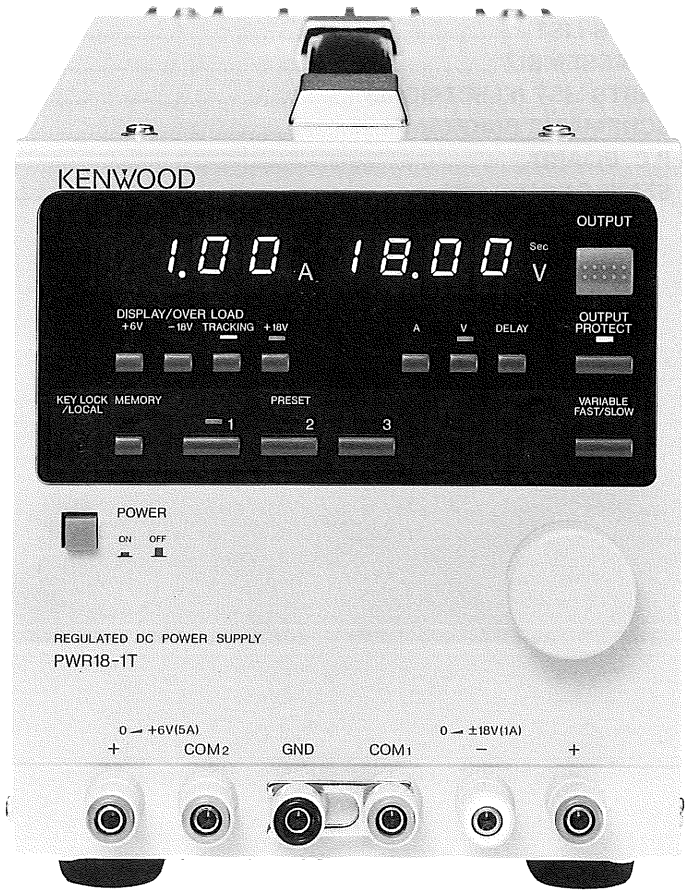
KENWOOD

REGULATED DC POWER SUPPLY

PWR18-1T

SERVICE MANUAL

KENWOOD CORPORATION



WARNING

The following instructions are for use by qualified personnel only. To avoid electric shock, do not perform any servicing other than contained in the operating instructions unless you are qualified to do so.

CONTENTS

SPECIFICATIONS

Model	PWR18-1T	
OUTPUT VOLTAGE		
Output voltage	0 to +18V/0 to −18V	0 to +6V
Setting resolution	10mV	
Max. output voltage	+18V/−18V	+6.0V
Dual tracking	0 to ±18V	
Tracking deviation	±(1%+40mV) of rated voltage	
OUTPUT CURRENT		
Output current	0 to +1A/0 to −1A	0 to +5A
Setting resolution	10mA	
Max. output current	+1A/−1A	+5.0A
Dual tracking	0 to ±1A	
Tracking deviation	(2%+40mA) of rated current	
CONSTANT VOLTAGE CHARACTERISTICS		
Input fluctuation (for surge of AC±10%)	1mV	2mV
Load fluctuation (for surge of 0 to 100%)	2mV	5mV
Ripple/noise rms (10Hz to 1MHz)	0.5mV rms	
Ripple peak (p-p)	2.8mV p-p	5.6mV p-p
Transient response	50μs Typical	100μs Typical
Temperature coefficient	100ppm/°C Typical	
CONSTANT CURRENT CHARACTERISTICS		
Input fluctuation (for surge of AC±10%)	2mA Typical	4mA Typical
Load fluctuation (for surge of 0 to 100%)	10mA Typical	20mA Typical
Ripple/noise rms (10Hz to 1MHz)	2mA rms Typical	5mA rms Typical
Ripple peak (p-p)	5.6mA p-p Typical	10mA p-p Typical
Temperature coefficient	300ppm/°C Typical	
VOLTMETER		
Display (3-1/2 digit LED)	max. 19.99V, fixed range red LED	
Accuracy (output "ON")	±(0.5% rdg+2 digit) (23°C±5°C, less than 80% RH)	
AMPMETER		
Display (3 digit LED)	max. 9.99A, fixed range red LED	
±Accuracy (output "ON")	(1.0% rdg+2 digit) 23°C±5°C, less than 80% RH	
FUNCTIONS		
Output ON/OFF	ON/OFF switch. However, output cannot be ON when MEMORY ON. Red LED lights up when ON.	
Output protect ON/OFF	Disables the output of unexpected voltage and current in the output mode. This 'PROTECT' function becomes active when a different value is set by one of the PRESET, VARIABLE and TRACKING keys in the output mode. (ON→Red LED active)	
Preset (1,2,3)	3 voltages or currents can be preset as desired. Preset values can be easily checked. Green LED lights up when ON.	

SPECIFICATIONS

Model	PWR18-1T
FUNCTIONS	
Memory	Several voltage and current presets can be stored. Red LED lights when ON.
Key Lock	Locks all functions as set. All controls except POWER are disabled. Red LED.
Delay	ON/OFF DELAY of ±18V and +6V output. Green LED lights up when ON.
V/A	Several voltages and currents can be set. Green LED.
Tracking and V/A display selection	±18V tracking, +18V, −18V, +6V
OUTPUT	
COM	±18V COM common, +6V single
Polarity	COM, positive or negative ground possible
Output terminals	+ (red), − (white), COM (blue), GND (black)
Ground proof voltage	±250V DC
SERIAL OUTPUT	0 to 36V +0 to 6V
OPERATION CONDITIONS	
Rated temperature/humidity range	0 to 40°C, 10 to 85% RH
Operation temperature/humidity range	0 to 40°C, 10 to 85% RH
Storage temperature/humidity range	−20 to 65°C, 10 to 85% RH
Cooling mechanism	Natural convection
POWER CONSUMPTION	
VA/W (at AC 100V)	approx. 210VA/176W
INPUT VOLTAGE	
Voltage, Frequency	AC 100V/120V/220V/240V±10% (max. 250V) 50/60Hz Internal switching possible.
DIMENSIONS AND WEIGHT	
Dimensions	width: 138mm height: 147mm depth: 372mm
Max. dimensions	width: 143mm height: 167mm depth: 392mm
Weight	approx. 8.2kg
Accessory items	1 instruction manual 1 power supply cord 2 fuses 1 moduler cable (for remote control)

■ Circuit and ratings are subject to change without notice due to developments in technology.

SAFETY

SAFETY

Before connecting the instrument to a power source, carefully read the following information, then verify that the proper power cord is used and the proper line fuse is installed for power source. If the power cord is not applied for specified voltage, there is always a certain amount of danger from electric shock.

Line voltage

This instrument operates using ac-power input voltages that 100/120/220/240 V at frequencies from 50 Hz to 60 Hz.

Power cord

The ground wire of the 3-wire ac power plug places the chassis and housing of the instrument at earth ground. Do not attempt to defeat the ground wire connection or float the instrument; to do so may pose a great safety hazard. The appropriate power cord is supplied by an option that is specified when the instrument is ordered.
The optional power cords are shown as follows in Fig. 1.

Line fuse

The fuse holder is located inside the instrument and contains the line fuse. Verify that the proper fuse is installed by replacing the line fuse.

Voltage conversion

This instrument may be operated from either a 100 V to 240 V, 50/60 Hz power source. Use the following procedure to change from 100 to 240 volt operation or vice versa.

1. Remove the case. Change the power voltage according to instruction manual.
2. Replace the fuse with a fuse of appropriate value, 2.5 amp for 100 VAC to 120 VAC operation, 1.5 amp for 220 VAC to 240 VAC operation.
3. When performing the reinsertion of fuse for the voltage conversion, the appropriate power cord should be used. (See Fig. 1.)

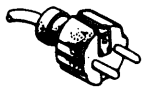
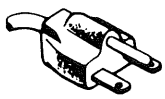
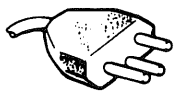
Plug configuration	Power cord and plug type	Factory installed instrument fuse	Line cord plug fuse	Parts No. for power cord set
	North American 120 volt/60 Hz Rated 15 amp (12 amp max; NEC)	2.5 A, 250 V Slow blow 6×30 mm	None	Cord: E30-1951-05
	Universal Europe 220 volt/50 Hz Rated 16 amp	1.5 A, 250 V Fast blow 6×30 mm	None	Cord: E30-1952-05
	U.K. 240 volt/50 Hz Rated 13 amp	1.5 A, 250 V Fast blow 6×30 mm	0.8 A Type C	E30-1945-05
	Australian 240 volt/50 Hz Rated 10 amp	1.5 A, 250 V Fast blow 6×30 mm	None	Cord: E30-1953-05
	North American 240 volt/60 Hz Rated 15 amp (12 amp max; NEC)	1.5 A, 250 V Fast blow 6×30 mm	None	—
	Switzerland 240 volt/50 Hz Rated 10 amp	1.5 A, 250 V Fast blow 6×30 mm	None	—

Fig. 1 Power Input Voltage Configuration

CIRCUIT DESCRIPTION

±18 OUTPUT LINE

1. ± 12V AND + 5V GENERATOR

The ± 12V and + 5V AC voltages from the AC Power Transformer T1, are first transformed into DC power by a center-tap type control rectifier (D1) and (C1 and C2). The center tap of the transformer is used as the reference. A +12V is then output through U2b and Q1 control circuits with the zener voltage (D4) as the reference voltage. The +12V input into the U2 circuit becomes the output as a +5V current, while that input into the U2a and Q2 control circuits becomes output as −12V, with the center tap as the reference point of potential.

The resulting 12V and +5V are used as the control power source of the 18 output and their reference of all center taps. The potentials are directly connected to the COM1.

2. RECTIFIER AND SMOOTHER (D21 AND C31)

AC Power output from T1 is transformed into DC power.

3. RECTIFIER AND SMOOTHER (D22 AND C32)

AC power output from T1 is transformed into DC power.

4. SERIES PASS TRANSISTORS (Q11 AND Q15)

Unstable DC power, output from D22 and C31, becomes stabilized. Transistor (Q11 and Q15) for PNP coupling are connected in series and regulated I signals output by amplifiers (Q3 and R45).

5. SERIES PASS TRANSISTORS (Q13 AND Q16)

Unstable DC power, output from D22 and C32, becomes stabilized. Transistors (Q13 and Q16) for NPN coupling are connected in parallel and controlled by signals output from amplifiers (Q4 and R46).

6. CURRENT DETECTOR (R57) AND VOLTAGE DIVIDER (VR3 AND R55)

Stable DC power output from Q11 and Q15 is led to the Power ON/OFF [k102 (1/2)] Switch via R57. The electric current input into R57 becomes output as voltage. This voltage input through VR3 and R55 becomes potential divided and in turn input into the Error Current Amplifier (U10a).

7. CURRENT DETECTOR (R58) AND VOLTAGE DIVIDER (VR4 AND R56)

Stable DC power output from Q13 and Q16 is led to the Power ON/OFF [k102 (2/2)] Switch via R58. The electric current input into R58 becomes output as voltage. This voltage input through VR4 and R56 becomes potential divided and in turn input into the Error Current Amplifier (U11a).

8. POWER ON/OFF [K102 (1/2) AND K102 (2/2)] SWITCHES AND POWER ON/OFF DRIVE (Q101)

Each ± DC power voltage, output from R57 and R58, passes through the Power ON/OFF Switch (K102) and in turn output from the Power Source__ Output Terminal. K102 (1/2) outputs positive power while K102 (2/2) outputs negative power. K102 (1/2) and K102 (2/2) each use two units of relays and the ON/OFF of ± the output is done simultaneously.

K102 is controlled by the Power Output ON/OFF Drive (Q101). K102 is ON when Q101 is ON and power is output. When Q101 is OFF, K102 is OFF and no power is output.

9. POWER OUTPUT DETECTION SWITCHES [K101 (1/2 AND 2/2)], POWER OUTPUT DETECTION DRIVE (Q103), AND SIGNAL DELAY (U102, D110, R124 AND C124)

For power output adjustment, positive voltage is input into K101 (1/2) and negative voltage is input into K101 (2/2). Output is made to each corresponding voltage driver. Both K101 (1/2) and K101 (2/2) constitute transfer relays and each one side is connected to the output side of K102 while each other side is connected to the opposite side, i.e opposite the output side of K102. Both K101 (1/2) and K101 (2/2) consist of 2 relay units and adjustment of the power output detection location is done simultaneously. When power is output through the main power source, potential detection is made on the sides of K101 (1/2) and K101 (2/2) which are on the output sides of K102. When there is no power output, power detection is made on the sides which are opposite the K102 output. K101 is controlled by the Power Output Detection Drive (Q102). When Q102 is ON, both K101 (1/2) and (2/2) become connected to each output side. When Q102 is OFF, the same become connected to the side opposite the output side.

Q102 is controlled by the signals from the Signal Delay (U102, D110, R124, and C124).The signals which turn Q101 to ON/OFF are buffered and sent as signals which turn Q102 to ON/OFF. Signals sent to Q102, versus those sent to Q102 ON/OFF. Signals sent to Q102, versus those sent to Q101, become delayed when Q102 is ON.

10. VOLTAGE DIVIDERS (R35) (R37)

R35 and R37 are the complex resistors of 3K and 12K. The electrical potentials output from K101 (1/2) and K101 (2/2) are divided by voltage dividers R35 and R37. The divided potentials are then input into the Positive/Negative Detector Selector.

CIRCUIT DESCRIPTION

11.VOLTAGE DIVIDER (R28)

R28 is the complex resistor of 2k and 1k. The electrical potentials of K101 (1/2) are output to the 10k resistor, while the electrical potentials of reference voltage generator V (U10b,U15,R51,C19,C30) are output to the 2k resistor. Furthermore, the electrical potentials of COM of the 2k and 10k resistors are output to the error voltage amplifier (U12b).

12.VOLTAGE DIVIDER (R30)

R30 is the complex resistor of 2k and 10k. The electrical potentials of K101 (2/2) are output to the 10k resistor, while the electrical potentials of reference voltage generator V (U11b,U16,R53,C21,C29) are output to the 2k resistor. Furthermore, the electrical potentials of COM of the 2k and 10k resistors are output to the error voltage amplifier (U12a).

13.ERROR CURRENT AMPLIFIER (U10a)

The electrical potentials output from the Voltage Dividers (VR3 and R55) and those output from Reference Voltage Generator A (R52 and C20) are compared and their errors amplified. They are then input into the Signal Selectors (D8 and D9).

14.ERROR CURRENT AMPLIFIER (U11a)

The electrical potentials output from the Voltage Dividers (VR4 and R56) and those output from the Reference Voltage Generator A (R54 and C22) are compared and their errors amplified. They are then input into Signal Selectors (D10 and D11).

15.ERROR VOLTAGE AMPLIFIER (U12b)

The electrical potentials output from the Voltage Divider (R28) and those output from COM are compared and their errors amplified. They are then input into Signal Selectors (D8 and D9).

16.ERROR VOLTAGE AMPLIFIER (U13a)

The electrical potentials output from the Voltage Divider (R30) and those output from Reference Voltage Generator A (U11b) are compared and their errors amplified. They are then input into Signal Selectors (D10 and D11).

17.SIGNAL SELECTORS (D8 AND D9) AND SIGNAL AMPLIFIERS (Q3 AND R45)

D8 and D9 constitute cathode commons. Signals, either output from U10a or U12b , are selected depending on their potential condition and in turn input into signal amplifiers (Q3 and R45). Q3 versus Q11,Q12, and Q15 are Darlington-connected in two layers.

18.SIGNAL SELECTORS (D10 AND D11) AND SIGNAL AMPLIFIERS (Q4 AND R46)

D10 and D11 constitute encode commons. Signals, either output from U11a or U13a, are selected depending on their potential condition and in turn input into signal amplifiers (Q4 and R46). Q4 versus Q13, Q14, and Q16 are Darlington-connected in two layers.

19.COMPARISON VOLTAGE GENERATORS (R39 - R41)

The reference voltage is generated from 12V for establishing whether the main power source ± power output is CV or CC. Potentials for positive power output are negative and are input into Comparator (U12a), While those for the negative power output are positive and are input into Comparator (U13b).

20.COMPARATORS (U12a AND U13b)

A comparison is made between signals from the Error Current Amplifiers and the Comparison Voltage Generator to establish whether the main power source + power output is CV or CC. The condition of the power output is determined and the corresponding signal is input into the CPU.

21.REFERENCE VOLTAGE GENERATOR V (U10b, U15, R51, C19 AND C30)

The reference voltage for the positive power output is generated by U15, R51, C19 and C30, and led through the buffer constituting U10 b, and output as reference voltage. The voltage is normally a negative potential.

22.REFERENCE VOLTAGE GENERATOR V (U11b, U16, R53, C21 AND C29)

The reference voltage for the positive power output is generated by U16, R53, C21 and C29, and led through the buffer constituting U11 b, and output as the reference voltage. The voltage is normally a positive potential.

23.REFERENCE VOLTAGE GENERATOR A (R52 AND C20)

The reference voltage for the positive output current is generated by R52 and C20. The voltage is normally a negative potential.

24.REFERENCE VOLTAGE GENERATOR A (R54 AND C22)

The reference voltage for the negative output current is generated by R54 and C22. The voltage is normally a positive potential.

25. +V TIMING (U17b) AND −V TIMING (U17c) GENERATORS

These constitute 3 input AND circuits. Each U15 and U16 functions in a conducting condition in case the positive/negative voltage in Reference Voltage Generator V is reset. With the exception of the above case, a non-conducting condition is maintained and the positive/negative voltage generating capacity of Reference Voltage Generator V is increased.

CIRCUIT DESCRIPTION

26.DETECTOR VOLTAGE SELECTOR [U8 (Y)]

The detector voltage of each positive and negative voltage and 1 potential,out of the 4 current potentials, are selected and output into the following Reference Voltage Selectors. This selector, controlled by 3 digital signals (D17, D19 and D20), becomes non-conductive when selection is being carried out.

D17	D19	D20	Conductivity & selected potential
H	—	—	Non-conductive
L	L	L	Positive detector voltage value
L	H	L	Positive detector current value
L	L	H	Negative detector voltage value
L	H	H	Negative detector current value

27.DETECTOR VOLTAGE SELECTOR [U7 (Z)]

Either the potential selected by [U8 (Y)] or the COM potential is selected and output to the Comparator. This selector is controlled by 1 digital signal (D16).

D16	Selected potential
L	[U8 (Y)] potential
H	COM potential

28. ± REFERENCE VOLTAGE GENERATOR DAC (U6, U9, D7, R17 - R22, R69 - R71 AND VR1 - VR2)

All reference voltages for the power source are generated here. U6 constitutes a 12 bit current adding type DAC. Current - to - voltage conversion is carried out in U19a and U19b,while negative potentials are generated in U19b. The digital signals used in DAC are D1 - D12. This DAC, however, can be used as a 14 bit DAC by simply adding 2 bits, digital signals D23 - D24 and through R69 - R71, on the LSB side. The reference voltage for AMP U9a and U9b, used for ± voltage - voltage conversion, becomes generated by D7 and in R19 - R22.

Input digital signal	000H	3FFFH
Generated + Voltage TYP value	−186 mV	+3.910 V
Generated − Voltage TYP value	+186 mV	−3.920 V

29. ± REFERENCE VOLTAGE SWITCH [U7 (X)]

Either the ± reference voltage output from U9a or that output from U9b is selected and input into the following Reference Voltage Switch [U7 (X)].
This switch is controlled by 1 digital signal (D14)

D14	Selected potential
L	Positive reference voltage
H	Negative reference voltage

30.REFERENCE VOLTAGE SWITCH [U7 (Y)]

A signal from [U7 (X)] is input either the comparator or the next Reference Voltage SWitch [U8 (X)] depending on the selection made.
This switch is controlled by 1 digital signal (D15).

D15	Where signal is sent
L	Comparator
H	U8 (X)

31.REFERENCE VOLTAGE SWITCH [U8 (X)]

A signal from [U7 (Y)] is input either to the four ± Reference Voltage Generators V or to Reference Voltage Generator A.

The signal that controls this switch is the same signal that controls the Reference Voltage Selector [U8 (Y)].

D17	D19	D20	Conducting condition & where signal is sent
H	—	—	Non-conducting condition
L	L	L	Positive Reference Voltage Generator V
L	H	L	Positive Reference Voltage Generator A
L	L	H	Negative Reference Voltage Generator V
L	H	H	Negative Reference Voltage Generator A

32.COMPARATOR (U14)

A comparison is made on the potentials of signals sent from [U7 (Y)] and [U7 (Z)] . Data decided from the comparison is then sent to the CPU via the Signal Converter. Overall speaking, data is output following successive comparison.

Contents of decided data	Signal from [U7 (Y)]	Signal from [U7 (Z)]
Detection of positive reference voltage 0V data	Positive reference	voltage COM
Detection of negative reference voltage 0V data	Negative reference	voltage COM
Detection of positive output voltage values	Positive reference	voltageVoltage Divider (R35)
Detection of negative output voltage values	Negative reference	voltage Voltage Divider (R37)
Detection of positive output current values	Negative reference	voltage Voltage Divider (VR3 and R55)
Detection of negative output current values	Positive reference	voltage Voltage Divider (VR4 and R56)

In order to minimize offset error in U14a, U14b is used as a buffer and offset error is overall canceled in U4.

33.SIGNAL CONVERTER (U17a, D18, R59 - R63)

The ± 12V signals sent from U14 are converted to ± 5V signals in D18 and R59 - R60. These signals get a 0.25V hysteresis, with 2.5V as the center, by U17a, R61 and R62. They are then sent to the CPU.

34.DATA LATCH (U3 - U5)

The 24 bit data sent to the serial from the CPU are serial parallel converted and output as 24 bit data.

CIRCUIT DESCRIPTION

+ 6 OUTPUT LINE

1. ± 12V AND + 5V GENERATOR

The ± 12V and + 5V AC voltages from the AC Power Transformer T1, are first transformed into DC power by a center-tap type control rectifier (D1) and (C1 and C2). The center tap of the transformer is used as the reference. A + 12V is then output through U2b and Q1 control circuits with the zener voltage (D4) as the reference voltage. The + 12V input into the U2 circuit becomes the output as a + 5V current, while that input into the U2a and Q2 control circuits becomes output as -12V, with the center tap as the reference point of potential.

The resulting 12V and + 5V are used as the control power source and their reference of all center taps. The potentials are directly connected to the COM2.

2. RECTIFIER AND SMOOTHER (D23 AND C31, C32)

AC power output from T1 is transformed into DC power.

3. SERIES PASS TRANSISTORS (Q11 - Q14)

Unstable DC power, output from D23 and C31, C32 becomes stabilized. Transistors (Q11 - Q14) for PNP coupling are connected in parallel and controlled by signals output from amplifiers (Q4 and R46).

4. CURRENT DETECTOR (R57, R58 AND R186) AND VOLTAGE DIVIDER (VR4 AND R56)

Stable DC power output from Q11 - Q14 is led to the Power ON/OFF [k104] Switch via R57, R58 and R186. The electric current input into R57, R58 and R186 becomes output as voltage. This voltage input through VR4 and R56 becomes potential divided and in turn input into the Error Current Amplifier (U11a).

5. POWER ON/OFF [K104] SWITCHES AND POWER ON/OFF DRIVE (Q102)

The DC power voltage, output from R57, R58 and R186, passes through the Power ON/OFF Switch(K104) and in turn output from the Power Source 8 Output Terminal. K104 output power.

K104 is controlled by the Power Output ON/OFF Drive (Q102). K104 is ON when Q102 is ON and power is output. When Q102 is OFF, K104 is OFF and no power is output.

6. POWER OUTPUT DETECTION SWITCHES [K103(2/2)], POWER OUTPUT DETECTION DRIVE (Q104), AND SIGNAL DELAY (U102, D111, R126 AND C123)

For power output adjustment, + 6 voltage is input. K103(2/2) is sent to corresponding voltage divider. One side is connected to the output side of K104 while each other side is connected to the opposite side, i.e opposite the output side of K104. When power is output through the + 6 power source, potential detection is made on the K104 which are on the output side of K104. When there is no power output, power detection is made on the sides which are opposite the K104 output. K103(2/2) is controlled by the Power Output Detection Drive (Q104). When Q102 is ON, both K101 (1/2) and (2/2) become connected to each output side. When Q102 is OFF, the same become connected to the side opposite the output side.

Q104 is controlled by the signals from the Signal Delay (U102, D111, R126 and C123).The signals which turn Q102 to ON/OFF are buffered and sent as signals which turn Q104 to ON/OFF. Signals sent to Q104, versus those sent to Q104 ON/OFF. Signals sent to Q104, versus those sent to Q102, become delayed when Q104 is ON.

7. VOLTAGE DIVIDERS (R37)

R37 is the complex resistor of 3K and 12K. The electrical potential output from K103 (2/2) are divided by voltage dividers R37. The divided potentials are then input into the Voltage Detector Switch.

8. VOLTAGE DIVIDER (R30)

R30 is the complex resistor of 2k and 10k. the electrical potentials of k101(2/2) are output to the 10k resistor, while the electrical potentials of reference voltage generator V (U11b, U16, R53, C21, C29) are output to the 2k resistor. Furthermore, the electrical potentials of COM of the 2k and 10k resistors are output to the error voltage amplifier(U12a).

9. ERROR CURRENT AMPLIFIER (U11a)

The electrical potentials output from the Voltage Dividers (VR4 and R56) and those output from the Reference Voltage Generator A (R54 and C22) are compared and their errors amplified. They are then input into Signal Selectors(D10 and D11).

10. ERROR VOLTAGE AMPLIFIER (U13a)

The electrical potentials output from the Voltage Dividers (R30) and those output from Reference Voltage Generator A (U11b) are compared and their errors amplified. They are then input into Signal Selectors (D10 and D11).

11. SIGNAL SELECTORS (D10 AND D11) AND SIGNAL AMPLIFIERS (Q4 AND R46)

D10 and D11 constitute encode commons. Signals, either output from U11a or U13a, are selected depending on their potential condition and in turn input into signal amplifiers (Q4 and R46). Q4 versus Q11 - Q14 are Darlington-connected in two layers.

CIRCUIT DESCRIPTION

12.COMPARISON VOLTAGE GENERATORS (R39 - R41)

The reference voltage is generated from 12V for establishing whether the main power source ± power output is CV or CC. While those for the + 6 power output are positive and are input into Comparator (U13b).

13.COMPARATOR (U13b)

A comparison is made between signals from the Error Current Amplifiers and the Comparison Voltage Generator to establish whether the main power source + power output is CV or CC. The condition of the power output is determined and the corresponding signal is input into the CPU.

14.REFERENCE VOLTAGE GENERATOR V (U11b, U16, R53, C21, AND C29)

The reference voltage for the positive power output is generated by U16, R53, C21, and C29, and led through the buffer constituting U11 b, and output as the reference voltage. The voltage is normally a positive potential.

15.REFERENCE VOLTAGE GENERATOR A (R54 AND C22)

The reference voltage for the negative output current is generated by R54 and C22. The voltage is normally a positive potential.

16.V TIMING (U17c) GENERATORS

These constitute 3 input AND circuits. U16 functions in a conducting condition in case the + 6 voltage in Reference Voltage Generator V is reset. With the exception of the above case, a non-conducting condition is maintained and the + 6 voltage generating capacity of Reference Voltage Generator V is increased.

17.REFERENCE VOLTAGE SELECTOR [U8 (Y)]

The reference voltage of each positive and negative voltage and 1 potential,out of the 4 current potentials, are selected and output into the following Reference Voltage Selectors. This selector, controlled by 3 digital signals (D18, D19, and D20), becomes non-conductive when selection is being carried out.

D18	D19	D20	Conductivity & selected potential
H	—	—	Non-conductive
L	L	L	
L	H	L	
L	L	H	+ 6 reference voltage value
L	H	H	+ 6 reference current value

18.REFERENCE VOLTAGE SELECTOR [U7 (Z)]

Either the potential selected by [U8 (Y)] or the COM potential is selected and output to the Comparator. This selector is controlled by 1 digital signal (D16).

D16	Selected potential
L	[U8 (Y)] potential
H	COM potential

19. ± REFERENCE VOLTAGE GENERATOR DAC (U6, U9, D7, R17 - R22, R68 - R71 AND VR1 - VR2)

All reference voltages for the power source are generated here. U6 constitutes a 12 bit current adding type DAC. Current - to - voltage conversion is carried out in U19a and U19b,while negative potentials are generated in U19b. The digital signals used in DAC are D1 - D12. This DAC, however, can be used as a 14 bit DAC by simply adding 2 bits, digital signals D23 - D24 and through R68 - R71, on the LSB side. The reference voltage for AMP U9a and U9b, used for ± voltage - voltage conversion, becomes generated by D7 and in R19 - R22.

Input digital signal	000H	3FFFH
Generated + Voltage TYP value	− 186 mV	+ 3.910 V
Generated − Voltage TYP value	+ 186 mV	− 3.920 V

20. ± REFERENCE VOLTAGE SWITCH [U7 (X)]

Either the ± reference voltage output from U9a or that output from U9b is selected and input into the following Reference Voltage Switch [U7 (X)].

This switch is controlled by 1 digital signal (D14)

D14	Selected potential
L	Positive reference voltage
H	Negative reference voltage

21.REFERENCE VOLTAGE SWITCH [U7 (Y)]

A signal from [U7 (X)] is input either the comparator or the next Reference Voltage SWitch [U8 (X)] depending on the selection made.

This switch is controlled by 1 digital signal (D15).

D15	Where signal is sent
L	Comparator
H	U8 (X)

22. REFERENCE VOLTAGE SWITCH [U8 (X)]

A signal from [U7 (Y)] is input either to the four ± Reference Voltage Generators V or to Reference Voltage Generator A.

