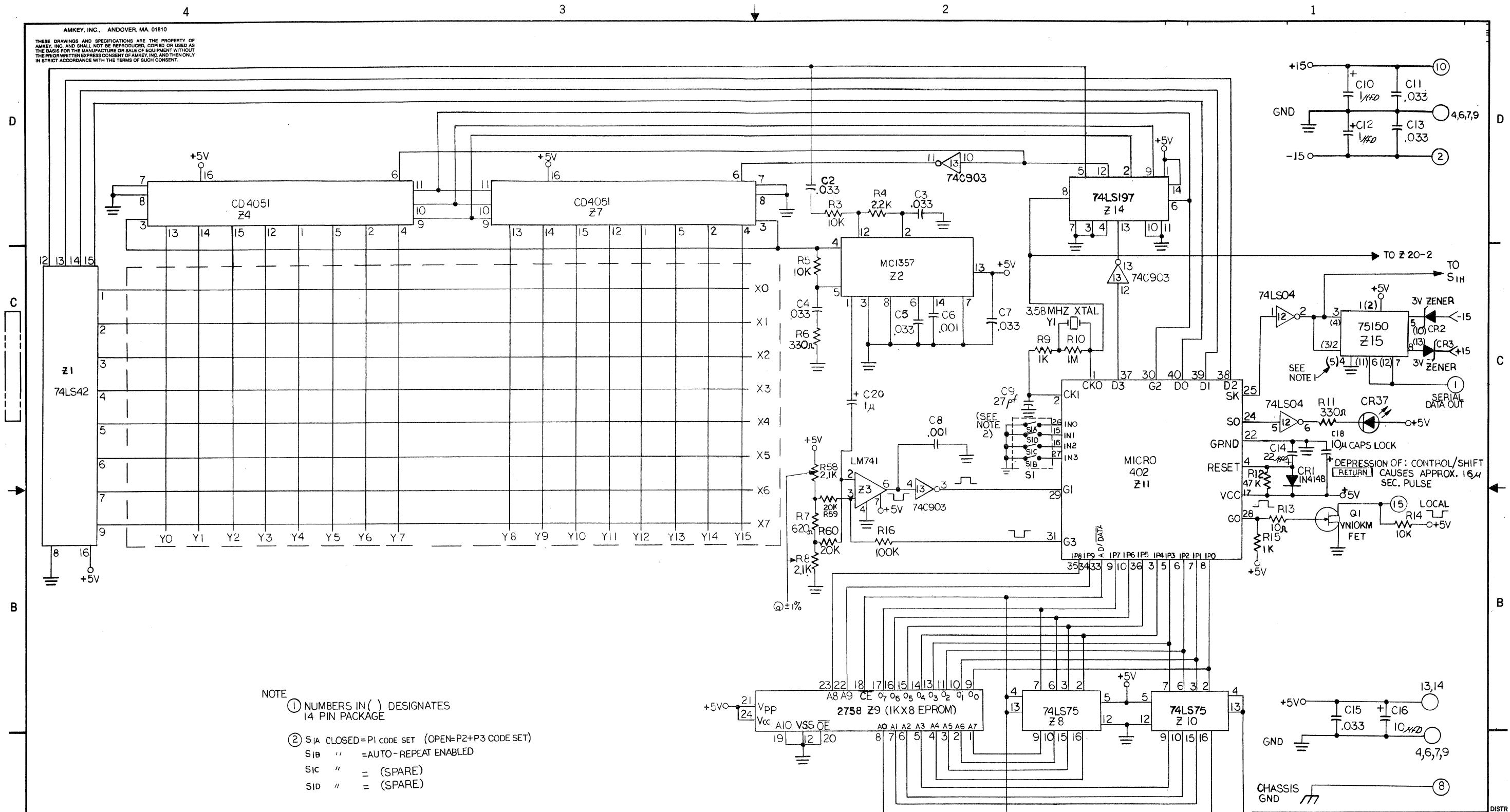
Amkey Amkey, Inc. A Subsidiary of American Power Devices, Inc.
220 Balladvale St. Wilmington, Massachusetts 01887
(617) 658-7800

KEY LAYOUT
MPNK-89-1

DO NOT SCALE PRINT			
TOLERANCES, UNLESS OTHERWISE DENOTED:		MATERIAL:	
2-PLACE DECIMALS	$\pm .$	FINISH:	
3-PLACE DECIMALS	$\pm .$	SPECIFICATIONS:	
ANGLES: (EXCEPT 90°)	\pm	M.C. MOTTRAM	DRW
PERPENDICULARITY (90° ANGLES)	\perp		PROJ ENGR
			SUPV
			ENGR
			MGR
			REL NO.
			REL DATE
			SCALE

