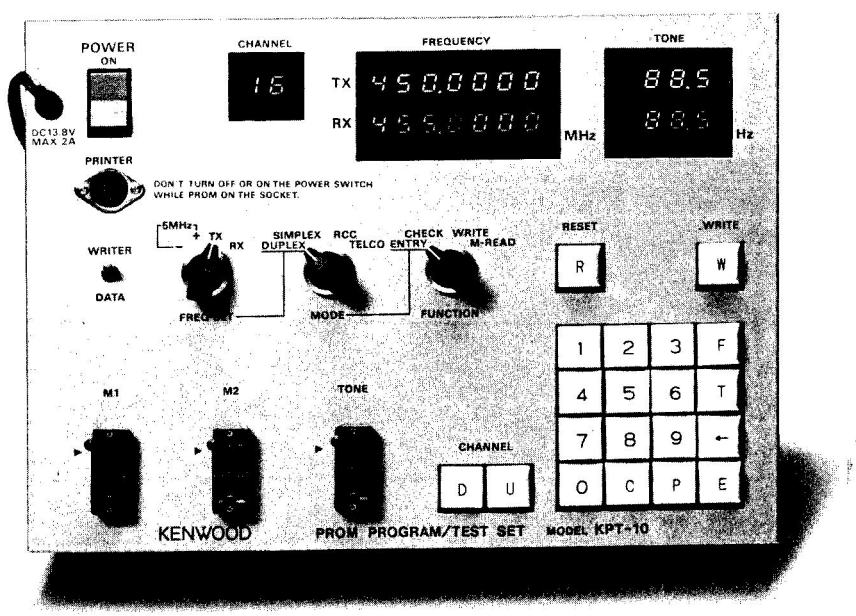
KENWOOD

P-ROM Writer

KPT-10

SERVICE MANUAL



CONTENTS

1. SPECIFICATION

1) Frequency range

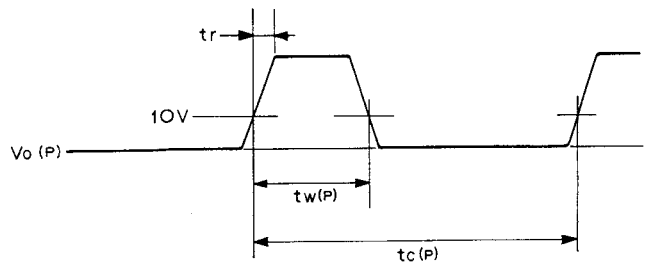
800MHz	806–825MHz (12.5kHz step)
UHF	400–512MHz (12.5kHz step)
VHF	150–174MHz (5kHz step)
Mid Band	54– 88MHz (2.5kHz step)
Low Band	25–53.9975MHz (2.5kHz step)

2) Used P-ROM

MITSUBISHI M54730AP (8bit x 32W)

3) Writer Timing

		MIN	TYP	MAX	
a. Bit Voltage	Vo(p)	20	21	21	V
b. Pulse Width	tw(p)	0.05	0.18	50	ms
c. Duty Cycle	tw(p)/tc(p)		20	25	%
d. Pulse rise time	tr	5	10	30	μs



4) Relation of frequency and Data

Devide ratio N_{800} = (F_{RCV} (MHz)−100) x 1000/12.5
N_{UHF} = (F_{RCV} (MHz)−21.4) x 1000/12.5
N_{VHF} = (F_{RCV} (MHz)−21.4) x 1000/5
N_{MID} = (F_{RCV} (MHz)−10.7) x 1000/2.5
N_{LOW} = (F_{RCV} (MHz)+10.7) x 1000/2.5

5) P-ROM Data Chart

ROM	M1								M2							
Figure	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Data	0	0	0	0	1	1	1	1	1	0	1	0	0	0	0	1
ROM Pin	1	2	3	4	5	6	7	9	1	2	3	4	5	6	7	9
	0			F					5			8				

Ex. : F_{RCV} = 450MHz
N_{UHF} = $(34288)_{10}$
HEX$ (N_{UHF}) = $(85F0)_{16}$

6) Size

	Body	Package
H	80mm	170mm
D	220mm	290mm
W	310mm	380mm
KPT-10U	W x D 49.5 x 48.3mm	

7) Weight

KPT-10	2.2kg
	3.2kg (incl. option)
KPT-10U	20g
	30g (incl. option)

2. CIRCUIT DESCRIPTION

CPU UNIT (X62-1040-10)

1. Power Supply Circuit

The KPT-10 has the following Automatic Voltage Regulators (AVR's), described as follows.

1) DC-DC converter

IC36 is a switching regulator. R10 is used to limit the collector current of the switching transistor contained within IC36. R12 is a current limiting resistor, which is used to stop the switching operation when the peak current passing through R12 exceeds approx. 2.3A. IC36 pin 13 is used as the sensor input.

The ON timing of Q8 is determined by C12. Fig. "a" shows the waveform at IC36 pin 3.

During the time assigned by C12, Q8 is turned ON. Fig. "d" shows the output waveform at IC36 pin 8. When Q8 is ON, current passes through L3 and energy is stored at L3. When Q8 is turned OFF, the voltage stored at L3 is added to the voltage supplied from the power source to be output.

This output is 27.2V. That is about two times the peak voltage of "b". Diode D1 is used to prevent C13 charge from flowing into Q8 when Q8 is ON. Its output voltage can be adjusted by VR1 and the normal voltage is 1.2V.

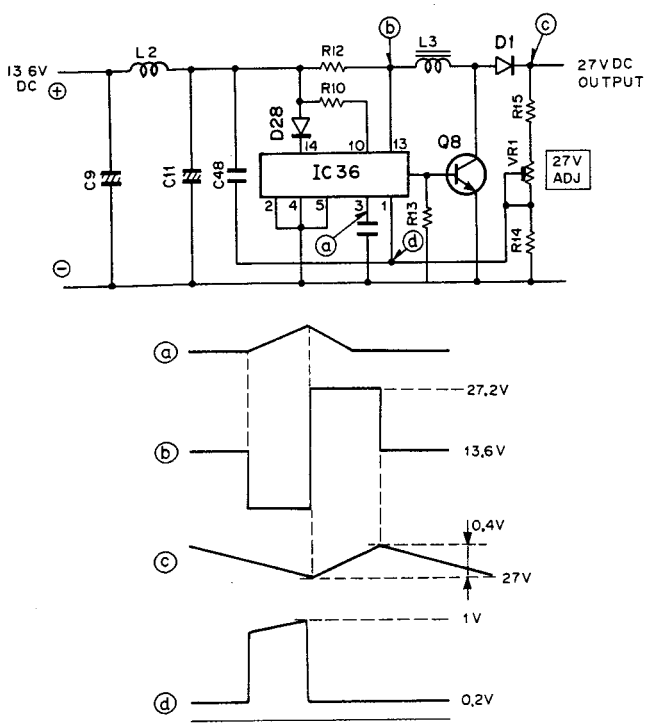


Fig. 1

2) Switching regulator (27VDC output)

This regulator supplies the high voltage required for writing data in the PROMs.

3) 5V regulator (5V output)

This 3-terminal regulator supplies 5V to the ICs.

4) VP regulator (21 or 0V output)

This generates the necessary voltage (21V) for writing data in the PROMs.

Fig. 2 shows the VP regulator circuit. The switching supply output (27V) is regulated to 21V by regulator circuit IC33 and Q4.

Except during a writing operation, a "H" is applied to the UP OFF terminal, Q7 is turned ON, and the VP regulator's operation is stoped. However, approx. 7V (constant) is always applied to the VP line throughD29.

R11 is the current detection resistor for limiting current to approx. 300mA.

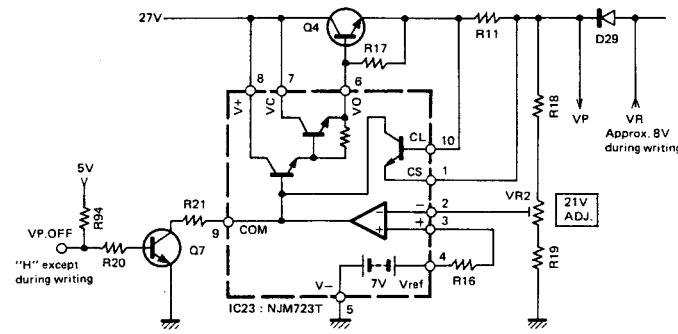


Fig. 2 VP Regulator Circuit

5) Vcc regulator (5V or 4.5V output)

This supplies power to the PROMs, and is switched to 5V during data writing and to 4.5V during data read-out.

Fig. 3 shows the Vcc regulator circuit. 13.6V input is regulated to 5V by IC34 and Q9. During read-out, a "H" is applied to the Vcc CONT terminal, Q6 is turned ON, and the comparison voltage applied to IC34 pin 3 is decreased to control the output at 4.5V.

R38 is the current detection resistor for the current limiter circuit, which operates at approximately 300mA.

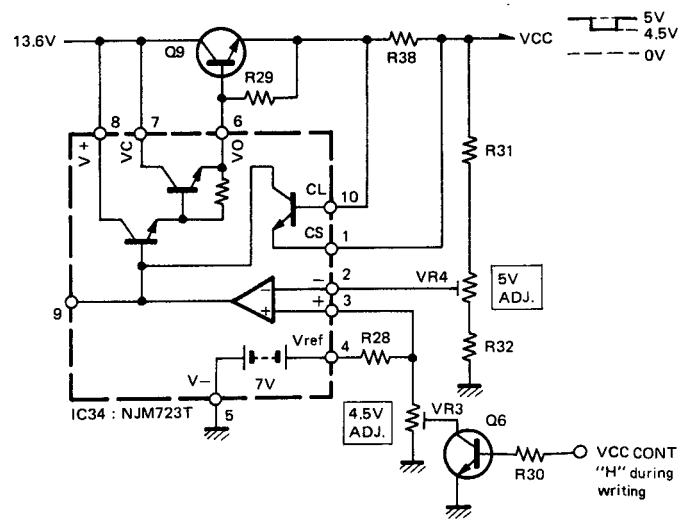


Fig. 3 Vcc Regulator Circuit

6) VS regulator (9V output)

This regulator supplies, both the power and a reference voltage to the comparator which monitors the Vcc voltage.

