HITACHI

MODEL V-680
OSCILLOSCOPE

SERVICE MANUAL

Hitachi Denshi,Ltd.

o TRIGGER

Trigger modes

A: Automatic, Normal, Single sweep, TV-V, TV-H

B: Automatic, Normal

Trigger source

A: CH1, CH2, CH3, LINE, ALT(CH1, CH2)

B: Same as A

Trigger sensitivity

*2

	DC to 10MHz	10 to 60MHz
CH1 and CH2	0.4 div	1.5 div
CH3	0.5 div	1.5 div

Trigger coupling

INT : DC

CH3 : AC, DC

Trigger slope

A/B : + or -

Trigger variable holdoff

Adjustable control permits a stable triggering of repetitive complex waveform

o READOUT FUNCTION

Panel setting displays

Vertical axis: V/DIV (CH1, CH2 only), INVERT (CH2 only), ADD, UNCAL, MAG (converted value), probe ATT. (converted value)

Horizontal axis: s/DIV (A/B), UNCAL, MAG (converted value)

Others: Delay time

Cursor readout functions

ΔV : Δ-REF

ΔT : Δ-REF

1/ΔT : 1/|Δ-REF|

o CALIBRATOR

0.5 V ±1%, 1 kHz ±20% square wave

o OUTPUT SIGNALS

CH1 output

25 mV/DIV ±20 % terminated into 50 Ω

DC to 20 MHz (-3 dB)

o	POWER SUPPLY	
	Voltage	100/120/220/240 V ±10% 50 to 400 Hz
	Power consumption	Approx. 50 W
o	DIMENSIONS	310(W) x 130(H) x 370(D) mm
o	WEIGHT	Approx. 8 kg
o	ENVIRONMENT	
	Temperature	
	Specification	+10 °C to +35 °C
	Operating	0 °C to +50 °C
	Storage	-20 °C to +70 °C
	Humidity	
	Operating	45 % to 85 %
	Storage	35 % to 85 %

NOTES:

*1: In the CAL state

*2: o Other than the ALT and CHOP mode, and readout operation

o CH1 and CH2 are x1 mode setting. In x5 mode, their amplitudes need to be multiplied by 5.

2. ACCESSORIES

The V-680 Oscilloscope is shipped with the following standard accessories:

2 Probes (AT-10AL1.5)

1 AC Power Cord

1 Operation Manual

1 Fuse (2 A for 120 V AC Power Source, or 1 A for 220 V AC and 240 V AC Power Source)

1 Dust Proof Cover

3. PREVENTIVE MAINTENANCE

Preventive maintenance, when performed on a regular basis, can prevent instrument breakdown and may improve the reliability of the oscilloscope. The severity of environment to which this instrument is subjected will determine the frequency of maintenance. A convenient time to perform preventive maintenance is preceding recalibration of the instrument.

Disassembly

Remove the top cover and the bottom cover of the instrument.

Most of the internal parts of the instrument are now accessible.

If access to the front of the circuit boards are necessary, remove the knobs from the external control shafts on the board.

Cleaning

The instrument should be cleaned as often as operating conditions require. Accumulation of dirt in the instrument can cause component breakdown.

The covers provide protection against dust in the interior of the instrument. Loose dust accumulated on these covers can be removed with a soft cloth or small brush.

Dirt that remains can be removed with a soft cloth dampened in a mild detergent and water solution. Abrasive cleaners should not be used. Cleaning the interior should only be occasionally necessary. The best way to clean the interior is to blow off the dust with a dray, low-velocity stream of air. A soft-bristle brush or a cotton-tipped applicator is useful for cleaning in narrow spaces or for cleaning more delicate components.

Visual Inspection

The instrument should be inspected occasionally for such defects as broken connections, improperly seated transistors, damaged circuit boards, and heat-damaged parts. The corrective procedure for most visible defects is apparent; however, particular care must be taken if heat-damaged components are found. Overheating usually indicates other trouble in the instrument; therefore, correcting the cause of the overheating is important to prevent recurrance of the damage.

4. CALIBRATION

Hitachi Denshi, Ltd. provides complete instrument repair and recalibration at our oversea's office, and authorized dealer. Contact your local Hitachi Denshi, Ltd, office or representative.

4.1 Calibration interval

To maintain instrument accuracy, perform the calibration of the V-680 at least every 1000 hours of operations or every six month if used infrequently.

4.2 Test equipment required

The following test equipment and accessories, or equivalent, are required for the complete calibration of the V-680. The given specifications for the equipment are the minimum necessary for accurate calibration. Therefore, the specifications of any test equipment used must meet or exceed the listed specifications.
All the test equipment is assumed to be correctly calibrated and operating within the listed specification. Operating instructions for the test equipment are not given in this procedure. Refer to the instruction manual for the test equipment if more information is needed.

4.3 Preliminary procedure

This instrument should be calibrated at an ambient temperature of +20°C (±5°C) for the best overall accuracy.

1. Connect the instrument to AC line voltage, 50 Hz to 400 Hz line source.
2. Set the instrument controls as given in the Preliminary Control Settings. Allow at least fifteen minutes of warmup before proceeding.
3. See the Adjustment Locations in the pullout pages.

Table 4-1

TEST EQUIPMENT REQUIRED

Description	Minimum Specification	Usage	Examples of Applicable Test Equipment
1. Constant Amplitude Signal Generator	50 kHz reference frequency; maximum frequency 150 MHz; variable amplitude	Check of horizontal, vertical and trigger bandwidth.	
2. Standard Amplitude Calibrator	Amplitude accuracy: 0.25 %, variable amplitude; 5 mV to 40 V; frequency: 1 kHz square wave	Check of horizontal and vertical gain.	
3. Square-wave Generator	Variable frequency: 10 Hz to 1 MHz; output amplitude; 10 mV to 100V	Check of probe and vertical compensation.	
4. Digital Multimeter	0.1 % accuracy	Check of power supply.	
5. Digital Frequency Counter	0.1 % accuracy	Check of CAL frequency.	
6. Time Mark Generator	0.1 % accuracy	Check of sweep rate	
7. Cable	Impedance, 50 Ω; type, RG-58/U; length, 42 inches, connectors, BNC.	Most check and adjustment with connecting signal.	Hitachi Part No.4202
8. Termination	Impedance, 50 Ω; connectors, BNC.	Check of vertical amplifier compensation	
9. Attenuator	Ratio, 10X; connectors, BNC; impedance, 50 Ω	Check of vertical amplifier bandwidth.	
10. T-Connector	Connectors, BNC.	Check of X-Y operation	Hitachi Part No.1301

4.4 Preliminary control settings

Preset the instrument controls to the setting given below, when starting the calibration procedures.

Controls	Setting
FOCUS	Midrange
SCALE ILLUM	CCW
TRACE ROTATION	As disired
INTENSITY	Midrange
READ OUT	CW
POSITION CH1 CH2	 Midrange Midrange, push in
V.VARIABLE	CW (CAL)
AC-GND-DC	GND
VOLTS/DIV (CH1 CH2)	5mV/DIV

Controls	Setting	
SWP VAR	CW (CAL)	
VERT MODE	CH1	
H.POSITION	Midrange, Push in	
A TIME/DIV	1 ms/DIV	
VAR HOLDOFF	CCW	
Horizontal display mode	A	
TRIGGER LEVEL	A	Midrange, push in
	B	CCW (AUTO)
TRIGGER MODE	AUTO	
TRIGGER SOURCE	CH1	

NOTE

CCW : Counterclockwise
CW : Clockwise

4.5 Initial starting procedure

1. Turn instrument POWER on.
2. Wait a few seconds for the cathode ray tube (CRT) to warm up. A trace should appear on the display of the CRT.
3. If trace disappears, increase (clockwise) the INTENSITY control setting until the trace is easily observed.
4. Adjust FOCUS control for the best focused display.
5. Readjust POSITION controls if necessary, to center the trace.