C	200-3580-2	ISSUE
		SCALE

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- NOTE
- ① NUMBERS IN () DESIGNATES 14 PIN PACKAGE
 - ② S1A CLOSED=P1 CODE SET (OPEN=P2+P3 CODE SET)
 S1B " =AUTO-REPEAT ENABLED
 S1C " = (SPARE)
 S1D " = (SPARE)

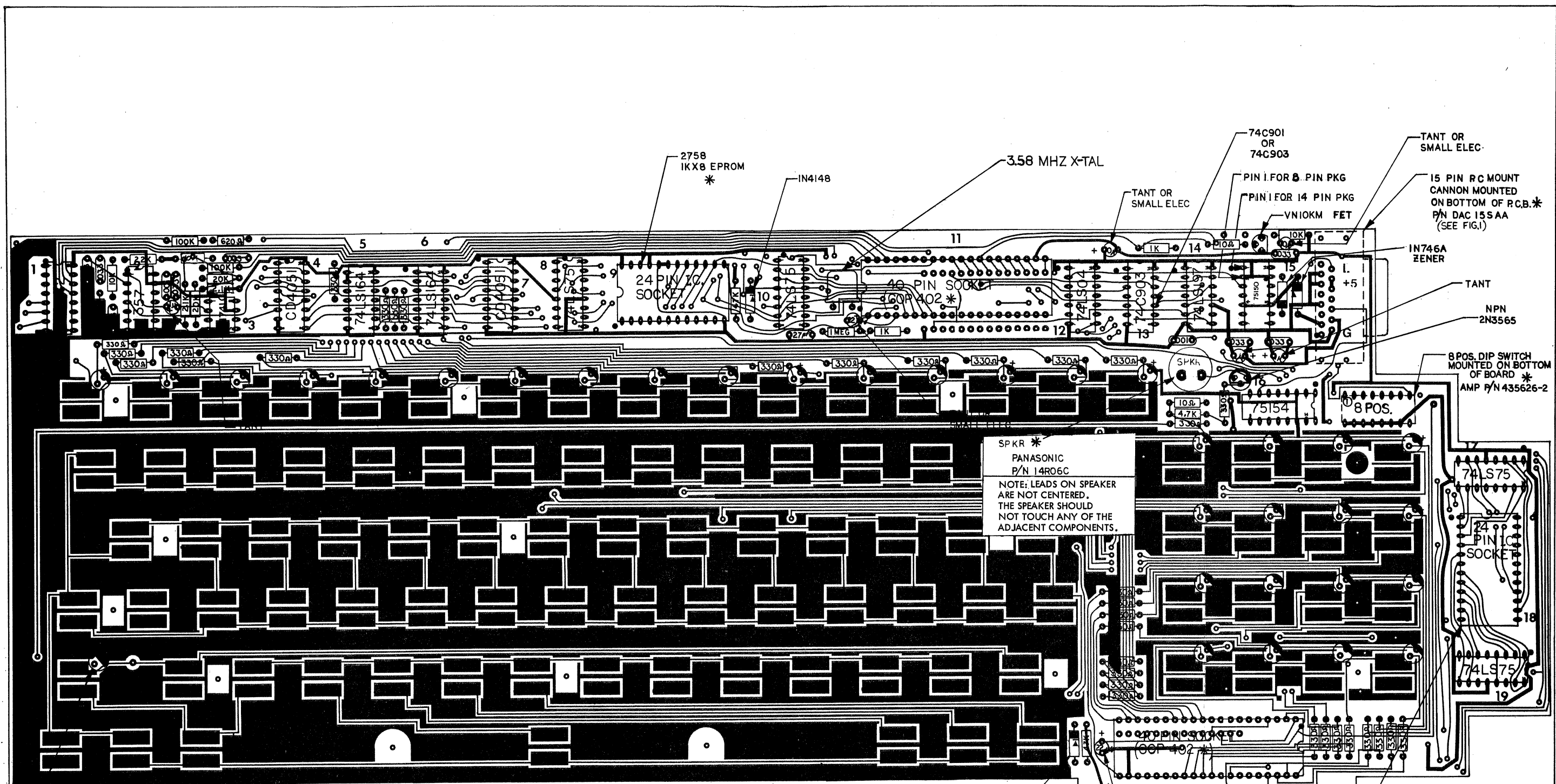
ISS	M	ECN	DRW	CHK	REVISIONS	APPD	DATE
B		1691	L.D.		SEE MARKED UP PRINT		7/1/81
A			L.J.		REMOVE ALL CHANGES TO THIS PRINT		6/1/81