The 13.6V power input is regulated at approx. 9V by Q2 and D2.

Fig. 4 shows the circuit diagram.

7) VR regulator (8V or 0V output)

This regulator is used to pull-up the PROM DATA ports when data is read-out from the PROMs.

Fig. 4 shows the circuit diagram.

The 13.6V power input is regulated to approx. 8V by D2, which is used along with the VS regulator and Q3. Except in the read-out data mode, IC24 pin 3 is "H", Q5 turns ON, Q3 base voltage becomes approx. 0V, and the output becomes 0V.

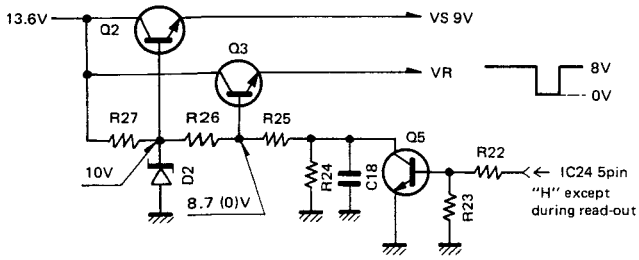


Fig. 4 VS and VR Requlator Circuits

2. Reset Circuit

This circuit applies a reset signal to the microprocessor, which is used for initialization when power is turned ON. Fig. 5 shows the circuit diagram and timing chart.

When power is turned ON, the voltage at point A increases from 0V to 13.6V in a short period of time (as shown on the chart). When the voltage at point A exceeds the voltage at D27 Zener diode (approx. 7V), the voltage at point B becomes the value of the voltage at point A minus 7V. The increasing voltage at point C is the same as at point A until Q59 is turned ON and remains at about 0.7V and Q58 is turned ON by the increase of voltage at point B. The voltage at point C then is at 0V. The voltage at point D reaches 5V before Q59 is turned ON. The voltage at point E is 0V until point C becomes 0V. When power is supplied to the microprocessor, Q58 is turned ON, Q59 is turned OFF, and the voltage at point E becomes 5V. This resets the microprocessor.

In addition, this unit is also supplied with a RESET switch, which may be used to reset the microprocessor if it malfunctions.

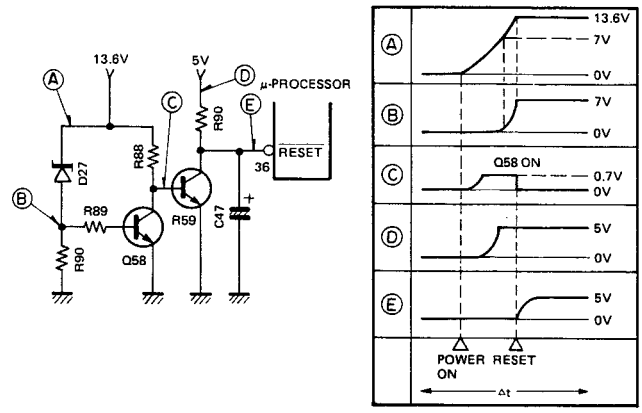


Fig. 5 Reset Circuit and Timing Chart

3. Vcc Comparator

This circuit monitors the Vcc and judges a malfunction of the PROMs.

The Vcc regulator is composed of a current limiter circuit, operating at approx. 300mA. The output voltage drops when the current flow becomes abnormally high. When the output voltage drops below the comparison voltage (approx. 3V), the comparator output goes "L".

This signal is applied to the microprocessor IC28 & EXT I/O IC2. The microprocessor applies the BUZZ signal to EXT I/O IC1.

IC1 outputs a "L" from terminal PC5, which makes the Piezo electric buzzer circuit operates.

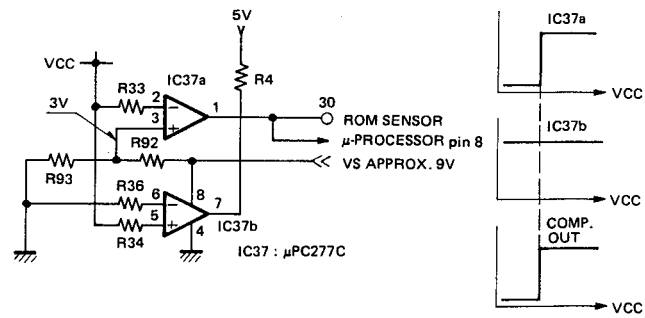


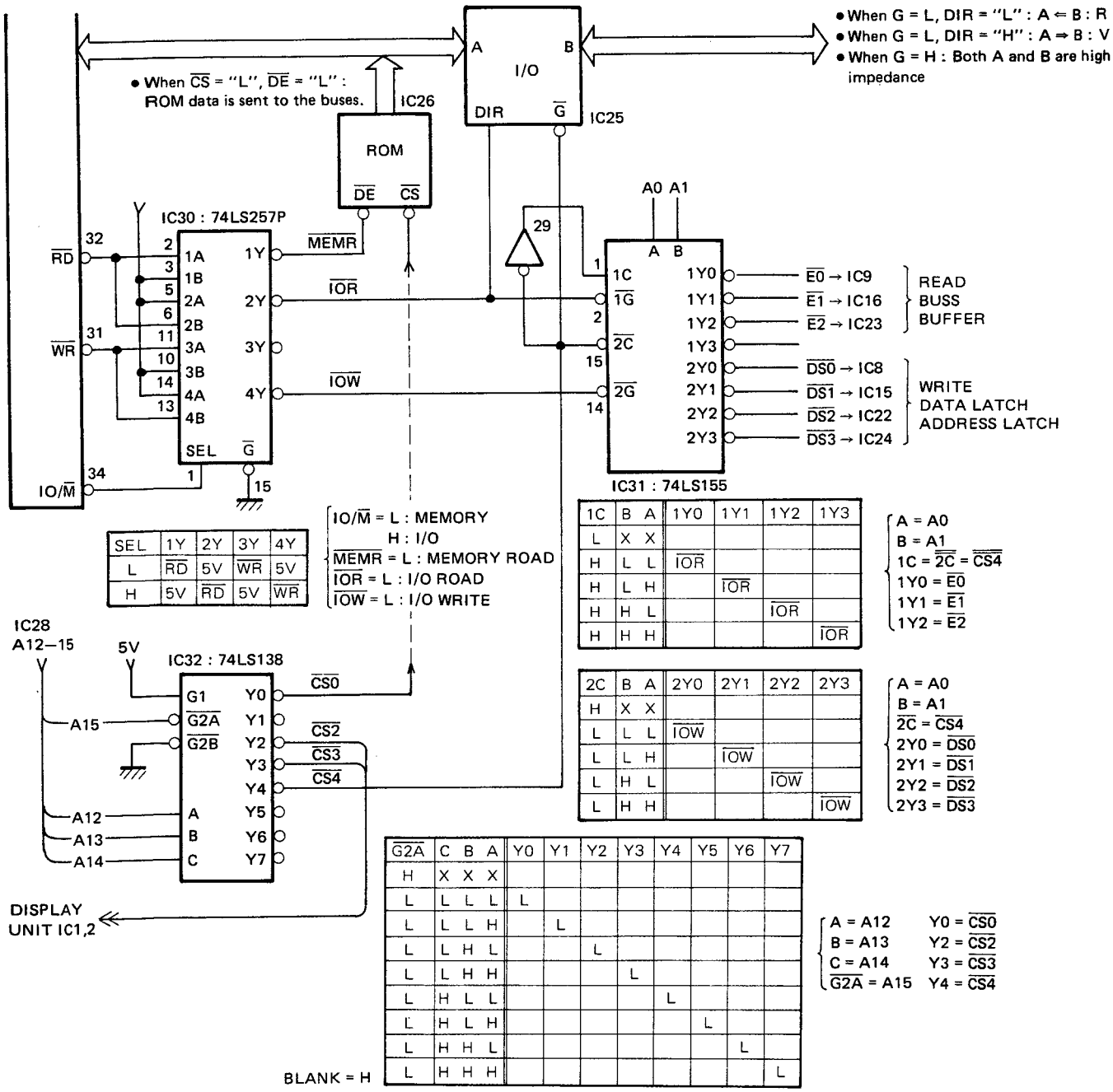
Fig. 6

4. Address Buses

Microprocessor IC28 AD0–7 lines output the address data while the ALE terminal output is "H". Address data is supplied to Display unit IC1 and IC2 by AD0–7 and ALE. The address data is latched by IC27 and supplied to the ROM (IC26). The data from AD0–7 is also supplied to the address latch IC24 for the PROMs. via I/O IC25.

The IC27 output is applied to the chip selector (IC31) together with IOR and IOW obtained by IC30, to generate the latch signal for ICs 8, 15, 22 and 24, and the bus buffer gate signal for ICs 9, 16 and 23. A12–15 are used as the data for the chip selector (IC32).

Fig. 7 shows the signal diagram of ICs 30 to 32.



SEL	1Y	2Y	3Y	4Y
L	RD	5V	WR	5V
H	5V	RD	5V	WR

1C	B	A	1Y0	1Y1	1Y2	1Y3
L	X	X				
H	L	L	IOR			
H	L	H		IOR		
H	H	L			IOR	
H	H	H				IOR

2C	B	A	2Y0	2Y1	2Y2	2Y3
H	X	X				
L	L	L	IOW			
L	L	H		IOW		
L	H	L			IOW	
L	H	H				IOW

G2A	C	B	A	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7
H	X	X	X								
L	L	L	L	L							
L	L	L	H		L						
L	L	H	L			L					
L	L	H	H				L				
L	H	L	L					L			
L	H	L	H						L		
L	H	H	L							L	
L	H	H	H								L

Fig. 7 Signal Diagram of ICs 30 to 32

5. Data buses

Microprocessor (IC28) AD0–7 lines input and output data when the ALE terminal output is "L". When WR is "L" they function as an output, and when RD is "L", they function as an input.

The AD0–7 lines are connected, via the ROM (IC26) and I/O (IC25), to the latch circuit (ICs 8, 15 and 22) for data written into the PROMs, and to the bus buffer circuit (IC9, 16 and 23) for data read-out from the PROMs.

The AD0–7 lines are also connected to Display unit ICs 1 and 2, together with the ALE.

6. R/W Control & R/W Driver

The R/W circuit controls the voltage applied to the PROM data lines, by controlling transistors Q10, 12, 14, 16, 18, 20, 22, 24, to Q11, 13, 15, 17, 19, 21, 23, 25 in the R/W driver circuit.