The signal that controls this switch is the same signal that controls the Reference Voltage Selector [U8 (Y)].

D18	D19	D20	Conducting condition & where signal is sent
H	—	—	Non-conducting condition
L	L	L	
L	H	L	
L	L	H	+ 6 Reference Voltage Generator V
L	H	H	+ 6 Reference Voltage Generator A

23. COMPARATOR (U14)

A comparison is made on the potentials of signals sent from [U7 (Y)] and [U7 (Z)] . Data decided from the comparison is then sent to the CPU via the Signal Converter. Overall speaking, data is output following successive comparison.

Contents of decided data	Signal from [U7 (Y)]	Signal from [U7 (Z)]
Detection of positive reference voltage 0V data	Positive reference voltage	COM
Detection of negative reference voltage 0V data	Negative reference voltage	COM
Detection of + 6 output voltage values	Negative reference voltage	Voltage Divider (R37)
Detection of + 6 output current values	Positive reference voltage	Voltage Divider (VR4 and R56)

In order to minimize offset error in U14a, U14b is used as a buffer and offset error is overall canceled in U4.

24. SIGNAL CONVERTER (U17a, D18, R59, R60 and R63)

The ± 12V signals sent from U14 are converted to ± 5V signals in D18 and R59 - R60 and U17a. They are then sent to the CPU.

25. DATA LATCH (U3 - U5)

The 24 bit data sent to the serial from the CPU are serial parallel converted and output as 24 bit data.

26. ISOLATOR AND +5V GENERATOR

The CPU and the AMP are electrically isolated and signals between them are transmitted using photo couplers in U103 - U106.

The power source on the CPU side is +5V generated in D101, C101 and U101.

27. NOISE SUPPRESSOR

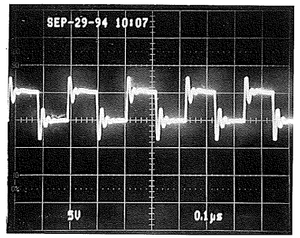
In an effort to prevent noise, the CPU and Panel are equipped inside with a shielded case. There is some noise, however, that passes through the line of signal transmission between the CPU and Isolator. Such line noise is removed by the application of through type condensers, a total of 12, including that for the power source line.

CIRCUIT DESCRIPTION

CPU SECTION

1. CPU

CPU



U4 - 64 Waveform, CPU Clock Waveform

By attaching X'tal oscillator X1, C3 and C4 to pins 2 and 3 of U4, U4 can be operated at half the frequency.

2. KEYBOARD INPUT, ROTARY ENCODER INPUT, INPUT PORT, AND INTERRUPT

When any of the keys (S51 - S63) are , pressed, the output of U55 becomes ''L'' and the CPU is interrupted. The pressed key becomes decided by signals (2 lines) from Output Port U53 and from Input Port U54. When the rotary encoder is operated, the collector potential of either Q62 or Q63 becomes ''L'', i.e. passing through the sequence U57e --» U57f --» U56, and this potential interrupts the CPU. The Rotary Encoder counts within a given time pass through U57a and U57b, and is input into the CPU via Input Port U7. As for the up/down decision of the encoder, data sent to the CPU via Input Port U7 is decided. This is because the Q output of U56a and U56b falls to ''L'', when data from the encoder first interrupts the CPU, and this state is maintained. Besides data from the keyboard or the rotary encoder, 3 types of data from the AMP and isolator are input into the Input Port U7 and U10. These data are different from those for the previously mentioned interrupt input. They are periodically read out by the CPU within the program loop, reaching the CPU via the Input Port U7 and U10.

Details of the said data are as a following:

(1) Comparative U14 data (Successive comparison data)
(2) Positive output data (CC state at ''L'')
(3) Negative output data (CC state at ''L'')

3. OUTPUT PORT

- The 2 pieces of data at Output Port U53 are normally ''H''. As previously mentioned, pressing any key (S51 - S63) turns either of the above data to ''L'' while the other remains ''H''. After data of the opposite nature is output, the key input becomes a decided.
- 8 pieces of data at Output Port U53 are used as control signals for the Display Drive.
- 5 pieces of data are sent to the AMP digital data generator from Output Port U53 via the isolator.

The above data are as the following :

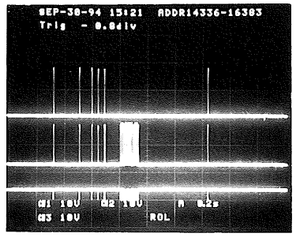
(1) 24 bit serial data
(2) 24 bit serial data shift clock data
(3) 24 bit serial data latch clock data

They are then sent to the digital data generator via the isolator. This action also compensates for any lag in the response time of the isolator's photo coupler.

4. DISPLAY DRIVE AND DISPLAY

Both U51 and U52 are ICs for dynamic blinking lights. Transmitters (R83 and C60, R84 and C61, respectively) are equipped. The display is controlled by the previously mentioned 4 pieces of data from U53.

Buffer Unit (X81-2890-00)

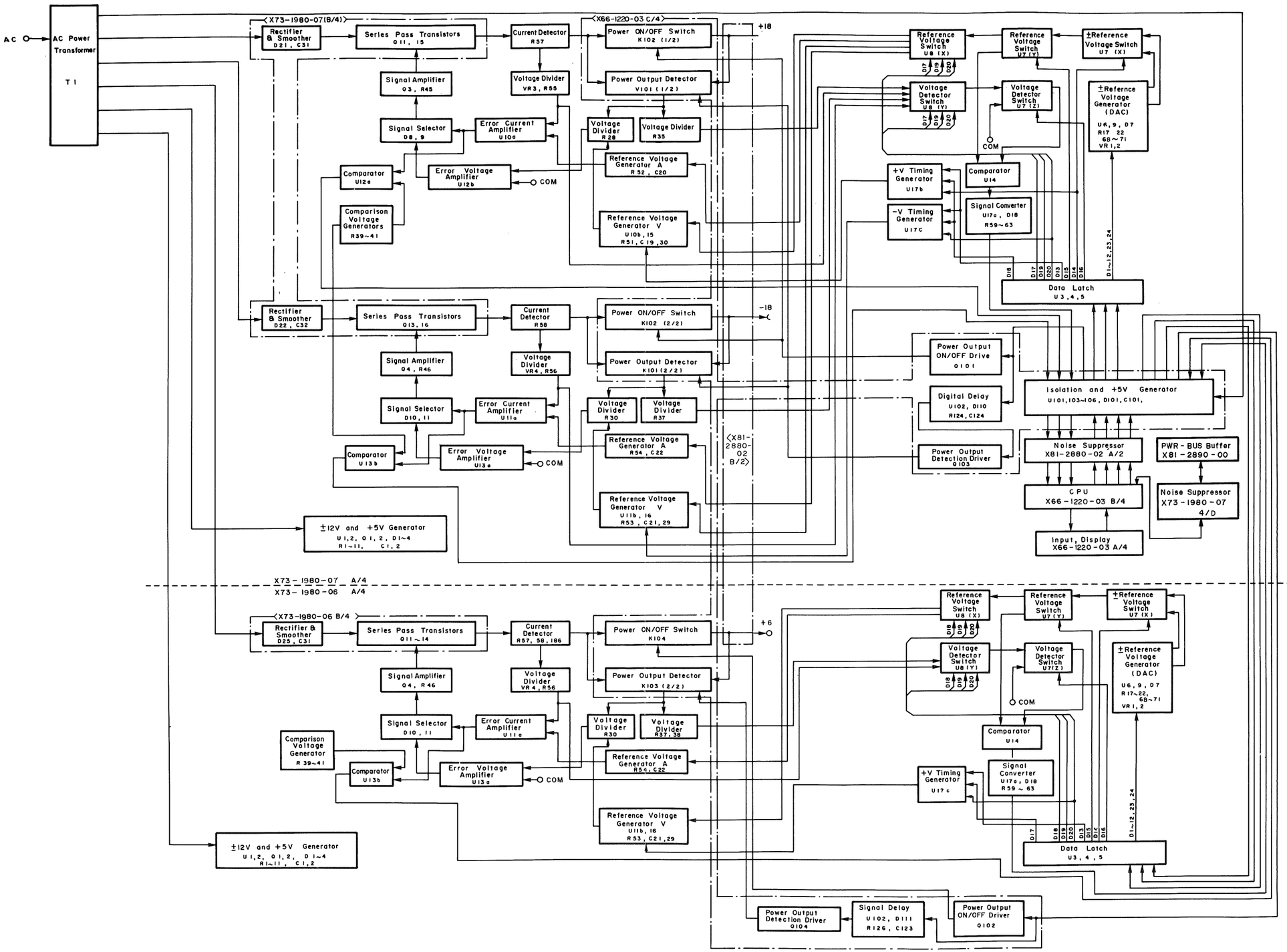


Waveforms at various points when the "ST" command is sent from the PC

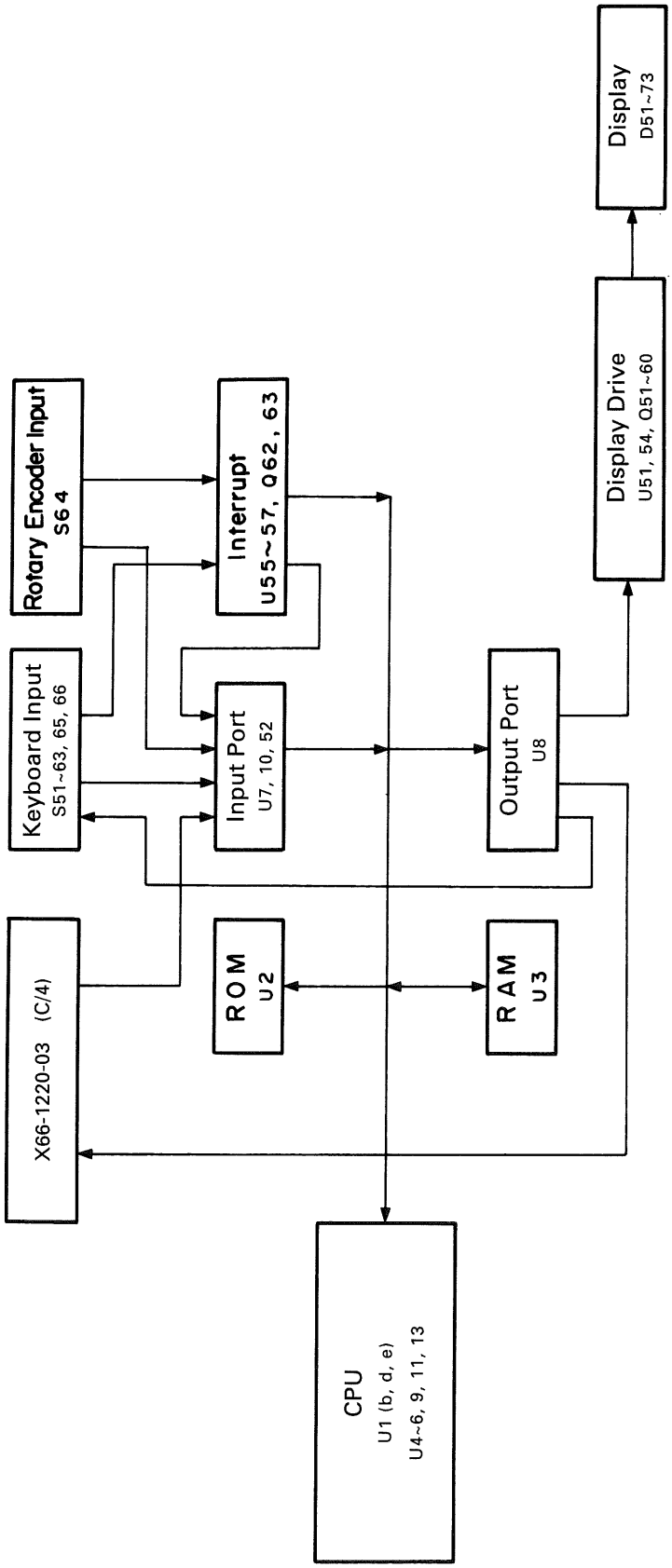
This unit converts the RS-232C signal level into the PWR-BUS signal level. The level of the RS-232C signal input through pin 5 of P2-IN is converted by U1 and Q1 into the PWR-BUS signal level, and this signal is sent inside the set through pin 5 of P1.

The PWR-BUS signal sent from inside the set is sent to U1 through pin 5 of P1, its level is converted by U1 into the RS-232C signal level, and this signal is output externally through pin 2 of P2-IN. At the same time, the PWR-BUS signal is also output externally through pin 3 of P2-IN and pin 3 of P2-OUT.

BLOCK DIAGRAM



BLOCK DIAGRAM



ADJUSTMENT

To obtain the best performance, periodically calibrate the unit. Sometimes, only one mode need be calibrated, while at other times, all modes should be calibrated. When one mode is calibrated, it must be noted that the other modes may be affected. When calibrating all modes, perform the calibration in the specified sequence.

The following calibration required an accurate measuring instrument and an insulated adjusting flat blade screwdriver. If they are not available, contact your dealer. For optimum adjustment, turn the power on and warm up the scope sufficiently (more than 30 minutes) before starting.

Before calibrating the unit, check the power supply voltage.

TEST EQUIPMENT REQUIRED

The following instrument or their equivalent should be used for making adjustment.

Multimeter	45	FLUKE
Oscilloscope	CS-4025	KENWOOD

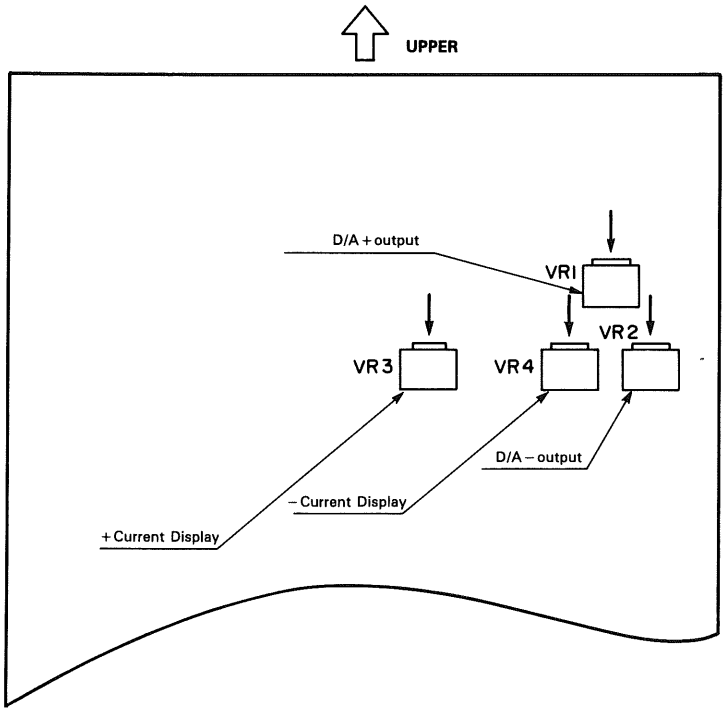
Item	Adjustment VR	P.C.B	Procedure
D/A + Output	VR1	X73-1980-07	1. Connect the multimeter as follows: Multimeter — PWR + to X73-1980-07 TP COM to COM_1 terminal on the panel At this point, set the multimeter to the voltage measurement mode. 2. Set the PWR to the voltage adjustment mode. Turn the power switch ON pressing the KEYLOCK switch. Set the KEYLOCK switch free when the LEDs go on. At this point, all the 7-segment LEDs display "8". 3. Press the PRESET1 and observe the multimeter. Assume that the value at this point is P. 4. Press the PRESET2. Then adjust the VR1 so that the multimeter indicates (P+4.096) V. ±2mV
D/A − Output	VR2		1. Press the PRESET3 and observe the multimeter. Assume that the value at this point is N. 2. Press the VARIABLE. Then adjust the VR2 so that the multimeter indicates (N + 4.096) V. ± 2mV 3. Cancel the voltage adjustment mode by pressing the V switch. (Cancellation will take about 10 seconds.)
+ Current Display	VR3		1. Connect the multimeter as follows: Multimeter — PWR + to +18 V terminal on the panel COM to COM_1 terminal on the panel At this point, set the multimeter to the current measurement mode. 2. Turn the OUTPUT switch ON. Then adjust the multimeter by turning the rotary knob so that it indicates 1.00 A. At this point, make sure that the +18 V LED blinks and the unit maintains a constant current. 3. Adjust the VR3 so that the multimeter indicates 1.00 A.
− Current Display	VR4		1. Connect the multimeter as follows: Multimeter — PWR + to −18 V terminal on the panel COM to COM_1 terminal on the panel At this point, set the multimeter to the current measurement mode. 2. Display −18 V on the 7-segment LED by pressing the −18 V switch. 3. Turn the OUTPUT switch ON. Then adjust the multimeter by turning the rotary knob so that it indicates −1.00 A. At this point, make sure that the −18 V LED blinks and the unit maintains a constant current. 4. Adjust the VR4 so that the multimeter indicates −1.00 A.

ADJUSTMENT

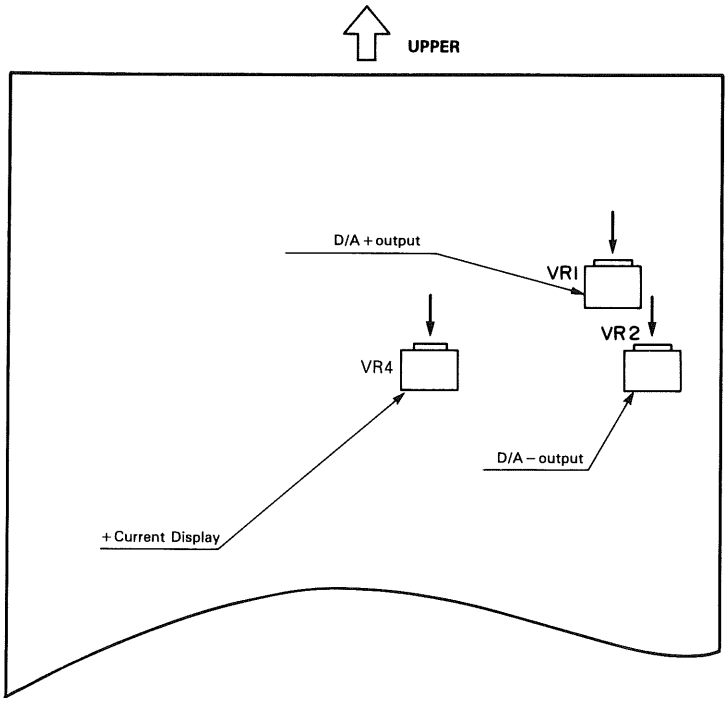
Item	Adjustment VR	P.C.B	Procedure
D/A + Output	VR1	X73-1980-06	1. Connect the multimeter as follows: Multimeter PWR + to X73-1980-06 TP COM to +6 V terminal on the panel At this point, set the multimeter to the voltage measurement mode. 2. Set the PWR to the voltage adjustment mode. Turn the power switch ON pressing the KEYLOCK switch. Set the KEYLOCK switch free when the LEDs go on. At this point, all the 7-segment LEDs display "8". 3. Press the PRESET1 and observe the multimeter. Assume that the value at this point is P. 4. Press the PRESET2. Then adjust the VR1 so that the multimeter indicates (P+4.096) V. ±2mV
D/A − Output	VR2		1. Press the PRESET3 and observe the multimeter. Assume that the value at this point is N. 2. Press the VARIABLE. Then adjust the VR2 so that the multimeter indicates (N + 4.096) V. ± 2mV 3. Cancel the voltage adjustment mode by pressing the V switch. (Cancellation will take about 10 seconds.)
+ Current Display	VR4		1. Connect the multimeter as follows: Multimeter PWR + to +6 V terminal on the panel COM to COM_2 terminal on the panel At this point, set the multimeter to the current measurement mode. 2. Display +6 V on the 7-segment LED by pressing the +6 V switch. 3. Turn the OUTPUT switch ON. Then adjust the multimeter by turning the rotary knob so that it indicates 5.00 A. At this point, make sure that the +6 V LED blinks and the unit maintains a constant current. 4. Adjust the VR4 so that the multimeter indicates 5.00 A.

ADJUSTMENT

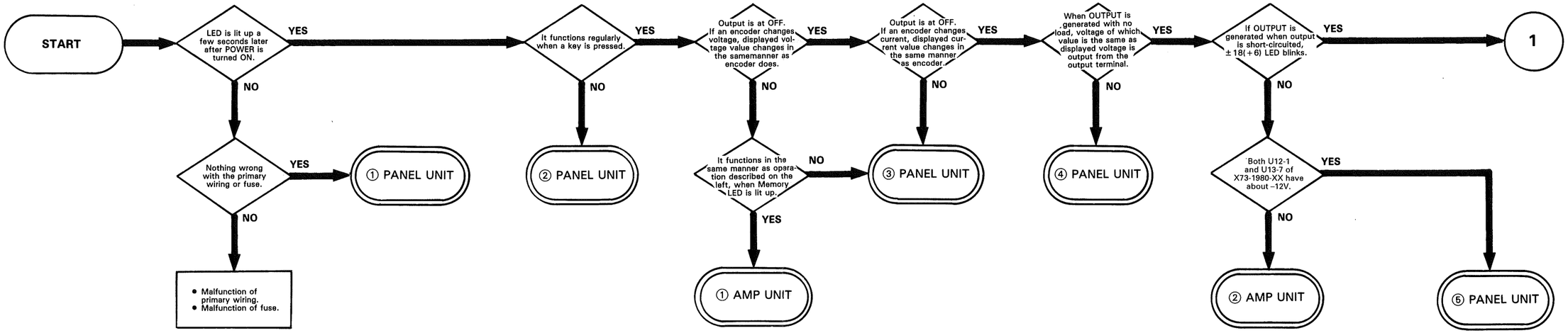
± 18 AMP UNIT (X73-1980-07)

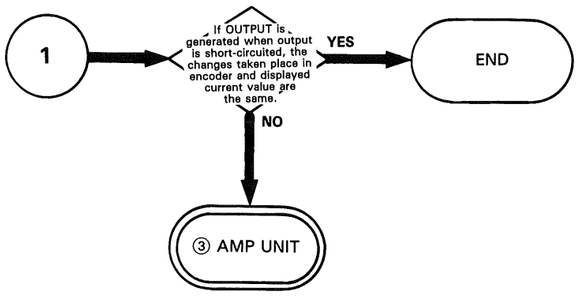


+ 6 AMP UNIT (X73-1980-06)



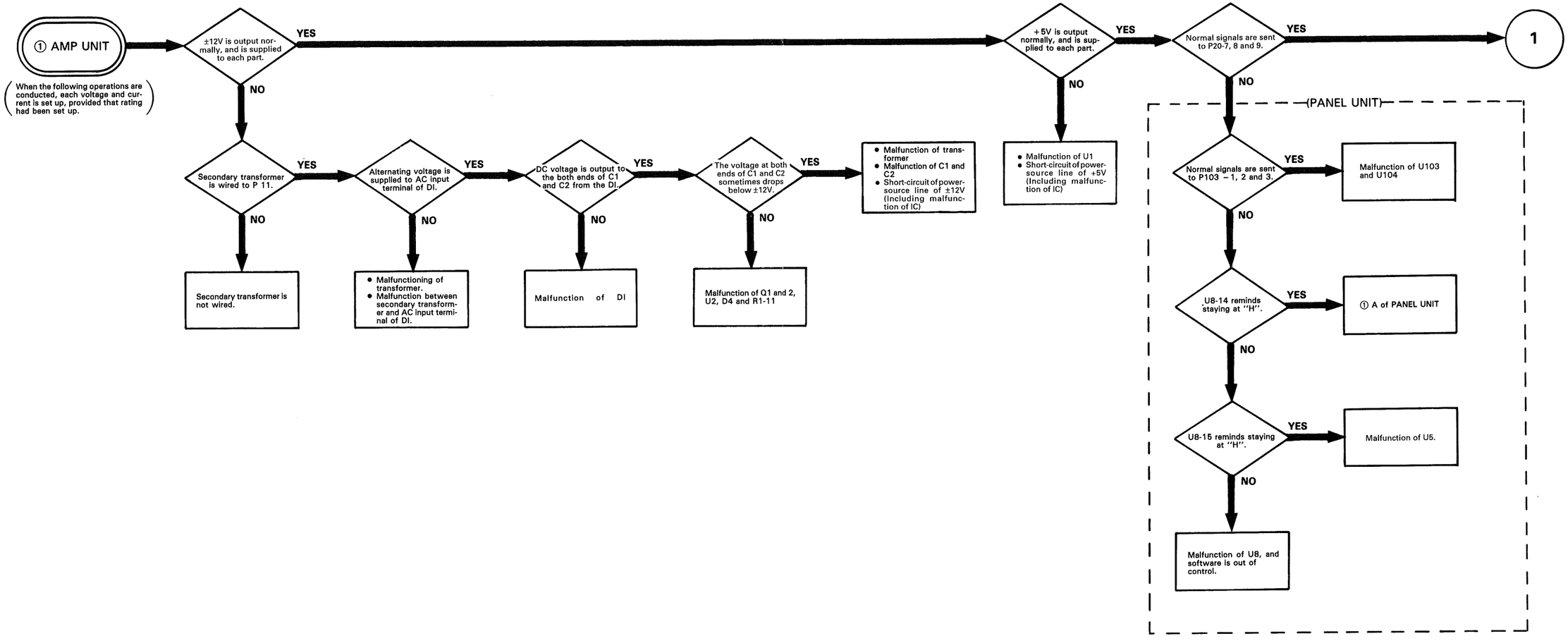
TROUBLESHOOTING





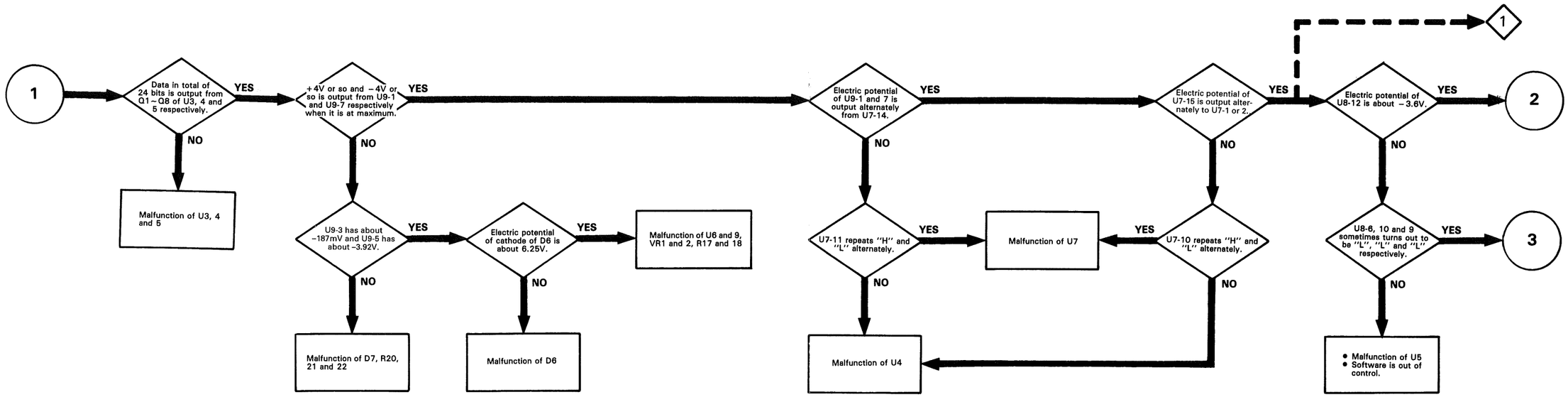
TROUBLESHOOTING

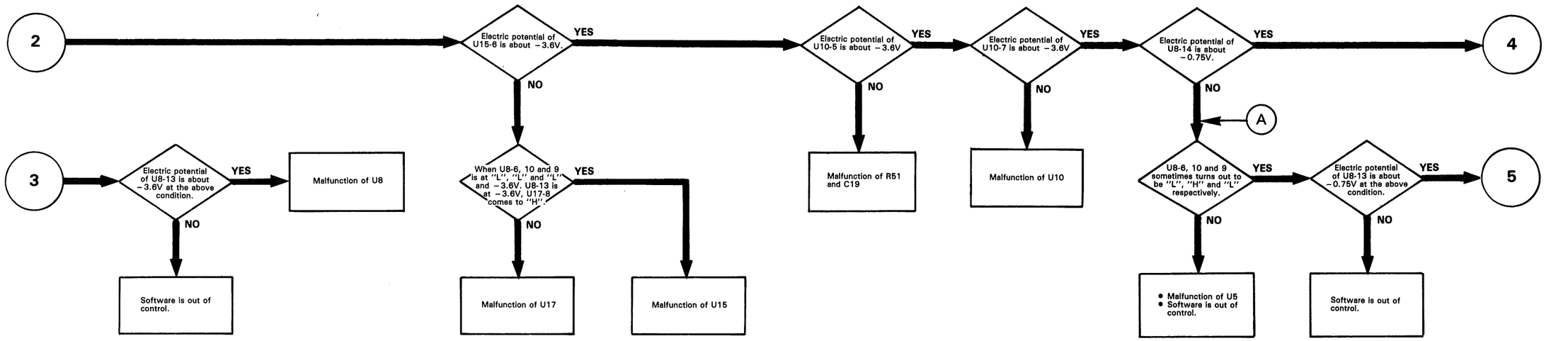
Symptom: When the voltage is varied with the encoder while the OUTPUT is OFF and MEMORY LED is not lit, the indicated voltage does not vary in accordance with the encoder operation.