POWER SUPPLY SYSTEM

NOTE

Before beginning, see the ADJUSTMENT LOCATIONS in the pullout pages.

Control Settings

Preset the controls as given in the Preliminary Control Setting.

(1) Check Low-voltage Supply, if necessary.

a. Connect the digital voltmeter (DVM) from the +8 V line.
: +7.984 V to +8.016 V (PEF-729 [+8V])

b. Connect the DVM from the -8 V line.
: -7.984 V to -8.016 V (PEF-729 [-8V])

c. Connect the DVM from the +5 V(a) line.
: +4.80 V to +5.20 V (PEF-729 [+5V])

d. Connect the DVM from the +5 V(d) line.
: +4.75 V to +5.25 V (PEF-770 IC2002-3)

e. Connect the DVM from the +75 V line.
: +70 V to +80 V (PEF-729 [+75V])

f. Connect the DVM from the +125 V line.
: +130.5 V to +147.5 V (PEF-729 [+125V])

g. Connect the DVM from the +7.5 V line.
: +6.5V to +8.5 V (PEF-729 [+7.5V])

h. Connect the DVM from the -15 V line.
: -18 V to -12 V (PEF-729 [-15V])

② Adjust Low-voltage Supply.

Adjust the adjustment RV1601 for DVM reading of +8 V (±0.016 V).

③ Check High Voltage Supply.

a. Connect the DVM to the H.V. test point (PEF-712 [H.V CHECK]) by High Voltage Probe.

b. Check for a reading of -1732 V to -1568 V

④ Check/Adjust CRT Bias.

a. Set the horizontal display mode switch to the X-Y position, and AC-GND-DC switch to GND.

b. Rotate the INTENSITY control, and set the voltage of TR1511-Collector (PEF-712) to 20 V.

c. Observe the trace of CRT.

d. Adjust Grid Bias Adjustment RV1566 (PEF-712 [CRT BIAS]) for that the trace makes an appear.

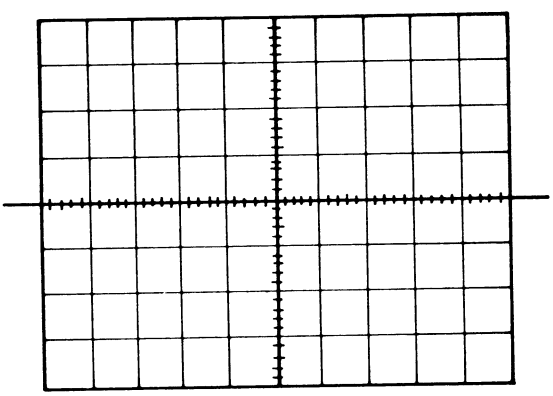
⑤ Check/Adjust Trace Rotation

a. Set the A TIME/DIV switch to 1 ms/DIV, and the horizontal display mode switch to A.

b. Set a trace to the center of screen, using a position control.

c. Check that the trace is aligned with the center horizontal line.

d. Adjust TRACE ROTATION control on the front panel for a trace that is aligned with the horizontal graticule lines.



⑥ Check/Adjust ASTIGmatism

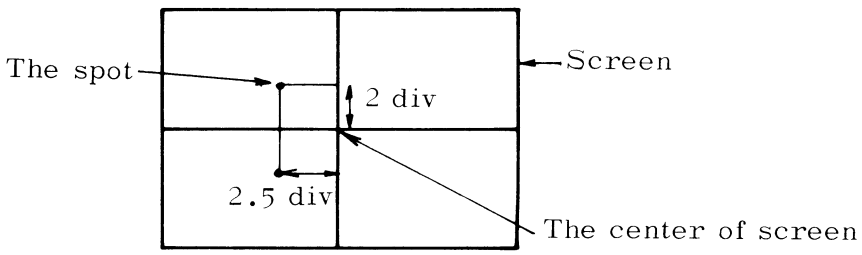
a. Set:

Horizontal display mode ---------- X-Y

AC-GND-DC ---------- GND

READOUT ---------- OFF

b. Set the spot, as the following figure, using CH1 and CH2 position controls.



c. Rotate the INTENSITY control just before the spot has a halation.

d. Rotate FOCUS control fully clockwise.

e. Check that the spot is round.

f. Adjust the ASTIG adjustment RV1281 (PEF-712 [ASTIG]) for a round spot.

g. Rotate FOCUS control to obtain a smallest spot.

HORIZONTAL SYSTEM

Control Settings

Preset the controls as given in the Preliminary Control settings.

⑦ Check/Adjust Sweep Reference.

a. Press the READOUT control to display characters.

b. Set:

VERT MODE ---------- CH1
CH1 AC-GND-DC ---------- DC
Horizontal display mode ---------- ALT
A TIME/DIV ---------- 1 ms/DIV
B TIME/DIV ---------- 50 ns/DIV
B MODE ---------- AUTO

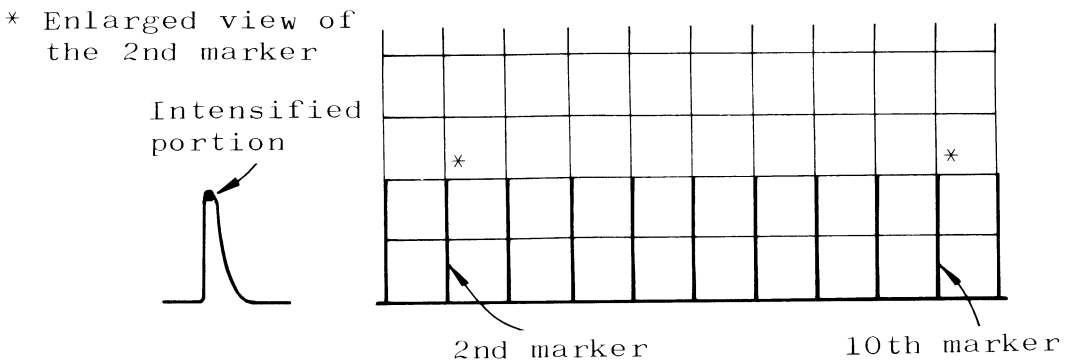
c. Press the two cursor switching buttons and the SINGLE RESET button simultaneously.

d. Connect the time mark generator to CH1 and set the time mark generator for 1 ms time marks.

e. Rotate the TRACE SEP control to position the B sweep trace for easy observation.

f. Rotate the DLY/CURSOR control so that the delay time readout is "1.000ms."

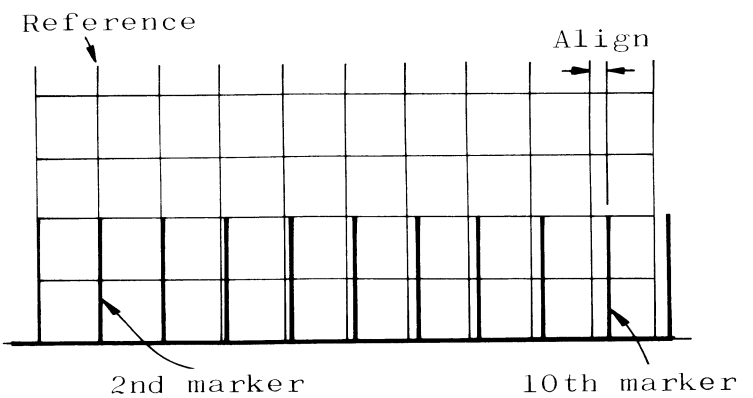
g. Adjust RV1030 [DLY 1 DIV] on the PEF-712 board to bring the intensified portion to the top of the 2nd marker.



h. Rotate the DLY/CURSOR control so that the delay time is readout is "9.000ms.'

i. Adjust RV1312 [DLY 9 DIV] on the PEF-712 board to bring the intensified portion to the top of the 10th marker.

j. Adjust RV1420 [H GAIN] on the PEF-712 board so that the 10th marker is aligned with the 2nd vertical scale line from the right; A sweep is calibrated.