1) Data write operation

The PROMs are always at logic "H" level as long as data is not written. VP (21V) is applied to the data line only when data is required to be "L", and data is to be written.

Writing is performed bit by bit in order to prevent writing error. After writing, data is read-out for one time for data checking. 21V is supplied to VP during writing, and VR becomes 0V and the control signal goes "H".

In Fig. 8, when Q0 is "H", Q10 turns OFF, writing voltage VP is not supplied to the PROMs, and writing is not performed.

When Q0 is "L", Q10 turns ON, VP is supplied to the PROMs, and writing to D0 is performed. The other latch outputs (Q1–7) are "H" at this time, and the PROM bits other than D0 are sent "L" by IC6. When writing to D1, the latch outputs other than Q1 are sent "H" so that writing is performed only to D1. Similar logic applies to writing of the other data bits. At this time, the latch input data is also changed every time one bit has been written.

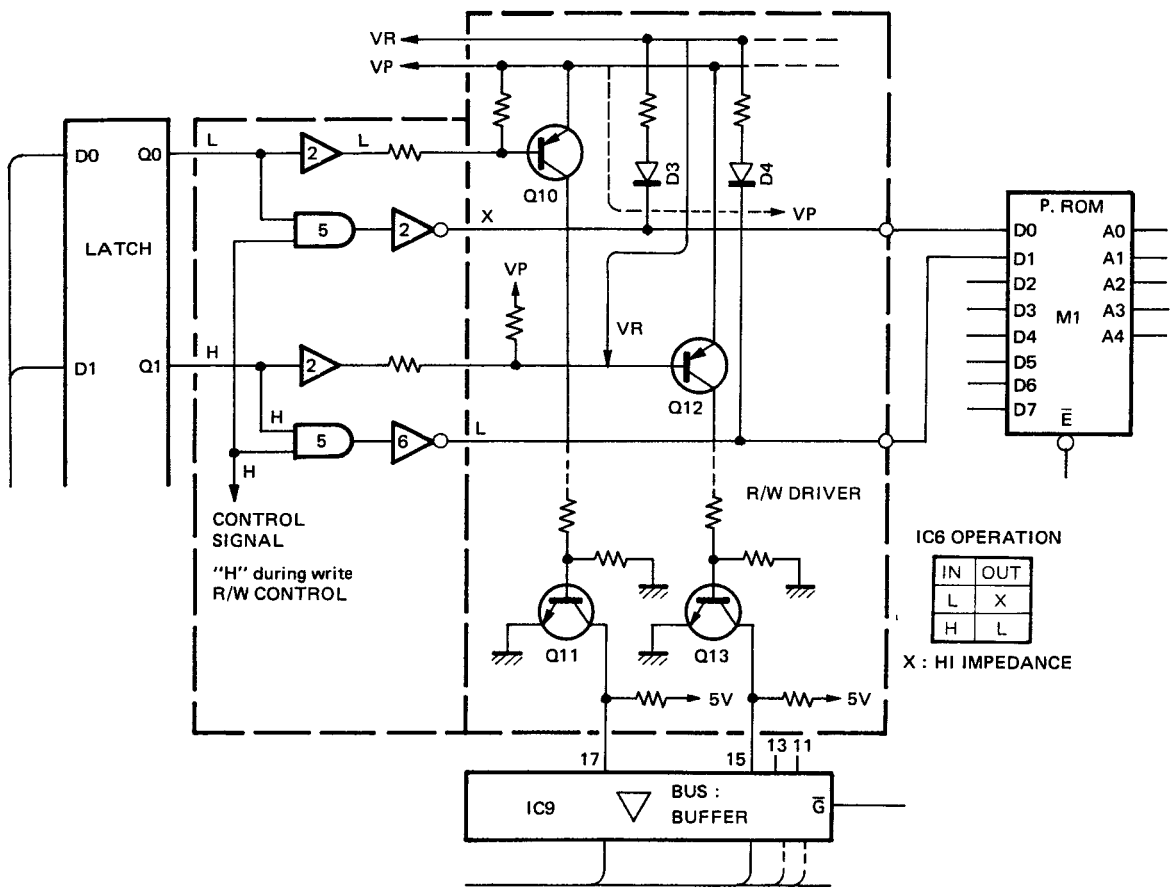


Fig. 8

2) Data read-out

In data writing, VP is supplied with approx. 7V, VR supplied with 8V, and the control signal becomes "L".

Since the control signal is "L", IC6 input is "L" and its output is at high impedance. VR (8V) is the voltage used to pull-up the PROM data lines. When the PROM data lines are "L", the read buffer transistor is OFF and the collector output becomes "H". When the data lines are "H", the collector outputs the inverse, a "L".

IC9 is the buss buffer, which connects the PROM data to the data buss lines when G becomes a data "L".

3) Here with follows a description of operations when the DATA/WRITER SW is set to the "DATA" position

When the Data/Writer switch is set to the data position, PLL and CTCSS data can be output from three PROM sockets on the KPT-10 programmer test set.

When the PROM sockets on the KPT-10 are connected to the PROM sockets on a transceiver (TK-801S/701, etc.), the channel data displayed on the KPT-10 is the PLL data for the radio. The channel may be changed using the [U] or [D] keys.

When the Data/Writer switch is set to the Data position, the control signalis high. At this time, the PLL data corresponding to the frequency displayed on the KPT-10 is latched by IC8, 15, 22.

7. Printout Operation

The printer is connected through port CN2 and is insulated from the KPT-10 by an opto-isolator in the printer. A synchronous command when data is output from IC28 SOD. IC28 detecs a manual print the [P] key is depressed, via IC2. When the [P] key is depressed, channel data both RX and TX and tone data are sequentially output from the SOD port, beginning from channel 1. Data output format is ASCII code.

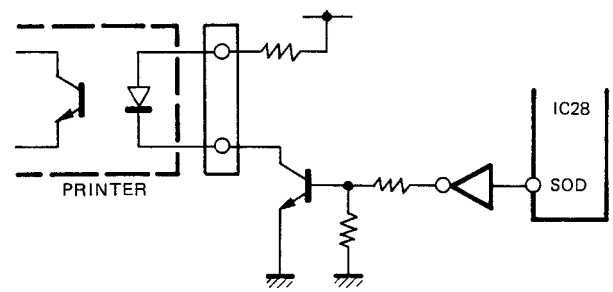


Fig. 9

Data output :

0 1 ␣ F – R X ␣ 4 5 0 . 0 0 0 0 ␣ M H z (CR, LF)

T – R X ␣ ␣ ␣ ␣ 0 0 0 . 0 ␣ ␣ H z

30	31	20	46	2D	52	58	20	34	35	30	2E	30	30	30	30	20	4D	48	7A	0D	0A	ASCII CODE
0	1	␣	F	–	R	X	␣	4	5	0	.	0	0	0	0	␣	M	H	z	CR	LF	PRINT (LETTER)

The output format in duplex is as follows :

0 1 ␣ F – R X ␣ O O O . O O O O ␣ M H z

␣ ␣ ␣ ␣ ␣ T X ␣ O O O . O O O O ␣ M H z

T – R X ␣ ␣ ␣ ␣ O O O . O ␣ ␣ H z

T X ␣ ␣ ␣ ␣ O O O . O ␣ ␣ H z

DISPLAY UNIT (X62-1030-10)

The operation of the Display unit follows. Please refer to block diagram and circuit diagram.

1. IC2 Operation

IC2 is the input I/O expander for the keyboard and FUNCTION rotary switch.

IC2 PC0 to PC5 are the Switch selector outputs, operating with active-low pulses. PD0 to PA7 are the inputs from the keyboard and PB0 to PB3 are the inputs from the rotary switch. PB4 is the input from SW2: When its level is "L", the KPT-10 functions as a PROM writer and, when its level is "H", it outputs data for use in place of the PROM in a transceiver. When it is used for data output, it is necessary to connect the KPT-10 PROM sockets to the transceiver's PROM sockets via two optional, uses supplied cables.

2. IC1 Operation

IC1 is the display control I/O expander, as well as the buzzer and UP: Vcc regulator control I/O.

PA0 to PA7 are the digit-driver outputs and PB to PB6 are the segment outputs. PB7 is used as the latch signal for storage of segment data in ICs 8 and 9. PC0 is the Vcc control signal and outputs "H" during PROM read-out.

PC1 outputs the VP OFF control signal and outputs "L" during PROM writing and "H" in other states.

PC5 outputs the buzzer control signal: The buzzer activates when the output is "L".