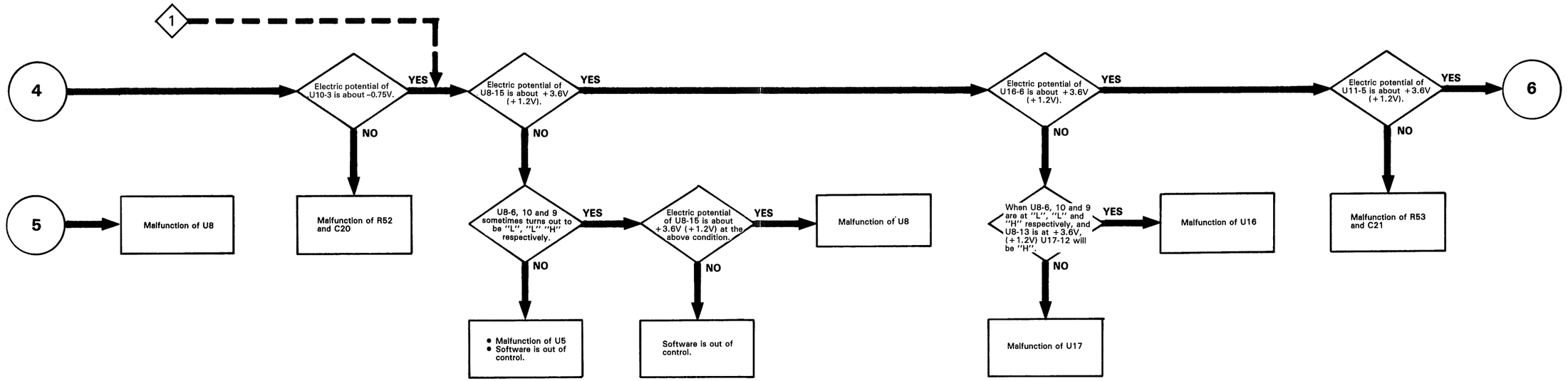
TROUBLESHOOTING

Note:
Subflow is applicable only in case of the AMP UNIT (X73-1980-06).

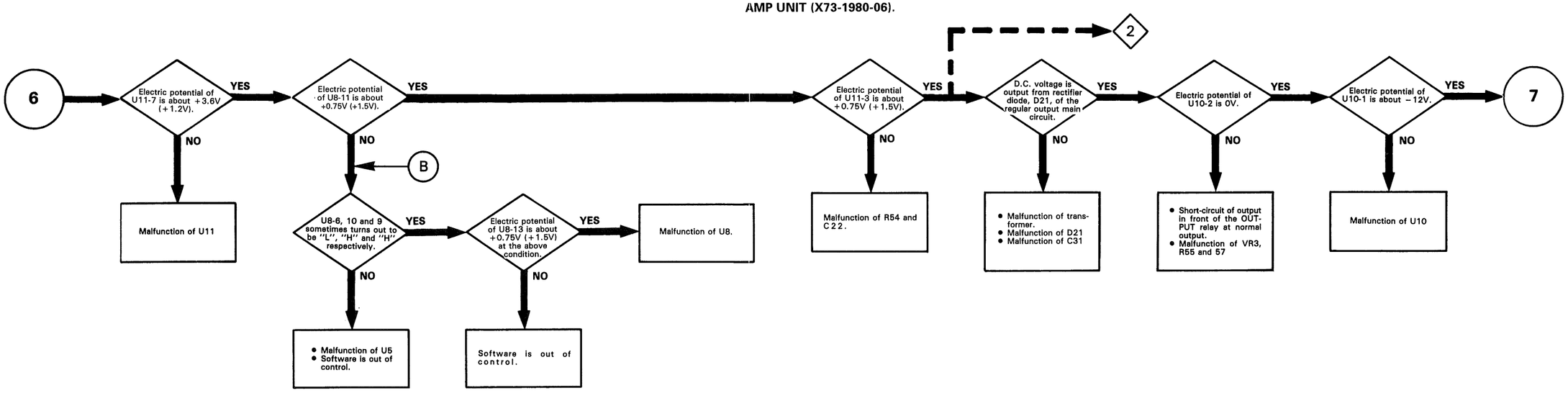




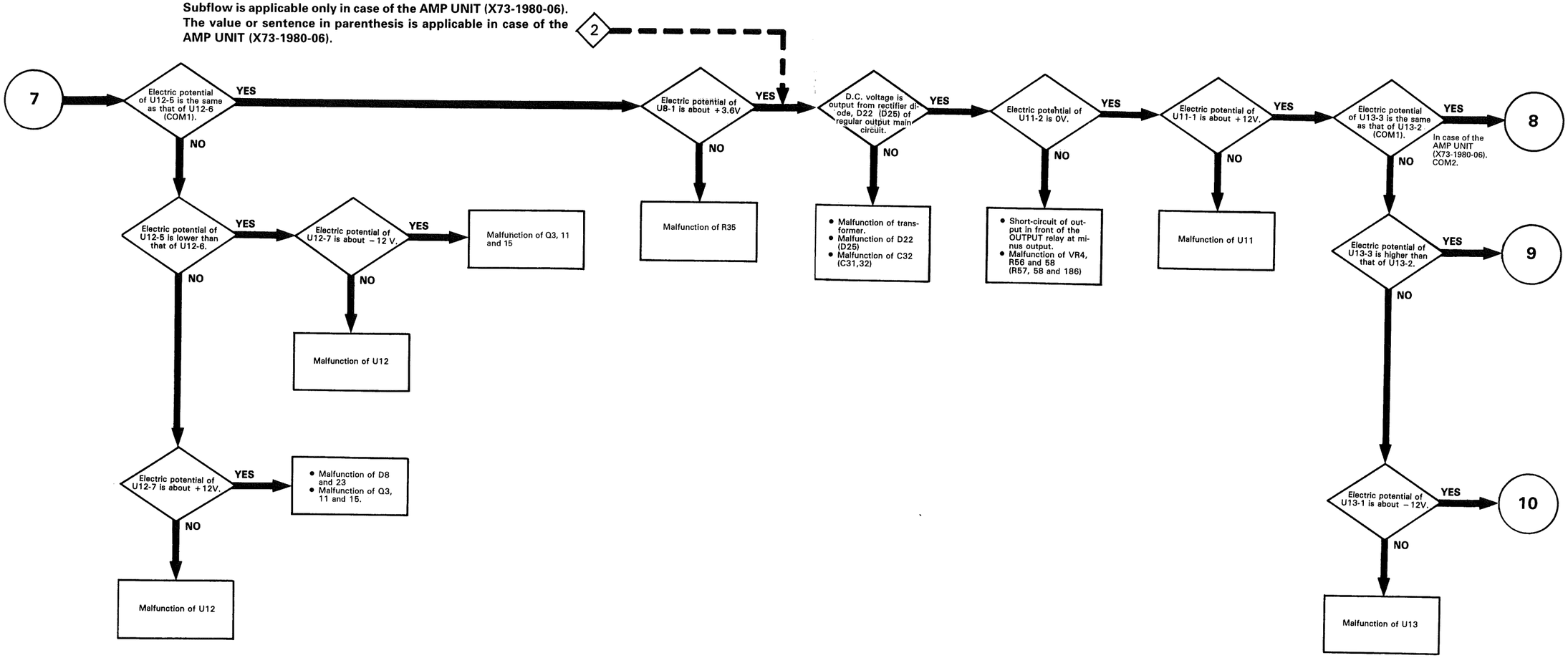
TROUBLESHOOTING

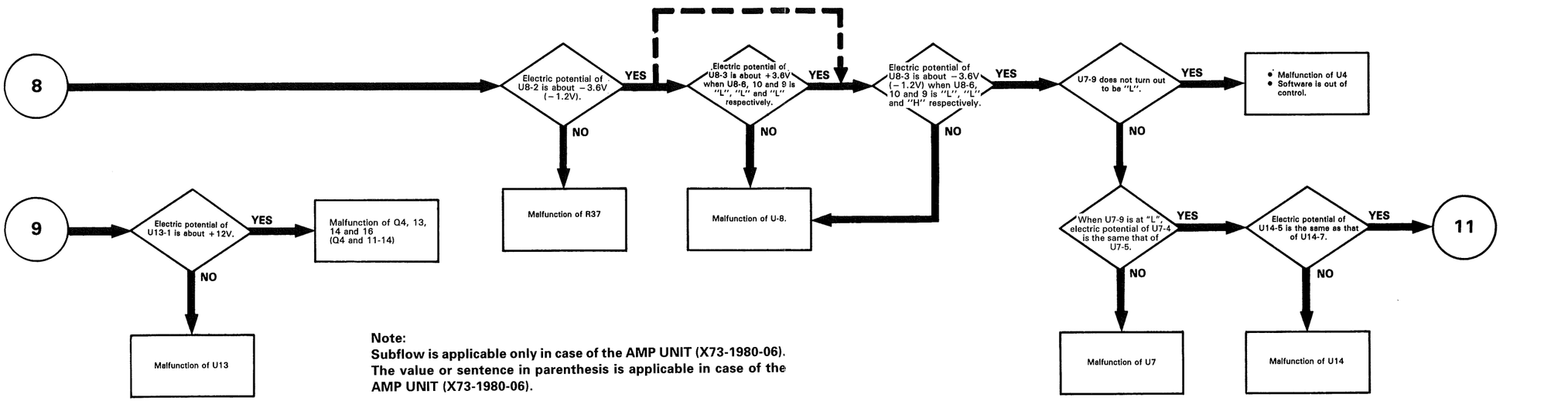


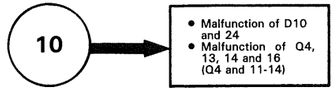
Note:
Subflow is applicable only in case of the AMP UNIT (X73-1980-06).
The value or sentence in parenthesis is applicable in case of the AMP UNIT (X73-1980-06).

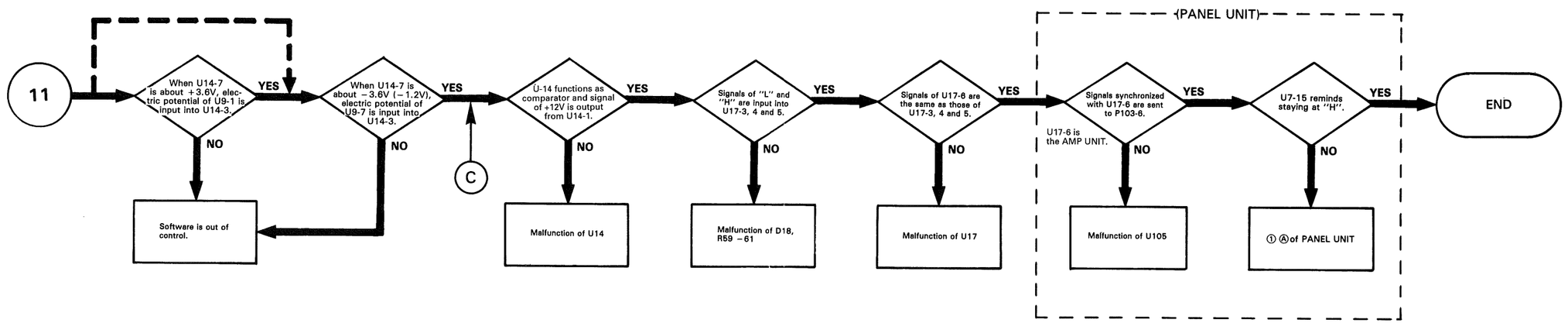


Note:
Subflow is applicable only in case of the AMP UNIT (X73-1980-06).
The value or sentence in parenthesis is applicable in case of the AMP UNIT (X73-1980-06).




8
Electric potential of U8-2 is about −3.6V (−1.2V).
YES
NO
Malfunction of R37
Electric potential of U8-3 is about +3.6V when U8-6, 10 and 9 is "L", "L" and "L" respectively.
YES
NO
Malfunction of U-8.
Electric potential of U8-3 is about −3.6V (−1.2V) when U8-6, 10 and 9 is "L", "L" and "H" respectively.
YES
NO
U7-9 does not turn out to be "L".
YES
NO
• Malfunction of U4
• Software is out of control.
9
Electric potential of U13-1 is about +12V.
YES
NO
Malfunction of Q4, 13, 14 and 16 (Q4 and 11-14)
Malfunction of U13
When U7-9 is at "L", electric potential of U7-4 is the same that of U7-5.
YES
NO
Malfunction of U7
Electric potential of U14-5 is the same as that of U14-7.
YES
NO
Malfunction of U14
11
Note:
Subflow is applicable only in case of the AMP UNIT (X73-1980-06).
The value or sentence in parenthesis is applicable in case of the AMP UNIT (X73-1980-06).

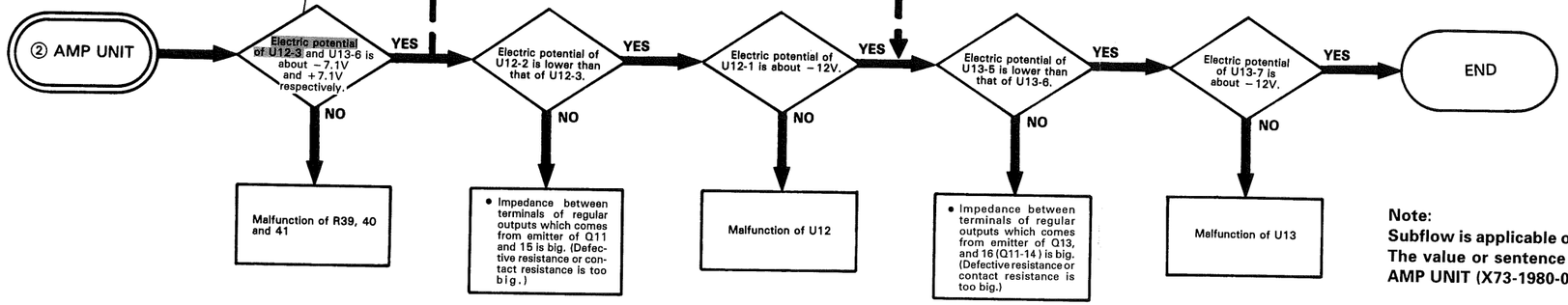

10
• Malfunction of D10 and 24
• Malfunction of Q4, 13, 14 and 16 (Q4 and 11-14)


11
When U14-7 is about +3.6V, electric potential of U9-1 is input into U14-3.
YES
NO
Software is out of control.
When U14-7 is about −3.6V (−1.2V), electric potential of U9-7 is input into U14-3.
YES
NO
C
U-14 functions as comparator and signal of +12V is output from U14-1.
YES
NO
Malfunction of U14
Signals of "L" and "H" are input into U17-3, 4 and 5.
YES
NO
Malfunction of D18, R59 − 61
Signals of U17-6 are the same as those of U17-3, 4 and 5.
YES
NO
Malfunction of U17
(PANEL UNIT)
Signals synchronized with U17-6 are sent to P103-6.
YES
NO
Malfunction of U105
U17-6 is the AMP UNIT.
U7-15 reminds staying at "H".
YES
NO
① Ⓐ of PANEL UNIT
END

TROUBLESHOOTING

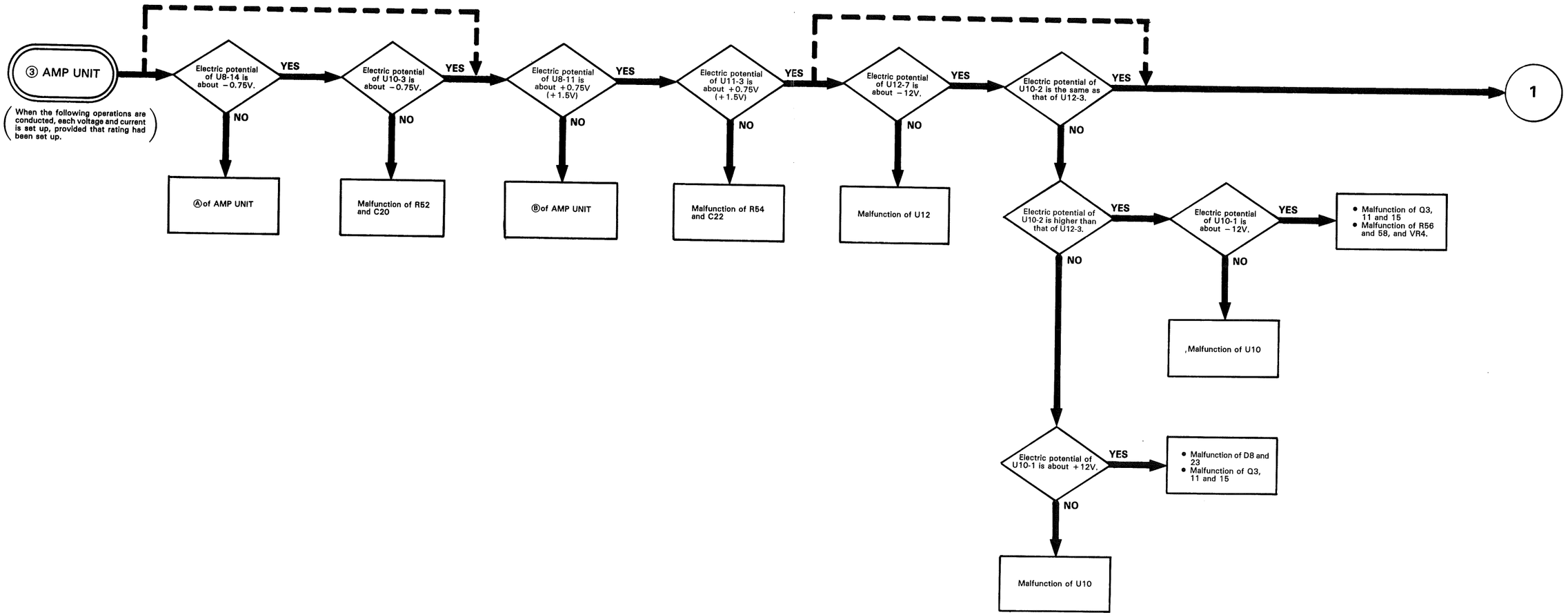
Symptom: When both outputs are used in CC state, the ±18 (+6) LEDs do not blink.

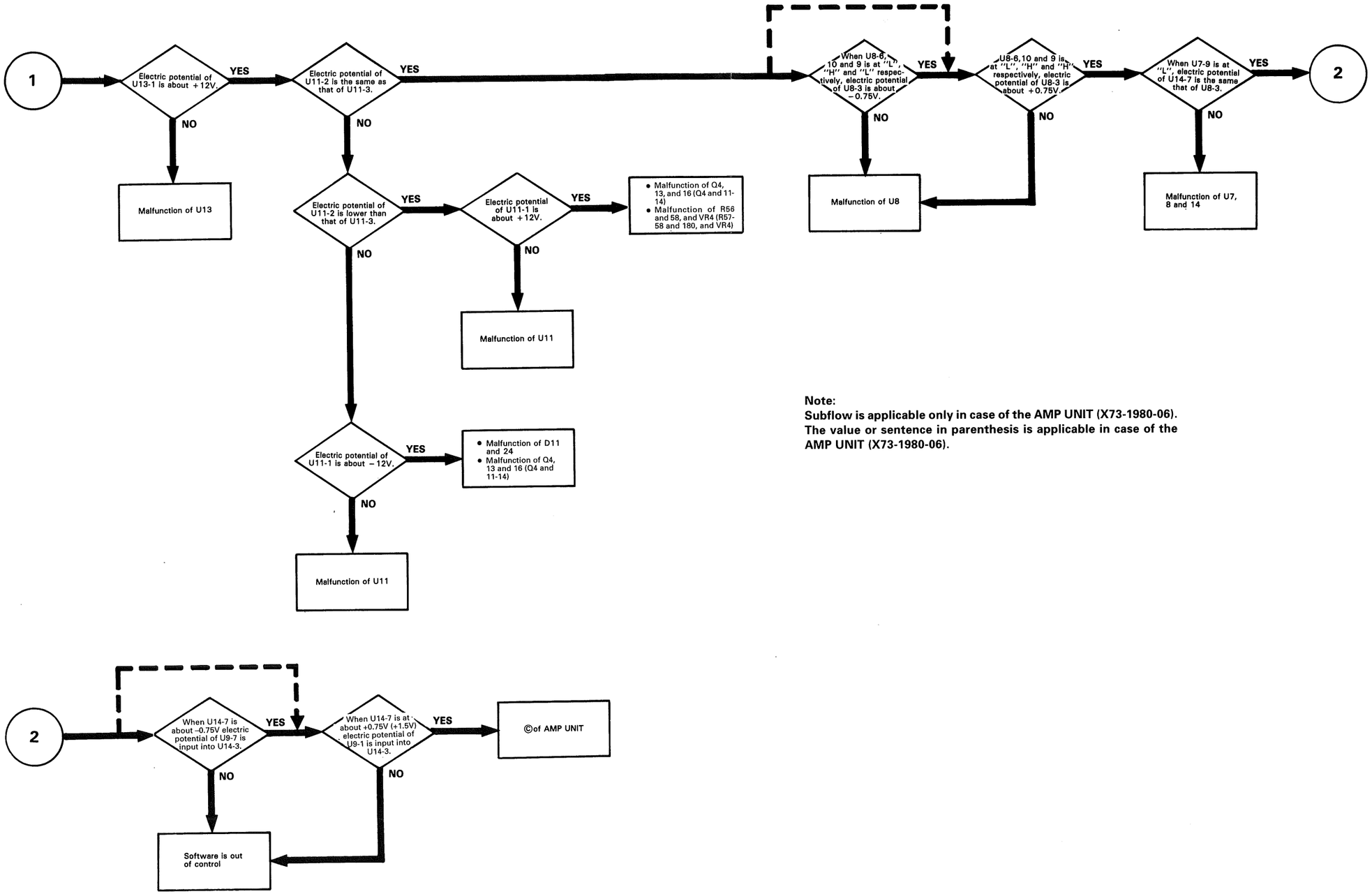
The portion indicated by ▒ is not attached to the X73-1980-06 unit.



Note:
Subflow is applicable only in case of the AMP UNIT (X73-1980-06).
The value or sentence in parenthesis is applicable in case of the AMP UNIT (X73-1980-06).

Symptom: When the OUTPUT is switched ON by shorting the output, the indicated current does not vary in accordance with the encoder operation.

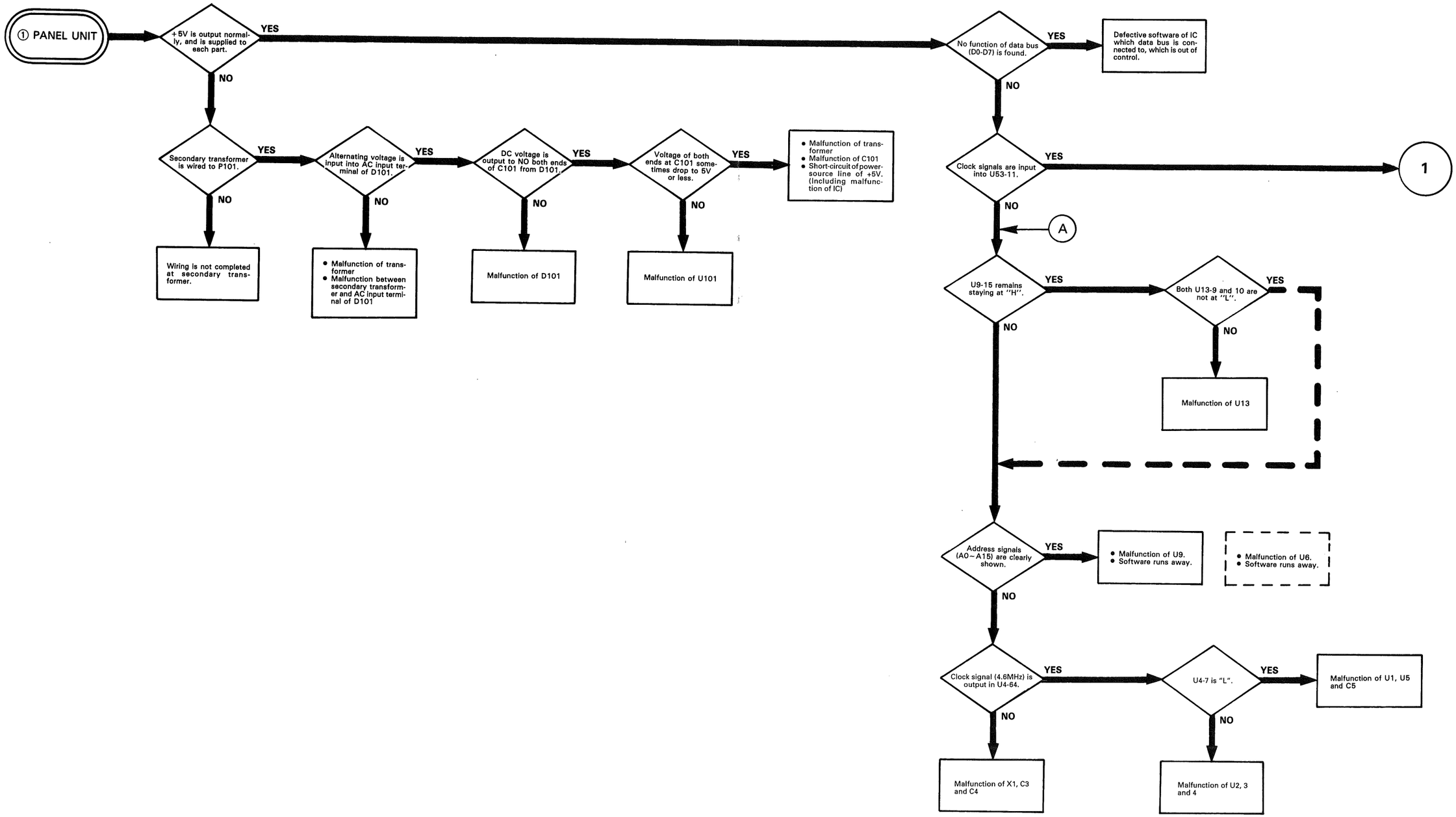




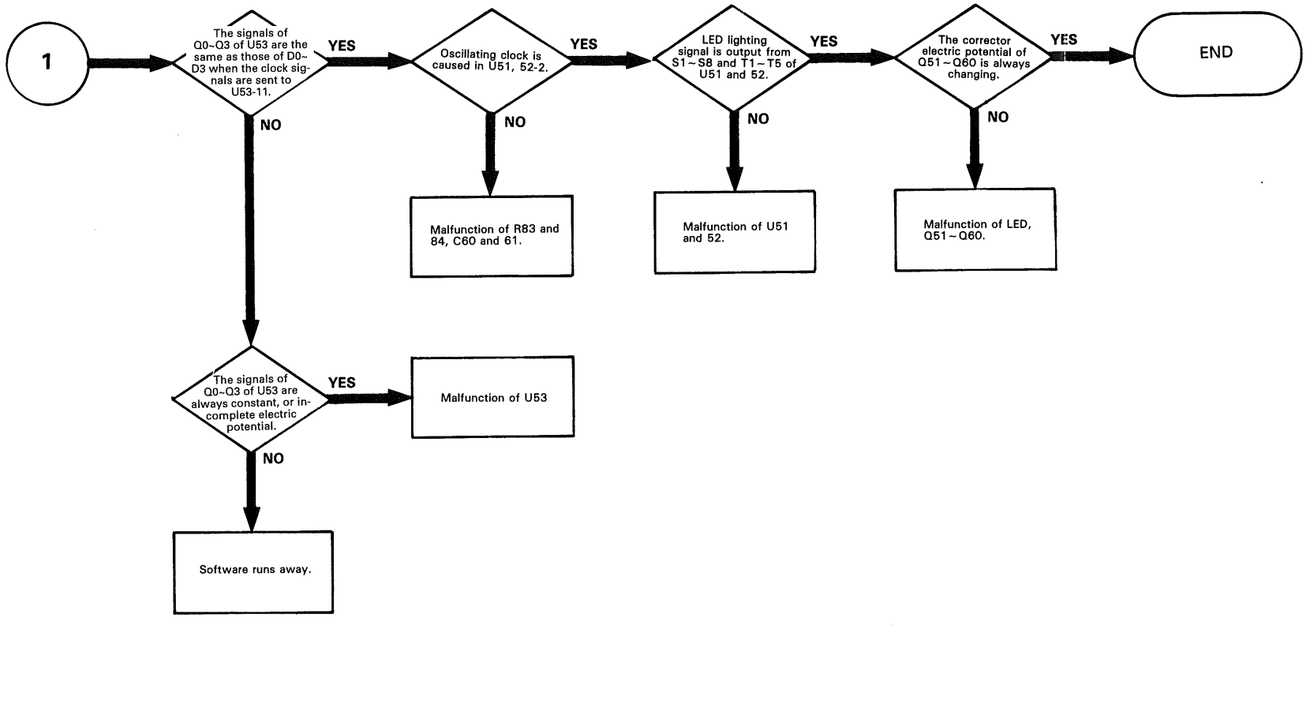
Note:
Subflow is applicable only in case of the AMP UNIT (X73-1980-06).
The value or sentence in parenthesis is applicable in case of the AMP UNIT (X73-1980-06).

TROUBLESHOOTING

Symptom: The LEDs do not light.