⑧ Check/Adjust Horizontal x10 MAG Gain.

a. Set the horizontal display mode switch to A and the A TIME/DIV switch to 1 ms/DIV.

b. Connect a 1 ms time marker generator.

c. Pull the inner knob of the horizontal POSITION control.

d. Check the one-cycle time marks to align with the ten-divisions graticule lines.

e. Adjust the MAG GAIN adjustment RV1424 (PEF-712 [MAG GAIN]) for one-cycle time marks to align with the ten-divisions graticule lines.

f. Push in the inner of the POSITION control after the check and adjustment.

⑨ Check/Adjust MAG CENTer

a. Set the A TIME/DIV switch to the 1 ms/DIV.

b. Connect a 1 ms time marker generator.

c. Pull the inner shaft of the horizontal POSITION and align the second time marker with the center vertical graticule line.

d. Push the inner shaft.

e. Check the discrepancy of the second time marker from the center vertical graticule line, within $\pm$1 division.

f. Adjust the MAG CENT adjustment RV1422 (PEF-712 [MAG CENT]).

⑩ Check/Adjust TIME/DIV

a. Set:

VERT MODE	.....	CH1
CH1 VOLTS/DIV	.....	As required for well observation
CH1 AC-GND-DC	.....	DC

b. Connect the time marker generator to CH1.

c. Set the TIME/DIV switch and the time marker generator as the following.

d. Check and adjust that the time marks align with the ten divisions graticule lines.

Item No.	Display mode	A TIME/DIV	B TIME/DIV	Time Marker	Adjustment (PEF-712)
(1)	A	0.1 μs/DIV	———	0.1 μs	CV884 0.1μs
(2)	A	10 μs/DIV	———	10 μs	RV1314 10μs
(3)	A	10 ms/DIV	———	10 ms	RV1313 10ms
(4)	A	5 ns/DIV (50ns/DIV, pull x10 MAG)	———	5 ns	CV1450 5ns
(5)	B	0.2 μs/DIV	0.1 μs/DIV	0.1 μs	CV984 0.1μs
(6)	B	20 μs/DIV	10 μs/DIV	10 μs	RV1387 10μs
(7)	B	2 ms/DIV	1 ms/DIV	1 ms	RV1385 1ms
(8)	B	20 ms/DIV	10 ms/DIV	10 ms	RV1386 10ms

VERTICAL SYSTEM

Control Setting

Preset the controls as given in the Preliminary Control Settings.

(11) Check/Adjust DC BAL

a. Set the vertical MODE switch to CH1.

b. Set the CH1 VOLTS/DIV switch to 5 mV/DIV and the CH1 AC-GND-DC Switch to GND.

c. Position the trace to the center horizontal graticule line.

d. Change the CH1 VOLTS/DIV switch to the 10 mV/DIV.

e. Check that the discrepancy of the trace is within ±1 division of the center horizontal graticule line.

f. Adjust the CH1 DC BAL adjustment RV37 (PEF-710 CH1 DC BAL) through a hole on the front panel for the discrepancy within ±0.05 division of the center horizontal graticule line.

g. Change the vertical MODE switch to CH2.

h. Repeat part b. through f. for CH2.

i. Adjust the CH2 DC BAL adjustment RV137 (PEF-710 [CH2 DC BAL]) through a hole on the front panel for the trace within ±0.05 division of the center horizontal graticule line.

⑫ Check/Adjust POSition CENTer

a. Set the vertical MODE switch to CH1.

b. Set the POSITION control at the midrange.

c. Adjust the CH1 POSition CENTer adjustment RV62 (PEF-710 [CH1 POS CENT]) for the trace align with the horizontal center line.

d. Change the vertical MODE switch to CH2.

e. Repeat part b. through c. for CH2.

f. Adjust the CH2 POSition CENTer adjustment RV162 (PEF-710 [CH2 POS CENT]) for the trace at the horizontal center line.

g. Set the vertical MODE switch to ALT or CHOP. Then pull the PULL TRIPLE & CH3 POS control.

h. Repeat part b. through c. for CH3.

i. Adjust the CH3 position center adjustment RV305 (PEF-710 [CH3 POS CENT]) for a trace at the horizontal center line.

⑬ Check/Adjust ADD Balance

a. Set the vertical MODE switch to ALT.

b. Position both CH1 and CH2 traces to coincide at the center horizontal graticule line.

c. Change the vertical MODE switch to ADD.

d. Check that the trace added CH1 and CH2 is within ±0.4 division from the center horizontal graticule line.

e. Adjust RV507 (PEF-711) for the trace within ±0.1 division from the center horizontal graticule line.

⑭ Check/Adjust X1 AC GAIN

a. Set:

Vertical MODE	CH1
CH1, CH2 VOLTS/DIV	10 mV/DIV
A TIME/DIV	1 ms/DIV
CH1, CH2 AC-GND-DC	DC
TRIG SOURCE	CH1

b. Connect the square-wave generator (using 1 kHz output range) to CH1.

c. Adjust the output amplitude of that generator for 5 divisions deflection of screen.

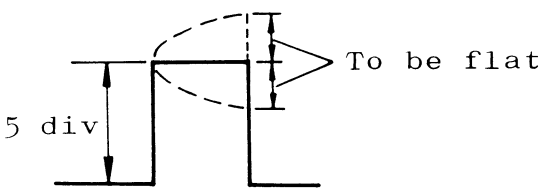
d. Check the high-voltage level of pulse is flat.

e. Adjust the CH1 x1 AC GAIN RV48 (PEF-710 [CH1 AC GAIN]) for a flat level.

f. Move the signal to CH2 and change the vertical MODE switch to CH2. Then set the TRIG SOURCE switch to CH2.

g. Repeat part b. through d. for CH2.

h. Adjust the CH2 x1 AC GAIN adjustment RV148 (PEF-710 [CH2 AC GAIN]) for a flat level.



⑮ Check/Adjust VERTICAL GAIN

a. Set the vertical MODE switch to the CH1 position and the TRIG SOURCE switch to CH1.

b. Connect the standard amplitude calibrator to the CH1 input connector.

c. Set the CH1 VOLTS/DIV switch to the 10 mV and the CH1 AC-GND-DC switch to DC.

d. Set the standard amplitude calibrator for a 50 mVp-p signal.

e. Check for a 5 divisions display.

f. Adjust the CH1 GAIN adjustment RV510 (PEF-711) for a display for 5 divisions.

g. Change both switches of the vertical MODE and the TRIG SOURCE to CH2 respectively, and move the signal to CH2.

h. Repeat part b. through e. for CH2.

i. Adjust the CH2 GAIN adjustment RV133 (PEF-710 [CH2 GAIN])

⑯ Check/Adjust CH1, CH2 Step Response.

a. Set: Vertical MODE CH1
CH1, CH2 VOLTS/DIV ..... 5 mV/DIV
CH1, CH2 AC-GND-DC ..... DC
A TIME/DIV ..... 0.1 μs or 0.2 μs
TRIG SOURCE CH1

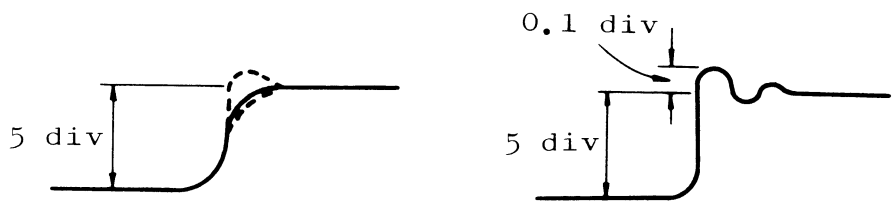
b. Connect the fast-rise (less than 1 ns), positive output of the square-wave generator to the CH1 input. Use a 50-ohm termination and cable.

c. Set the square-wave generator to 1 MHz. Adjust the square-wave generator output for a 5-divisions display.

d. And adjust CV509, CV521, CV534 (PEF-711) CV160 (PEF-710) for a square wave that is flat and for over-shoot that is +0.1 div.

e. Move the signal to CH2 and set the vertical MODE to CH2. Then change the TRIG SOURCE switch to CH2.

f. Adjust CV160 (PEF-710) for over-shoot that is +0.1 div.