3. Indication Operation

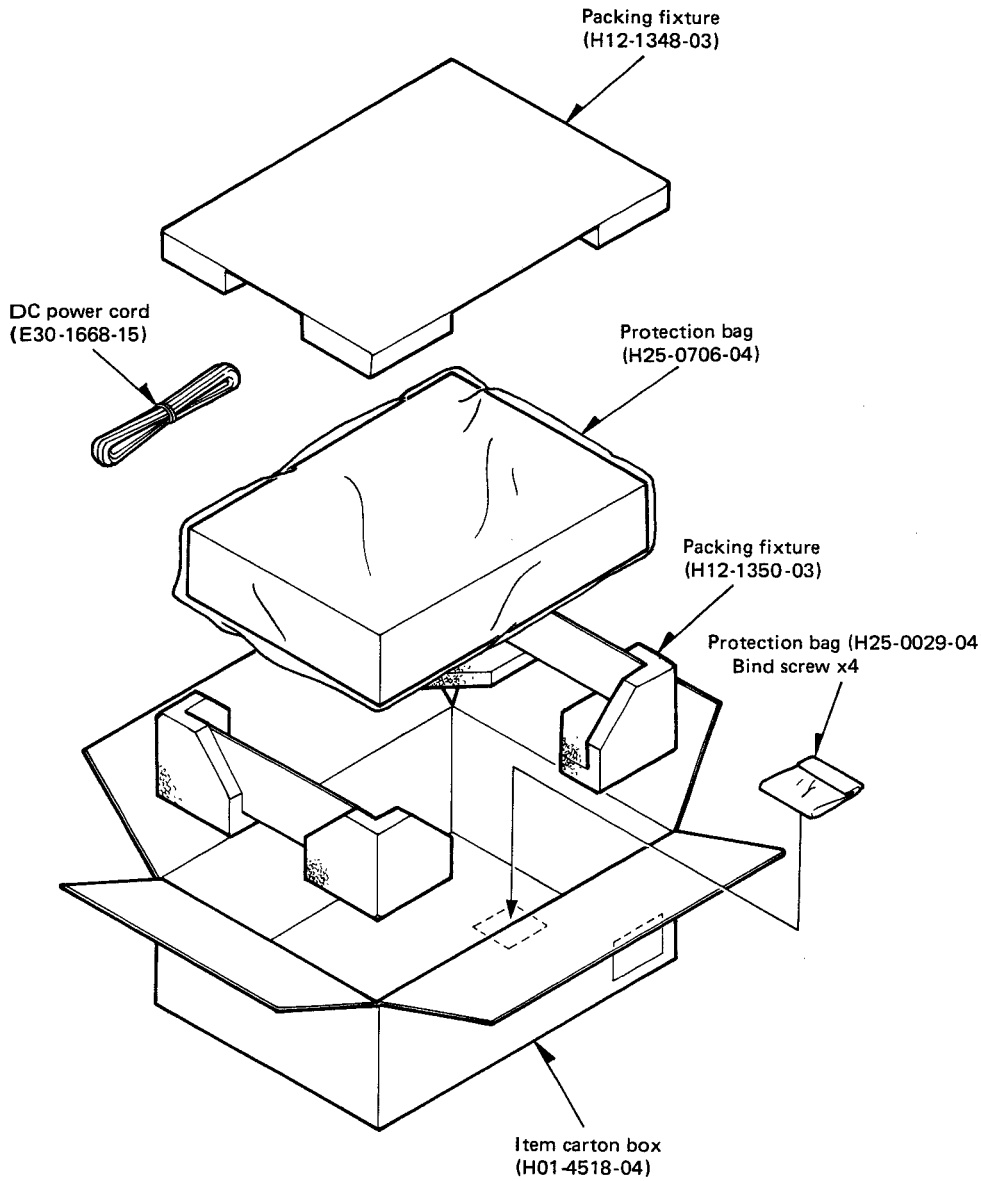
1. First, the segment data for LEDs 1 to 8 are input to PB0 to PB6, and catched by IC9 with a "H" trigger from PB7.
2. Then the data for LEDs 9 to 16 are input to PB0 to PB6, and IC9 data is re-written with the "H" trigger from PB7. At this time, the data previously held by IC9 is transferred to IC8 (PB7 : "H"), so that data for the LEDs are supplied to LED drivers 1 to 8, and to LED drivers 9 to 16.
3. Next, the data for LEDs 17 to 24 are input PB0 to PB6. The PB7 output stays "L" at this time. Since PB7 is "L", ICs 8 and 9 hold the data previously stored and described step.
4. Now that the data for only one LED digit is present, the bits corresponding to that digit among the digit driver inputs PB0 to PB7 go "H", so only that digit lights.
5. Sunsequently, the procedure from step 1 through 4 are repeated in sequence until all eight digits light.

3. ADJUSTMENT

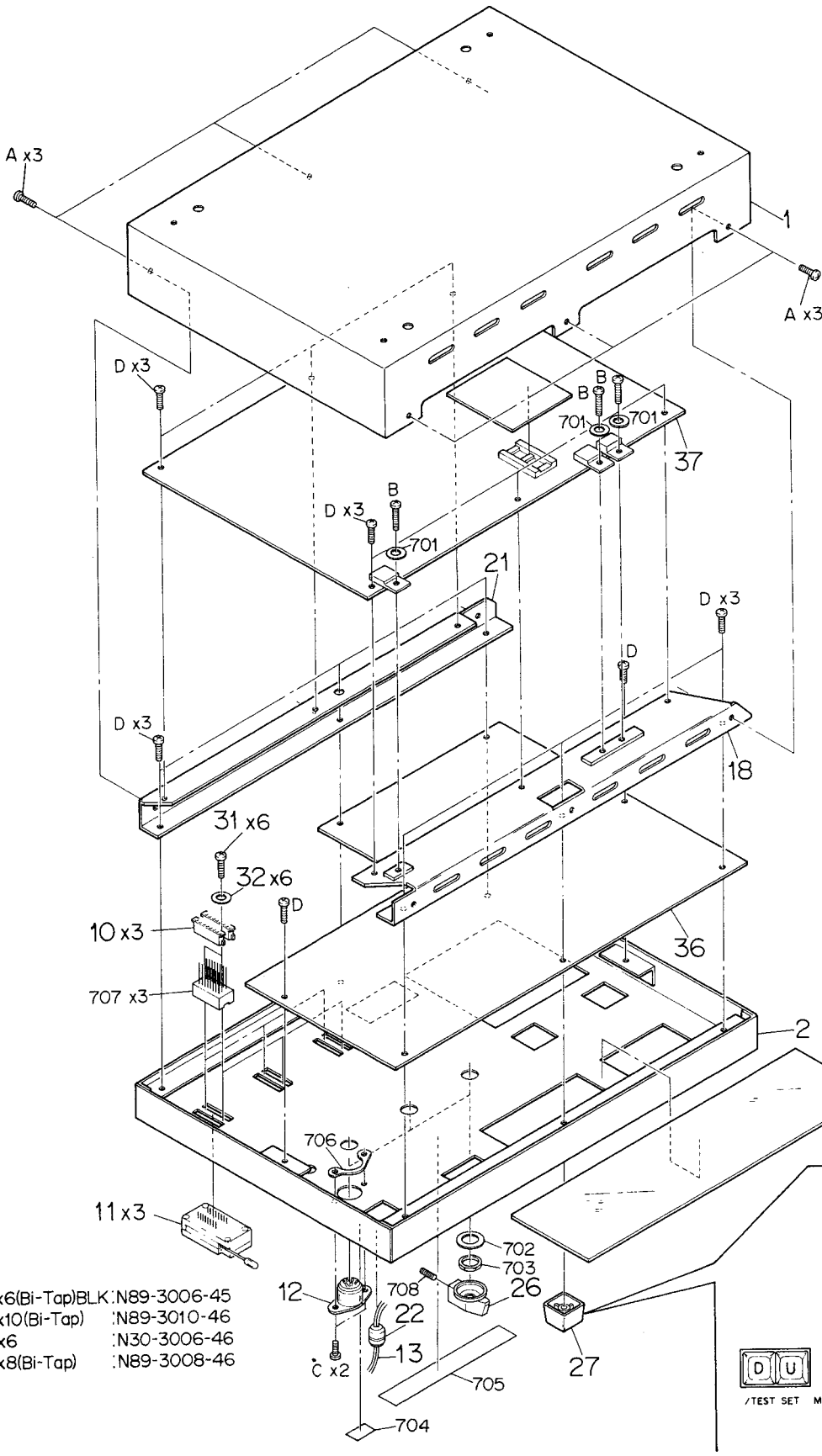
ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
AVR ADJ.	1) Connect to 13.8V DC supply.							
1. 27V AVR	1) POWER ON	DVM	CPU	Cathod of D1	CPU	VR1	Adjust for 27V	27V±2V
2. 21V AVR	1) Press WRITE key			Cathod of D29		VR2	Adjust for 21V	21V±1V
3. 5V AVR	1) Press RESET key 2) VR3 Preset : Mid point			PROM socket M1 Pin 16		VR4	Adjust for 5V	5V±1V
4. 4.5V AVR	1) Press WRITE key			M1 Pin 16		VR3	Adjust for 4.5V	4.5V±1V

4. PACKING


Packing fixture
(H12-1348-03)
DC power cord
(E30-1668-15)
Protection bag
(H25-0706-04)
Packing fixture
(H12-1350-03)
Protection bag (H25-0029-04)
Bind screw x4
Item carton box
(H01-4518-04)

5. DISASSEMBLY



A	ø3x6(Bi-Tap)BLK	:N89-3006-45
B	ø3x10(Bi-Tap)	:N89-3010-46
C	M3x6	:N30-3006-46
D	ø3x8(Bi-Tap)	:N89-3008-46

Parts with the exploded numbers larger than 700 are not supplied.