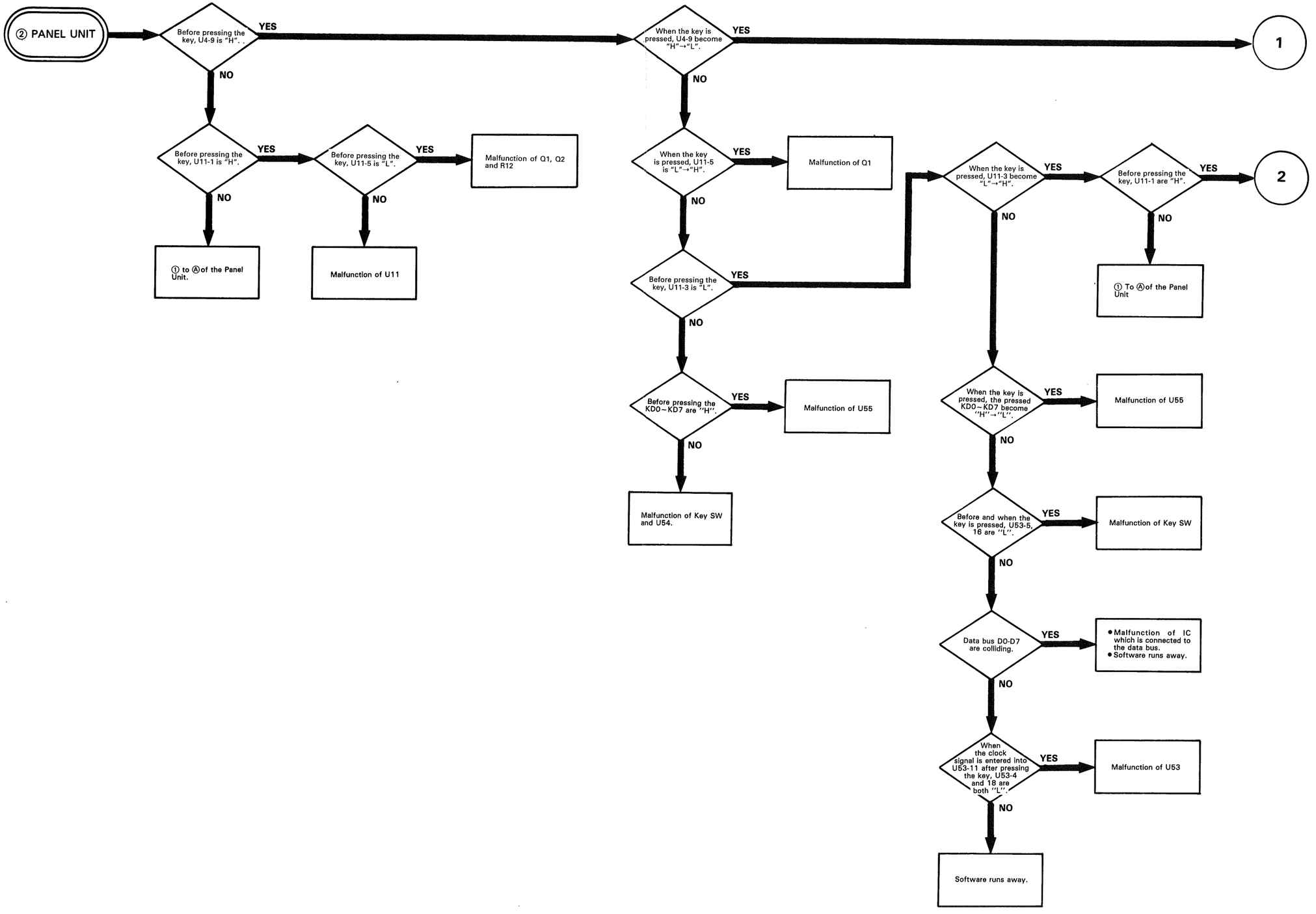


TROUBLESHOOTING

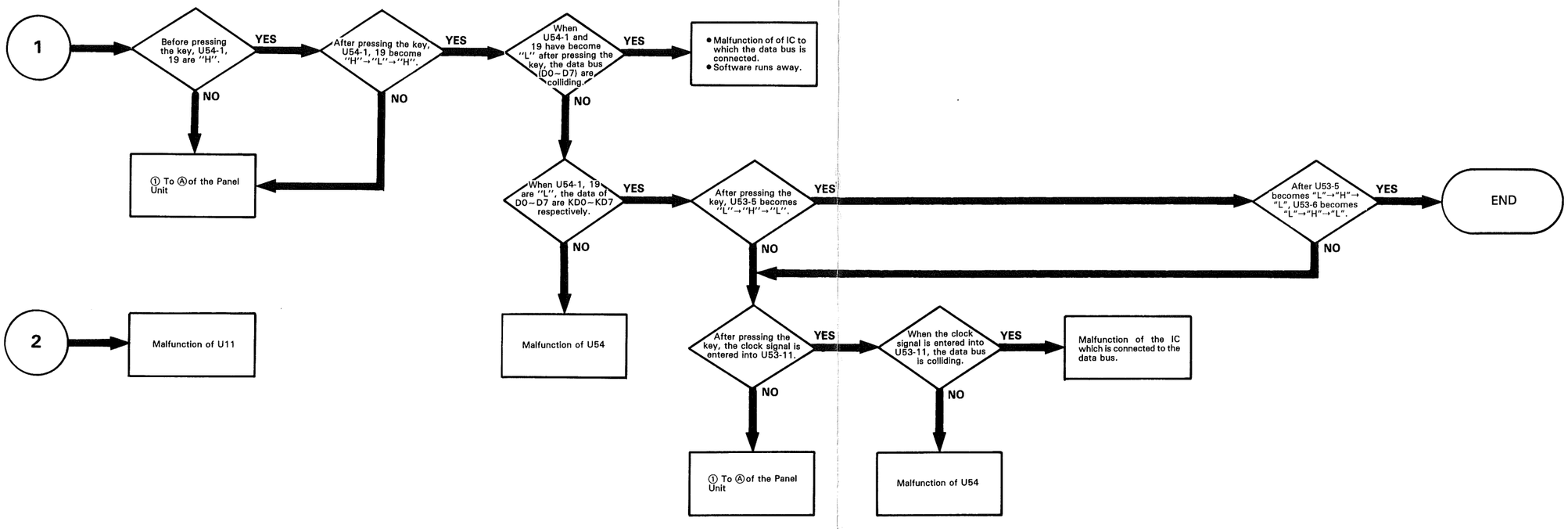


TROUBLESHOOTING

Symptom: The operation requested by pressing a key does not occur.

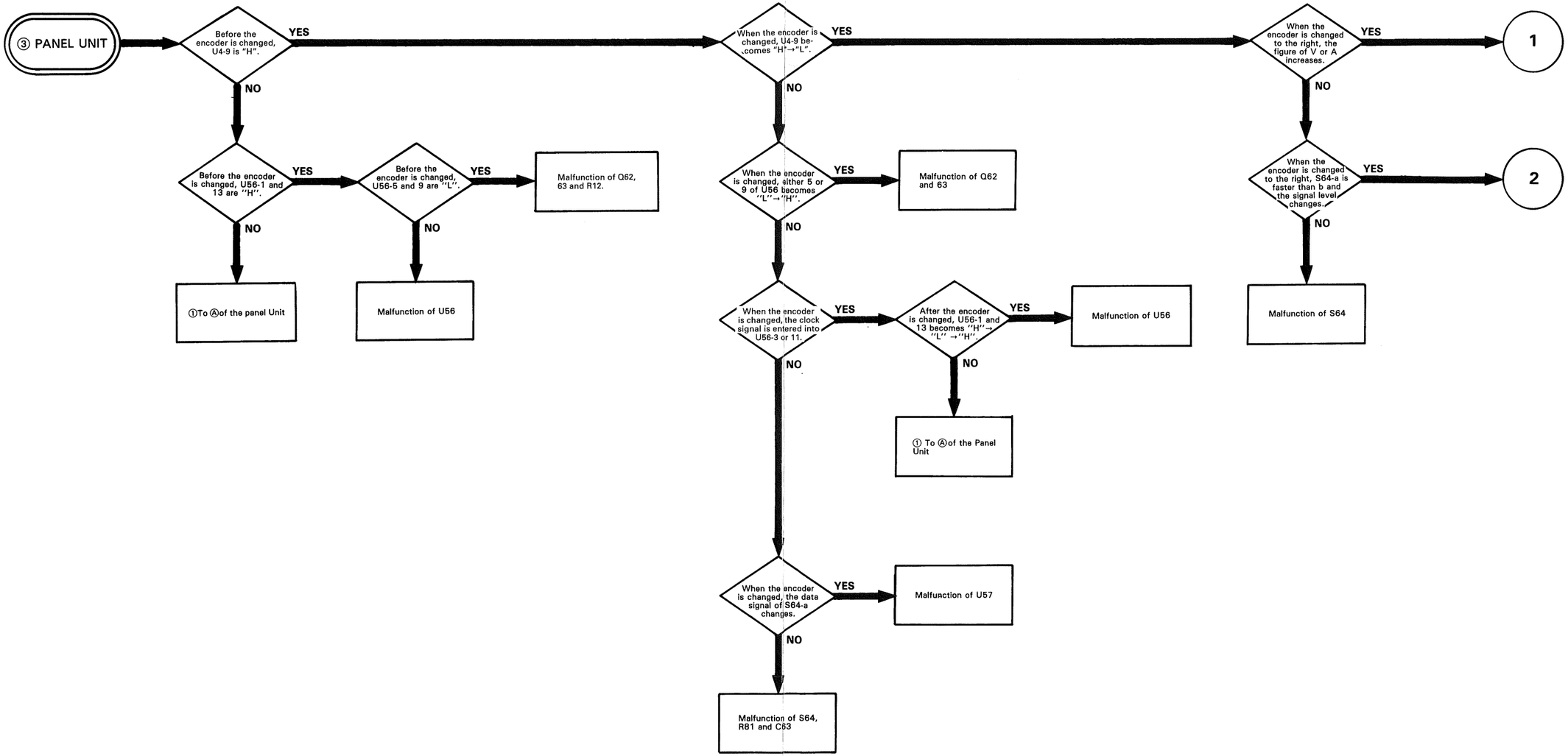


TROUBLESHOOTING

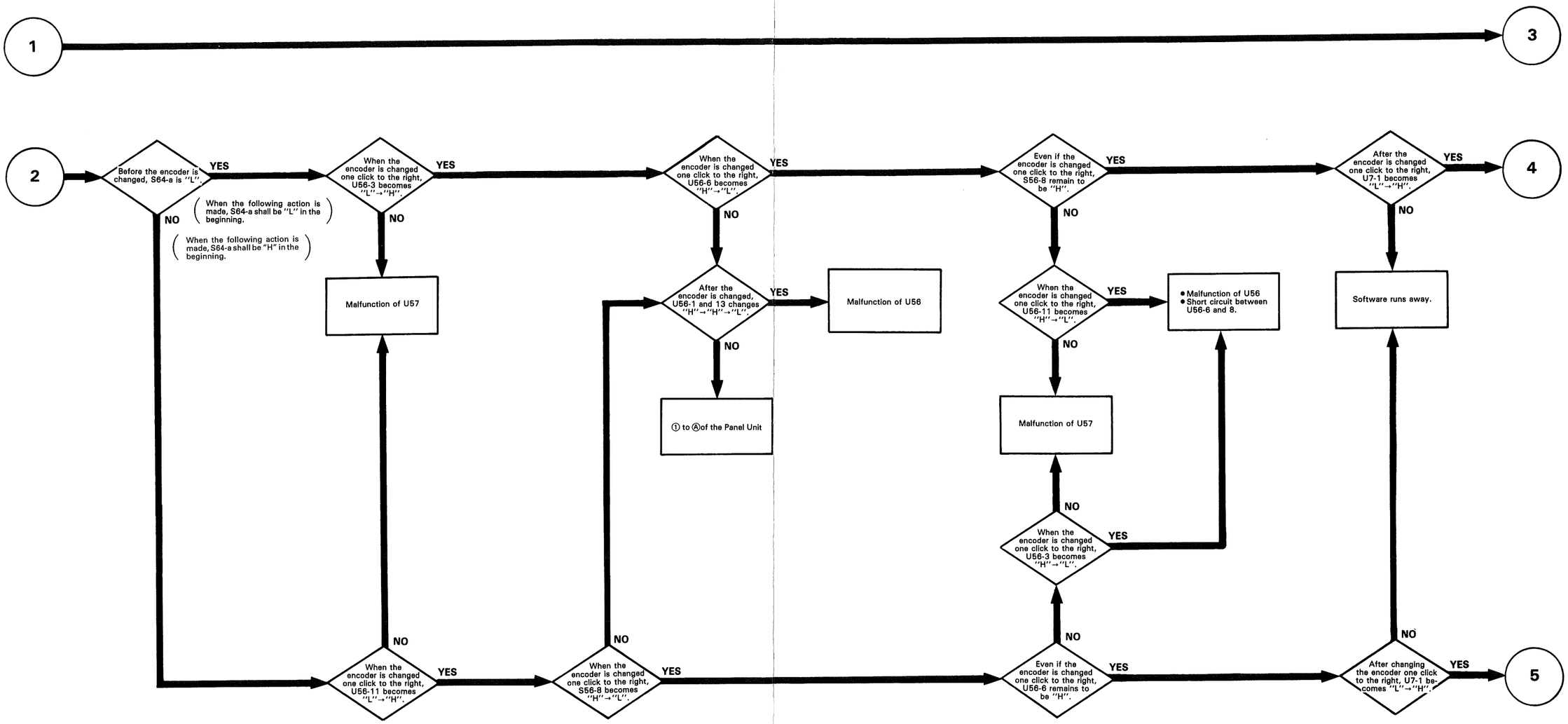


TROUBLESHOOTING

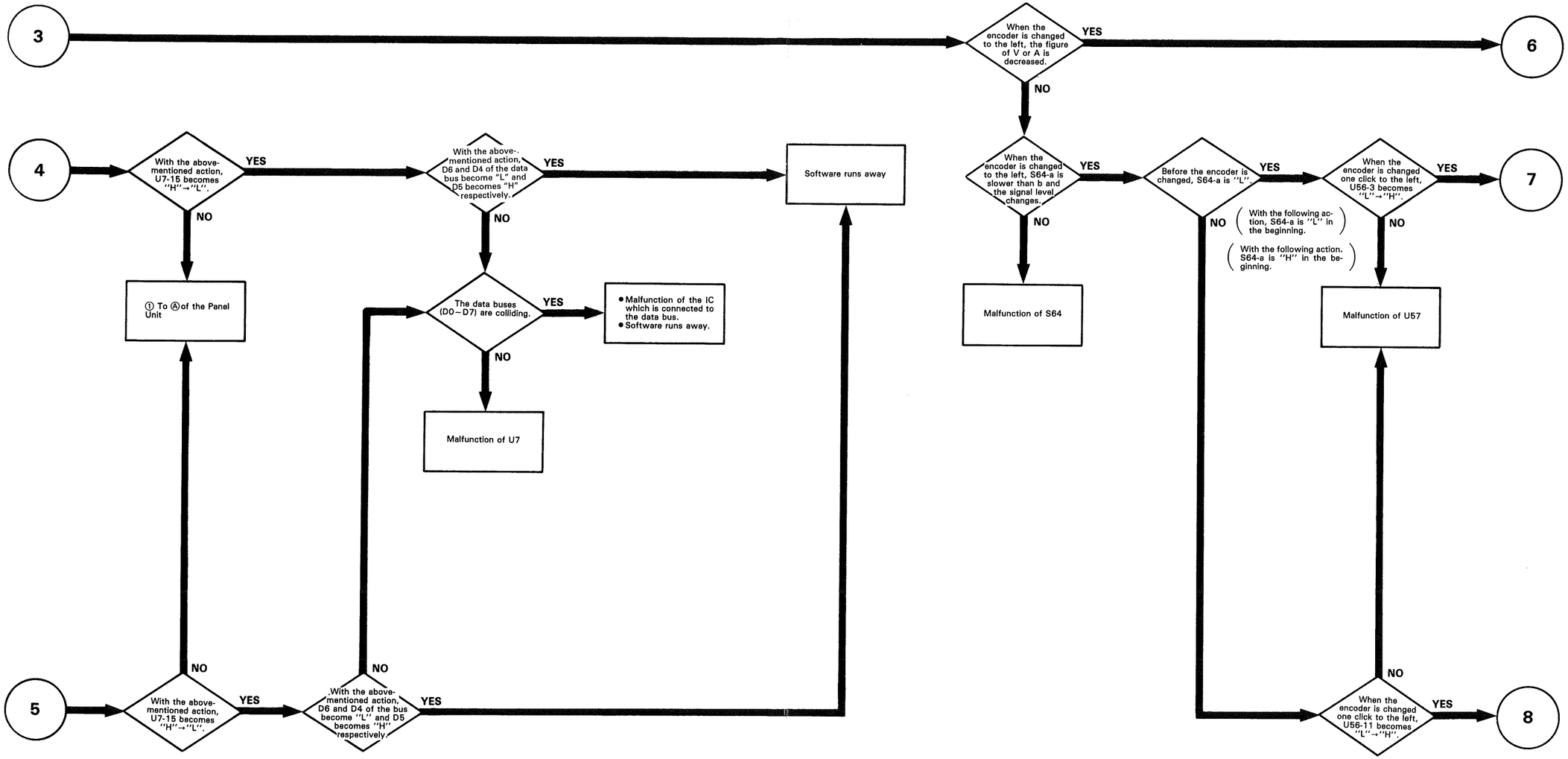
Symptom: When the V and A are varied with the encoder while the MEMORY LED is lit, the indicated V and A do not vary in accordance with the encoder operation.



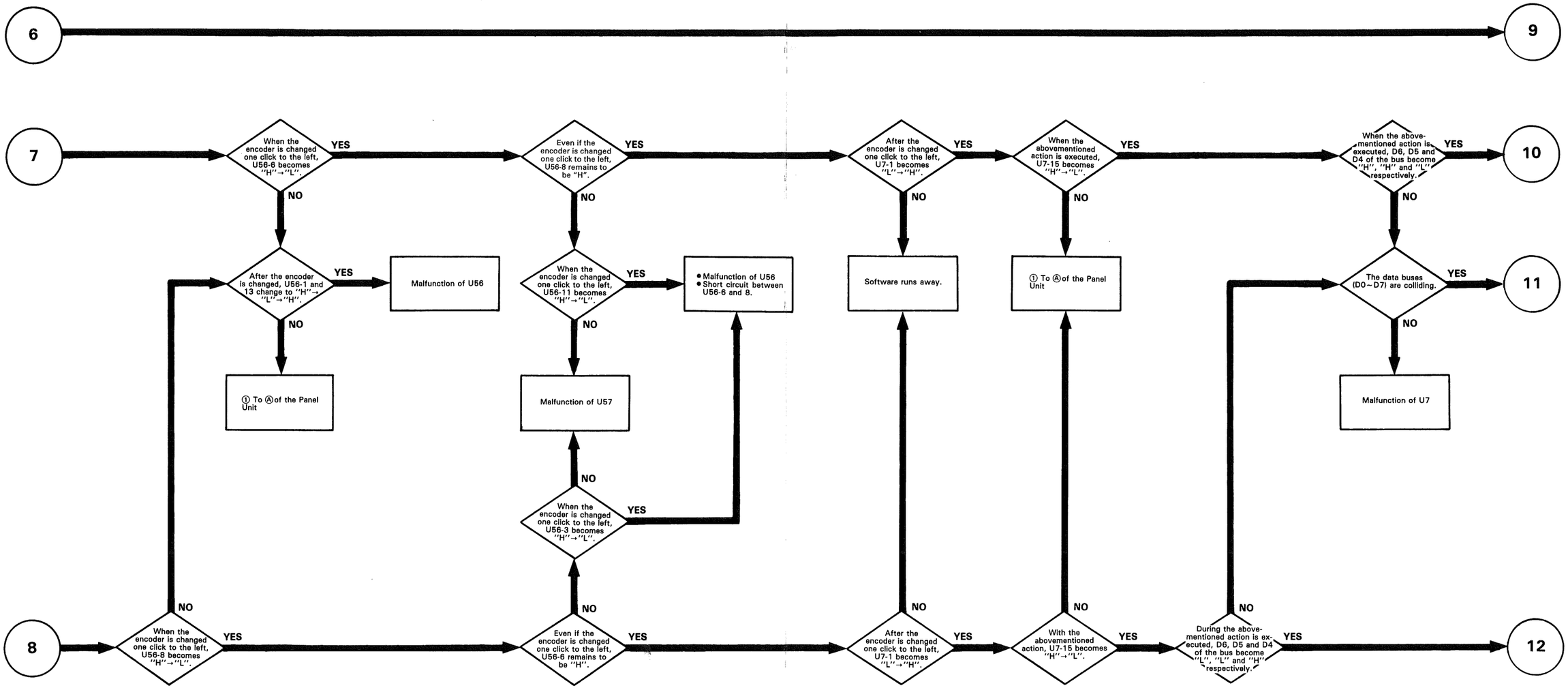
TROUBLESHOOTING

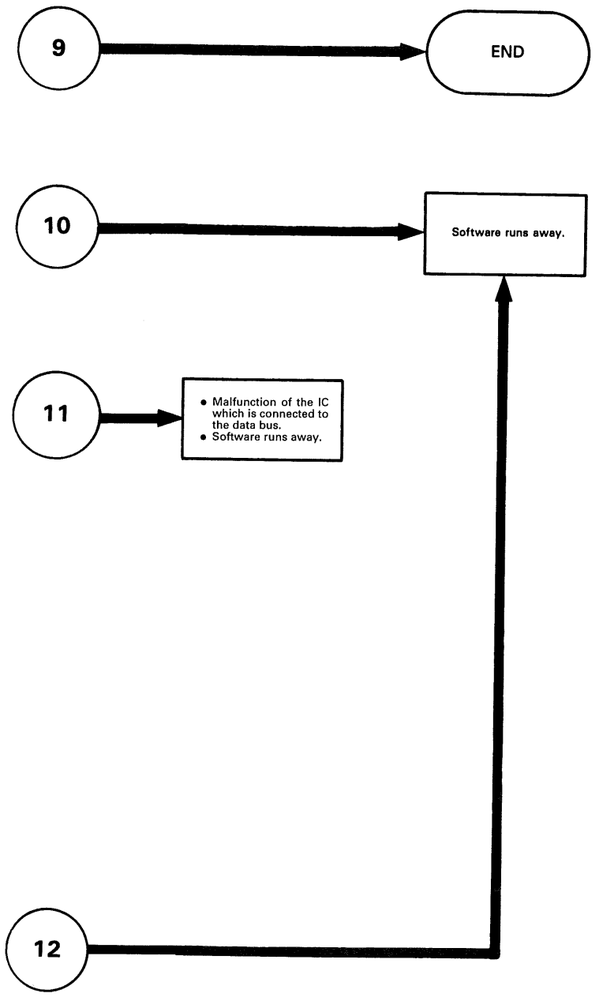


TROUBLESHOOTING



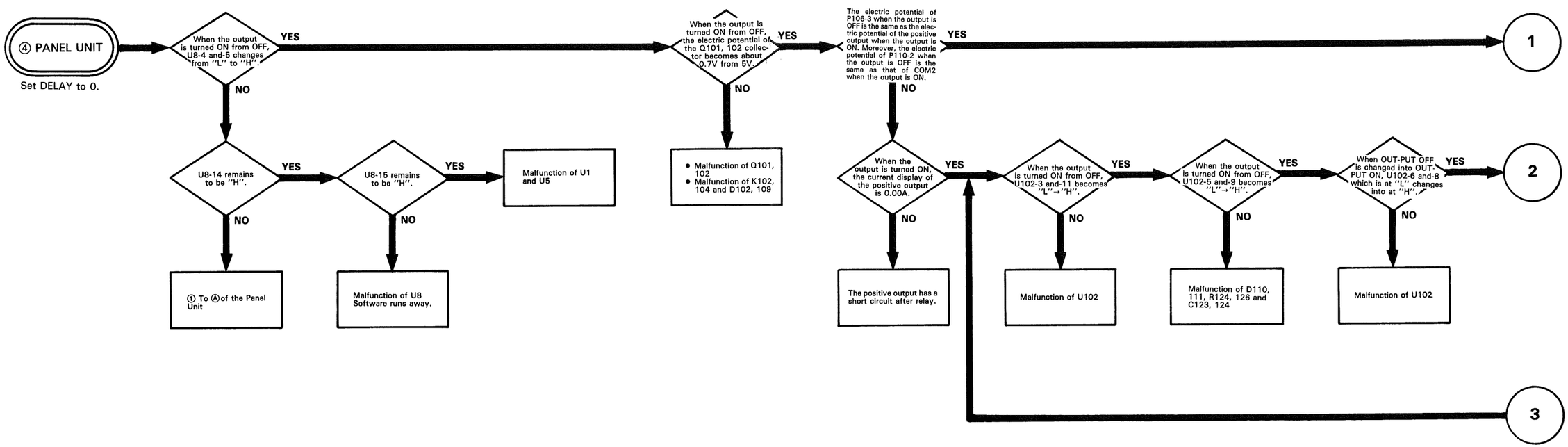
TROUBLESHOOTING



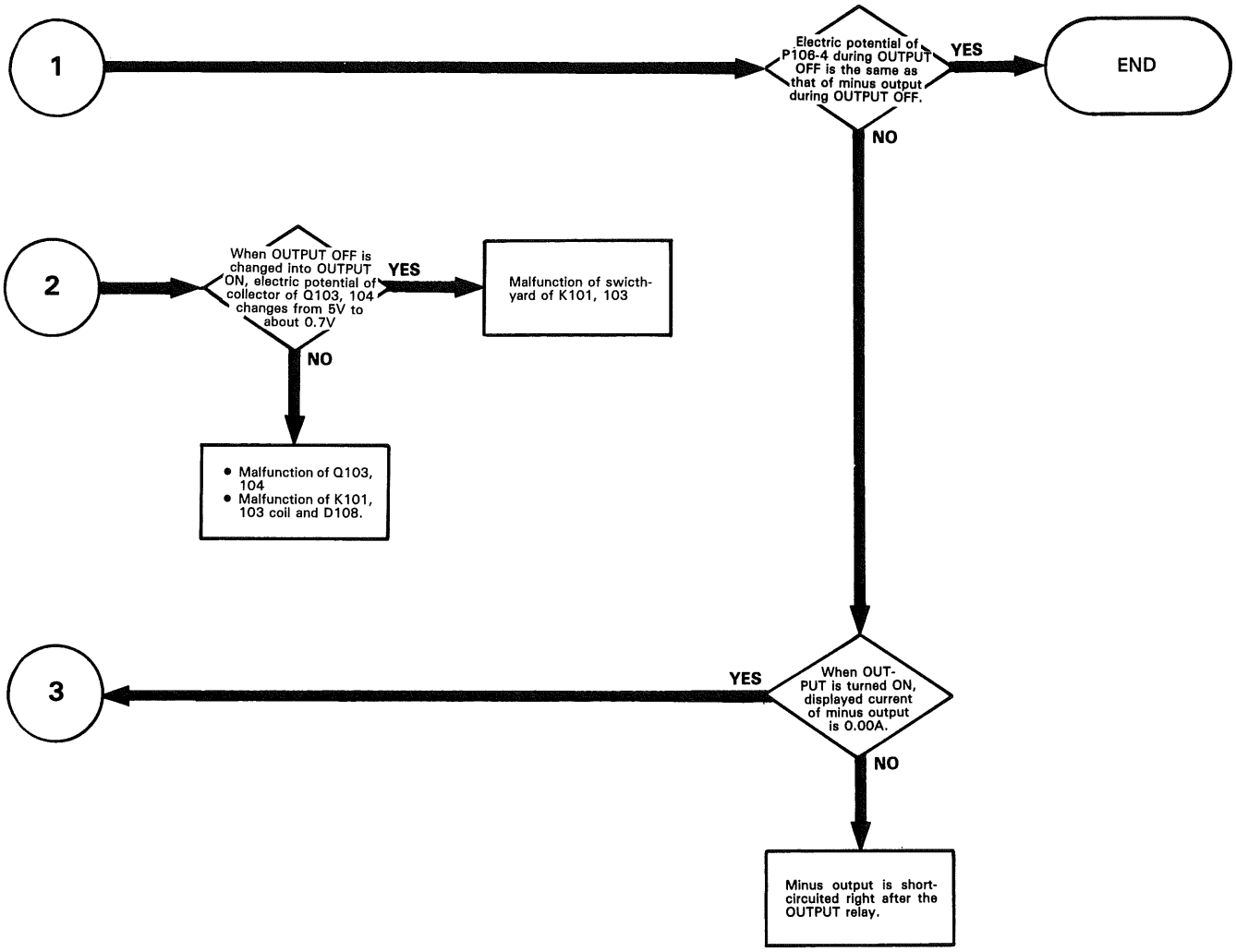

9
END
10
Software runs away.
11
• Malfunction of the IC which is connected to the data bus.
• Software runs away.
12

TROUBLESHOOTING

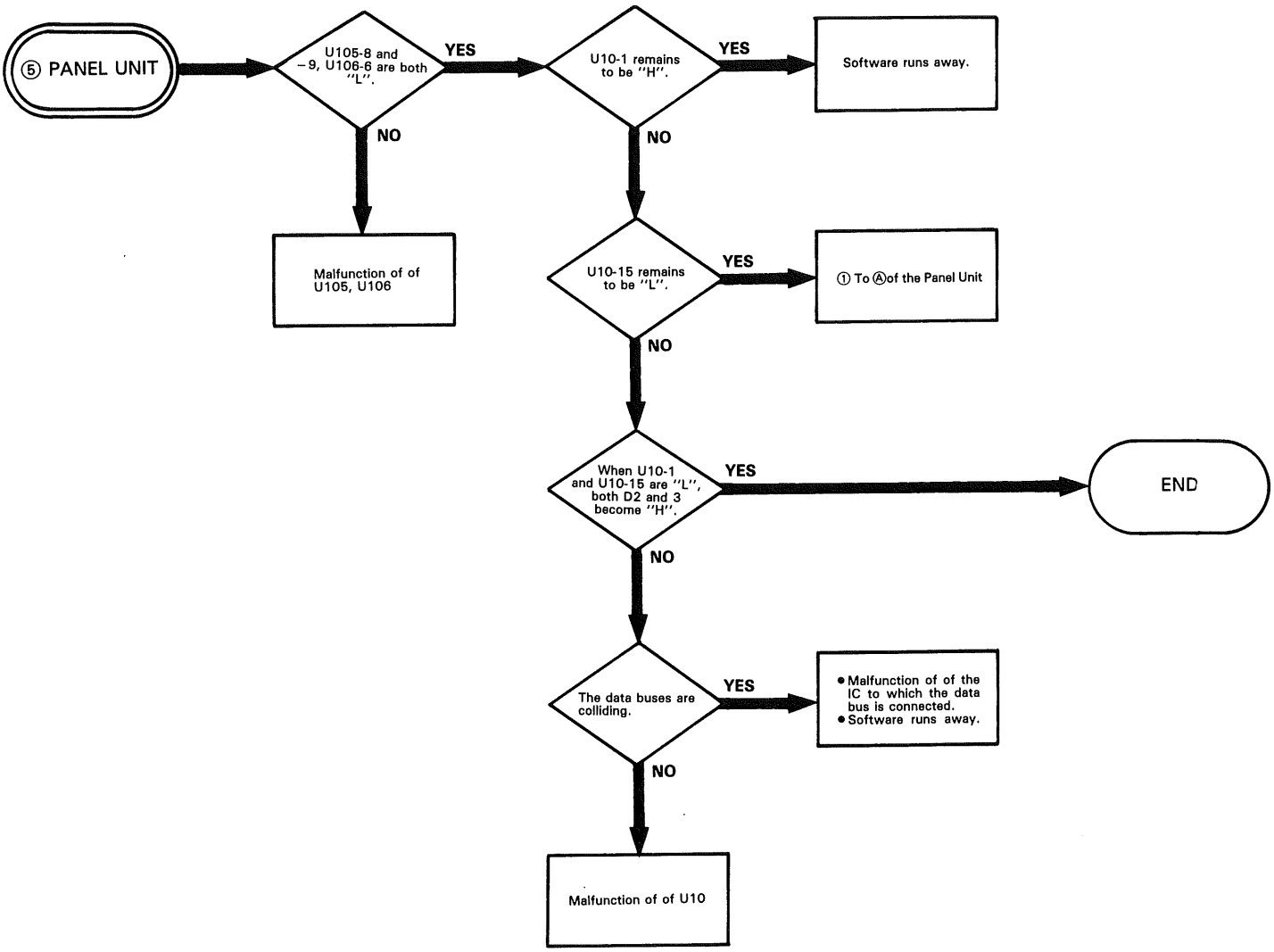
Symptom: When the OUTPUT is switched ON while there is no load, the output voltage is not as indicated by the voltage indication.