⑰ Check/Adjust CH1, CH2 Attenuation Compensation.
(ATT: ÷ 10, ÷ 100)

a. Set the MODE select switch, AC-GND-DC switch, TRIG SOURCE switch, VOLTS/DIV switch and COUPLING switch according to the following table.

b. Connect the square wave (1 kHz) generator to the square wave input connector according to the following table to check that a square wave is flat (flat top).

c. Adjust the trimmer capacitors for a square (flat top) under the following settings.

ATT	CH	Setting						Square wave generator output	Adjust
		MODE select	AC-GND-DC	TRIG SOURCE	COUPLING	Square wave input connector	VOLTS/DIV		
÷10	CH1	CH1	DC	CH1		CH1	0.1V	0.4V	CV5 (PEF-710)
	CH2	CH2	DC	CH2		CH2	0.1V	0.4V	CV105 (PEF-710)
	CH3	ALT or CHOP		EXT	DC ÷10	CH3	0.1V	0.4V	CV803 (PEF-712)
÷100	CH1	CH1	DC	CH1		CH1	1V	4V	CV15 (PEF-710)
	CH2	CH2	DC	CH2		CH2	1V	4V	CV115 (PEF-710)

⑱ Check/Adjust CH1, CH2 Input Capacity. (ATT: ÷ 10, ÷ 100).

a. Connect the L-C meter to the input terminal.

b. Check the input capacity for a approximately 23 pF.

c. Adjust the trimmer capacitors so that the input capacity of CH1 and CH2 in ÷ 10 mode is same as that in ÷ 1 mode under the following settings.

As for ÷100 mode, perform the same adjustment.

ATT	VOLTS/DIV	Adjust (PEF-710) CH1	CH2
÷ 1	5 mV		
÷ 10	0.1 V	CV4	CV104
÷100	1 V	CV14	CV114

TRIGGER

⑲ Check/Adjust TRIGer CENTer

Adjust the CH3 TRIG LEVEL CENT control before adjusting each TRIG LEVEL CENT control of CH1 and CH2.

(1) CH3 TRIG LEVEL CENT

a. Set:

PULL TRIPLE & CH3 POS ..... PULL

TRIG SOURCE ..... EXT

COUPLING (trigger coupling) ..... AC

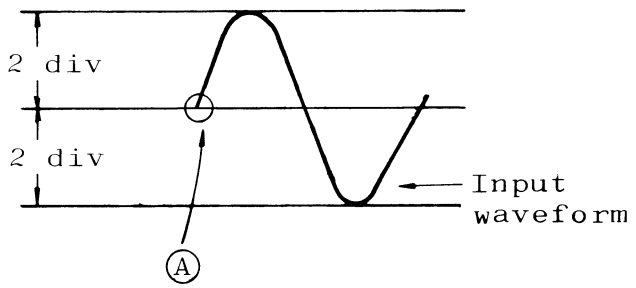
A TRIG SLOPE ..... +

Vertical MODE ..... ALT or CHOP

TIME/DIV ..... 5 μs/DIV

b. Connect a sine-wave generator to the CH1 input for 4 div (50 kHz)

c. Adjust the A TRIG LEVEL control so that the trigger is effected in the center of the waveform amplitude (point Ⓐ).



d. Set the COUPLING select switch from AC to DC, and the trigger start point may move.
Adjust RV293 (PEF-710 CH3 TRIG DC LEVEL) so that the trigger is effected in the center of the waveform amplitude (point Ⓐ) with holding the preset value by the A TRIG LEVEL control.

(2) CH2 TRIG LEVEL CENT

e. After setting switches as shown below, supply sine wave of 50 kHz to CH2 to obtain the 4 div display.

TRIG SOURCE : CH2

MODE select : CH2

AC-GND-DC : AC

f. Adjust RV217 (PEF-710, CH2 TRIG DC LEVEL) for trigger effected on the point Ⓐ of the waveform with holding the preset value by the A TRIG LEVEL control.

(3) CH1 TRIG LEVEL CENT

g. After setting switches as shown below, supply sine wave of 50 kHz to CH1 to obtain the div display.

TRIG SOURCE : CH1

MODE select : CH1

AC-GND-DC : AC

h. Adjust RV207 (PEF-710 CH1 TRIG DC LEVEL) for trigger effected on the point A of the waveform with holding the preset value by the A TRIG LEVEL control.

X - Y OPERATION

(20) Check/Adjust X GAIN

a. Set:

CH1 VOLTS/DIV ..... 10 mV/DIV

CH1 AC-GND-DC ..... AC

Horizontal display mode ..... X-Y

b. Connect the standard amplitude calibrator to CH1.

c. Set the standard amplitude calibrator for 50 mV.

d. Check for a display of 5 divisions within ±3 %.

e. Adjust RV1062 for a display of 5 division within ±1.5 %.

(21) Check/Adjust X CENTer

a. Set:

CH1 AC-GND-DC ..... GND

Horizontal display mode ..... X-Y

Horizontal POSITION ..... Midrange

b. Check for a spot at the center vertical graticule line within ±1.0 division.

c. Adjust RV1063 for a spot at the center vertical graticule line within ±0.1 division.

SIGNAL OUTPUT

(22) Check/Adjust CALibrator

a. Jumper between 1 pin and 2 pin of P654.

b. Connect a digital voltage meter to the CAL terminal.

c. Check for CAL output voltage 0.495 V to 0.505 V.

d. Adjust RV655 for CAL output voltage 0.497 V to 0.503 V.

(23) Check/Adjust

a. Set the CH1 AC-GND-DC switch to GND and the VERT MODE switch to CH1.

b. Connect a digital voltage meter to the CH1 OUT terminal.

c. Check for the voltage 0 V within ±0.1 V.

d. Adjust RV603 for the voltage 0 V within ±0.1 V.

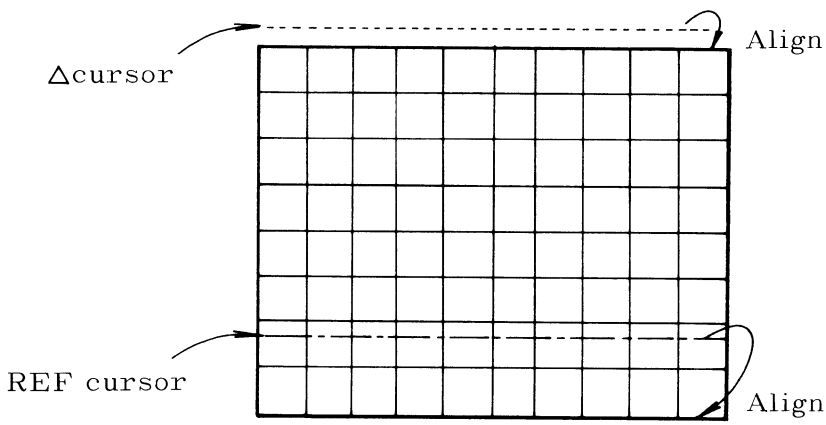
READOUT & CURSOR

(24) Check/Adjust CHR-Y gain and CHR-Y CENTer

a. Set READOUT INTENSITY control as required for well defind the character.

b. Press the two cursor switching buttons and the SINGLE RESET button simultaneously to display the two vertical cursors.