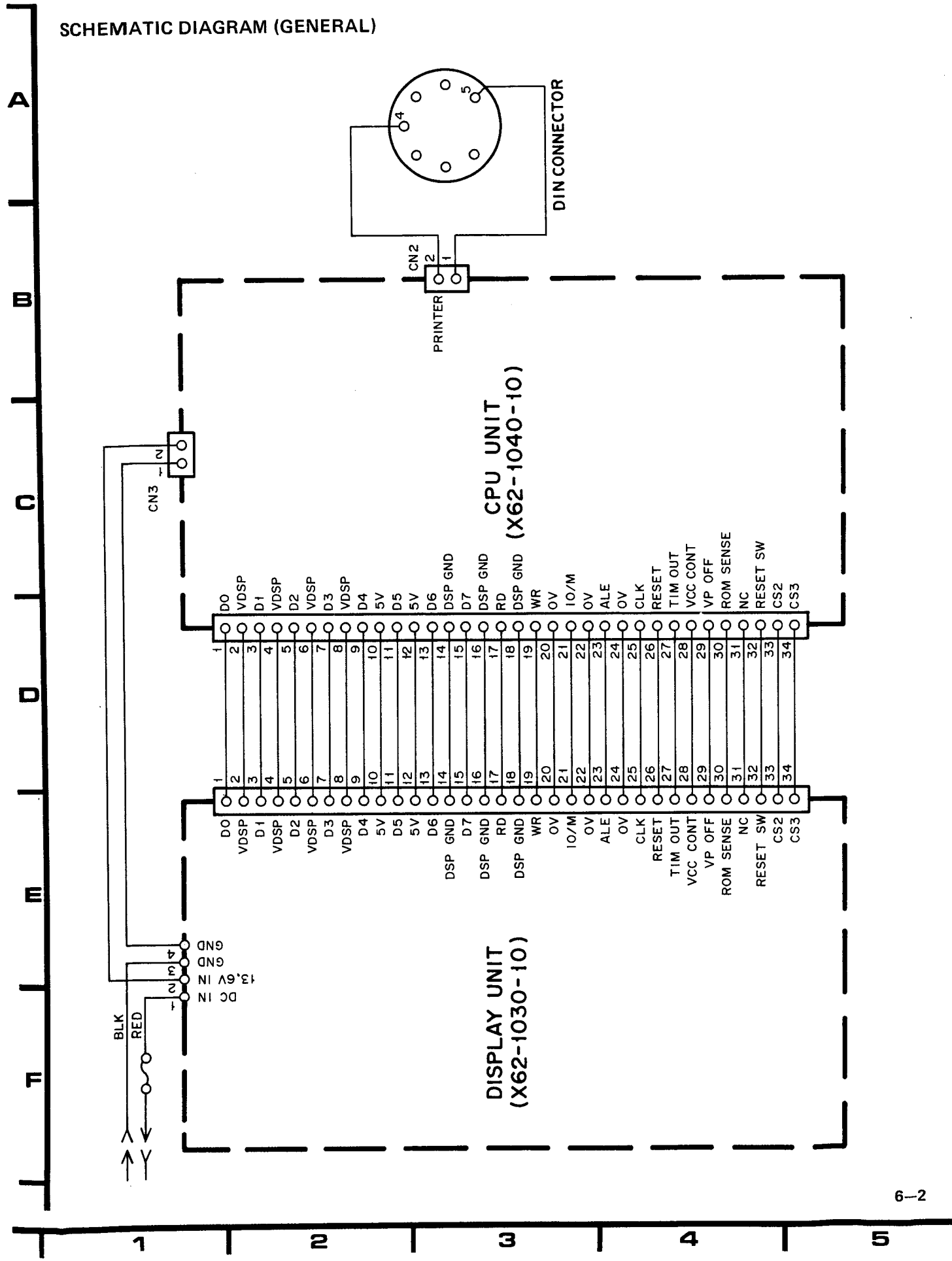
6. DIAGRAM & PARTS LIST

PARTS LIST (GENERAL)

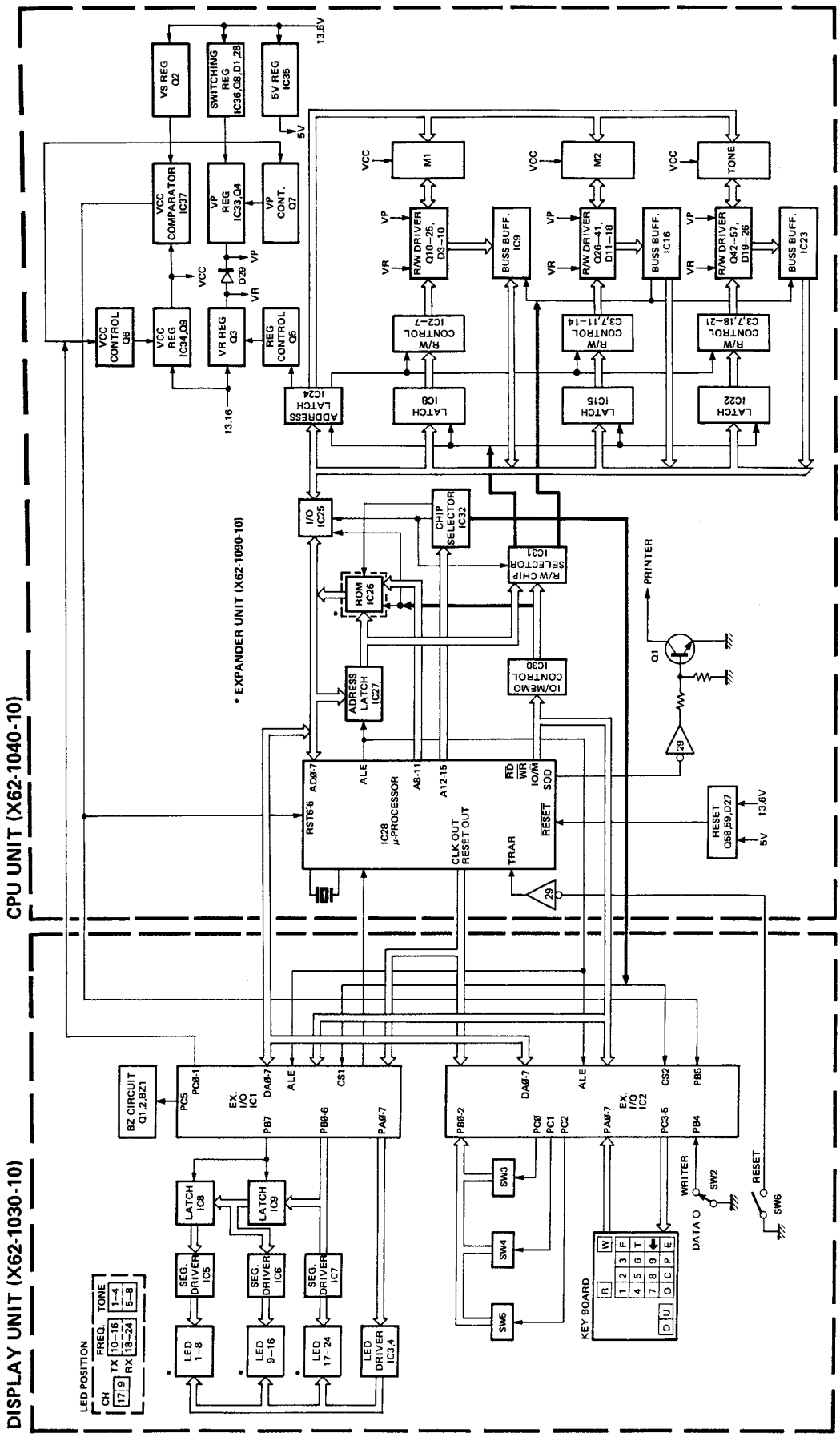
* New Parts
Parts without **Parts No.** are not supplied.
Les articles non mentionnes dans le **Parts No.** ne sont pas fournis.
Teile ohne **Parts No.** werden nicht geliefert.

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
			KPT-10 GENERAL			
1	4B	*	A01-0966-02	METALLIC CABINET		
2	4E	*	A20-2498-02	PANEL ASSY		
6	5E	*	B10-0659-03	FRONT GLASS		
-		*	B41-0640-04	CAUTION LABEL		
-		*	B42-2318-04	LABEL		
10	1D	*	E02-0118-05	IC SOCKET		
11	1F	*	E02-0119-05	IC SOCKET		
12	2F		E06-0751-05	CYLINDRICAL RECEPTACLE(PRINTER)		
13	3F	*	E30-1668-15	DC POWER CORD		
-		*	E31-3004-05	CONNECTING WIRE (M1)		
-		*	E31-3005-05	CONNECTING WIRE (M2)		
-		*	E31-3006-05	CONNECTING WIRE (TONE)		
-		*	E31-3019-05	CONNECTING WIRE (CN1)		
18	4D	*	F01-0901-02	HEAT SINK		
-		*	H01-4518-04	ITEM CARTON BOX		
-		*	H12-1348-03	PACKING FIXTURE		
-		*	H12-1350-03	PACKING FIXTURE		
-			H25-0029-04	PROTECTION BAG		
-		*	H25-0706-04	PROTECTION BAG		
21	3C	*	J21-4210-03	MOUNTING HARDWARE (HEAT SINK)		
22	3F		J41-0006-05	BUSHING		
26	3F		K21-0723-04	KNOB		
27	3F		K27-0462-05	KNOB ASSY(BUTTON)		
31	2D	*	N09-0670-05	SCREW		
32	2D		N19-0632-05	FLAT WASHER		
A	1A,4B		N89-3006-45	BINDING HEAD TAPTITE SCREW		
B	3C,4B		N89-3010-46	BINDING HEAD TAPTITE SCREW		
C	2F		N30-3006-46	PAN HEAD MACHINE SCREW		
D	2B,4C		N89-3008-46	BINDING HEAD TAPTITE SCREW		
IC1			M54730AP	IC		
IC10			M54730AP	IC		
IC17			M54730AP	IC		
36	4E	*	X62-1030-10	L.M.R (CONTROL)		
37	4C	*	X62-1040-10	L.M.R (CONTROL)		
			KPT-10U (EXPANDER)			
-		*	B50-8032-00	INSTRUCTION MANUAL		
-			G13-0682-04	CUSHION		
-		*	H25-0710-04	PROTECTION BAG		
-		*	X62-1090-10T	EXP ROM UNIT		

SCHEMATIC DIAGRAM (GENERAL)