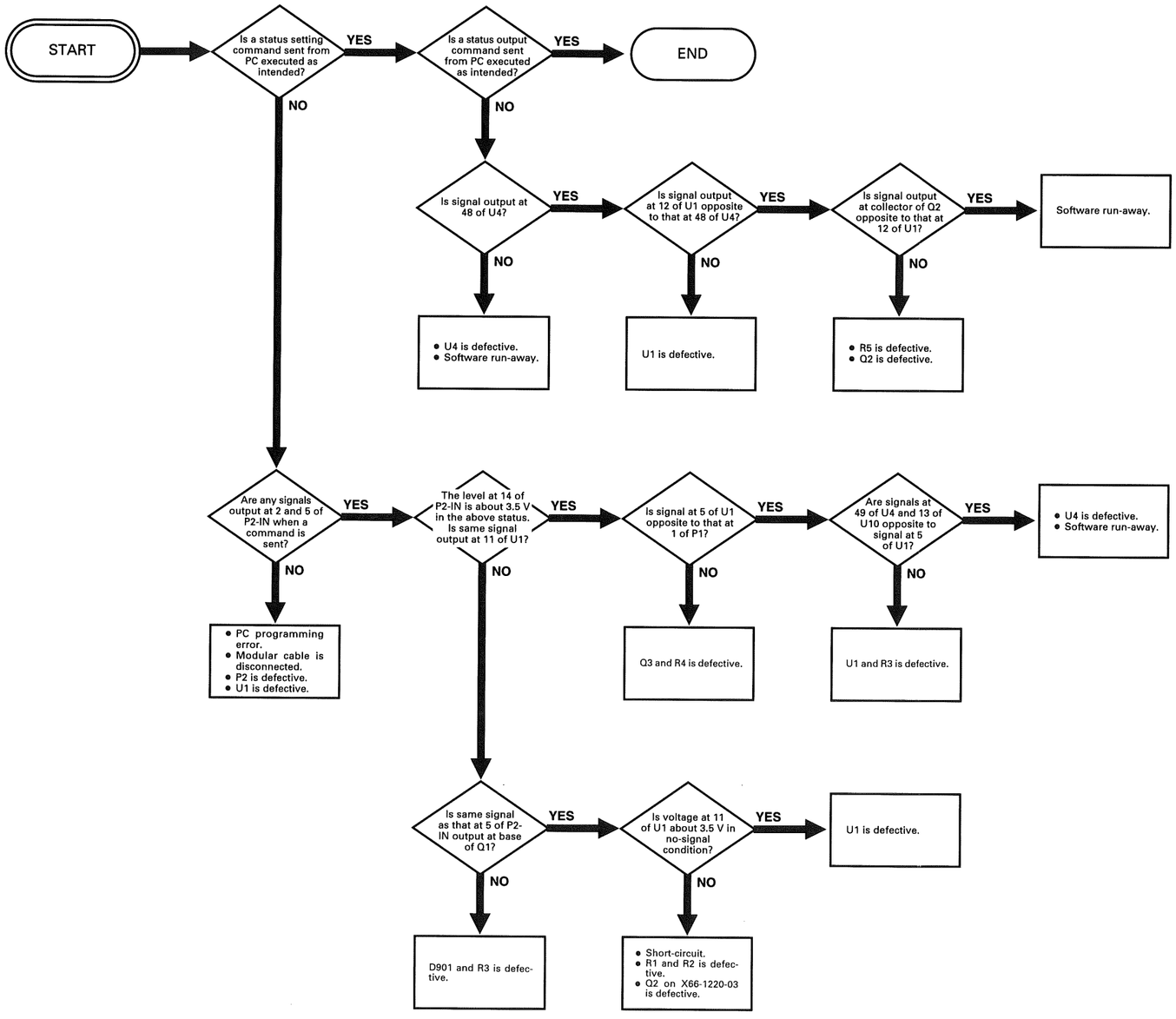
TROUBLESHOOTING



TROUBLESHOOTING



TROUBLESHOOTING



PARTS LIST

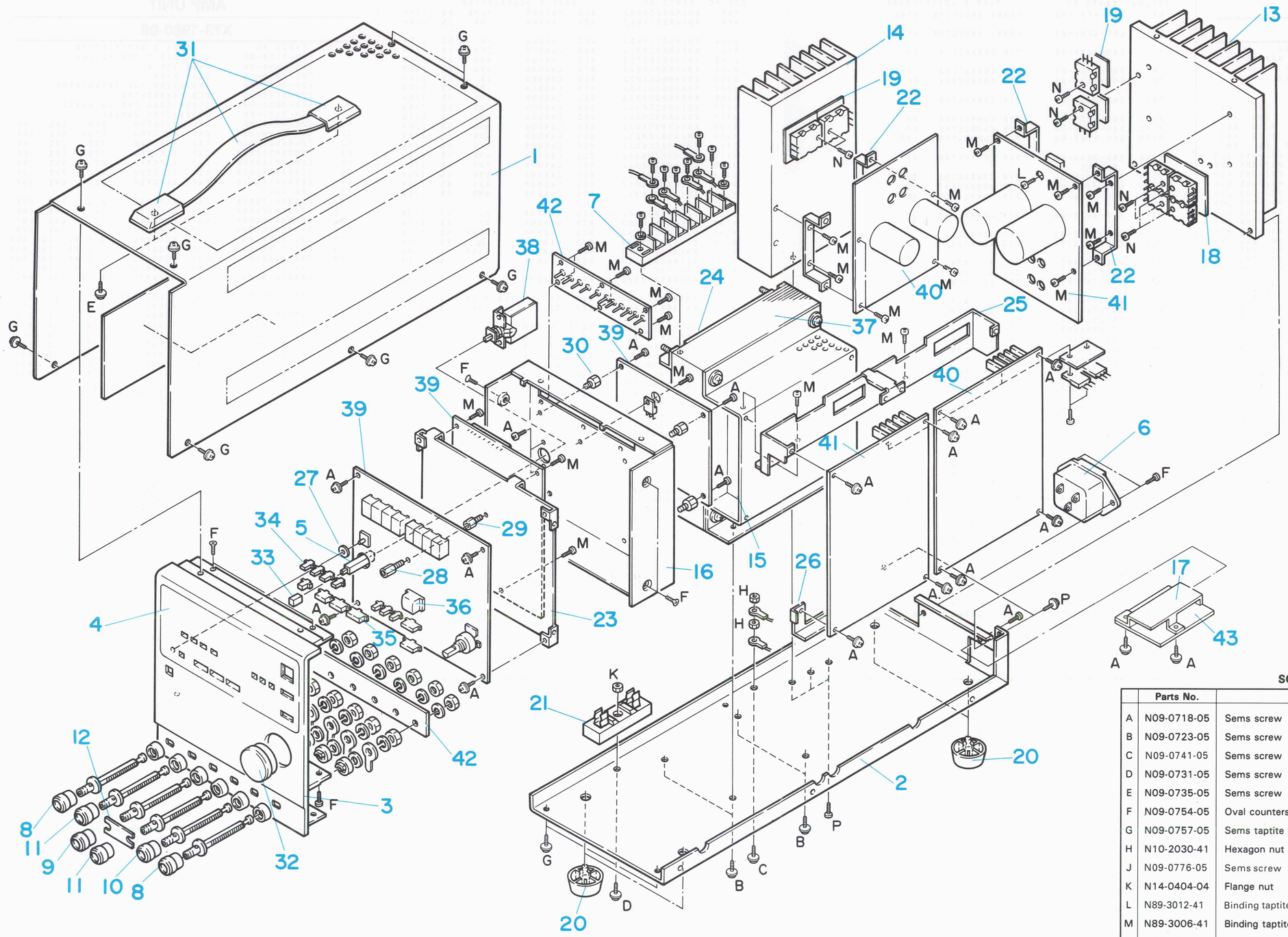
PWR18-1T UNIT

Y86-1460-00

REF.NO	PARTS NO	NAME & DESCRIPTION
	B40-2737-24	SERIAL NO. PLATE
	B41-0835-14	RATING;AC100V 50/60HZ 176W
	B41-0836-04	RATING;AC120V 50/60HZ 176W
	B41-0837-04	RATING;AC220V 50/60HZ 160W
	B41-0838-04	RATING;AC240V 50/60HZ 160W
	B41-0839-04	RATING;AC120V 60HZ 176W
	B41-0840-14	FUSE RATING LABEL
	B42-3743-04	REMOTE LABEL
	B63-0029-00	INSTRUCTION MANUAL;JAPANESE
	B63-0030-00	INSTRUCTION MANUAL;ENGLISH
	B63-0053-20	REMOTE MANUAL;JAPANESE
	B63-0054-20	REMOTE MANUAL;ENGLISH
	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
	E30-1929-05	BS POWER CORD
	E30-1950-05	JIS POWER CORD
	E30-1951-05	UL/CSA POWER CORD
	E30-1952-05	CEE POWER CORD
	E30-1953-05	SAA POWER CORD
	E31-5811-15	WIRE ASS'Y;PIERCED CAP. TO CPU
	E31-5812-15	WIRE ASS'Y;PIERCED CAP. TO CPU
	E31-5813-15	WIRE ASS'Y
	E31-5815-15	WIRE ASS'Y;PIERCED CAP. TO CPU
	E31-5858-15	WIRE ASS'Y;OUTPUT TERMINAL
	E31-5859-25	WIRE ASS'Y;AC PRIMARY
	E31-5861-05	WIRE ASS'Y;P103 TO PIERCED CAP
	E31-5862-05	WIRE ASS'Y;CHANGING VOLTAGE
	E31-5863-15	WIRE ASS'Y;PIERCED CAP. TO CPU
	E31-5864-05	WIRE ASS'Y;OUTPUT TERMINAL
	E38-0109-15	WIRE ASS'Y
	E38-0151-05	WIRE ASS'Y;CONTROLED COMMUNI.
	E38-0153-05	WIRE ASS'Y;COMMUNICATION CABLE
	F05-1524-05	FUSE(6X32MM) 1.5A/250V
	F51-0003-05	FUSE(6X32MM) T2.5A/250V
	F51-0003-05	FUSE(6X32MM) T2.5A/250V
	H10-2846-12	FOAMED STYRENE PAD(FRONT)
	H10-2847-02	FOAMED STYRENE PAD(REAR)
	H20-1743-04	VINYL COVER
	H53-0023-04	CARTON BOX
	J19-1620-05	CORD KEEP
	NJM7805FA	IC,3-TERMINAL REGULATOR
	N17-1030-41	LOCK WASHER M3
	N19-0712-04	WASHER D=7,M3
	N19-0728-04	WASHER D=10,M3
	R92-1502-05	RES. CEMENT 0.68 5% 15W
	2SA1301(R)	TR. SI, PNP
	2SC3280(R)	TR. SI, NPN

REF.NO	PARTS NO	NAME & DESCRIPTION
D21	S10VB20	DIODE
D22	S10VB20	DIODE
D25	S10VB20	DIODE
D107	D6K20	DIODE
1	A01-1226-02	CASE
2	A10-1460-22	CHASSIS
3	A63-0017-03	FRONT PANEL
4	B11-0523-03	FILTER
5	D21-0926-04	EXTENSION SHAFT
6	E18-0351-05	AC INLET
7	E70-0611-05	TERMINAL BLOCK;TRANS
8	E21-0670-03	TERMINAL;RED
9	E21-0671-03	TERMINAL;BLACK
10	E21-0672-03	TERMINAL;WHITE
11	E21-0673-03	TERMINAL;BULE
12	E29-0506-04	SHORTING BAR
13	F01-0877-03	HEAT SINK
14	F01-0878-03	HEAT SINK
15	F10-1626-03	SHIELD PLATE
16	F11-1240-13	SHIELD CASE
17	J21-4725-04	BRACKET;BUFFER UNIT
18	F20-0689-05	INSULATOR
19	F20-0692-05	INSULATOR
20	J02-0323-05	RUBBER FOOT
21	J13-0038-05	FUSE HOLDER
22	J21-4678-04	BRACKET;P.C.B
23	J21-4697-03	BRACKET;SHIELD CASE
24	J21-4700-24	BRACKET;TERMINAL
25	J21-4701-13	BRACKET;TOP
26	J21-4702-03	BRACKET;BOTTOM
27	J30-0632-04	SPACER
28	J32-0122-04	BOSS L=9
29	J32-0893-04	BOSS L=5.5
30	J32-0894-04	BOSS L7.5
31	K01-0544-05	HANDLE
32	K21-0907-14	KNOB
33	K27-0509-04	PUSH BUTTON;POWER,ORANGE
34	K27-0555-04	BUTTON;SMALL
35	K27-0556-04	BUTTON;LARGE
36	K27-0557-04	BUTTON;OUTPUT,RED
37	L01-9936-25	POWER TRANSFORMER
38	S40-2524-05	PUSH SWITCH;POWER
39	X66-1220-03	PANEL UNIT
40	X73-1980-07	AMP UNIT
41	X73-1980-06	AMP UNIT
42	X81-2880-02	TERMINAL UNIT
43	X81-2890-00	BUFFER UNIT

DISASSEMBLY



SCREWS

	Parts No.	Parts Name		Figure
A	N09-0718-05	Sems screw	(M3×6)	
B	N09-0723-05	Sems screw	(M5×10)	
C	N09-0741-05	Sems screw	(M3×6)	
D	N09-0731-05	Sems screw	(M3×12)	
E	N09-0735-05	Sems screw	(M4×6)	
F	N09-0754-05	Oval countersunk head screw	(3×8)	
G	N09-0757-05	Sems taptite screw	(3×6)	
H	N10-2030-41	Hexagon nut	(M3)	
J	N09-0776-05	Sems screw	(M3×16)	
K	N14-0404-04	Flange nut	(M3)	
L	N89-3012-41	Binding taptite screw	(3×12)	
M	N89-3006-41	Binding taptite screw	(3×6)	
N	N89-3010-41	Binding taptite screw	(3×10)	
P	N09-0739-05	Sems taptite screw	(3×8)	

PARTS LIST

PANEL UNIT

X66-1220-03

REF.NO	PARTS NO	NAME & DESCRIPTION
	E31-5841-05	WIRE ASS'Y;JW101 TO NJM7805FA
	E31-5853-15	WIRE ASS'Y; FOR D107
	E31-5872-05	WIRE ASS'Y;JW2 TO P52
	F15-0744-05	BLIND PLATE
	J73-0155-12	PCB (UNMOUNTED)
C1	CE04EW1A471M	CAP. ELECTRO 470 20% 10V
C2	CE04EW1A471M	CAP. ELECTRO 470 20% 10V
C3	CC45CH1H100D	CAP. CERAMIC 10P 0.5% 50V
C4	CC45CH1H100D	CAP. CERAMIC 10P 0.5% 50V
C5	CF92V1H474J	CAP. POLYESTER 0.47 5% 50V
C6	C91-1310-05	CAP. DOUBLE 0.1 80/-20% 5.5
C7	C91-1128-05	CAP. CERAMIC 0.1 80/-20% 50V
C8	C91-1128-05	CAP. CERAMIC 0.1 80/-20% 50V
C9	C91-1128-05	CAP. CERAMIC 0.1 80/-20% 50V
C10	C91-1128-05	CAP. CERAMIC 0.1 80/-20% 50V
C11	C91-1128-05	CAP. CERAMIC 0.1 80/-20% 50V
C12	C91-1128-05	CAP. CERAMIC 0.1 80/-20% 50V
C13	C91-1128-05	CAP. CERAMIC 0.1 80/-20% 50V
C14	C91-1128-05	CAP. CERAMIC 0.1 80/-20% 50V
C15	C91-1128-05	CAP. CERAMIC 0.1 80/-20% 50V
C16	C91-1128-05	CAP. CERAMIC 0.1 80/-20% 50V
C17	C91-1128-05	CAP. CERAMIC 0.1 80/-20% 50V
C18	C91-1128-05	CAP. CERAMIC 0.1 80/-20% 50V
C51	CE04EW1A221M	CAP. ELECTRO 220 20% 10V
C52	CE04EW1A221M	CAP. ELECTRO 220 20% 10V
C53	C91-1128-05	CAP. CERAMIC 0.1 80/-20% 50V
C54	C91-1128-05	CAP. CERAMIC 0.1 80/-20% 50V
C55	C91-1128-05	CAP. CERAMIC 0.1 80/-20% 50V
C56	C91-1128-05	CAP. CERAMIC 0.1 80/-20% 50V
C57	C91-1128-05	CAP. CERAMIC 0.1 80/-20% 50V
C58	C91-1128-05	CAP. CERAMIC 0.1 80/-20% 50V
C59	C91-1128-05	CAP. CERAMIC 0.1 80/-20% 50V
C60	CC45CH1H101J	CAP. CERAMIC 100P 5% 50V
C61	CC45CH1H101J	CAP. CERAMIC 100P 5% 50V
C101	C90-3008-05	CAP. ELECTRO 3900 20% 16V
C102	CE04EW1A471M	CAP. ELECTRO 470 20% 10V
C103	C91-1128-05	CAP. CERAMIC 0.1 80/-20% 50V
C104	CE04EW1A101M	CAP. ELECTRO 100 20% 10V
C105	C91-1128-05	CAP. CERAMIC 0.1 80/-20% 50V
C106	CE04EW1A101M	CAP. ELECTRO 100 20% 10V
C123	CF92V1H104J	CAP. POLYESTER 0.1 5% 50V
C124	CF92V1H104J	CAP. POLYESTER 0.1 5% 50V
C125	C91-1128-05	CAP. CERAMIC 0.1 80/-20% 50V
C126	C91-1128-05	CAP. CERAMIC 0.1 80/-20% 50V
D1	MA700	DIODE
D2	MA700	DIODE
D51	B30-0974-05	LED;RED,7 SEGMENT
D52	B30-0974-05	LED;RED,7 SEGMENT
D53	B30-0974-05	LED;RED,7 SEGMENT
D54	B30-0974-05	LED;RED,7 SEGMENT
D55	B30-0974-05	LED;RED,7 SEGMENT
D56	B30-0974-05	LED;RED,7 SEGMENT
D57	B30-0974-05	LED;RED,7 SEGMENT
D58	B30-0974-05	LED;RED,7 SEGMENT
D59	B30-0994-05	LED;RED
D60	B30-0995-05	LED;GREEN/YELLOW
D61	B30-0994-05	LED;RED
D62	B30-0995-05	LED;GREEN/YELLOW
D63	B30-0995-05	LED;GREEN/YELLOW
D64	B30-0995-05	LED;GREEN/YELLOW
D65	B30-0994-05	LED;RED
D66	B30-0986-05	LED;GREEN/YELLOW AND RED
D67	B30-0994-05	LED;RED
D68	B30-0995-05	LED;GREEN/YELLOW
D69	B30-0995-05	LED;GREEN/YELLOW
D70	B30-0995-05	LED;GREEN/YELLOW
D71	B30-0986-05	LED;GREEN/YELLOW AND RED
D72	B30-0995-05	LED;GREEN/YELLOW
D73	B30-0995-05	LED;GREEN/YELLOW
D101	S1VB20	DIODE,BRIDGE
D102	1SS132	DIODE
D103	1SS132	DIODE
D104	S3V10	DIODE
D105	S3V10	DIODE
D108	1SS132	DIODE
D109	1SS132	DIODE
D110	1SS132	DIODE
D111	1SS132	DIODE
K101	S51-2508-05	RELAY
K102	S51-2511-05	RELAY
K103	S51-2508-05	RELAY
K104	S51-1529-05	RELAY

REF.NO	PARTS NO	NAME & DESCRIPTION
L1	L40-4701-03	FERRI INDUCTOR 47UH
L51	L40-4701-03	FERRI INDUCTOR 47UH
P1	E40-3237-05	PIN CONNECTOR 2P
P4	E40-5067-05	PIN CONNECTOR 10P
P5	E40-3237-05	PIN CONNECTOR 2P
P51	E40-3237-05	PIN CONNECTOR 2P
P101	E40-3237-05	PIN CONNECTOR 2P
P102	E40-3239-05	PIN CONNECTOR 4P
P103	E40-5067-05	PIN CONNECTOR 10P
P106	E40-3239-05	PIN CONNECTOR 4P
P107	NO USE	
P108	E40-4248-05	PIN CONNECTOR 2P
P109	E40-3911-05	PIN CONNECTOR 3P
P110	E40-3239-05	PIN CONNECTOR 4P
P116	E40-3237-05	PIN CONNECTOR 2P
P120	E23-1515-05	LUG TERMINAL
P121	E23-1515-05	LUG TERMINAL
Q1	2SC2785(F)	TR. SI, NPN
Q2	2SC2785(F)	TR. SI, NPN
Q3	2SC2785(F)	TR. SI, NPN
Q51	2SC2785(F)	TR. SI, NPN
Q52	2SC2785(F)	TR. SI, NPN
Q53	2SC2785(F)	TR. SI, NPN
Q54	2SC2785(F)	TR. SI, NPN
Q55	2SC2785(F)	TR. SI, NPN
Q56	2SC2785(F)	TR. SI, NPN
Q57	2SC2785(F)	TR. SI, NPN
Q58	2SC2785(F)	TR. SI, NPN
Q59	2SC2785(F)	TR. SI, NPN
Q60	2SC2785(F)	TR. SI, NPN
Q61	NO USE	
Q62	2SC2785(F)	TR. SI, NPN
Q63	2SC2785(F)	TR. SI, NPN
Q64	2SA1175(F)	TR. SI, PNP
Q65	2SA1175(F)	TR. SI, PNP
Q101	2SC1815(Y)	TR. SI, NPN
Q102	2SC1815(Y)	TR. SI, NPN
Q103	2SC1815(Y)	TR. SI, NPN
Q104	2SC1815(Y)	TR. SI, NPN
R1	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R2	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R3	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R4	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R5	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R6	R90-0612-05	RES. NETWORK 4.7KX8
R7	R90-0612-05	RES. NETWORK 4.7KX8
R8	NO USE	
R9	RD14BB2C751J	RES. CARBON 750 5% 1/6W
R51	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R52	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R53	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R54	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R55	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R56	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R57	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R58	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R59	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R60	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R61	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R62	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R63	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R64	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R65	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R66	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R67	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R68	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R69	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R70	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R71	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R72	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R73	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R74	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R75	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R76	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R79	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R80	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R81	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R82	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R83	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
R84	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
R85	R90-0612-05	RES. NETWORK 4.7KX8
R86	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R87	RD14BB2C151J	RES. CARBON 150 5% 1/6W

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION
R88	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R89	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R100	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R101	RD14BB2C221J	RES. CARBON 220 5% 1/6W
R102	RD14BB2C221J	RES. CARBON 220 5% 1/6W
R103	RD14BB2C221J	RES. CARBON 220 5% 1/6W
R104	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R105	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R106	RD14BB2C431J	RES. CARBON 430 5% 1/6W
R107	RD14BB2C431J	RES. CARBON 430 5% 1/6W
R108	RD14BB2C431J	RES. CARBON 430 5% 1/6W
R109	RD14BB2C431J	RES. CARBON 430 5% 1/6W
R110	RD14BB2C431J	RES. CARBON 430 5% 1/6W
R111	RD14BB2C431J	RES. CARBON 430 5% 1/6W
R112	RD14BB2C431J	RES. CARBON 430 5% 1/6W
R113	RD14BB2C431J	RES. CARBON 430 5% 1/6W
R114	RD14BB2C431J	RES. CARBON 430 5% 1/6W
R115	RD14BB2C431J	RES. CARBON 430 5% 1/6W
R116	RD14BB2C431J	RES. CARBON 430 5% 1/6W
R122	RD14BB2E220J	RES. CARBON 22 5% 1/4W
R123	RD14BB2E220J	RES. CARBON 22 5% 1/4W
R124	RD14BB2C154J	RES. CARBON 150K 5% 1/6W
R125	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R126	RD14BB2C154J	RES. CARBON 150K 5% 1/6W
R127	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R128	NO USE	
R129	RD14BB2E220J	RES. CARBON 22 5% 1/4W
R140	RN14BK2C3901F	RES. METAL FILM 3.9K 1% 1/6W
R141	RN14BK2C1002F	RES. METAL FILM 10K 1% 1/6W
S51	S50-1426-05	TACT SWITCH
S52	S50-1426-05	TACT SWITCH
S53	S50-1426-05	TACT SWITCH
S54	S50-1426-05	TACT SWITCH
S55	S50-1426-05	TACT SWITCH
S56	S50-1426-05	TACT SWITCH
S57	S50-1426-05	TACT SWITCH
S58	S50-0503-05	TACT SWITCH
S59	S50-1426-05	TACT SWITCH
S60	S50-1426-05	TACT SWITCH
S61	S50-1426-05	TACT SWITCH
S62	S50-1426-05	TACT SWITCH
S63	S50-1426-05	TACT SWITCH
S64	W02-1762-05	ROTARY ENCORDER
S65	S50-1426-05	TACT SWITCH
S66	S50-1426-05	TACT SWITCH
U1	TC74HC14AP	IC,HEX SCHMITT INVERTER
U2	T93-0722-14	IC,PROGRAMMED ROM
U3	HM6264ALP-15L	IC,C-MOS STATIC RAM
U4	HD64180R1P6	IC,CPU
U5	MB3773P-G	IC,RESET
U6	TC74HC139AP	IC,DUAL 2 TO 4 LINE DECODER
U7	TC74HC257AP	IC,QUAD 2-CHANNEL MPX(3-STATE)
U8	TC74HC259AP	IC,8-BIT ADDRESSABLE LATCH
U9	TC74HC139AP	IC,DUAL 2 TO 4 LINE DECODER
U10	TC74HC257AP	IC,QUAD 2-CHANNEL MPX(3-STATE)
U11	TC74HC74AP	IC,DUAL D-FLIP FLOP
U12	NO USE	
U13	TC74HC32AP	IC,QUAD 2-INPUT OR GATE
U51	TC9191P	IC,DRIVER
U52	TC74HC541AP	IC,OCTAL BUS BUFFER (3-STATE)
U53	TC74HC374AP	IC,OCTAL 3-STATE D-FFS
U54	TC9191P	IC,DRIVER
U55	TC74HC30AP	IC,8-INPUT NAND GATE
U56	TC74HC74AP	IC,DUAL D-FLIP FLOP
U57	TC74HC14AP	IC,HEX SCHMITT INVERTER
U102	TC74HC125AP	IC,QUAD 3 STATE BUS BUFFERS
U103	PC837	IC,PHOTO COUPLER
U104	PC837	IC,PHOTO COUPLER
U105	PC837	IC,PHOTO COUPLER
U106	PC827	IC,PHOTO COUPLER
X1	L78-0114-05	CERAMIC OSCILLATOR(9.210MHZ)