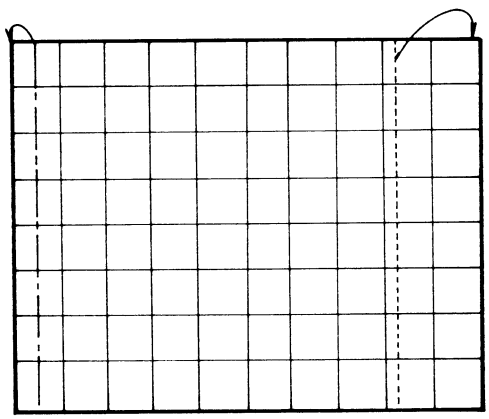
c. Adjust RV357 and RV356 so that the cursors align with the top and the bottom graticule lines.



㉕ Check/Adjust CHR-X gain and CHR-X center

a. Rotate the DLY/CURSOR counterclockwise with the vertical cursor set in Item ㉔ to display the horizontal cursors.

b. Adjust RV1434 and RV1435 so that the cursors align with the rightmost and the leftmost graticule lines.



NOTE: Press the SINGLE RESET button to release this mode.

Erro code / Item / bit / Input level	SW NG 0					SW NG 1					SW NG 2			SW NG 3					SW NG 4			SW NG 5	SW NG 6					SW NG 7		
	CH1 V/DIV					CH2 V/DIV					V. VAR, etc.			V. MODE, etc.					H. SWEEP, VAR, etc.			H. SWEEP and others	TRIG MODE, etc.					CH2 INV and others		
	2^0	2^1	2^2	2^3	V/DIV	2^0	2^1	2^2	2^3	V/DIV	CH1 CAL/VAR	CH2 CAL/VAR	CH1 X1/X5	CH1	CH2	DUAL	ADD	CH2 X1/X5	H. CAL VAR	H. X1/X10	B AUTO/NORM	PUSH(A/B)	A	ALT	B	X-Y	SINGLE	PUSH (DELAY FAST)	CH2 INV	
	0.5 V	1.0 V	2.0 V	4.0 V		0.5 V	1.0 V	2.0 V	4.0 V		0.5 V	1.0 V	2.0 V	0.5 V	1.0 V	1.5 V	2.0 V	2.0 V	0.5V	1.0V	2.0V	0.5V	0.5 V	1.0 V	1.5 V	2.0 V	2.0 V	0.5V	1.0V	
5.0V max	0	1	0	1	5mV	0	1	0	1	5mV	NG display			NG display					NG diaplay			NG diaplay	NG diaplay					NG diaplay		
4.5V	1	0	0	1	10mV	1	0	0	1	10mV																				
4.0V	0	0	0	1	20mV	0	0	0	1	20mV				ADD									X-Y							
3.5V	1	1	1	0	50mV	1	1	1	0	50mV	CH1 VAR	CH2 VAR	CH1 X5	DUAL (CHOP ALT)				CH2 X5	H. VAR	H. X1	B AURO		B				SINGLE			
3.0V	0	1	1	0	0.1V	0	1	1	0	0.1V	CH1 CAL			CH2					H. CAL				ALT							
2.5V	1	0	1	0	0.2V	1	0	1	0	0.2V	CH1 VAR	CH2 CAL		CH1					H. VAR	H. X10			A							
2.0V	0	0	1	0	0.5V	0	0	1	0	0.5V	CH1 CAL			ADD					H. CAL				X-Y							
1.5V	1	1	0	0	1V	1	1	0	0	1V	CH1 VAR	CH2 VAR	CH1 X1	DUAL (CHOP ALT)				CH2 X1	H. VAR	H. X1	B NORM		B				$\overline{\text{SINGLE}}$	PUSH	CH2 INV	
1.0V	0	1	0	0	2V	0	1	0	0	2V	CH1 CAL			CH2					H. CAL				ALT					$\overline{\text{PUSH}}$		
0.5V	1	0	0	0	5V	1	0	0	0	5V	CH1 VAR	CH2 CAL		CH1					H. VAR	H. X10		PUSH(A/B)	A					PUSH	$\overline{\text{CH2 INV}}$	
0.0V min.	The last set value display					The last set value display					CH1 CAL			The last set value display					H. CAL			$\overline{\text{PUSH}}$(A/B)	The last set value display					$\overline{\text{PUSH}}$		
Pin No. of IC2051 (μCOM, PEF-770)	㉞					㉟					㊱			㊲					㊳			㊴	㊵					㊶		

6. DETAILED CIRCUIT DESCRIPTION

6.1 ◇1◇ CH1, CH2 PREAMPLIFIER CIRCUIT (PEF-708, 709, 710)

Figure 6-1 is a detailed block diagram of the CH1, CH2 PREAMPLIFIER circuit. This circuit consists of the CH1 vertical circuit and the CH2 vertical circuit. Since the two circuits are nearly same, the CH1 vertical circuit only is described here. (Refer to Figure 6-1 in page 29)

The CH1 signal (SIG) from J1 is supplied to the CH1 INPUT COUPLING circuit, where S1 selects the coupling mode AC, GND, or DC.
Then the CH1 SIG is supplied to the CH1 1ST ATTENUATOR (ATT 1a), and the signal level is attenuated to 1/1, 1/10, or 1/100. The attenuation is required since the amplifier in the oscilloscope is designed for low input signal and its gain is constant.

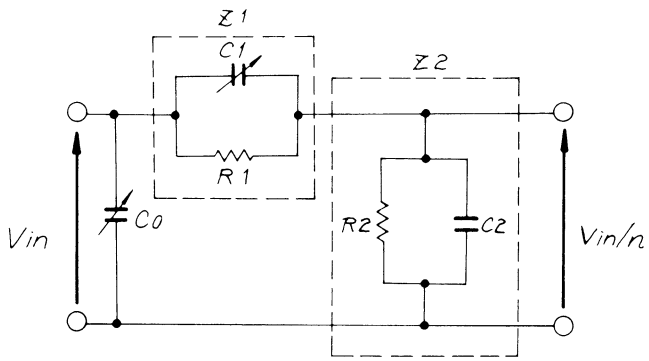


Fig.6-2

The basic circuit of the attenuator is shown in Figure 6-2.
Conditions in the case that the attenuation ratio is 1/n regardless of frequency are derived from equation $Z2/(Z1 + Z2) = 1/n$ as follows:

$$R1 = (n - 1) \cdot R2 \quad \ldots\ldots\ldots (1)$$
$$C1 \cdot R1 = C2 \cdot R2 \quad \ldots\ldots\ldots (2)$$

The input capacity of each attenuation ratio (range) at the time when the attenuation range is switched is made equal by adjusting C_0.
Adjusting C_1 makes an accurate frequency characteristic to be obtained at each attenuation range.
For the circuit in use for each attenuation range, refer to the schematic diagram ◇1◇.

The CH1 SIG from the CH1 1ST ATTENUATOR is supplied to the CH1 INPUT AMP and its impedance is converted (high input impedance and low output im-

pedance).

The CH1 INPUT AMP also switches the output voltage to 1x or 5x.