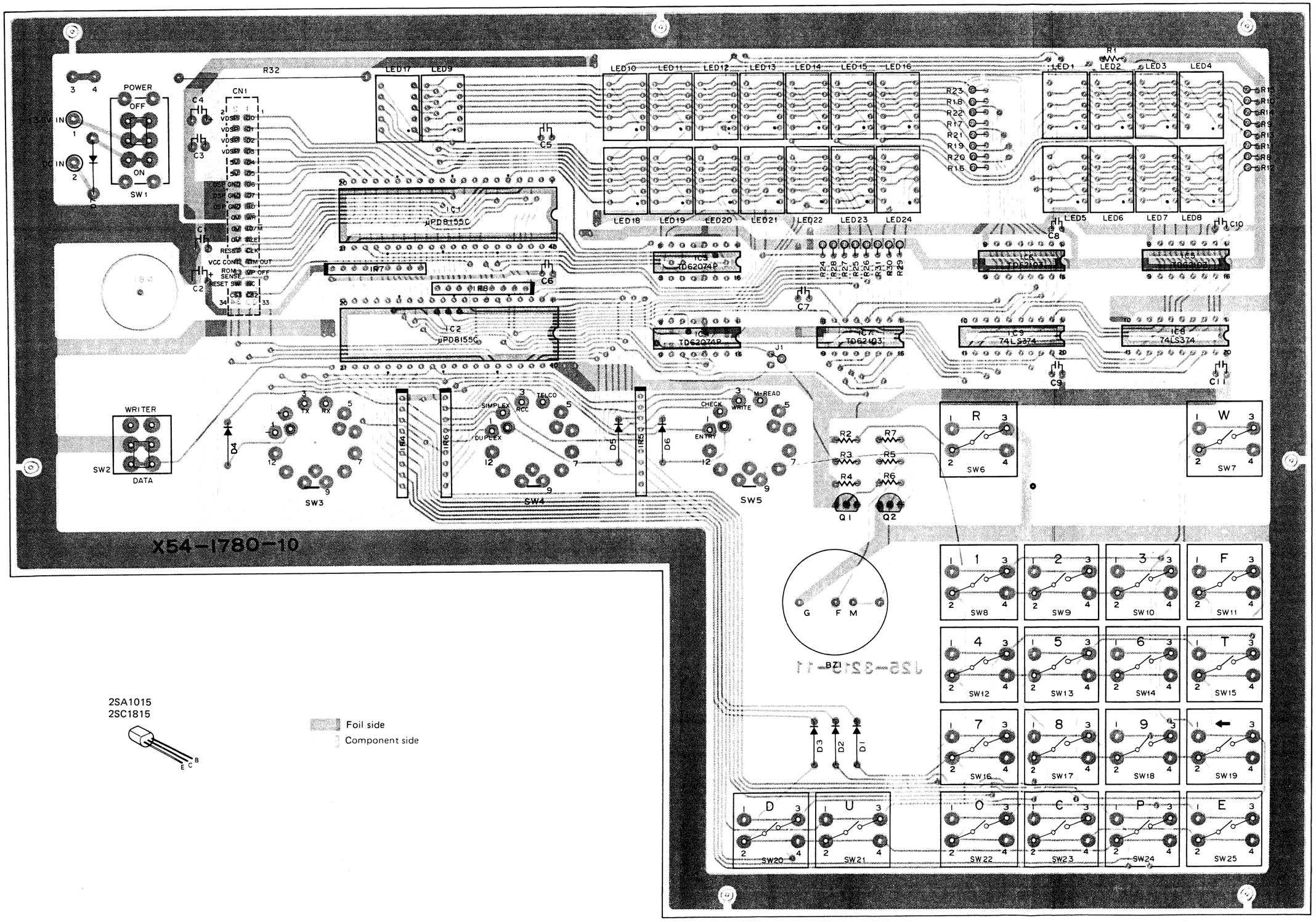


BLOCK DIAGRAM



PC BOARD

DISPLAY UNIT (X62-1030-10) Component side view



2SA1015
2SC1815

Foil side

Component side

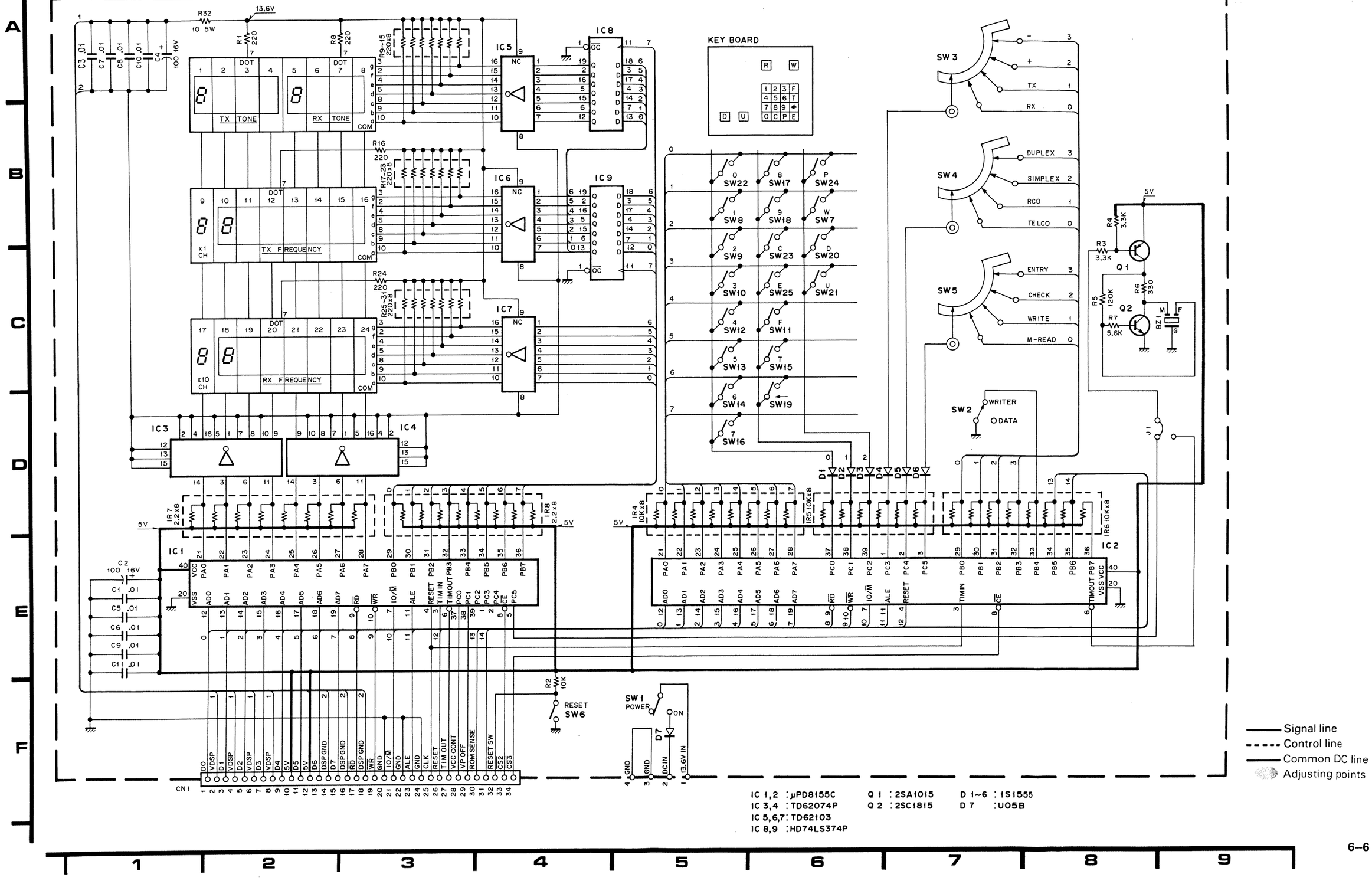
PARTS LIST (DISPLAY UNIT)

* New Parts
Parts without **Parts No.** are not supplied.
Les articles non mentionnes dans le **Parts No.** ne sont pas fournis.
Telle ohne **Parts No.** werden nicht geliefert.

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
DISPLAY UNIT (X62-1030-10)						
C1			C91-0131-05	CERAMIC 0.01UF K		
C2			CE04W1C101M	ELECTRO 100UF 16WV		
C3			C91-0131-05	CERAMIC 0.01UF K		
C4			CE04W1C101M	ELECTRO 100UF 16WV		
C5 -11			C91-0131-05	CERAMIC 0.01UF K		
-			E31-3001-15	CONNECTING WIRE		
-		*	E31-3002-05	CONNECTING WIRE		
IR4 -6			R90-0533-05	MULTI-COMP		
IR7 ,8		*	R90-0572-05	MULTI-COMP		
J1 ,2			R92-0150-05	JUMPER REST 0 OHM		
J4 ,5			R92-0150-05	JUMPER REST 0 OHM		
R1			RD14BB2C221J	RD 220 J 1/6W		
R2			RD14BB2C103J	RD 10K J 1/6W		
R3 ,4			RD14BB2C332J	RD 3.3K J 1/6W		
R5			RD14BB2C124J	RD 120K J 1/6W		
R6			RD14BB2C331J	RD 330 J 1/6W		
R7			RD14BB2C562J	RD 5.6K J 1/6W		
R8 -31			RD14CB2E221J	RD 220 J 1/4W		
R32			RS14AB3H100J	FL-PROOF RS 10 J 5W		
S1		*	S33-2406-05	LEVER SWITCH		
S2		*	S44-2405-05	TOGGLE SWITCH		
S3 -5		*	S01-1437-05	ROTARY SWITCH		
S6 -25		*	S50-1416-05	SENSITIVE SWITCH		
BZ1		*	T95-0053-05	BUZZER		
D1 -6			1S1555	DIODE		
D7			U05B	DIODE		
IC1 ,2		*	UPD8155C	IC		
IC3 ,4		*	TD62074P	IC		
IC5 -7		*	TD62103P	IC		
IC8 ,9		*	SN74LS374N	IC		
LED1-4		*	GL8N03D	LED		
LED5-8		*	GL8D03D	LED		
LED9-17		*	GL8N03D	LED		
LED18-24		*	GL8D03D	LED		
Q1			2SA1015(Y)	TRANSISTOR		
Q2			2SC1815(Y)	TRANSISTOR		

SCHEMATIC DIAGRAM (DISPLAY UNIT)

DISPLAY UNIT (X62-1030-10)