AMP UNIT

X73-1980-06

REF.NO	PARTS NO	NAME & DESCRIPTION
	E38-0104-05	WIRE ASS'Y;P22 TO JW1
	E38-0854-05	WIRE ASS'Y
	F02-0520-05	HEAT SINK
	F20-0647-05	INSULATOR;FOR TRANSISTOR
	J73-0161-02	PCB (UNMOUNTED)
	N09-0626-04	SCREW,SEMS PAN HD M3X10
	N19-0191-05	INSULATING WASHER
C1	C90-3009-05	CAP. ELECTRO 2700 20% 25V
C2	C90-3009-05	CAP. ELECTRO 2700 20% 25V
C3	CE04EW1C331M	CAP. ELECTRO 330 20% 16V
C4	CE04EW1C221M	CAP. ELECTRO 220 20% 16V
C5	CE04EW1A470M	CAP. ELECTRO 47 20% 10V
C6	CE04EW1A101M	CAP. ELECTRO 100 20% 10V
C7	CE04EW1A101M	CAP. ELECTRO 100 20% 10V
C8	NO USE	
C9	CE04HW1H2R2M	CAP. ELECTRO 2.2 20% 50V
C10	CE04EW1C100M	CAP. ELECTRO 10 20% 16V
C11	CE04EW1C100M	CAP. ELECTRO 10 20% 16V
C12	CE04EW1C100M	CAP. ELECTRO 10 20% 16V
C13	C91-1128-05	CAP. CERAMIC 0.1 80/-20% 50V
C14	C91-1128-05	CAP. CERAMIC 0.1 80/-20% 50V
C15	C91-1128-05	CAP. CERAMIC 0.1 80/-20% 50V
C16	C91-1128-05	CAP. CERAMIC 0.1 80/-20% 50V
C17	CK45FF1H103Z	CAP. CERAMIC 0.01 10% 50V
C21	CF92V1H105J	CAP. POLYESTER 1P 5% 50V
C22	CF92V1H474J	CAP. POLYESTER 0.47 5% 50V
C23	CK45FF1H103Z	CAP. CERAMIC 0.01 10% 50V
C24	CK45FF1H103Z	CAP. CERAMIC 0.01 10% 50V
C25	CK45FF1H103Z	CAP. CERAMIC 0.01 10% 50V
C26	CK45FF1H103Z	CAP. CERAMIC 0.01 10% 50V
C27	CK45FF1H103Z	CAP. CERAMIC 0.01 10% 50V
C28	CK45FF1H103Z	CAP. CERAMIC 0.01 10% 50V
C29	CF92V1H474J	CAP. POLYESTER 0.47 5% 50V
C30	NO USE	
C31	C90-3015-05	CAP. ELECTRO 22000 20% 25V
C32	C90-3015-05	CAP. ELECTRO 22000 20% 25V
C43	CE04BW1H470M	CAP. ELECTRO 47 20% 50V
C60	CF93AN2E104K	CAP. POLYESTER 0.1 10% 250V
D1	S1VB20	DIODE,BRIDGE
D2	MTZ13JB	DIODE,ZENER
D3	MTZ13JB	DIODE,ZENER
D4	MTZ5.1JB	DIODE,ZENER
D5	MTZ9.1JC	DIODE,ZENER
D6	HZT7A3	DIODE,ZENER
D7	MTZ5.1JA	DIODE,ZENER
D10	1SS132	DIODE
D11	1SS132	DIODE
D14	1SS132	DIODE
D15	1SS132	DIODE
D16	NO USE	
D17	1SS132	DIODE
D18	1SS132	DIODE
D24	DSK1D2	DIODE
L1	L40-4701-03	FERRI INDUCTOR 47UH
P1	E23-1515-05	LUG TERMINAL
P2	NO USE	
P3	E23-1515-05	LUG TERMINAL
P4	NO USE	
P5	E23-1515-05	LUG TERMINAL
P6	E23-1515-05	LUG TERMINAL
P7	E23-1515-05	LUG TERMINAL
P8	NO USE	
P9	E23-1515-05	LUG TERMINAL
P10	NO USE	
P11	E40-3238-05	PIN CONNECTOR 3P
P12	NO USE	
P13	E40-3237-05	PIN CONNECTOR 2P
P18	E40-4248-05	PIN CONNECTOR 2P
P19	NO USE	
P20	E40-5067-05	PIN CONNECTOR 10P
P21	NO USE	
P22	E40-3237-05	PIN CONNECTOR 2P
P23	E23-0401-05	PIN TERMINAL
Q1	2SA1111(Q)	TR. SI, PNP
Q2	2SC2591(Q)	TR. SI, NPN
Q3	NO USE	
Q4	2SC2911(R,S)	TR. SI, NPN

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION			
R1	RD14BB2E361J	RES. CARBON	360	5%	1/4W
R2	RD14BB2E361J	RES. CARBON	360	5%	1/4W
R3	RD14BB2C431J	RES. CARBON	430	5%	1/6W
R4	RD14BB2C431J	RES. CARBON	430	5%	1/6W
R5	RD14BB2C512J	RES. CARBON	5.1K	5%	1/6W
R6	RN14BK2C1002F	RES. METAL FILM	10K	1%	1/6W
R7	RN14BK2C1002F	RES. METAL FILM	10K	1%	1/6W
R8	RN14BK2C6801F	RES. METAL FILM	6.8K	1%	1/6W
R9	RN14BK2C5101F	RES. METAL FILM	5.1K	1%	1/6W
R10	RD14BB2C512J	RES. CARBON	5.1K	5%	1/6W
R11	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R12	RD14BB2C181J	RES. CARBON	180	5%	1/6W
R13	RD14BB2C221J	RES. CARBON	220	5%	1/6W
R14	R92-0150-05	JUMPING RES.	ZERO OHM(10MM)		
R15	RN14BK2C6651F	RES. METAL FILM	6.65K	1%	1/6W
R16	RN14BK2C1002F	RES. METAL FILM	10K	1%	1/6W
R17	RN14BK2C8530F	RES. METAL FILM	953	1%	1/6W
R18	RN14BK2C8530F	RES. METAL FILM	953	1%	1/6W
R19	RD14BB2C112J	RES. CARBON	1.1K	5%	1/6W
R20	RN14BK2C8200F	RES. METAL FILM	820	1%	1/6W
R21	RN14BK2C3001F	RES. METAL FILM	3K	1%	1/6W
R22	RN14BK2C1500F	RES. METAL FILM	150	1%	1/6W
R30	R92-1465-05	RES. NETWORK	2K,10K		
R33	RD14BB2C361J	RES. CARBON	360	5%	1/6W
R34	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R37	R90-1118-05	RES. NETWORK	3K,12K		
R38	NO USE				
R39	RD14BB2C512J	RES. CARBON	5.1K	5%	1/6W
R40	RD14BB2C153J	RES. CARBON	15K	5%	1/6W
R41	RD14BB2C512J	RES. CARBON	5.1K	5%	1/6W
R44	RD14BB2E152J	RES. CARBON	1.5K	5%	1/4W
R45	NO USE				
R46	RD14BB2C162J	RES. CARBON	1.6K	5%	1/6W
R47	R92-1061-05	JUMPING RES.	ZERO OHM (5MM)		
R48	R92-0150-05	JUMPING RES.	ZERO OHM(10MM)		
R53	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R54	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R55	NO USE				
R56	RD14BB2C181J	RES. CARBON	180	5%	1/6W
R57	R92-1501-05	RES. CEMENT	2	5%	5W
R58	R92-1501-05	RES. CEMENT	2	5%	5W
R59	RD14BB2C122J	RES. CARBON	1.2K	5%	1/6W
R60	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R63	RD14BB2C361J	RES. CARBON	360	5%	1/6W
R64	RN14BK2C1602F	RES. METAL FILM	16K	1%	1/6W
R65	RN14BK2C1801F	RES. METAL FILM	1.8K	1%	1/6W
R66	RN14BK2C1602F	RES. METAL FILM	16K	1%	1/6W
R67	RN14BK2C1801F	RES. METAL FILM	1.8K	1%	1/6W
R68	RN14BK2C1004F	RES. METAL FILM	1M	1%	1/6W
R69	RN14BK2C1004F	RES. METAL FILM	1M	1%	1/6W
R70	RN14BK2E2004F	RES. METAL FILM	2M	1%	1/4W
R71	RN14BK2E2004F	RES. METAL FILM	2M	1%	1/4W
R72	NO USE				
R73	RD14BB2C511J	RES. CARBON	510	5%	1/6W
R74	NO USE				
R75	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R76	NO USE				
R77	R92-1061-05	JUMPING RES.	ZERO OHM (5MM)		
R81	R92-1061-05	JUMPING RES.	ZERO OHM (5MM)		
R82	R92-0150-05	JUMPING RES.	ZERO OHM(10MM)		
R151	E31-2170-05	JUMPING WIRE			
R152	E31-2170-05	JUMPING WIRE			
R153	E31-2170-05	JUMPING WIRE			
R157	RD14DB3DR43J	RES. CARBON	0.43	5%	2W
R158	RD14DB3DR43J	RES. CARBON	0.43	5%	2W
R159	NO USE				
R160	RD14BB2E101J	RES. CARBON	100	5%	1/4W
R161	RD14BB2E101J	RES. CARBON	100	5%	1/4W
R164	RD14DB3DR43J	RES. CARBON	0.43	5%	2W
R165	RD14DB3DR43J	RES. CARBON	0.43	5%	2W
R166	NO USE				
R167	RD14BB2E101J	RES. CARBON	100	5%	1/4W
R168	RD14BB2E101J	RES. CARBON	100	5%	1/4W
R169	NO USE				
R170	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R171	E31-2170-05	JUMPING WIRE			
R172	E31-2170-05	JUMPING WIRE			
R173	E31-2170-05	JUMPING WIRE			
R174	NO USE				
R175	RD14BB2E271J	RES. CARBON	270	5%	1/4W
R186	R92-1501-05	RES. CEMENT	2	5%	5W
R187	E31-2170-05	JUMPING WIRE			
R188	E31-2170-05	JUMPING WIRE			
R189	E31-2170-05	JUMPING WIRE			
R215	R92-1061-05	JUMPING RES.	ZERO OHM (5MM)		

REF.NO	PARTS NO	NAME & DESCRIPTION
TP1	E23-0401-05	PIN TERMINAL
U1	NJM7805FA	IC,3-TERMINAL REGULATOR
U2	NJM4558D	IC,DUAL OP-AMP
U3	TC4094BP	IC,8-BIT SHIFT/STORE BUS REGI.
U4	TC4094BP	IC,8-BIT SHIFT/STORE BUS REGI.
U5	TC4094BP	IC,8-BIT SHIFT/STORE BUS REGI.
U6	HA17012PB	IC,12-BIT D/A CONVERTER
U7	HD14053BP	IC,TRIPLE 2CH ANALOG MPX/DE-MP
U8	HD14052BP	IC,DUAL 4-CH ANALOG MPX/DE-MP
U9	NJM4558D	IC,DUAL OP-AMP
U10	NO USE	
U11	NJM072BD	IC,JFET INPUT OP AMP
U12	NO USE	
U13	NJM4558D	IC,DUAL OP-AMP
U14	NJM4560D	IC,OP AMP
U15	NO USE	
U16	TLP595A	IC,PHOTO COUPLER
U17	TC74HC11AP	IC,TRIPLE 3 INPUT AND GATE
VR1	R12-0556-05	RES. SEMI FIXED 100 B
VR2	R12-0556-05	RES. SEMI FIXED 100 B
VR3	NO USE	
VR4	R12-0541-05	RES. SEMI FIXED 100 B

AMP UNIT

X73-1980-07

REF.NO	PARTS NO	NAME & DESCRIPTION			
	E38-0018-05	WIRE ASS'Y;JW2 TO Q15			
	E38-0019-15	WIRE ASS'Y;JW3 TO Q16			
	E38-0103-05	WIRE ASS'Y;P17,18,22 TO P108,			
	F02-0520-05	HEAT SINK			
	F20-0647-05	INSULATOR;FOR TRANSISTOR			
	J73-0161-02	PCB (UNMOUNTED)			
	N09-0626-04	SCREW,SEMS PAN HD M3X10			
	N19-0191-05	INSULATING WASHER			
C1	C90-3009-05	CAP. ELECTRO	2700	20%	25V
C2	C90-3009-05	CAP. ELECTRO	2700	20%	25V
C3	CE04EW1C331M	CAP. ELECTRO	330	20%	16V
C4	CE04EW1C221M	CAP. ELECTRO	220	20%	16V
C5	CE04EW1A470M	CAP. ELECTRO	47	20%	10V
C6	CE04EW1A101M	CAP. ELECTRO	100	20%	10V
C7	CE04EW1A101M	CAP. ELECTRO	100	20%	10V
C8	CE04EW1H2R2M	CAP. ELECTRO	2.2	20%	50V
C9	CE04HW1H2R2M	CAP. ELECTRO	2.2	20%	50V
C10	CE04EW1C100M	CAP. ELECTRO	10	20%	16V
C11	CE04EW1C100M	CAP. ELECTRO	10	20%	16V
C12	CE04EW1C100M	CAP. ELECTRO	10	20%	16V
C13	C91-1128-05	CAP. CERAMIC	0.1	80/-20%	50V
C14	C91-1128-05	CAP. CERAMIC	0.1	80/-20%	50V
C15	C91-1128-05	CAP. CERAMIC	0.1	80/-20%	50V
C16	C91-1128-05	CAP. CERAMIC	0.1	80/-20%	50V
C17	CK45FF1H103Z	CAP. CERAMIC	0.01	10%	50V
C18	NO USE				
C19	CF92V1H105J	CAP. POLYESTER	1P	5%	50V
C20	CF92V1H474J	CAP. POLYESTER	0.47	5%	50V
C21	CF92V1H105J	CAP. POLYESTER	1P	5%	50V
C22	CF92V1H474J	CAP. POLYESTER	0.47	5%	50V
C23	CK45FF1H103Z	CAP. CERAMIC	0.01	10%	50V
C24	CK45FF1H103Z	CAP. CERAMIC	0.01	10%	50V
C25	CK45FF1H103Z	CAP. CERAMIC	0.01	10%	50V
C26	CK45FF1H103Z	CAP. CERAMIC	0.01	10%	50V
C27	CK45FF1H103Z	CAP. CERAMIC	0.01	10%	50V
C28	CK45FF1H103Z	CAP. CERAMIC	0.01	10%	50V
C29	CF92V1H474J	CAP. POLYESTER	0.47	5%	50V
C30	CF92V1H474J	CAP. POLYESTER	0.47	5%	50V
C31	C90-3014-05	CAP. ELECTRO	4700	20%	50V
C32	C90-3014-05	CAP. ELECTRO	4700	20%	50V
C33	CF93AN2E104K	CAP. POLYESTER	0.1	10%	250V
C34	CF93AN2E104K	CAP. POLYESTER	0.1	10%	250V
C41	CE04EW1H470M	CAP. ELECTRO	47	20%	50V
C42	NO USE				
C43	CE04BW1H470M	CAP. ELECTRO	47	20%	50V
C51	C91-2586-05	CAP. CERAMIC	1000P		500V
C52	C91-2586-05	CAP. CERAMIC	1000P		500V
D1	S1VB20	DIODE,BRIDGE			
D2	MTZ13JB	DIODE,ZENER			
D3	MTZ13JB	DIODE,ZENER			
D4	MTZ5.1JB	DIODE,ZENER			
D5	MTZ9.1JC	DIODE,ZENER			
D6	HZT7A3	DIODE,ZENER			
D7	MTZ5.1JA	DIODE,ZENER			
D8	1SS132	DIODE			
D9	1SS132	DIODE			
D10	1SS132	DIODE			
D11	1SS132	DIODE			
D12	1SS132	DIODE			
D13	1SS132	DIODE			
D14	1SS132	DIODE			
D15	1SS132	DIODE			

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION
D16	1SS132	DIODE
D17	1SS132	DIODE
D18	1SS132	DIODE
D23	DSM1D2	DIODE
D24	DSM1D2	DIODE
L1	L40-4701-03	FERRI INDUCTOR 47UH
P1	E23-1515-05	LUG TERMINAL
P2	E23-1515-05	LUG TERMINAL
P3	E23-1515-05	LUG TERMINAL
P11	E40-3238-05	PIN CONNECTOR 3P
P12	NO USE	
P13	E40-3237-05	PIN CONNECTOR 2P
P14	E40-4248-05	PIN CONNECTOR 2P
P15	E40-4248-05	PIN CONNECTOR 2P
P16	NO USE	
P17	E40-4248-05	PIN CONNECTOR 2P
P18	E40-4248-05	PIN CONNECTOR 2P
P19	NO USE	
P20	E40-5067-05	PIN CONNECTOR 10P
P21	NO USE	
P22	E40-3237-05	PIN CONNECTOR 2P
P23	E23-0401-05	PIN TERMINAL
P24	E23-0401-05	PIN TERMINAL
Q1	2SA1111(Q)	TR. SI, PNP
Q2	2SC2591(Q)	TR. SI, NPN
Q3	2SA1209(R,S)	TR. SI, PNP
Q4	2SC2911(R,S)	TR. SI, NPN
R1	RD14BB2E361J	RES. CARBON 360 5% 1/4W
R2	RD14BB2E361J	RES. CARBON 360 5% 1/4W
R3	RD14BB2C431J	RES. CARBON 430 5% 1/6W
R4	RD14BB2C431J	RES. CARBON 430 5% 1/6W
R5	RD14BB2C512J	RES. CARBON 5.1K 5% 1/6W
R6	RN14BK2C1002F	RES. METAL FILM 10K 1% 1/6W
R7	RN14BK2C1002F	RES. METAL FILM 10K 1% 1/6W
R8	RN14BK2C6801F	RES. METAL FILM 6.8K 1% 1/6W
R9	RN14BK2C5101F	RES. METAL FILM 5.1K 1% 1/6W
R10	RD14BB2C512J	RES. CARBON 5.1K 5% 1/6W
R11	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R12	RD14BB2C181J	RES. CARBON 180 5% 1/6W
R13	RD14BB2C221J	RES. CARBON 220 5% 1/6W
R14	R92-0150-05	JUMPING RES. ZERO OHM(10MM)
R15	RN14BK2C6651F	RES. METAL FILM 6.65K 1% 1/6W
R16	RN14BK2C1002F	RES. METAL FILM 10K 1% 1/6W
R17	RN14BK2C9530F	RES. METAL FILM 953 1% 1/6W
R18	RN14BK2C9530F	RES. METAL FILM 953 1% 1/6W
R19	RD14BB2C112J	RES. CARBON 1.1K 5% 1/6W
R20	RN14BK2C8200F	RES. METAL FILM 820 1% 1/6W
R21	RN14BK2C3001F	RES. METAL FILM 3K 1% 1/6W
R22	RN14BK2C1500F	RES. METAL FILM 150 1% 1/6W
R28	R92-1465-05	RES. NETWORK 2K,10K
R29	NO USE	
R30	R92-1465-05	RES. NETWORK 2K,10K
R31	RD14BB2C361J	RES. CARBON 360 5% 1/6W
R32	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R33	RD14BB2C361J	RES. CARBON 360 5% 1/6W
R34	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R35	R90-1118-05	RES. NETWORK 3K,12K
R36	NO USE	
R37	R90-1118-05	RES. NETWORK 3K,12K
R38	NO USE	
R39	RD14BB2C512J	RES. CARBON 5.1K 5% 1/6W
R40	RD14BB2C153J	RES. CARBON 15K 5% 1/6W
R41	RD14BB2C512J	RES. CARBON 5.1K 5% 1/6W
R42	NO USE	
R43	RD14BB2E152J	RES. CARBON 1.5K 5% 1/4W
R44	RD14BB2E152J	RES. CARBON 1.5K 5% 1/4W
R45	RD14BB2C162J	RES. CARBON 1.6K 5% 1/6W
R46	RD14BB2C162J	RES. CARBON 1.6K 5% 1/6W
R47	R92-0150-05	JUMPING RES. ZERO OHM(10MM)
R48	R92-1061-05	JUMPING RES. ZERO OHM (5MM)
R51	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R52	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R53	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R54	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R55	RD14BB2C181J	RES. CARBON 180 5% 1/6W
R56	RD14BB2C181J	RES. CARBON 180 5% 1/6W
R57	R92-1456-05	RES. CEMENT 1 5% 3W
R58	R92-1456-05	RES. CEMENT 1 5% 3W
R59	RD14BB2C122J	RES. CARBON 1.2K 5% 1/6W
R60	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R63	RD14BB2C361J	RES. CARBON 360 5% 1/6W
R64	RN14BK2C1602F	RES. METAL FILM 16K 1% 1/6W
R65	RN14BK2C1801F	RES. METAL FILM 1.8K 1% 1/6W
R66	RN14BK2C1602F	RES. METAL FILM 16K 1% 1/6W
R67	RN14BK2C1801F	RES. METAL FILM 1.8K 1% 1/6W
R68	RN14BK2C1004F	RES. METAL FILM 1M 1% 1/6W
R69	RN14BK2C1004F	RES. METAL FILM 1M 1% 1/6W
R70	RN14BK2E2004F	RES. METAL FILM 2M 1% 1/4W
R71	RN14BK2E2004F	RES. METAL FILM 2M 1% 1/4W
R72	RD14BB2C511J	RES. CARBON 510 5% 1/6W
R73	RD14BB2C511J	RES. CARBON 510 5% 1/6W
R74	RD14BB2C331J	RES. CARBON 330 5% 1/6W
R75	RD14BB2C331J	RES. CARBON 330 5% 1/6W
R76	NO USE	
R77	R92-1061-05	JUMPING RES. ZERO OHM (5MM)
R81	R92-1061-05	JUMPING RES. ZERO OHM (5MM)
R82	R92-0150-05	JUMPING RES. ZERO OHM(10MM)
R154	E31-2170-05	JUMPING WIRE
R155	E31-2170-05	JUMPING WIRE
R156	E31-2170-05	JUMPING WIRE
R157	RD14DB3AR82J	RES. CARBON 0.82 5% 1W
R158	NO USE	
R159	RD14DB2H2R2J	RES. CARBON 2.2 5% 1/2W
R160	RD14BB2C131J	RES. CARBON 130 5% 1/6W
R161	NO USE	
R162	RD14BB2C301J	RES. CARBON 300 5% 1/6W
R163	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R164	RD14DB3AR82J	RES. CARBON 0.82 5% 1W
R165	NO USE	
R166	RD14DB2H2R2J	RES. CARBON 2.2 5% 1/2W
R167	RD14BB2C131J	RES. CARBON 130 5% 1/6W
R168	NO USE	
R169	RD14BB2C301J	RES. CARBON 300 5% 1/6W
R170	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R174	RD14DB3A681J	RES. CARBON 680 5% 1W
R175	RD14DB3A681J	RES. CARBON 680 5% 1W
R211	E31-2170-05	JUMPING WIRE
R212	E31-2170-05	JUMPING WIRE
R213	E31-2170-05	JUMPING WIRE
R214	E31-2170-05	JUMPING WIRE
TP1	E23-0401-05	PIN TERMINAL
U1	NJM7805FA	IC,3-TERMINAL REGULATOR
U2	NJM4558D	IC,DUAL OP-AMP
U3	TC4094BP	IC,8-BIT SHIFT/STORE BUS REGI.
U4	TC4094BP	IC,8-BIT SHIFT/STORE BUS REGI.
U5	TC4094BP	IC,8-BIT SHIFT/STORE BUS REGI.
U6	HA17012PB	IC,12-BIT D/A CONVERTER
U7	HD14053BP	IC,TRIPLE 2CH ANALOG MPX/DE-MP
U8	HD14052BP	IC,DUAL 4-CH ANALOG MPX/DE-MP
U9	NJM4558D	IC,DUAL OP-AMP
U10	NJM072BD	IC,JFET INPUT OP AMP
U11	NJM072BD	IC,JFET INPUT OP AMP
U12	NJM4558D	IC,DUAL OP-AMP
U13	NJM4558D	IC,DUAL OP-AMP
U14	NJM4560D	IC,OP AMP
U15	TLP595A	IC,PHOTO COUPLER
U16	TLP595A	IC,PHOTO COUPLER
U17	TC74HC11AP	IC,TRIPLE 3 INPUT AND GATE
VR1	R12-0556-05	RES. SEMI FIXED 100 B
VR2	R12-0556-05	RES. SEMI FIXED 100 B
VR3	R12-0541-05	RES. SEMI FIXED 100 B
VR4	R12-0541-05	RES. SEMI FIXED 100 B

TERMINAL UNIT

X81-2880-02

REF.NO	PARTS NO	NAME & DESCRIPTION
	E38-0017-05	WIRE ASS'Y;JL1,2,3 TO P109
	E38-0020-15	WIRE ASS'Y
	E38-0106-05	WIRE ASS'Y
	J73-0019-03	PCB (UNMOUNTED)
C1	CE04EW1E471M	CAP. ELECTRO 470 20% 25V
C2	CE04EW1E471M	CAP. ELECTRO 470 20% 25V
C3	NO USE	
C4	CE04EW1C102M	CAP. ELECTRO 1000 20% 16V
C111	C91-2586-05	CAP. CERAMIC 1000P 500V
C112	C91-2586-05	CAP. CERAMIC 1000P 500V
C113	C91-2586-05	CAP. CERAMIC 1000P 500V
C114	C91-2586-05	CAP. CERAMIC 1000P 500V
C115	C91-2586-05	CAP. CERAMIC 1000P 500V
C116	C91-2586-05	CAP. CERAMIC 1000P 500V
C117	C91-2586-05	CAP. CERAMIC 1000P 500V
C118	C91-2586-05	CAP. CERAMIC 1000P 500V
C119	C91-2586-05	CAP. CERAMIC 1000P 500V
C120	C91-2586-05	CAP. CERAMIC 1000P 500V
C121	C91-2586-05	CAP. CERAMIC 1000P 500V
C122	C91-2586-05	CAP. CERAMIC 1000P 500V
R1	RD14DB3D301J	RES. CARBON 300 5% 2W
R2	RD14DB3D301J	RES. CARBON 300 5% 2W
R3	NO USE	
R4	R92-1061-05	JUMPING RES. ZERO OHM (5MM)
R5	R92-1061-05	JUMPING RES. ZERO OHM (5MM)
R6	RD14BB2E301J	RES, CARBON 300 5% 1/4W