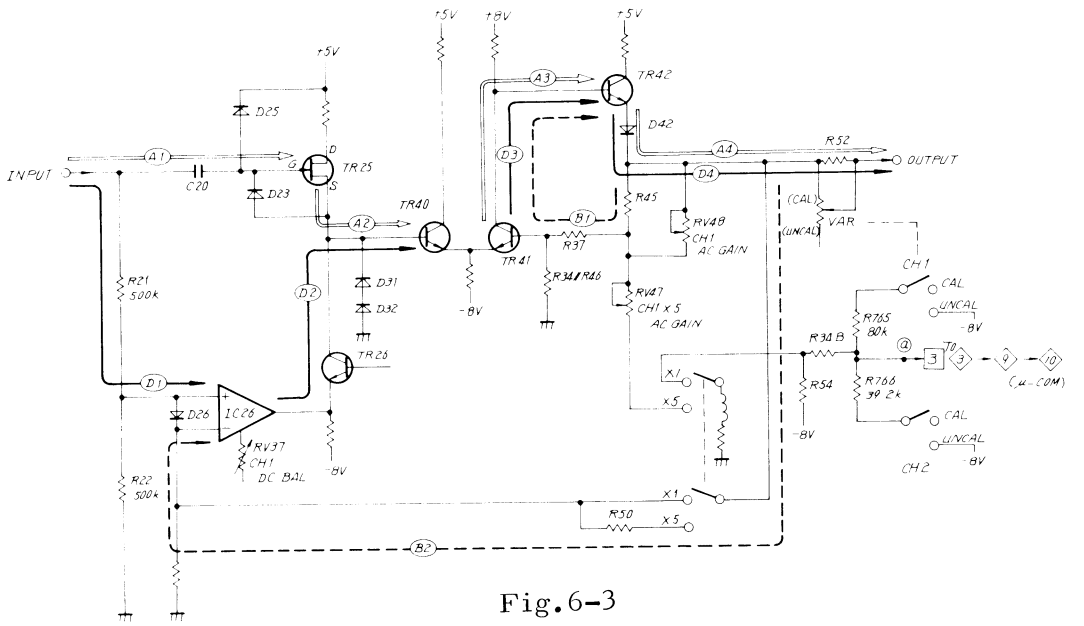


Fig.6-3

A detailed operation of the CH1 INPUT AMP is described below by using Figure 6-3. An AC component of the CH1 SIG flows in the direction of (A1) → (A2) → (A3) → (A4), and part of it is fed back as shown with (B1).

The AC component is supplied to source follower TR25 through C20, and then supplied to TR42 via differential amplifiers TR40 and TR41. A DC component of the CH1 SIG flows in the direction of (D1) → (D2) → (D3) → (D4), and part of it is fed back as shown with B2 (→ (D2) → (D3)). IC26 is a DC amplifier. TR26 separates the DC component from the AC component so that they do not affect each other.

It is ideal that the output voltage is 0 V when the input voltage is 0 V. In an actual DC amplifier, however, some offset voltage can appear at the output. CH1 DC BAL control RV37 compensates for the offset voltage of IC26. This is achieved by adjusting RV37 to make the GND line constant in any VOLTS/DIV ranges with the input coupling at GND.

CH1 AC GAIN control RV48 controls the AC gain by changing the AC feedback quantity. Since the DC gain is exactly decided, the AC gain is set to the same level of that of the DC gain. This is achieved by adjusting RV48 to obtain the

same square wave output signal as the input signal.

CH1 X5 AC GAIN control RV47 adjusts the AC gain of the 5x output signal.

Diodes D23 and D25 protect FET TR25 from ⊖ and ⊕ surge voltages, respectively. Diode D26 protects IC26 from ⊕ surge voltage. Diodes D31 and D32 protect TR25 and TR40 from ⊖ surge voltage, respectively. Diode D42 raises the bias voltage of the emitter of TR42 by 0.7 V approx., since the voltage difference between the base and the collector of TR41 is small.

Variable resistor VAR is in the CAL state at the position where R52 is short-circuited (at the fully clockwise position). At the fully counterclockwise position, the output of CH1 INPUT AMP is attenuated to 1/2.5 or less.

A current flowing through point ⓐ depends on the combination of the conditions of each input amplifier as shown below:

(1) CH1 INPUT AMP is in the 1x or 5x state.
(2) The output of the CH1 INPUT AMP is in the CAL or UNCAL state.
(3) The output of the CH2 INPUT AMP is in the CAL or UNCAL state.

The OP AMP (IC 753) in circuit ◇3◇ converts the current value in each condition into a voltage value, and supplies it to the microcomputer in circuit ◇10◇. Then, the microcomputer acknowledges the settings of CH1 and CH2 INPUT AMPs.

See Figure 6-1 again. The output from the CH1 INPUT AMP is supplied to the CH1 2ND ATTENUATOR consisting of RM52 and ATT 1b to be attenuated to 1/1, 1/2, 1/4, or 1/10 according to the VOLTS/DIV range. The output impedance in any levels is 150 Ω approximately.

The microcomputer acknowledges whether the CH2 INPUT AMP is in the 1x or 5x state through [4].

Table 6-1 shows the relationship between the overall gain from CH1 INPUT COUPLING to the CH1 2ND ATTENUATOR and the VOLTS/DIV range.

Table 6-1

VOLTS/DIV SW Position	1st Attenuator	INPUT AMP Gain	2nd Attenuator	Overall gain (approx.)	VOLTS/DIV x Overall Gain
5 mV	1	2.5	1	2.5	12.5 mV/div
10 mV	1	2.5	0.5 (÷2)	1.25	12.5 mV/div
20 mV	1	2.5	0.25 (÷4)	0.625	12.5 mV/div
50 mV	1	2.5	0.1 (÷10)	0.25	12.5 mV/div
0.1 V	0.1 (÷10)	2.5	0.5 (÷2)	0.125	12.5 mV/div
0.2 V	0.1 (÷10)	2.5	0.25 (÷4)	0.0625	12.5 mV/div
0.5 V	0.1 (÷10)	2.5	0.1 (÷10)	0.025	12.5 mV/div
1 V	0.01 (÷100)	2.5	0.5 (÷2)	0.0125	12.5 mV/div
2 V	0.01 (÷100)	2.5	0.25 (÷4)	0.00625	12.5 mV/div
5 V	0.01 (÷100)	2.5	0.1 (÷10)	0.0025	12.5 mV/div