IC 1,2 : μPD8155C
IC 3,4 : TD62074P
IC 5,6,7: TD62103
IC 8,9 : HD74LS374P

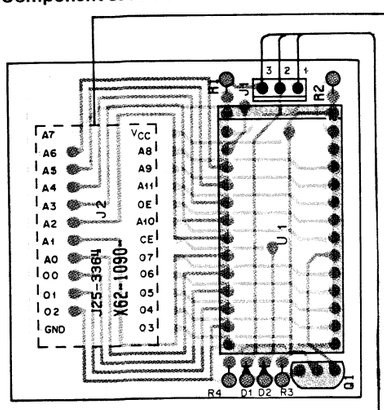
Q 1 : 2SA1015
Q 2 : 2SC1815

D 1~6 : 1S1555
D 7 : U05B

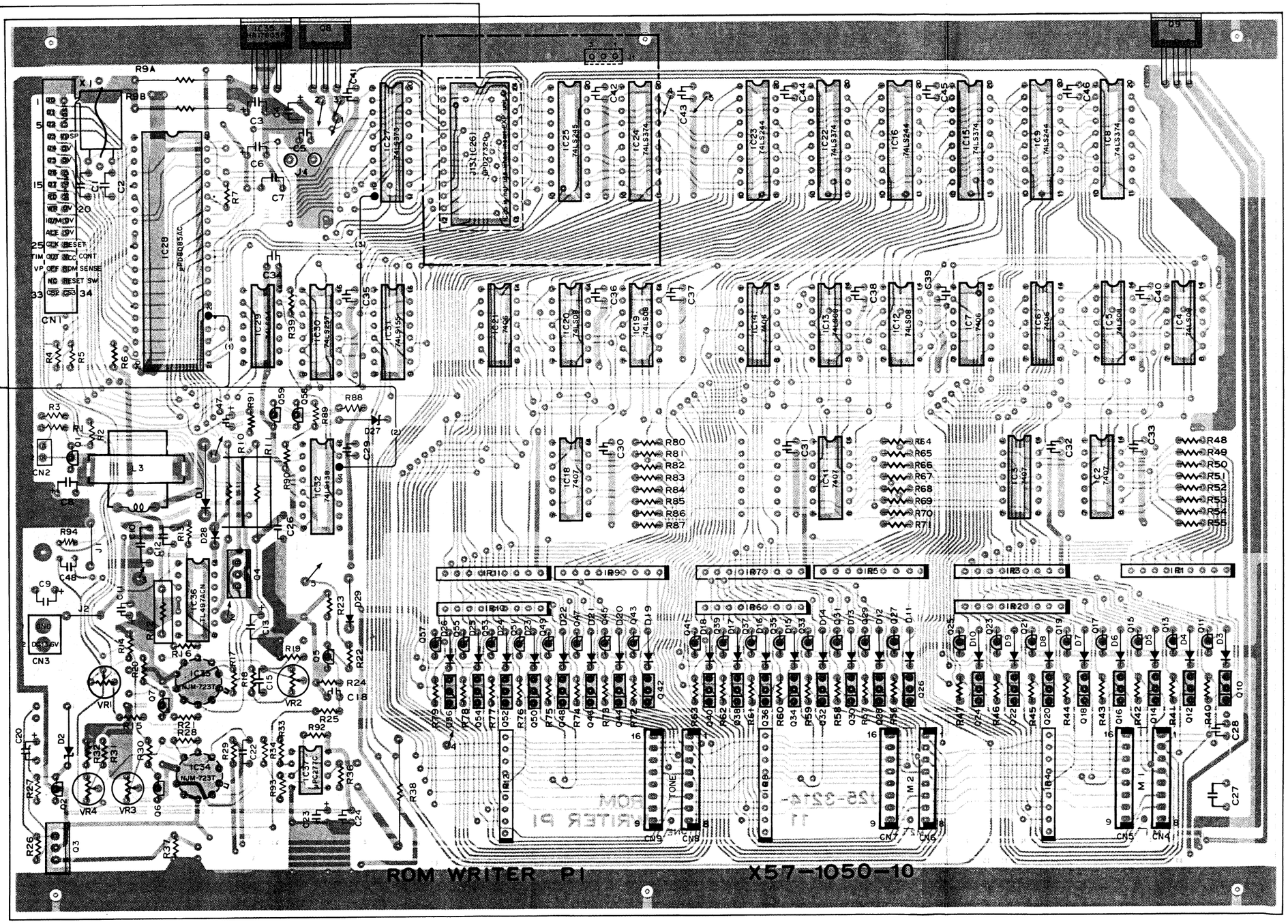
Signal line
Control line
Common DC line
Adjusting points

PC BOARD

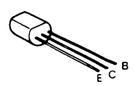
EXPANDER UNIT (X62-1090-10)
Component side view



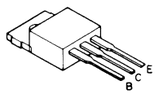
CPU UNIT (X62-1040-10) Component side view



2SC1815

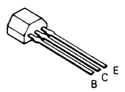


2SD1273

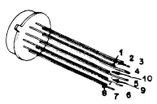


2SB793A

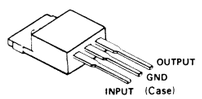
2SC2603



NJM723T



HA17805P



Foil side
Component side

PARTS LIST (CPU UNIT)

* New Parts
Parts without **Parts No.** are not supplied.
Les articles non mentionnes dans le **Parts No.** ne sont pas fournis.
Telle ohne **Parts No.** werden nicht geliefert.

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
CPU UNIT (X62-1040-10)						
C1 ,2			CC45CH1H220J	CERAMIC 22PF J		
C3 ,4			CE04W1C101M	ELECTRO 100UF 16WV		
C5			C91-0131-05	CERAMIC 0.01UF K		
C6			CE04W1C101M	ELECTRO 100UF 16WV		
C7			CQ92M1H104K	MYLAR 0.10UF K		
C8 ,9			CE04W1C101M	ELECTRO 100UF 16WV		
C10			CQ92M1H104K	MYLAR 0.10UF K		
C11			CE04W1C101M	ELECTRO 100UF 16WV		
C12			CQ92M1H682K	MYLAR 6800PF K		
C13			CE04W1V471M	ELECTRO 470UF 35WV		
C15			CC45SL1H391J	CERAMIC 390PF J		
C18			C91-0131-05	CERAMIC 0.01UF K		
C20			CE04W1C101M	ELECTRO 100UF 16WV		
C22			CC45SL1H391J	CERAMIC 390PF J		
C23			CE04W1C330M	ELECTRO 33UF 16WV		
C24			C91-0131-05	CERAMIC 0.01UF K		
C26 -46			C91-0131-05	CERAMIC 0.01UF K		
C47			CE04W1H100M	ELECTRO 10UF 50WV		
C48			CQ92M1H102K	MYLAR 1000PF K		
-		*	E33-1581-00	FINISHED WIRE SET		
CN1			E10-3451-15	CONNECTOR		
CN2			E40-0273-05	PIN CONNECTOR		
CN3			E40-0201-05	PIN CONNECTOR		
CN4 -9			E40-3013-05	PIN CONNECTOR		
J13		*	E02-0117-05	TRANSISTOR SOCKET (IC26)		
L3			L15-0016-05	CHOKE COIL		
X1			L77-0999-05	CRYSTAL RESONATOR		
IR1		*	R90-0573-05	MULTI-COMP		
IR2			R90-0533-05	MULTI-COMP		
IR3			R90-0510-05	MULTI-COMP		
IR4			R90-0533-05	MULTI-COMP		
IR5		*	R90-0573-05	MULTI-COMP		
IR6			R90-0533-05	MULTI-COMP		
IR7			R90-0510-05	MULTI-COMP		
IR8			R90-0533-05	MULTI-COMP		
IR9			R90-0573-05	MULTI-COMP		
IR10			R90-0533-05	MULTI-COMP		
IR11			R90-0510-05	MULTI-COMP		
IR12			R90-0533-05	MULTI-COMP		
J1 ,2			R92-0150-05	JUMPER REST 0 OHM		
J4 ,5			R92-0150-05	JUMPER REST 0 OHM		
R1 ,2			RD14BB2C562J	RD 5.6K J 1/6W		
R3			RD14BB2C331J	RD 330 J 1/6W		
R4 -7			RD14BB2C472J	RD 4.7K J 1/6W		
R9A ,9B		*	RS14AB3F8R2J	FL-PROOF RS 8.2 J 3W		
R10		*	RD14DB3D470J	SMALL-RD 47 J 2W		
R11			RS14AB3D2R2J	FL-PROOF RS 2.2 J 2W		
R12			R92-0601-05	METAL-PLATE 0.22 K 1W		
R13			RD14BB2C102J	RD 1.0K J 1/6W		
R14			RD14BB2C152J	RD 1.5K J 1/6W		
R15			RD14BB2C273J	RD 27K J 1/6W		
R16			RD14BB2C392J	RD 3.9K J 1/6W		

* New Parts
Parts without **Parts No.** are not supplied.
Les articles non mentionnes dans le **Parts No.** ne sont pas fournis.
Telle ohne **Parts No.** werden nicht geliefert.

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
R17			RD14BB2C102J	RD 1.0K J 1/6W		
R18			RD14BB2C103J	RD 10K J 1/6W		
R19			RD14BB2C392J	RD 3.9K J 1/6W		
R20			RD14BB2C562J	RD 5.6K J 1/6W		
R21			RD14BB2C222J	RD 2.2K J 1/6W		
R22 ,23			RD14BB2C562J	RD 5.6K J 1/6W		
R25			RD14BB2C100J	RD 10 J 1/6W		
R26			RD14BB2C331J	RD 330 J 1/6W		
R27			RD14BB2C181J	RD 180 J 1/6W		
R28			RD14BB2C103J	RD 10K J 1/6W		
R29			RD14BB2C102J	RD 1.0K J 1/6W		
R30			RD14BB2C562J	RD 5.6K J 1/6W		
R31 ,32			RD14BB2C682J	RD 6.8K J 1/6W		
R33 ,34			RD14BB2C102J	RD 1.0K J 1/6W		
R36			RD14BB2C104J	RD 100K J 1/6W		
R37			RD14BB2C103J	RD 10K J 1/6W		
R38			RS14AB3D2R2J	FL-PROOF RS 2.2 J 2W		
R39			RD14BB2C472J	RD 4.7K J 1/6W		
R40 -47			RD14BB2C153J	RD 15K J 1/6W		
R48 -55			RD14BB2C272J	RD 2.7K J 1/6W		
R56 -63			RD14BB2C153J	RD 15K J 1/6W		
R64 -71			RD14BB2C272J	RD 2.7K J 1/6W		
R72 -72			RD14BB2C153J	RD 15K J 1/6W		
R80 -87			RD14BB2C272J	RD 2.7K J 1/6W		
R88 ,89			RD14BB2C473J	RD 47K J 1/6W		
R90			RD14BB2C102J	RD 1.0K J 1/6W		
R91			RD14BB2C333J	RD 33K J 1/6W		
R92			RD14BB2C682J	RD 6.8K J 1/6W		
R93			RD14BB2C392J	RD 3.9K J 1/6W		
R94			RD14BB2C472J	RD 4.7K J 1/6W		
VR1			R12-3430-05	TRIMMING POT.		
VR2 -4			R12-2409-05	TRIMMING POT.		
D1			U05B	DIODE		
D2			MTZ10JC	ZENER DIODE		
D3 -26			1S1555	DIODE		
D27		*	MTZ6.8JC	ZENER DIODE		
D28			1S1555	DIODE		
D29		*	W03B	DIODE		
IC2 ,3		*	SN7407N	IC		
IC4 ,5		*	SN74LS08N	IC		
IC8		*	SN74LS374N	IC		
IC9		*	SN74LS244N	IC		
IC11		*	SN7407N	IC		
IC12,13		*	SN74LS08N	IC		
IC14		*	SN7406N	IC		
IC15		*	SN74LS374N	IC		
IC16		*	SN74LS244N	IC		
IC18		*	SN7407N	IC		
IC19,20		*	SN74LS08N	IC		
IC21		*	SN7406N	IC		
IC22		*	SN74LS374N	IC		
IC23		*	SN74LS244N	IC		
IC24		*	SN74LS374N	IC		
IC25			SN74LS245N	IC		

* New Parts
Parts without Parts No. are not supplied.
Les articles non mentionnes dans le Parts No. ne sont pas fournis.
Teile ohne Parts No. werden nicht geliefert.