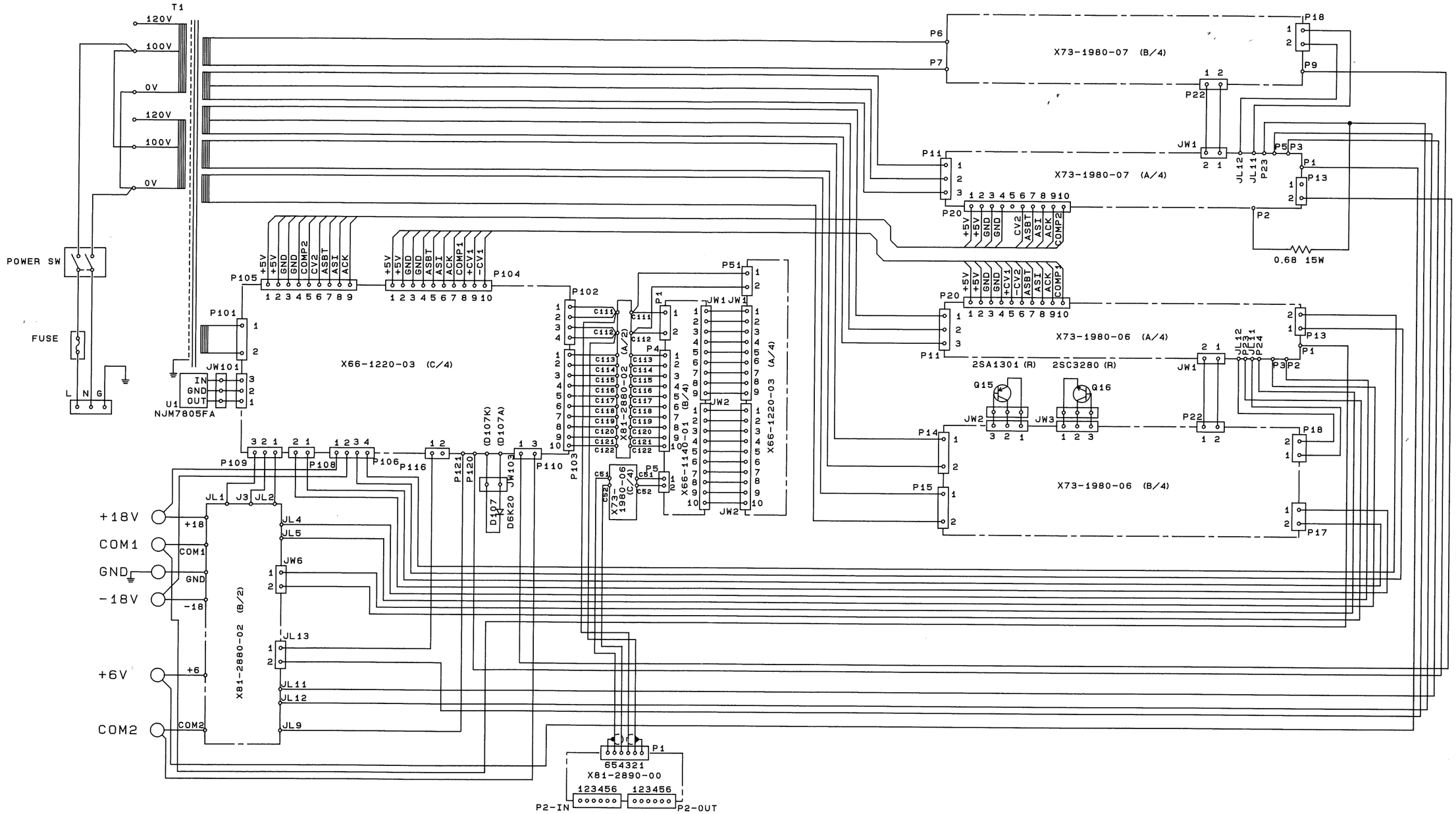
PARTS LIST

BUFFER UNIT

X81-2890-00

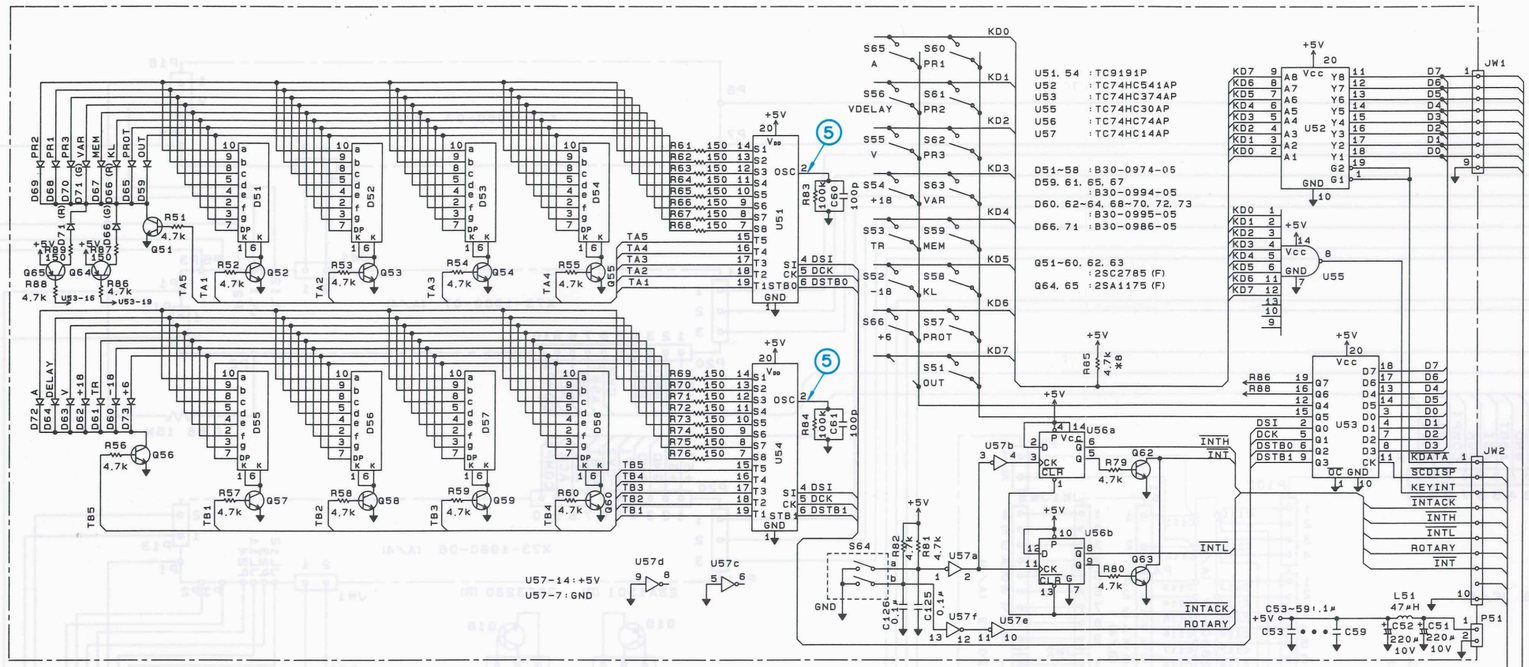
REF.NO	PARTS NO	NAME & DESCRIPTION			
	J73-0030-03	PCB (UNMOUNTED)			
C1	CE04EW1A100M	CAP. ELECTRO	10	20%	10V
C2	CE04EW1C220M	CAP. ELECTRO	22	20%	16V
C3	CE04EW1C220M	CAP. ELECTRO	22	20%	16V
C4	CE04EW1C220M	CAP. ELECTRO	22	20%	16V
C5	CE04JW1A100M	CAP. ELECTRO	10	20%	10V
C6	CE04EW1C220M	CAP. ELECTRO	22	20%	16V
D901	1SS132	DIODE			
P1	E40-3303-05	PIN CONNECTOR	6P		
P2	E58-0606-05	MODULE CONNECTOR			
Q1	2SC2785(F)	TR. SI, NPN			
R1	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R2	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R3	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
U1	MAX232CPE	IC,RS-232C DRIVERS/RECEIVERS			

SCHEMATIC DIAGRAM

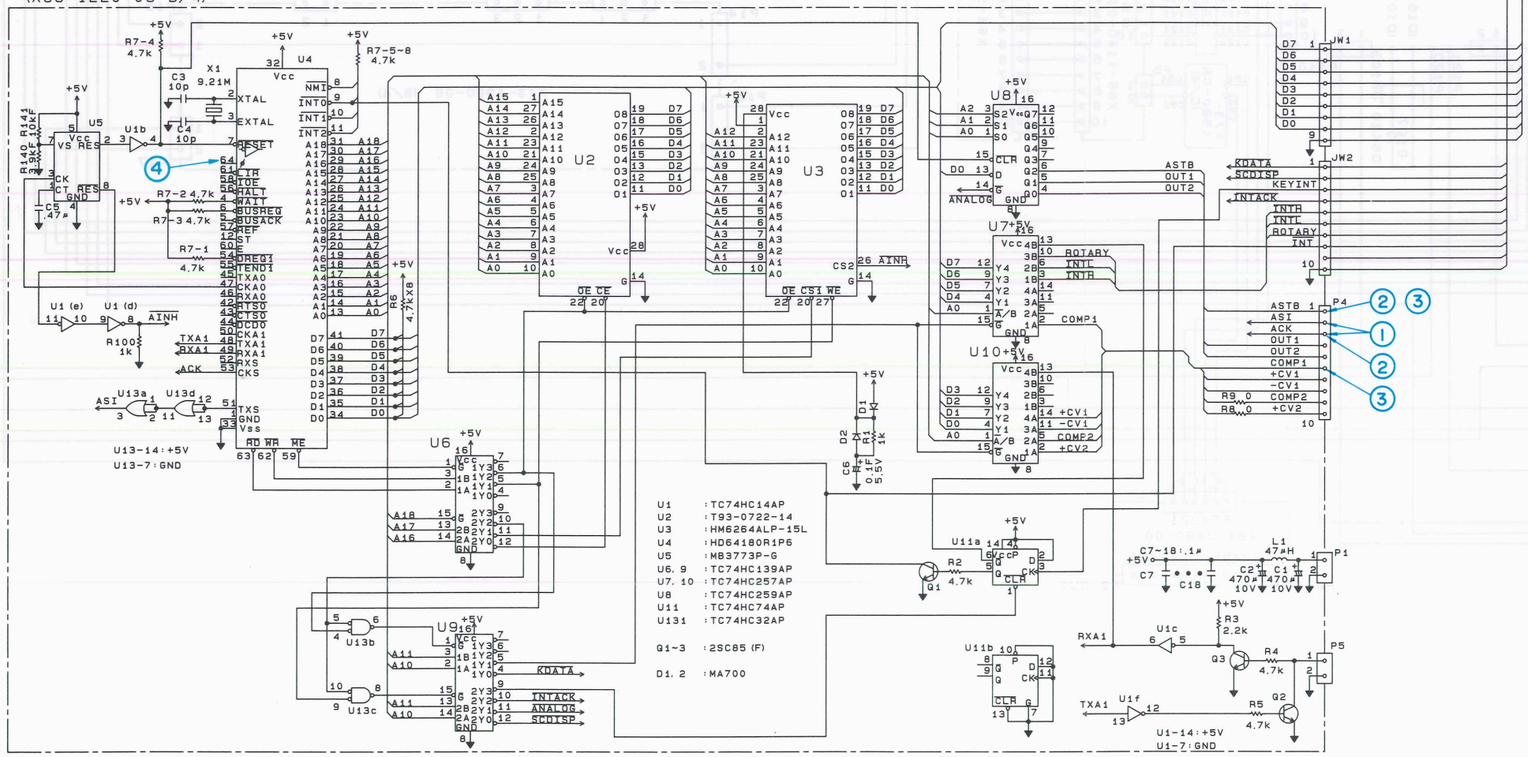


SCHEMATIC DIAGRAM

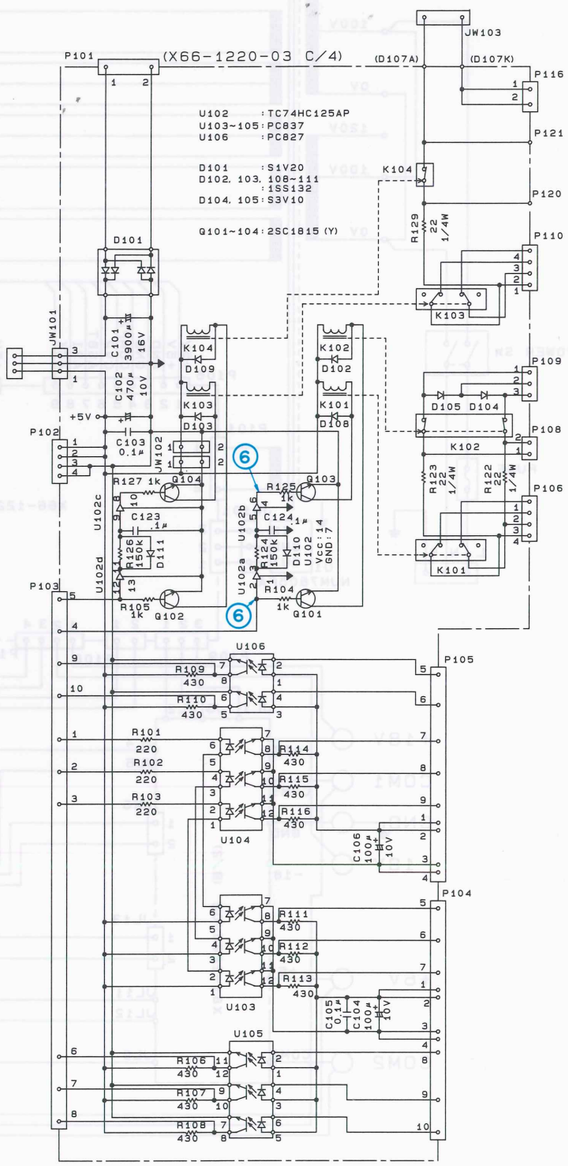
PANEL UNIT (X66-1220-03 A/4)



(X66-1220-03 B/4)

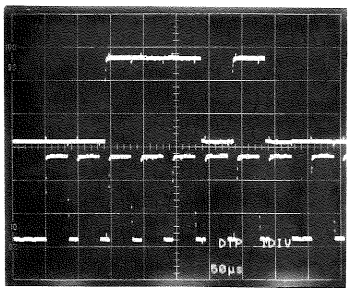


(X66-1220-03 C/4)



WAVEFORM

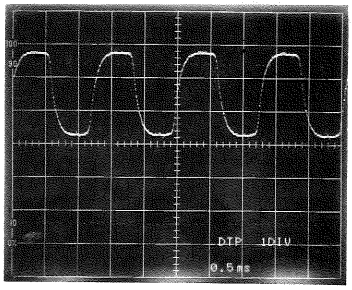
①



← 5V
P4-2 Waveform
In case of X73-1980-07, it takes DATA Waveform.
← GND
← 5V
P4-3 Waveform
In case of X73-1980-07, it takes STROBE Waveform.
← GND

50µs/diV

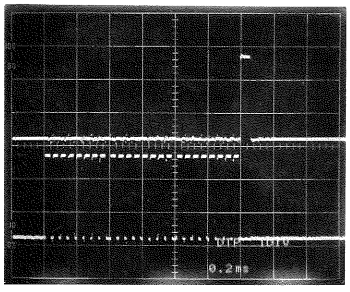
④



← 5V
U4-64 Waveform, CPU Clock Waveform
← GND

0.5ms/diV

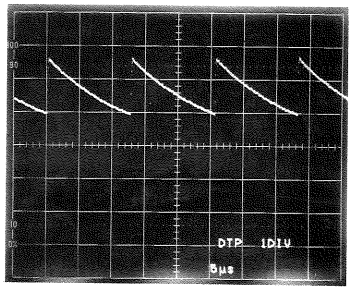
②



← 5V
P4-1 Waveform
In case of X73-1980-07, it takes CLOCK Waveform.
← GND
← 5V
P4-3 Waveform
← GND

0.2ms/diV

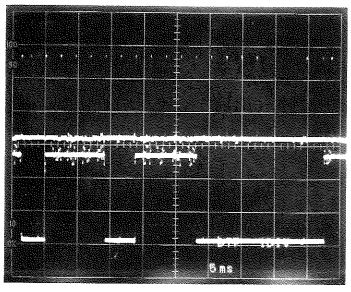
⑤



← 5V
U51 and 52-2 Waveform
← GND

5µs/diV

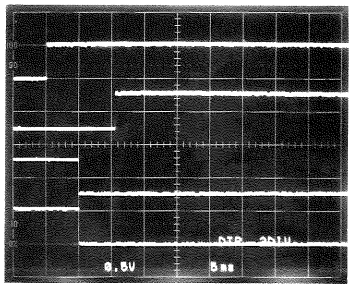
③



← 5V
P4-1 Waveform
← GND
← 5V
P4-6 Waveform
In case of X73-1980-07, it takes P20-10 Waveform.
← GND

5ms/diV

⑥

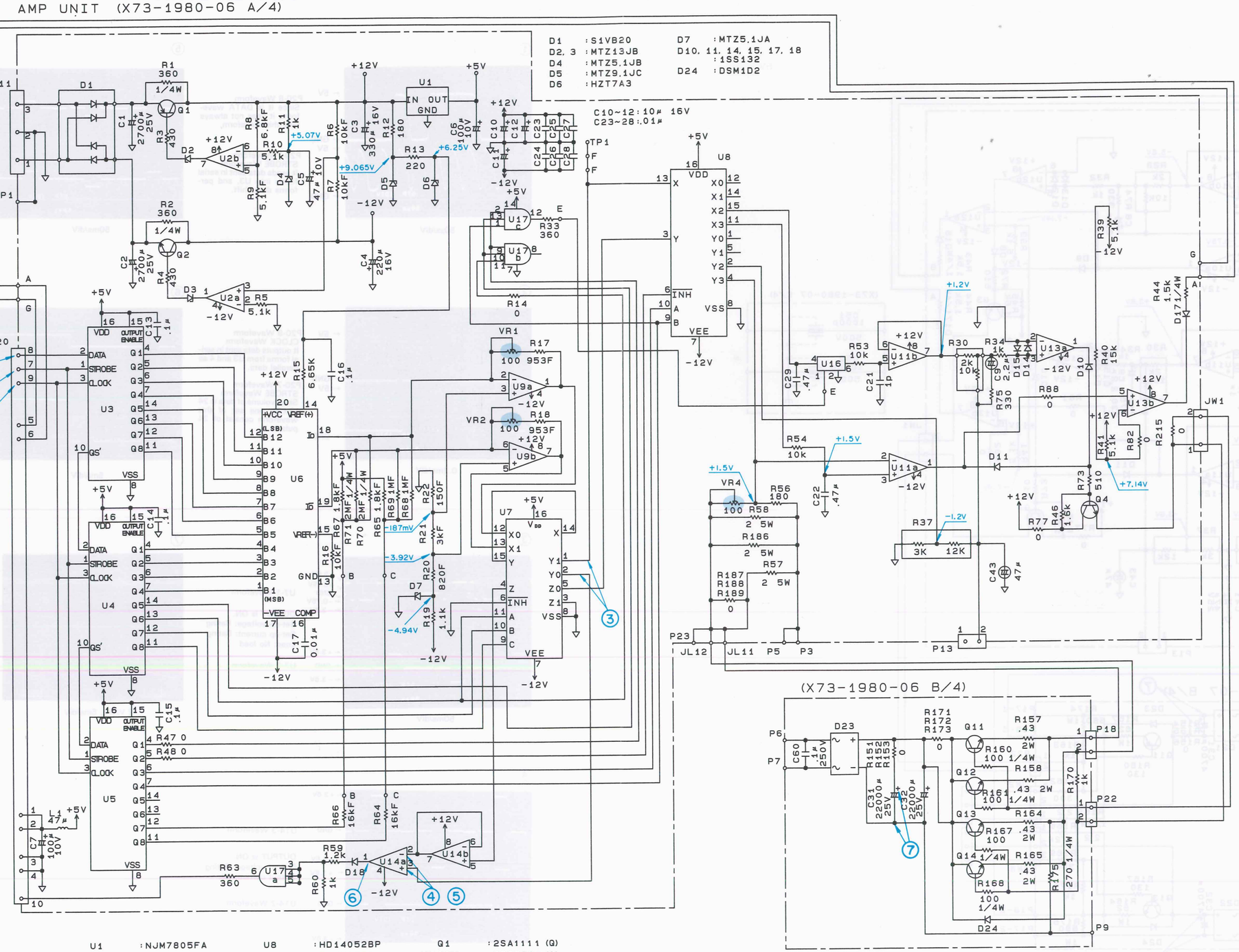


← U102-2 Waveform (for K101 disturbance)
← GND
← U102-6 Waveform (for K102 disturbance) — During OUTPUT is ON
← GND
← U102-7 Waveform (for K101 disturbance)
← GND
← U102-6 Waveform (for K102 disturbance) — During OUTPUT is OFF

3V/diV, 5ms/diV

SCHEMATIC DIAGRAM

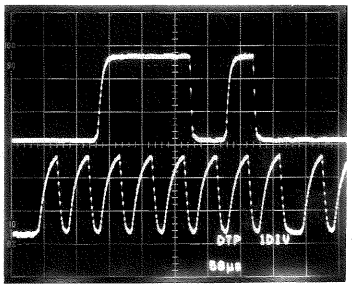
AMP UNIT (X73-1980-06 A/4)



U1	: NJM7805FA	U8	: HD14052BP	Q1	: 2SA1111 (Q)
U2, 9, 13	: NJM4558D	U11	: 7NJM072B	Q2	: 2SC2591 (Q)
U3, 4, 5	: TC4094BP	U14	: NJM4560D	Q4	: 2SC2911 (R, S)
U6	: HA17012PB	U16	: TLP595A		
U7	: HD14053BP	U17	: TC74HC11AP		

WAVEFORM

①

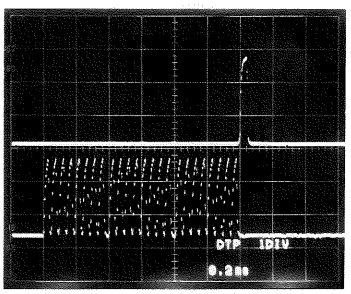


50μs/diV

P20-8 Waveform
Since it is DATA waveform, it does not always take this waveform.

P20-7 Waveform
STROBE Waveform
It sends data sent in serial forms into U3, and performs data shift.

②

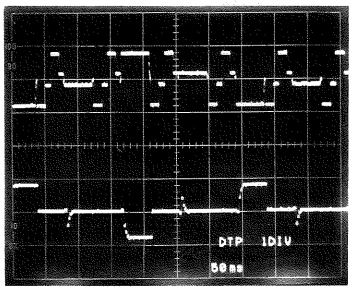


0.2ms/diV

P20-9 Waveform
CLOCK Waveform
It outputs data sent in serial forms from U3 and 4 as parallel data.

P20-7 Waveform
STROBE Waveform
Since volume of data is 24 (3×8), one set of this waveform consist of 24 pulses.

③



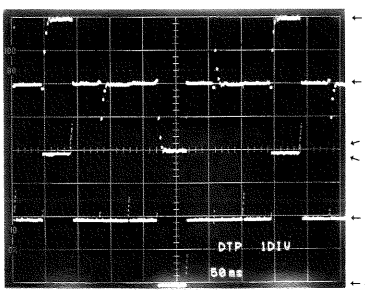
50ms/diV

U7-1 Waveform

OUTPUT is ON.
Set-up voltage: Rating
Set-up current: Rating
Load: No load

U7-2 Waveform

④



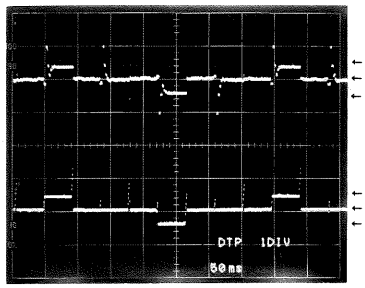
50ms/diV

U14-3 Waveform

OUTPUT is ON.
Output voltage: Rating
Output current: 0A

U14-2 Waveform

⑤



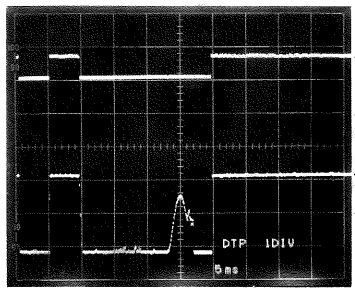
50ms/diV

U14-3 Waveform

OUTPUT is ON.
Output terminal: Short-circuit
Output current: Rating

U14-2 Waveform

⑥



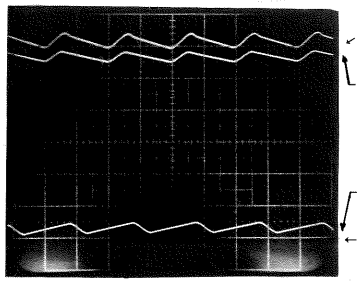
5ms/diV

P20-10 Waveform

Since this waveform is compared by a comparater on a serial manner, it does not always take this waveform.

U14-1 Waveform

⑦

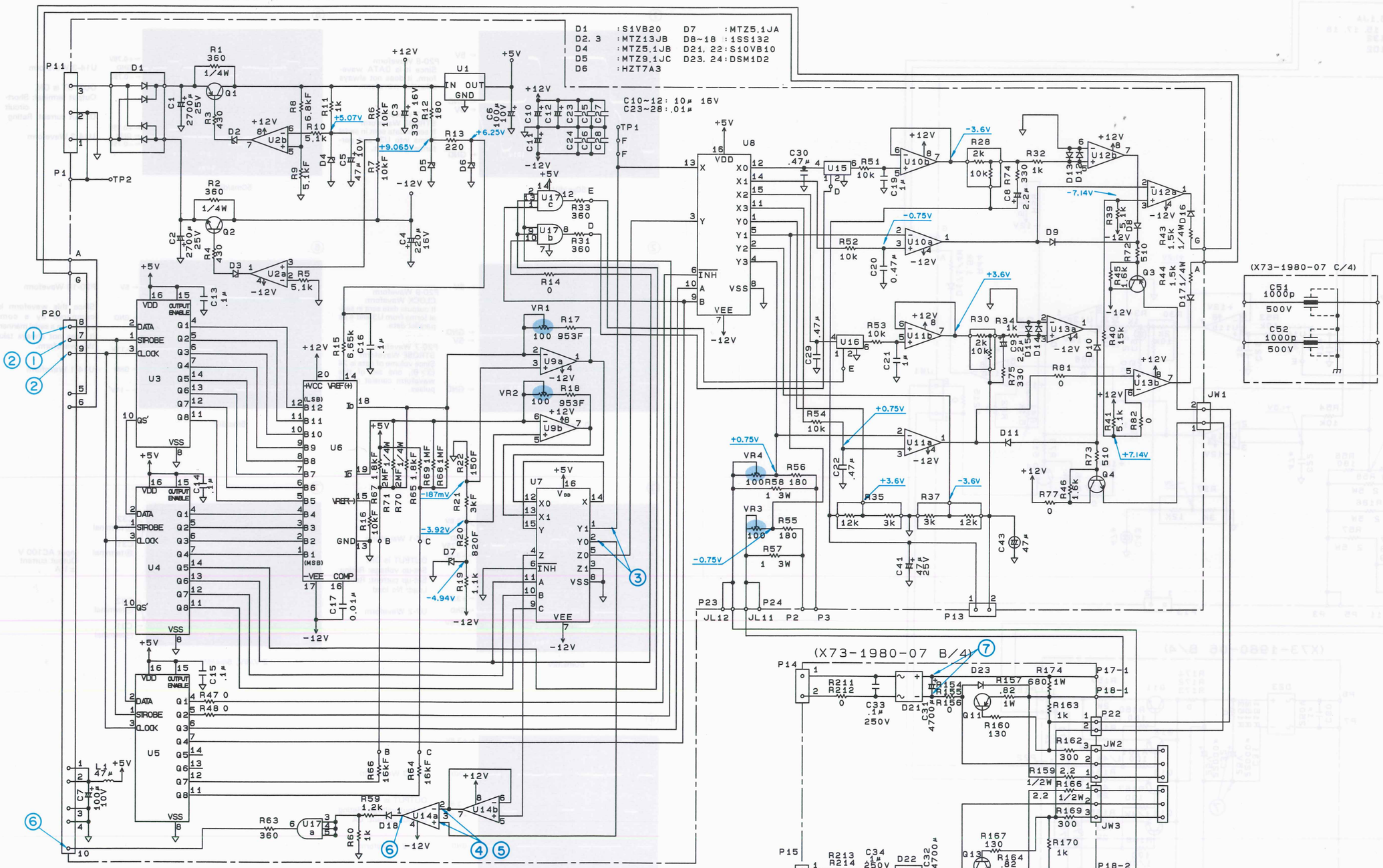


2 V/diV, 5ms/diV

Input AC100 V
Output current
±1 A

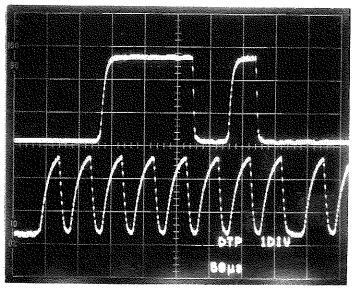
SCHEMATIC DIAGRAM

AMP UNIT (X73-1980-07 A/4)



WAVEFORM

①

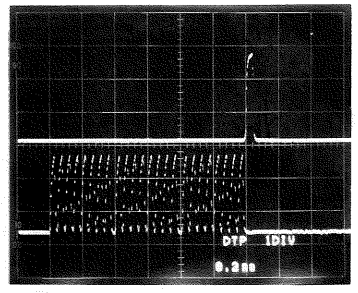


50μs/diV

P20-8 Waveform
Since it is DATA waveform, it does not always take this waveform.

P20-7 Waveform
STROBE Waveform
It sends data sent in serial forms into U3, and performs data shift.

②

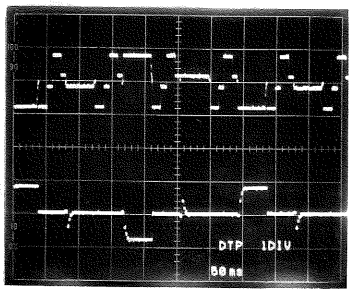


0.2ms/diV

P20-9 Waveform
CLOCK Waveform
It outputs data sent in serial forms from U3 and 4 as parallel data.

P20-7 Waveform
STROBE Waveform
Since volume of data is 24 (3×8), one set of this waveform consist of 24 pulses.

③



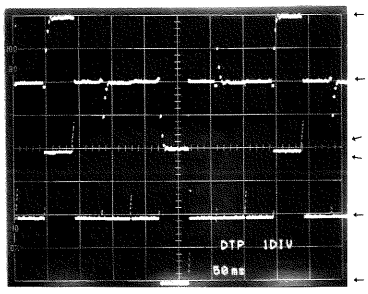
50ms/diV

U7-1 Waveform

OUTPUT is ON.
Set-up voltage: Rating
Set-up current: Rating
Load: No load

U7-2 Waveform

④



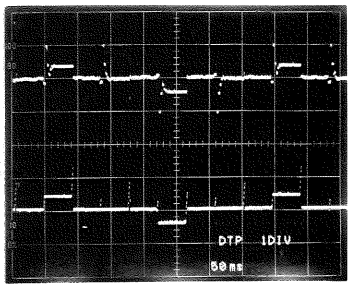
50ms/diV

U14-3 Waveform

OUTPUT is ON.
Output voltage: Rating
Output current: 0A

U14-2 Waveform

⑤



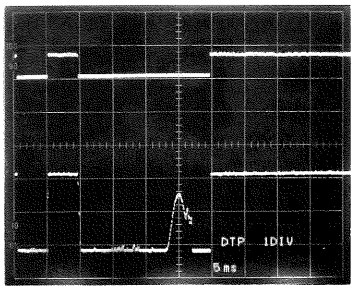
50ms/diV

U14-3 Waveform

OUTPUT is ON.
Output terminal: Short-circuit
Output current: Rating

U14-2 Waveform

⑥



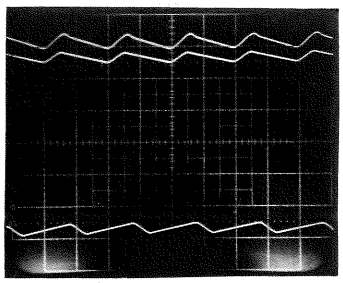
5ms/diV

P20-10 Waveform

Since this waveform is compared by a comparater on a serial manner, it does not always take this waveform.