DO NOT SCALE PRINT
 TOLERANCES, UNLESS OTHERWISE DENOTED:
 2-PLACE DECIMALS ±.
 3-PLACE DECIMALS ±.
 ANGLES: (EXCEPT 90°) ±.
 PERPENDICULARITY ⊥ (90° ANGLES)

ASSEMBLY NO.		ASSEMBLY NAME		QTY
		SANDERS		
Amkey, Inc. A Subsidiary of American Power Devices, Inc. 7 Andover Street, Andover, Massachusetts 01810 (617) 475-4268				
SCHEMATIC (SANDERS)				
MPNK 89-1 L.E.D.				
L. DOWD		DRW	PROJ ENGR	
		CHK	SUPV	
		ENGR	MGR	
REL NO.		REL DATE		ISSUE
D 200-3581-1				B
				SCALE

DRAWING 40107 36205-2

DISTR TO



SPKR *
 PANASONIC
 P/N 14R06C
 NOTE: LEADS ON SPEAKER
 ARE NOT CENTERED.
 THE SPEAKER SHOULD
 NOT TOUCH ANY OF THE
 ADJACENT COMPONENTS.

* INSTALLED
 AFTER SOLDERING

TANT = TANTALUM
 ELEC = ELECTROLYTIC

RED(CLEAR) L.E.D.
 ESR-5501

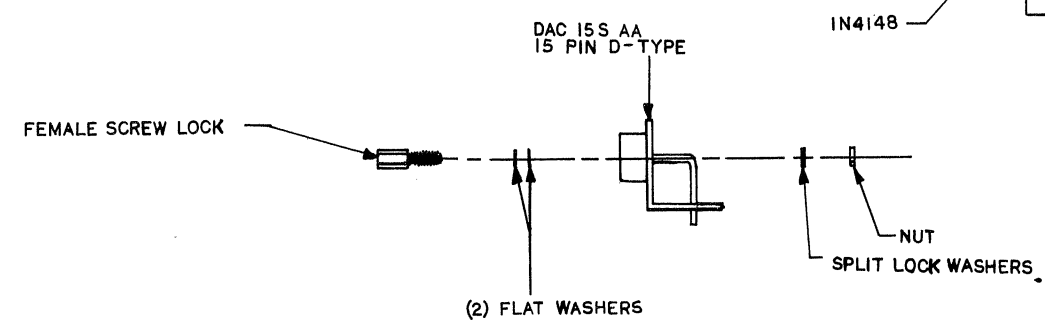
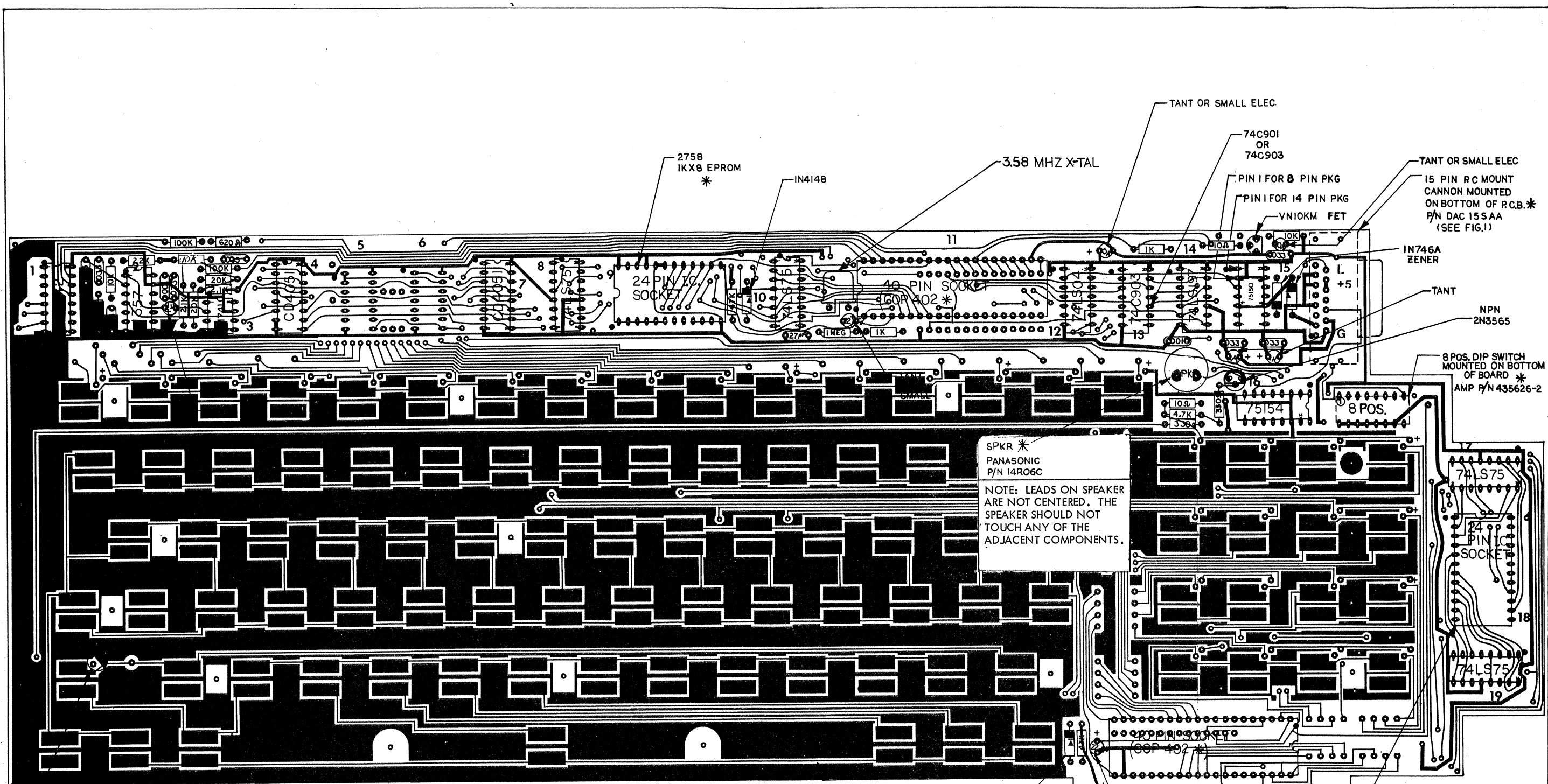