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
IC26		*	UPD2732D	IC		
IC27		*	SN74LS373N	IC		
IC28		*	UPD8085AC	IC		
IC29			SN74LS04N	IC		
IC30		*	SN74LS257N	IC		
IC31		*	SN74LS155N	IC		
IC32		*	SN74LS138N	IC		
IC33,34		*	NJM723T	IC		
IC35		*	HA17805P	IC		
IC36		*	TL497ACN	IC		
IC37		*	UPC277C	IC		
IC6,7		*	SN7406N	IC		
Q1 ,2			2SC1815(Y)	TRANSISTOR		
Q3 ,4			2SD1273(P)	TRANSISTOR		
Q5 -7			2SC1815(Y)	TRANSISTOR		
Q8 ,9			2SD1273(P)	TRANSISTOR		
Q10		*	2SB793A(S)	TRANSISTOR		
Q11			2SC1815(Y)	TRANSISTOR		
Q12		*	2SB793A(S)	TRANSISTOR		
Q13			2SC1815(Y)	TRANSISTOR		
Q14		*	2SB793A(S)	TRANSISTOR		
Q15			2SC1815(Y)	TRANSISTOR		
Q16		*	2SB793A(S)	TRANSISTOR		
Q17			2SC1815(Y)	TRANSISTOR		
Q18		*	2SB793A(S)	TRANSISTOR		
Q19			2SC1815(Y)	TRANSISTOR		
Q20		*	2SB793A(S)	TRANSISTOR		
Q21			2SC1815(Y)	TRANSISTOR		
Q21			2SC1815(Y)	TRANSISTOR		
Q22		*	2SB793A(S)	TRANSISTOR		
Q23			2SC1815(Y)	TRANSISTOR		
Q24		*	2SB793A(S)	TRANSISTOR		
Q25			2SC1815(Y)	TRANSISTOR		
Q26		*	2SB793A(S)	TRANSISTOR		
Q27			2SC1815(Y)	TRANSISTOR		
Q28		*	2SB793A(S)	TRANSISTOR		
Q29			2SC1815(Y)	TRANSISTOR		
Q30		*	2SB793A(S)	TRANSISTOR		
Q31			2SC1815(Y)	TRANSISTOR		
Q32		*	2SB793A(S)	TRANSISTOR		
Q33			2SC1815(Y)	TRANSISTOR		
Q34		*	2SB793A(S)	TRANSISTOR		
Q35			2SC1815(Y)	TRANSISTOR		
Q36		*	2SB793A(S)	TRANSISTOR		
Q37			2SC1815(Y)	TRANSISTOR		
Q38		*	2SB793A(S)	TRANSISTOR		
Q39			2SC1815(Y)	TRANSISTOR		
Q40		*	2SB793A(S)	TRANSISTOR		
Q41			2SC1815(Y)	TRANSISTOR		
Q42		*	2SB793A(S)	TRANSISTOR		
Q43			2SC1815(Y)	TRANSISTOR		
Q44		*	2SB793A(S)	TRANSISTOR		
Q45			2SC1815(Y)	TRANSISTOR		
Q46		*	2SB793A(S)	TRANSISTOR		
Q47			2SC1815(Y)	TRANSISTOR		

* New Parts
Parts without Parts No. are not supplied.
Les articles non mentionnes dans le Parts No. ne sont pas fournis.
Telle ohne Parts No. werden nicht geliefert.

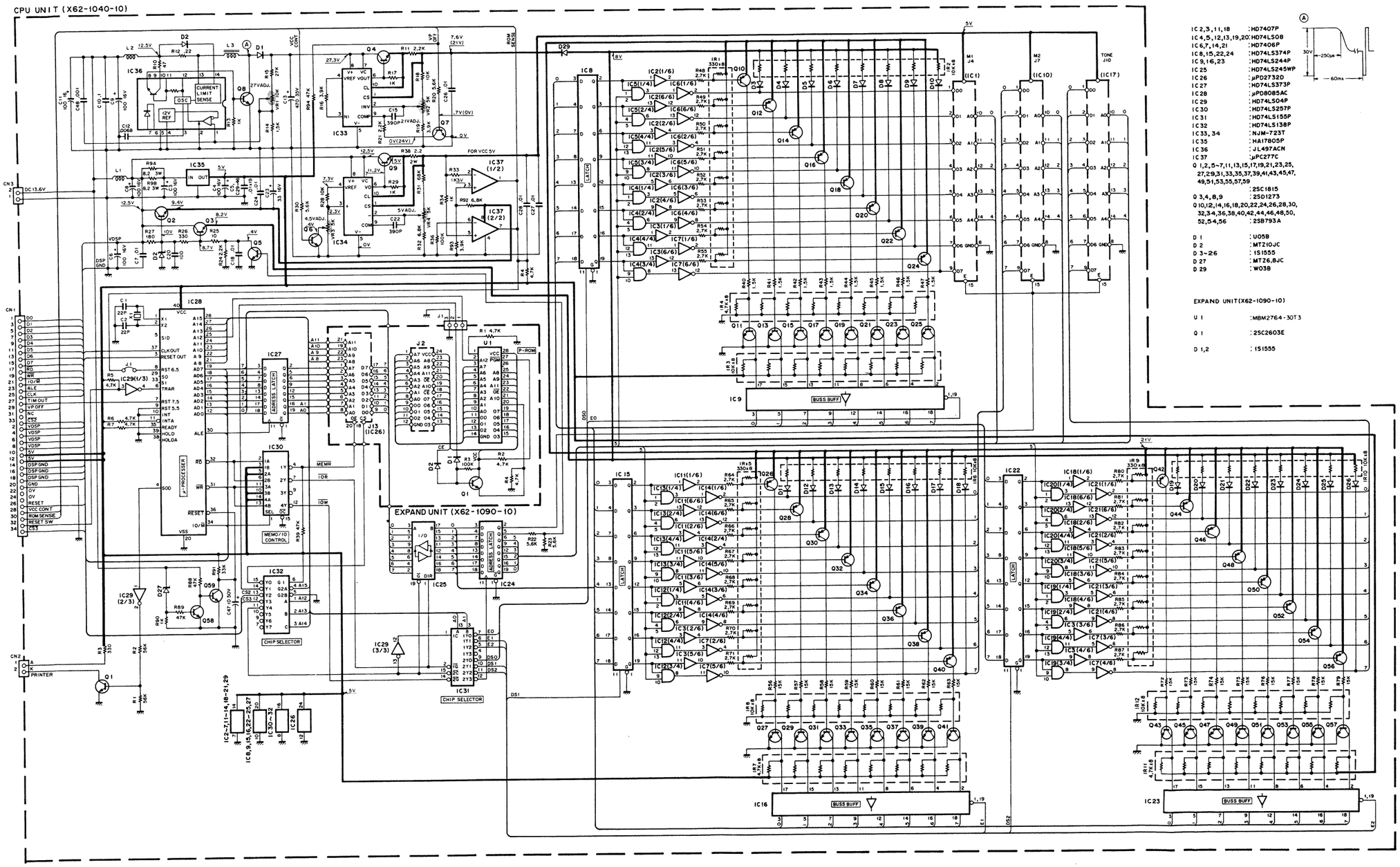
Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
Q48		*	2SB793A(S)	TRANSISTOR		
Q49			2SC1815(Y)	TRANSISTOR		
Q50		*	2SB793A(S)	TRANSISTOR		
Q51			2SC1815(Y)	TRANSISTOR		
Q52		*	2SB793A(S)	TRANSISTOR		
Q53			2SC1815(Y)	TRANSISTOR		
Q55			2SC1815(Y)	TRANSISTOR		
Q56		*	2SB793A(S)	TRANSISTOR		
Q57 -59			2SC1815(Y)	TRANSISTOR		

PARTS LIST (EXPANDER UNIT)

* New Parts
Parts without Parts No. are not supplied.
Les articles non mentionnes dans le Parts No. ne sont pas fournis.
Telle ohne Parts No. werden nicht geliefert.

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
EXPANDER UNIT (X62-1090-10)						
-			E02-0123-05	IC SOCKET (28P)		
J1			E40-0373-05	CONNECTOR (3P)		
J2			E10-2451-05	CONNECTOR (IC49)		
R1 ,2			RD14CB2C472J	RD 4.7K J 1/6W		
R3			RD14CB2C104J	RD 100K J 1/6W		
R4			RD14CB2C472J	RD 4.7K J 1/6W		
D1 ,2			1S1555	DIODE		
Q1			2SC2603(E)	TRANSISTOR		
U1		*	MBM2764-30T3	IC		

SCHEMATIC DIAGRAM
(CPU UNIT, EXPANDER UNIT)



IC 2,3,11,18	:HD7407P
IC 4,5,12,13,19,20	:HD74LS08
IC 6,7,14,21	:HD7406P
IC 8,15,22,24	:HD74LS374P
IC 9,16,23	:HD74LS244P
IC 25	:HD74LS245WP
IC 26	:μPD27320
IC 27	:HD74LS373P
IC 28	:μPD8085AC
IC 29	:HD74LS04P
IC 30	:HD74LS257P
IC 31	:HD74LS155P
IC 32	:HD74LS138P
IC 33, 34	:NJM-723T
IC 35	:HA17805P
IC 36	:JL497ACN
IC 37	:μPC277C
Q 1,2,5~7,11,13,15,17,19,21,23,25, 27,29,31,33,35,37,39,41,43,45,47, 49,51,53,55,57,59	:2SC1815
Q 3,4,8,9	:2SD1273
Q 10,12,14,16,18,20,22,24,26,28,30, 32,34,36,38,40,42,44,46,48,50, 52,54,56	:2SB793A
D 1	:U05B
D 2	:MTZ10JC
D 3~26	:1S1555
D 27	:MTZ6.8JC
D 29	:W03B

EXPAND UNIT(X62-1090-10)

U 1	:MBM2764-30T3
Q 1	:2SC2603E
D 1,2	:1S1555

Signal line
Control line
Common DC line
Adjusting points