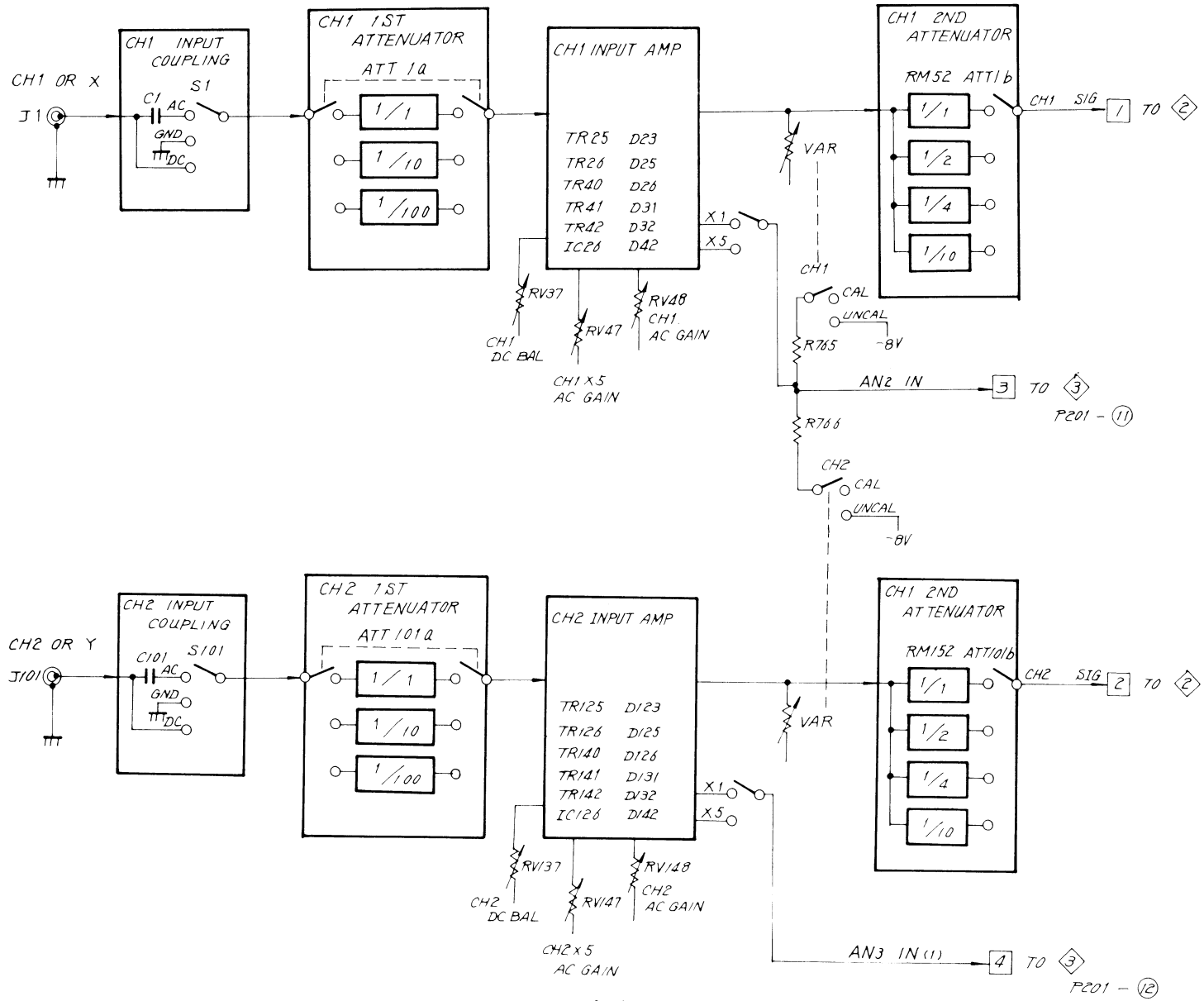

CH1 OR X
J1
CH1 INPUT COUPLING
C1
AC
GND
DC
S1
CH1 1ST ATTENUATOR
ATT 1a
1/1
1/10
1/100
CH1 INPUT AMP
TR25 D23
TR26 D25
TR40 D26
TR41 D31
TR42 D32
IC26 D42
RV37
CH1 DC BAL
RV47
CH1 X5 AC GAIN
RV48
CH1 AC GAIN
X1
X5
VAR
CH1 2ND ATTENUATOR
RM52 ATT1b
1/1
1/2
1/4
1/10
CH1 SIG 1 TO 2
CH1
CAL
UNCAL
-8V
R765
AN2 IN 3 TO 3
P201 - (11)
R766
CH2
CAL
UNCAL
-8V
CH2 OR Y
J101
CH2 INPUT COUPLING
C101
AC
GND
DC
S101
CH2 1ST ATTENUATOR
ATT 101a
1/1
1/10
1/100
CH2 INPUT AMP
TR125 D123
TR126 D125
TR140 D126
TR141 D131
TR142 D132
IC126 D142
RV137
CH2 DC BAL
RV147
CH2 X5 AC GAIN
RV148
CH2 AC GAIN
X1
X5
VAR
CH1 2ND ATTENUATOR
RM152 ATT101b
1/1
1/2
1/4
1/10
CH2 SIG 2 TO 2
AN3 IN (1) 4 TO 3
P201 - (12)

Fig.6-1

6.2 ◇2 VERTICAL SWITCHING CIRCUIT (PEF-710, 713, 727) (Including ◇3 1/2, ◇7 1/3)

Figure 6-4 is a detailed block diagram of the VERTICAL SWITCHING circuit.

The CH1 SIG from [1] is supplied to the CH1 PREAMP consisting of TR57, TR58, TR71, and TR72, and is converted from a single-ended signal to a paraphase signal. A cascode AMP consisting of TR57 and TR71 is suitable for a wide band amplification since a loss of input impedance due to Miller effect is small.

RV63 varies the vertical position of the CH1 SIG by changing the DC voltage supplied to the base of TR58. RV62 is adjusted to set the CH1 SIG on the center of the CRT with RV63 set at the mid-position of the variable range. CV60 compensates for a loss of the frequency response of high frequency.

Part of the CH1 SIG from [1] is fed out from [5], and is supplied to the CH1 TRIG PICKOFF circuit ◇4. The same operation is applied to the CH2 PREAMP, the CH3 PREAMP, and the CHR-Y PREAMP.

The CH1 SIG from the CH1 PREAMP is supplied to the DIODE GATE 1 consisting of D71, D72, D73, and D74. The DIODE GATE 1 is switched by switching transistor TR460. When the "H" signal is supplied to the base of TR460, TR460 becomes off, and its emitter becomes "H" to set D71 and D72 to off. As a result, the CH1 SIG passes through the DIODE GATE 1, and is supplied to the next stage.

When the "L" signal is supplied to the base of TR460, it becomes on, and its emitter becomes "L" to set D71 and D72 to on. Then, the CH1 SIG cannot pass the DIODE GATE 1. As for the DIODE GATE 2 and TR461, the DIODE GATE 3 and TR462, and the DIODE GATE 4 and TR463, the same circuit operation is applied to.

Only the CH2 SIG from the CH2 PREAMP is supplied to the DIODE GATE 2 via TR SW (1) or TR SW (2).

When the INVERT switch is set at the position as shown in Figure 6-4 (not pulled state), each base of TR171 and TR172 becomes "L", and the base bias current flows. Then, TR171 and TR172 become on. At the time, TR175 and TR177 are off since each base of TR175 and TR177 is "H."

As a result, the CH2 SIG is supplied to the DIODE GATE 2 via TR SW (2) with the same polarity.

When the INVERT switch is in the pulled state, TR SW (1) becomes on and TR SW (2) becomes off. Then, the CH2 SIG is supplied to the DIODE GATE 2 via TR SW (1).

However, since the output lines of TR SW (1) cross each other as shown in Figure 6-4, the inverted CH2 SIG is supplied to the DIODE GATE 2.

Only the signal(s) through the DIODE GATE is supplied to the DELAY LINE DRIVER consisting of TR450 and TR451. Since the DELAY LINE DRIVER is a voltage feedback circuit with its emitter grounded, both of input and output impedance are low. In addition, the impedance of the driver is designed to be matched with that of DELAYLINE DL1 at the next stage. The output from the DELAY LINE DRIVER is supplied to the DIFFERENTIAL AMP (1) in circuit ◇4◇ via [16] and [17].

The DC voltage (ALT SEP SIG) which is set by TRACE SEP control RV1104 in circuit ◇6◇ is supplied to [12]. The ALT SEP PULSE is supplied to [13]. When the ALT SEP PULSE is positive, switching FET TR456 becomes on to supply the ALT SEP SIG (DC voltage) to the base of TR452. The DIFFERENTIAL AMP consists of TR452 and TR453.

While TR SW (3) is on, TR452 is on and TR453 is off, or TR452 is off and TR453 is on. When FET TR456 is off, TR453 is on, and part of the base current of TR451 flows through R459.
When FET TR456 is on, TR452 is on, and part of the base current of TR450 flows through R458. As shown above, "A ALT B" operation is realized.

When displaying a character, the $\overline{\text{CHR EN}}$ (character enable) signal from [14] becomes "L" to set switching transistor TR454 to off. When displaying others, the $\overline{\text{CHR EN}}$ signal becomes "H".
The $\overline{\text{CHR EN}}$ signal is supplied to pin G of IC410 via INVERTER TR422.
D454 is a 10 V Zener diode and is used for DC level shifting.

The channel select signal ("H" or "L") is supplied to each base of switching transistors TR460 through TR463 from IC410. The CH SW CONTROLLER

consisting of IC410, IC413 (1/2), and IC413 (2/2), the DIODE GATE (D410 through D420, D780, D781), and the V. MODE switch decide the polarity of the channel select signal.

Main operations of the CH SW CONTROLLER, the DIODE GATEs, and the V. MODE switch are described below.

(1) Kinds of display

Character display ..... Pin G of IC410 is "H".

Others ..... Pin G of IC410 is "L".

(2) Oscilloscope operation

i) X-Y operation

Display switch S1158-a in circuit ◇7 sets D780 and D781 in circuit ◇2 to on, TR701 in circuit ◇3 to off, and TR780 in circuit ◇2 to off.

Then, IC 413 (1/2) is reset, and IC413 (2/2) is set. Pin S (select) of IC410 becomes "H", pins A1 and B3 becomes "L", and pin B2 becomes "H".