FIG. 1

MATERIAL:		Amkey Amkey, Inc. A Subsidiary of American Power Devices, Inc. 7 Andover Street, Andover, Massachusetts 01810 (617) 475-4266	
FINISH:		ASSEMBLY	
SPECIFICATIONS:		MPNK-89-1	
DRW <i>S. David</i>	PROJ ENGR	C	200-3584-1
CHK	SUPP	REL NO.	REL DATE
ENGR	MGR	SCALE	ISSUE A



* = INSTALLED AFTER SOLDERING

TANT= TANTALUM
ELEC= ELECTROLYTIC

RED(CLEAR) L.E.D.
ESBR- 5501

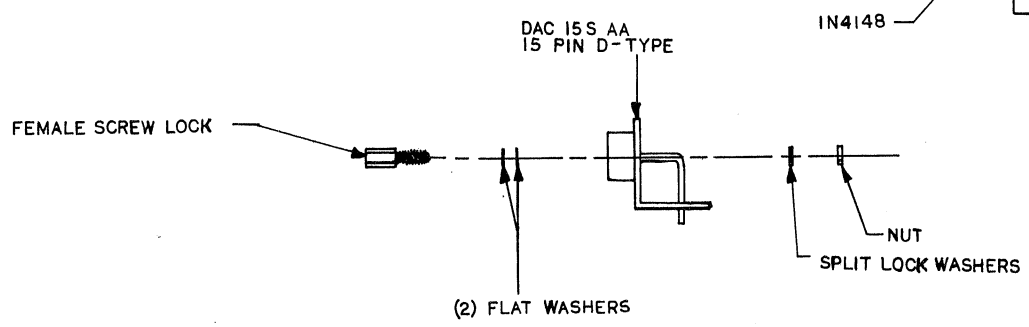


FIG. *1

MATERIAL:		Amkey, Inc. A Subsidiary of American Power Devices, Inc. 7 Andover Street, Andover, Massachusetts 01810 (617) 475-4266	
FINISH:		ASSEMBLY (NON L.E.D. VERSION)	
SPECIFICATIONS:		MPNK-89-1	
DRW	PROJ ENGR	C	200-3584-2
CHK	SUPV	REL NO.	REL DATE
ENGR	MGR	SCALE	ISSUE

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Part Number _____

Software/Firmware System _____

Version _____

Host computer _____

Host operating system _____ Version _____

Host-GRAPHIC interface _____

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firmware manual

Related tech manual number _____