U14-1 Waveform

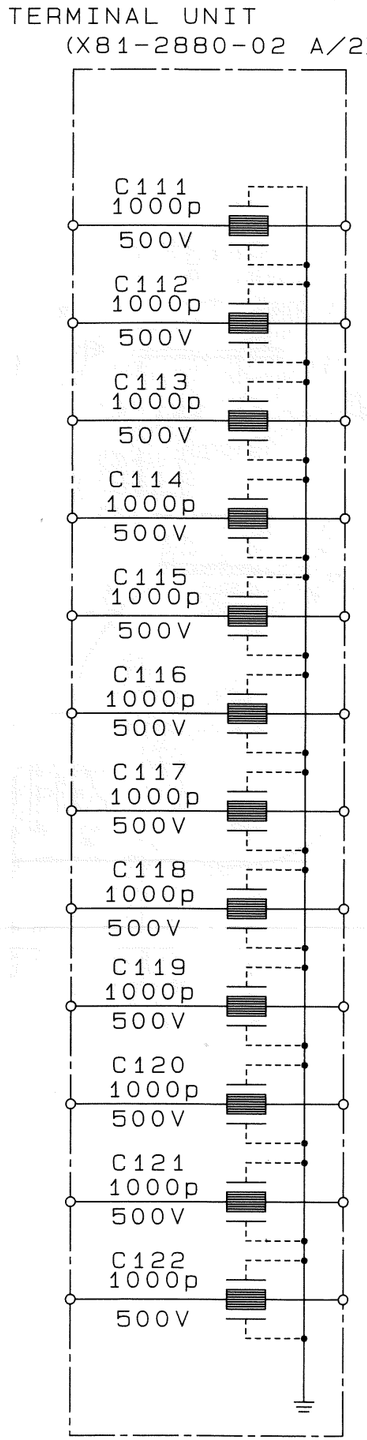
⑦

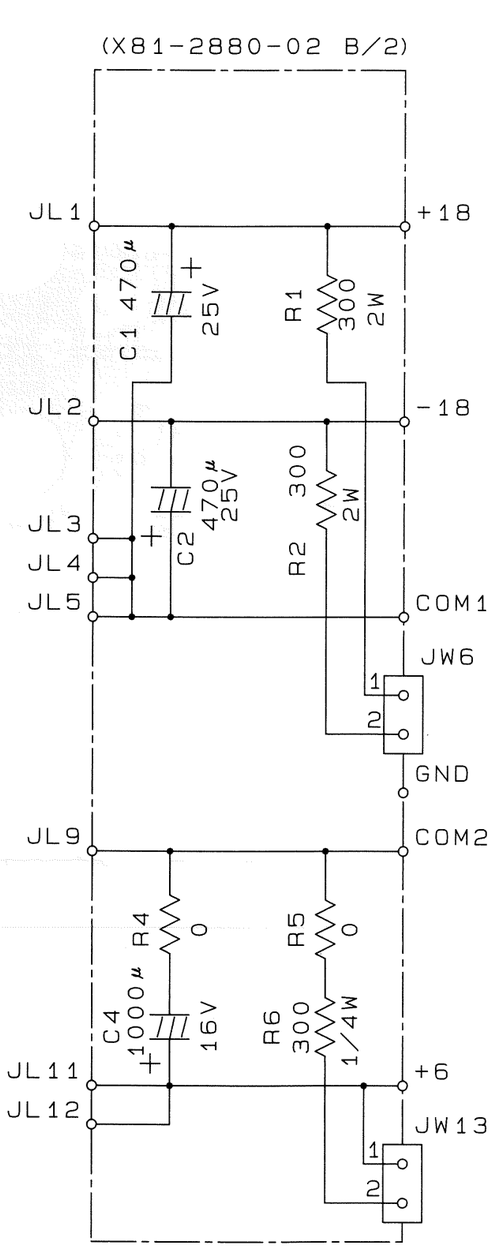


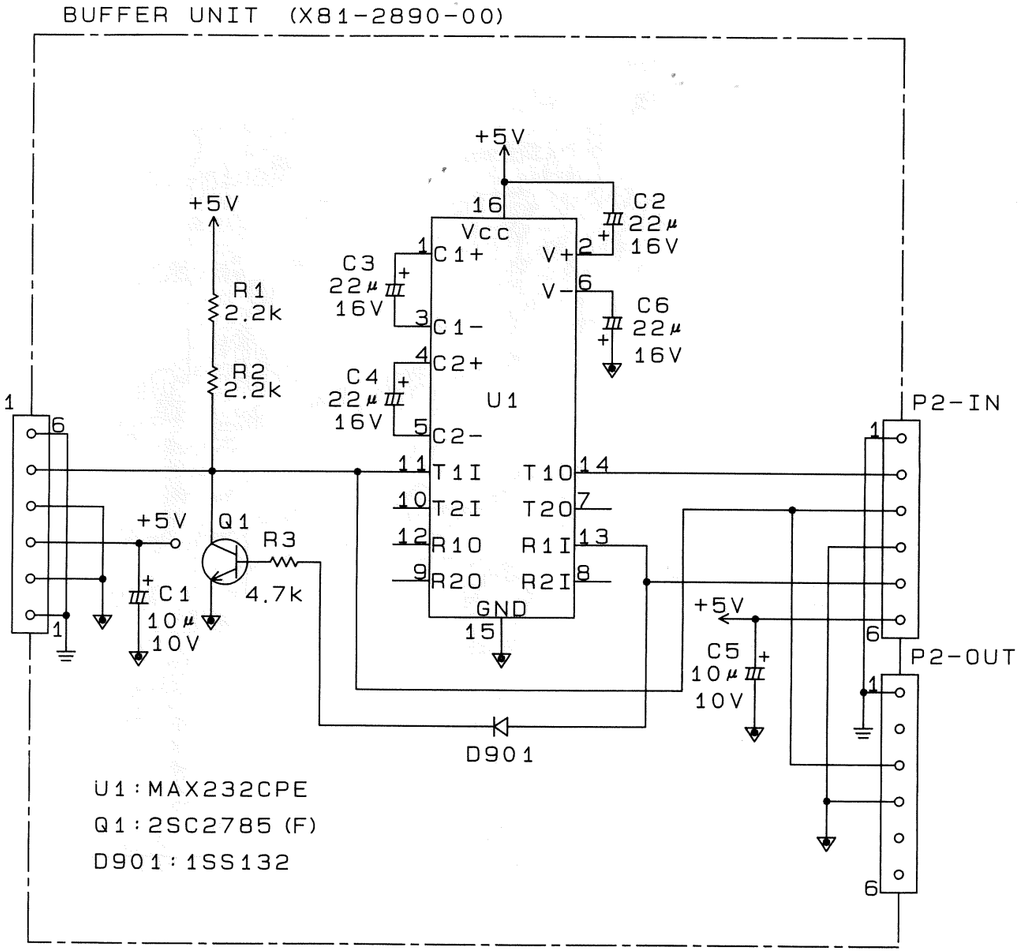
2 V/diV, 5ms/diV

Input AC100 V
Output current
5 A

SCHEMATIC DIAGRAM



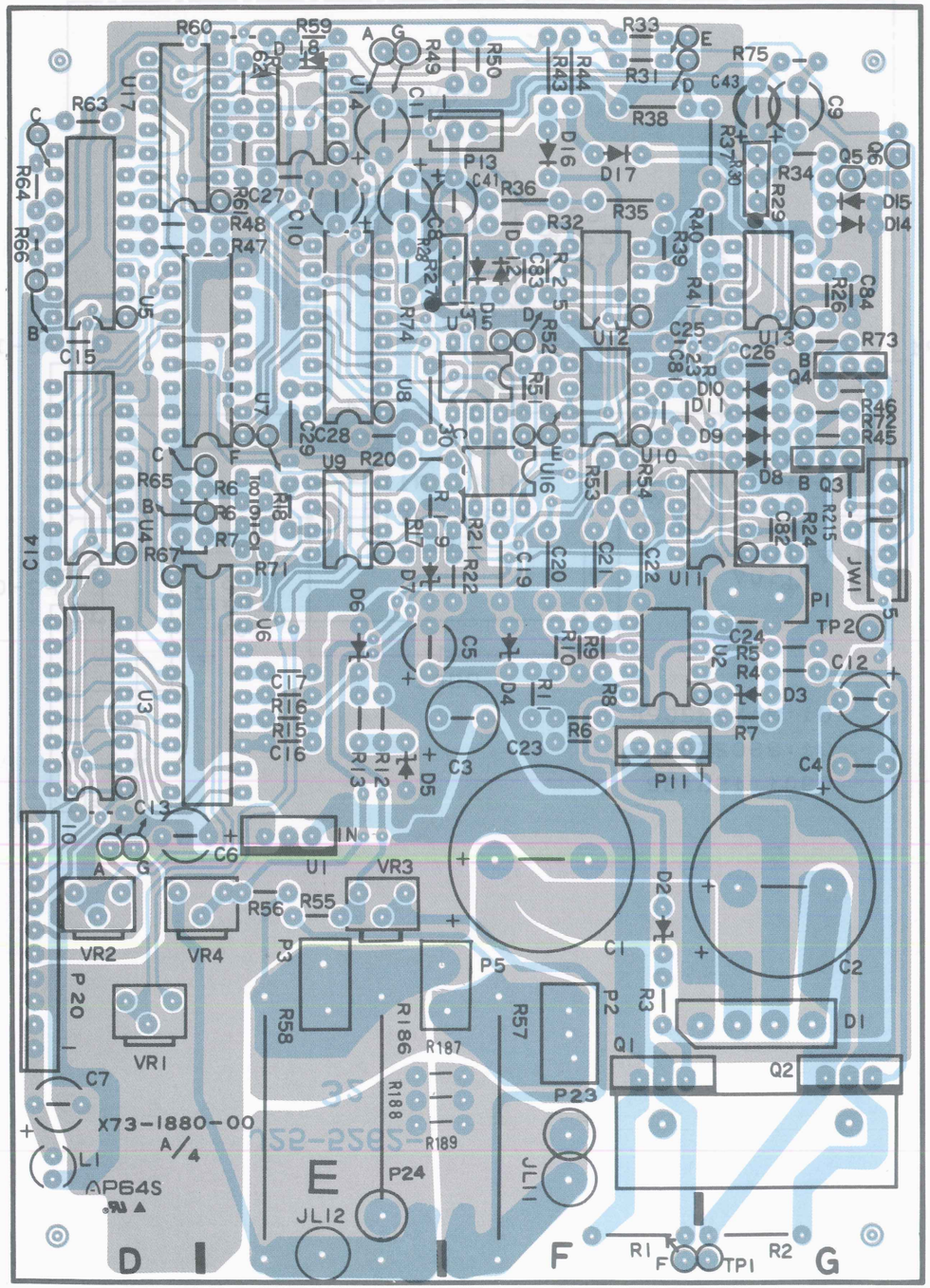




P.C. BOARD

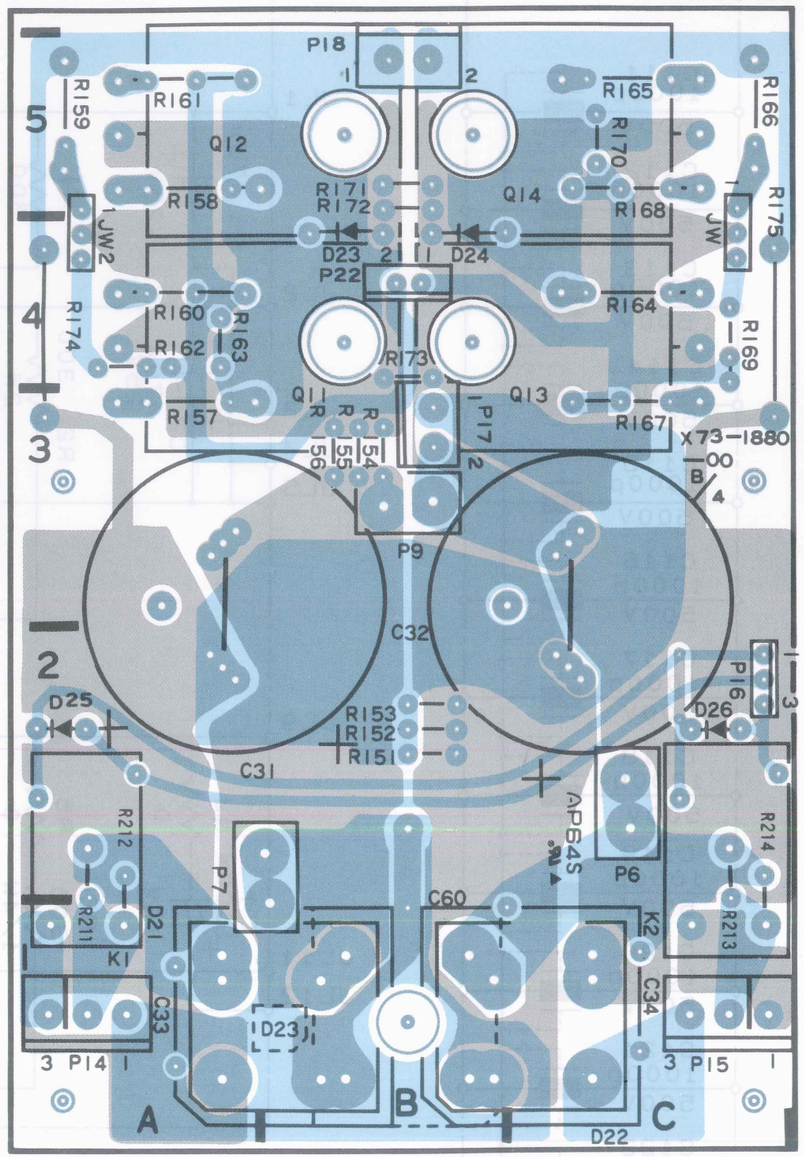
AMP UNIT (A/4)

Parts side view



AMP UNIT (B/4)

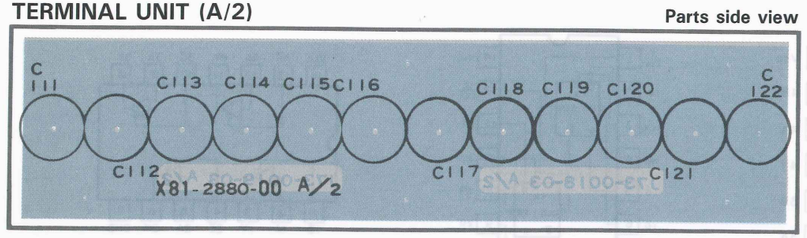
Parts side view



P.C. BOARD

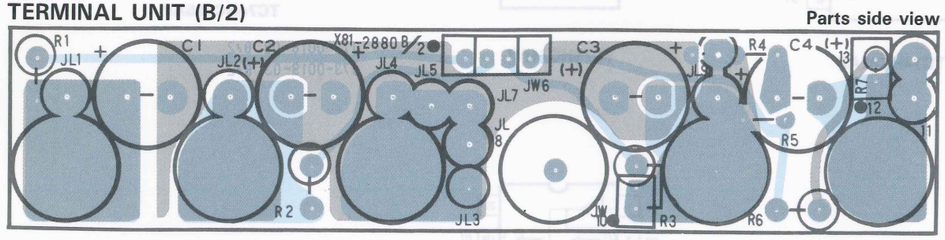
TERMINAL UNIT (A/2)

Parts side view



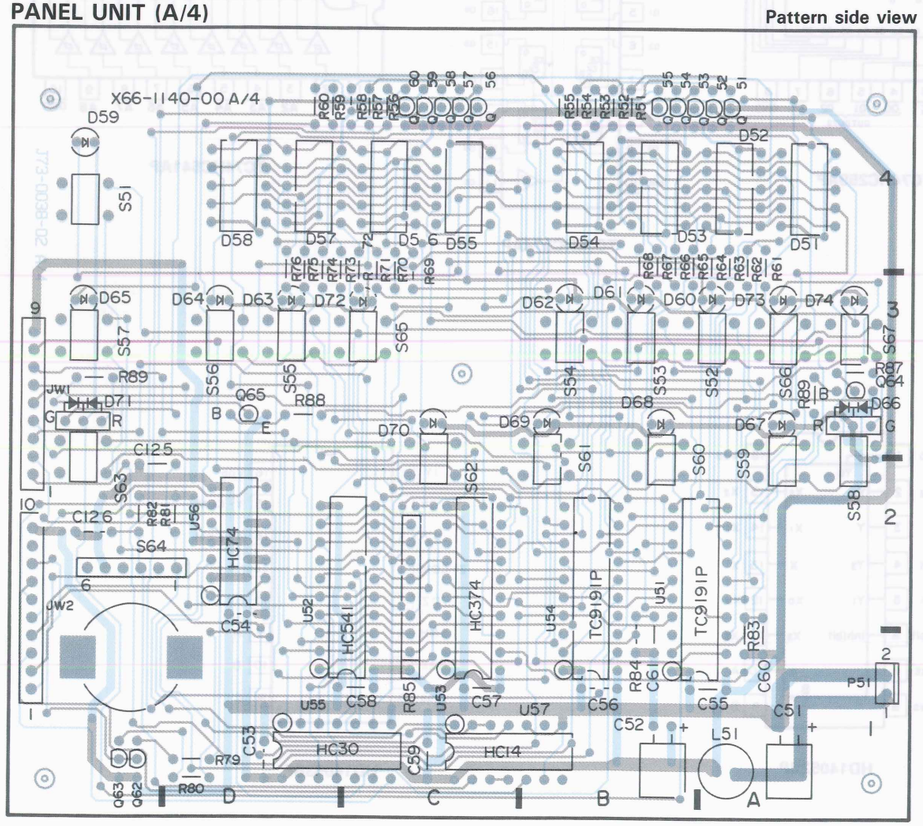
TERMINAL UNIT (B/2)

Parts side view



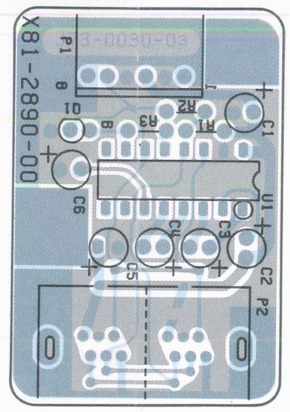
PANEL UNIT (A/4)

Pattern side view



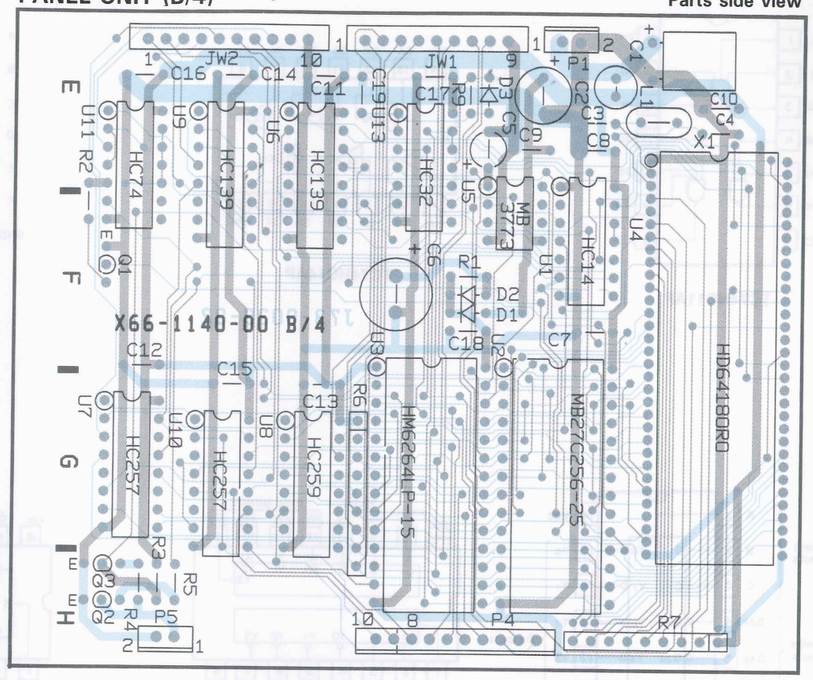
BUFFER UNIT

Pattern side view



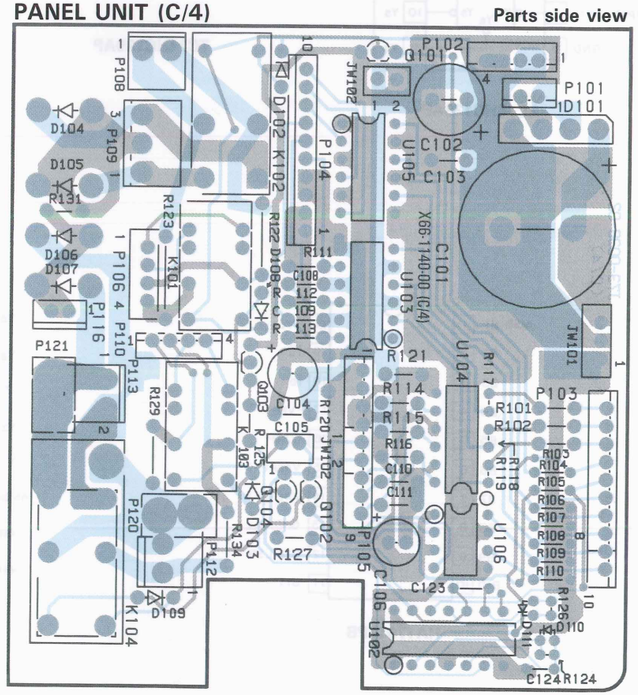
PANEL UNIT (B/4)

Parts side view

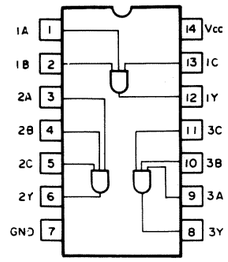


PANEL UNIT (C/4)

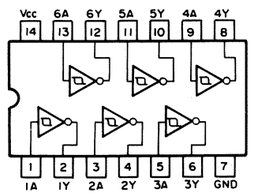
Parts side view



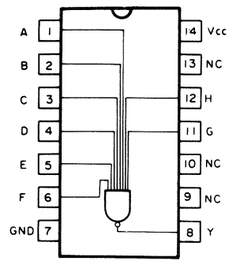
SEMICONDUCTORS



TC74HC11AP



TC74HC14AP



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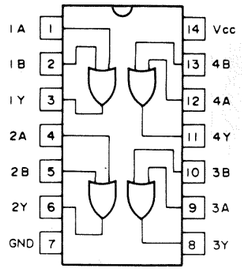

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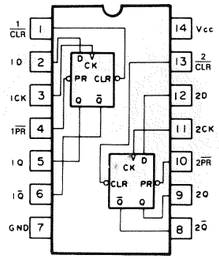

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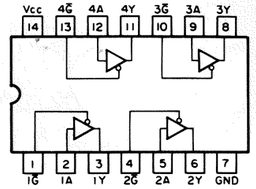

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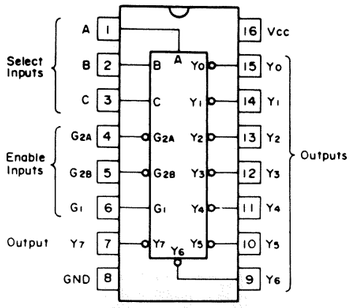

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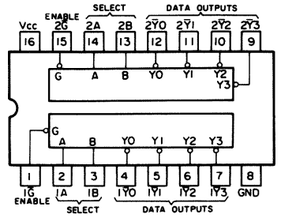

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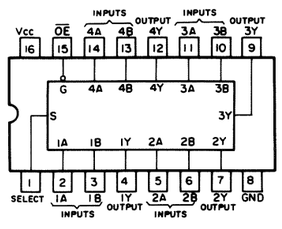

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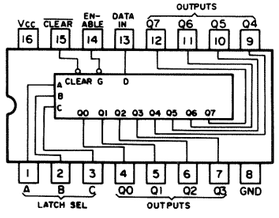

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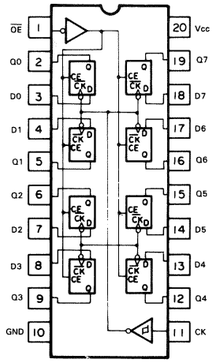

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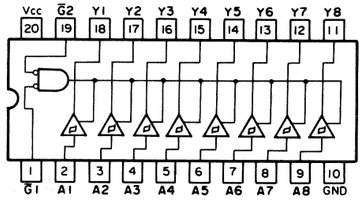

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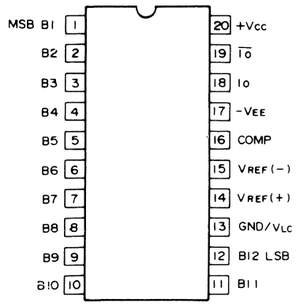

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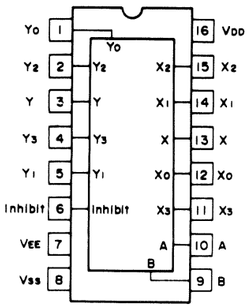

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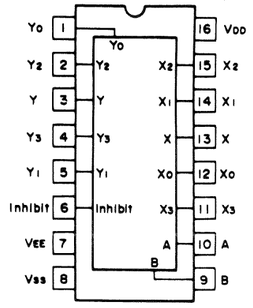

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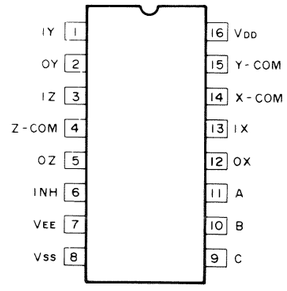

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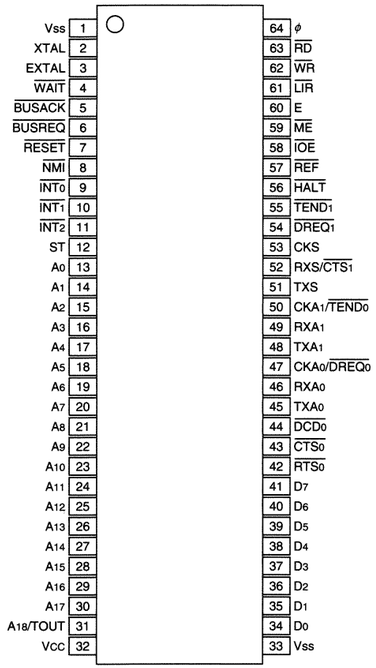
SEMICONDUCTORS



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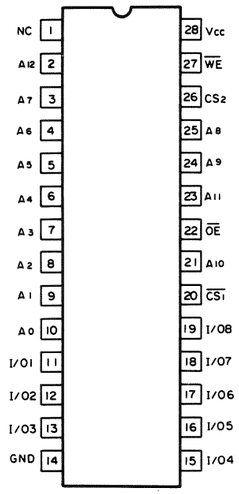

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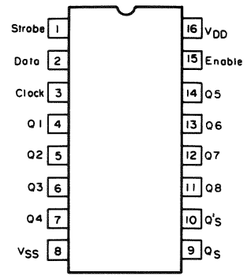

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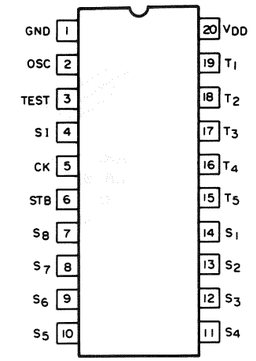

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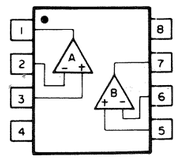
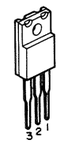


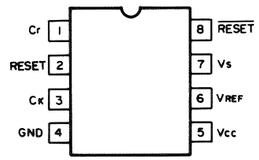
Pin name
1. A OUTPUT
2. A (–) INPUT
3. A (+) INPUT
4. V⁻
5. B (+) INPUT
6. B (–) INPUT
7. B OUTPUT
8. V⁺

NJM072BD
NJM2068D
NJM4558D
NJM4560D



1. OUT
2. GND
3. IN

NJM7805FA
NJM7812FA



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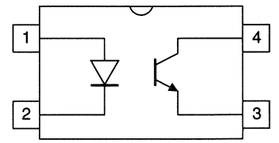

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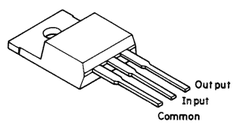

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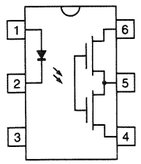

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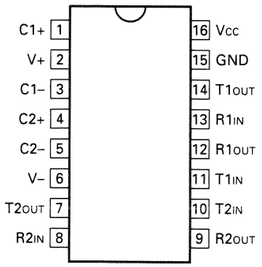

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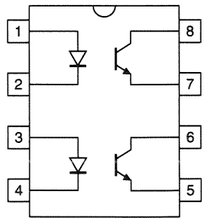

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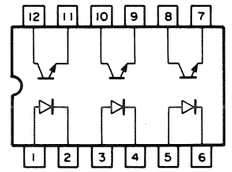

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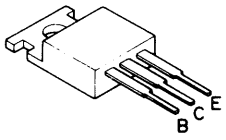
SEMICONDUCTORS



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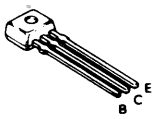

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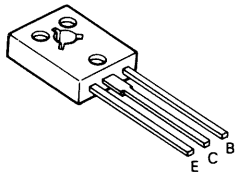

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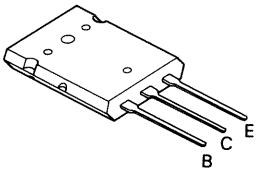
2SA1209(R, S)
2SC2911(R)
2SC2911(R, S)



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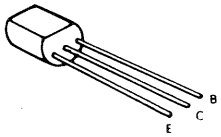
2SC3281



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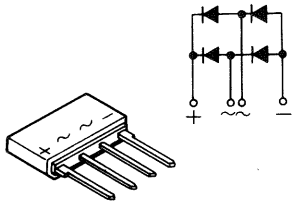

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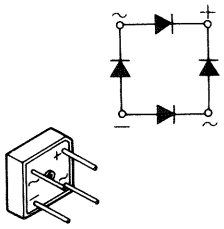

S4VB20
S4VB20F1
S10VB20
S10VB20F1

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