When a character is not displayed, pin G (strobe) of IC410 becomes "L" to supply B1 input ("L") from Y1, B2 input ("H") from Y2, and B3 input from Y3.

As a result, the DIODE GATEs 1, 3, and 4 become off, and only the CH2 SIG is supplied to the DELAY LINE DRIVER via the DIODE GATE 2. That is, the Y signal in the X-Y operation passes through the CH2 SIG route. The X signal passes through the route of [5] in circuit ◇2 ⟶ [5] in circuit ◇4 ⟶ [35] in circuit ◇4 ⟶ [35] in circuit ◇5 ⟶ [36] in circuit ◇6.

The "L" signal from [28] in circuit ◇6 stops the operation of IC1031 (2/2) so that no input signal is supplied to the Z-axis AMP. The "L" signal at [24] in circuit ◇5 which is supplied by S1158-b stops the operation of the A SWEEP GATE circuit.

Since TR701 and TR780 are off in the X-Y operation, the TRIG SOURCE and the V. MODE switches are not available.

ii) Operations other than X-Y

In circuit ◇2, D780 and D781 become off and TR780 becomes on and

TR701 in circuit ◇3 becomes on, and the V. MODE, TRIG SOURCE, and CH3 VIEW switches become effective.

(3) When the V. MODE switch is effective

i) Each channel select signal ("H" or "L") corresponding to the V. MODE is supplied from pins Y1, Y2, and Y3 of IC410. When pin G (strobe) of IC410 is "L" and pin S (select) is "H", the signals at pins B1, B2, and B3 are supplied from Y1, Y2, and Y3, respectively.

When both of pins G and S are "L", signals at pins A1, A2, and A3 are supplied from Y1, Y2, and Y3, respectively.
When pin G is "H", the "L" signal is supplied from Y1, Y2, and Y3 regardless of inputs at A1, A2, A3, B1, B2, and B3.

The setting condition of the V. MODE switch is transferred into the microcomputer via [23] in circuit ◇3.

ii) TR701 in circuit ◇3 is on in the operations other than X-Y. TR702 is normally off and is on only when the V. MODE switch is set to ALT with the TRIG SOURCE at VERT.

iii) The CH3 VIEW switch is null when the V. MODE switch is set to CH1, CH2, and ADD. The switch is effective only in the ALT and CHOP modes in the pulled state. Then the CH3 signal appears on the CRT.

iv) Normally IC413 (2/2) operates as a counter. When the CH3 VIEW switch functions, however, IC413 (1/2) and IC413 (2/2) operate as a ternary counter.

v) The CHOP PULSE is supplied to [15] in circuit ◇2 in the CHOP mode. The gate pulse is supplied every sweep to [15] in circuit ◇2 in the ALT mode.

vi) A current flows through Zener diode D455 in circuit ◇2 only in the ADD mode to set TR455 to on. In other words, the base bias current of the DELAY LINE DRIVER flows into TR455 through XR470 and R471 only in the ADD mode. In the modes other than ADD, the current flows into R472.

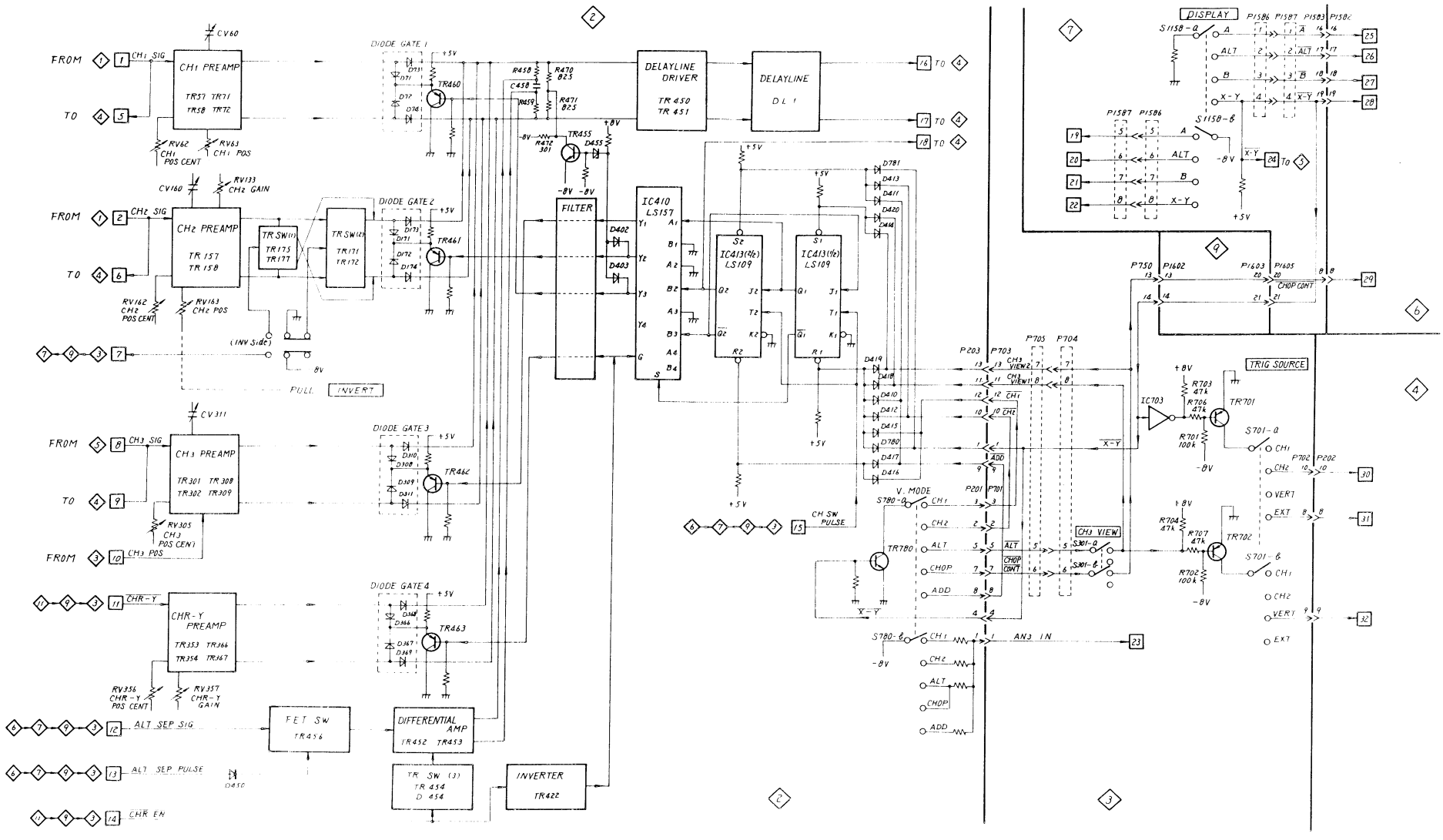

CH1 PREAMP
CH2 PREAMP
CH3 PREAMP
CHR-Y PREAMP
DELAYLINE DRIVER
DELAYLINE D.L 1
FILTER
IC410 LS157
IC413(1/2) LS109
DIFFERENTIAL AMP
FET SW
INVERTER
DISPLAY
TRIG SOURCE
V. MODE
CH SW PULSE
ALT SEP SIG
ALT SEP PULSE
CHR EN
FROM
TO
INVERT
PULL

Fig.6-4

6.3 ◇3◇ VOLTS/DIV SELECTOR CIRCUIT 2/2 (PEF-713, 715, 725, 726)

Figure 6-5 is a detailed block diagram of the VOLTS/DIV SELECTOR circuit 2/2. There are four PANEL STATUS circuits whose operations are same. They convert current signals depending on the contact condition into voltage signals, and supply them to the microcomputer via circuit ◇9◇ so that the microcomputer supplies control signals according to the contact condition.

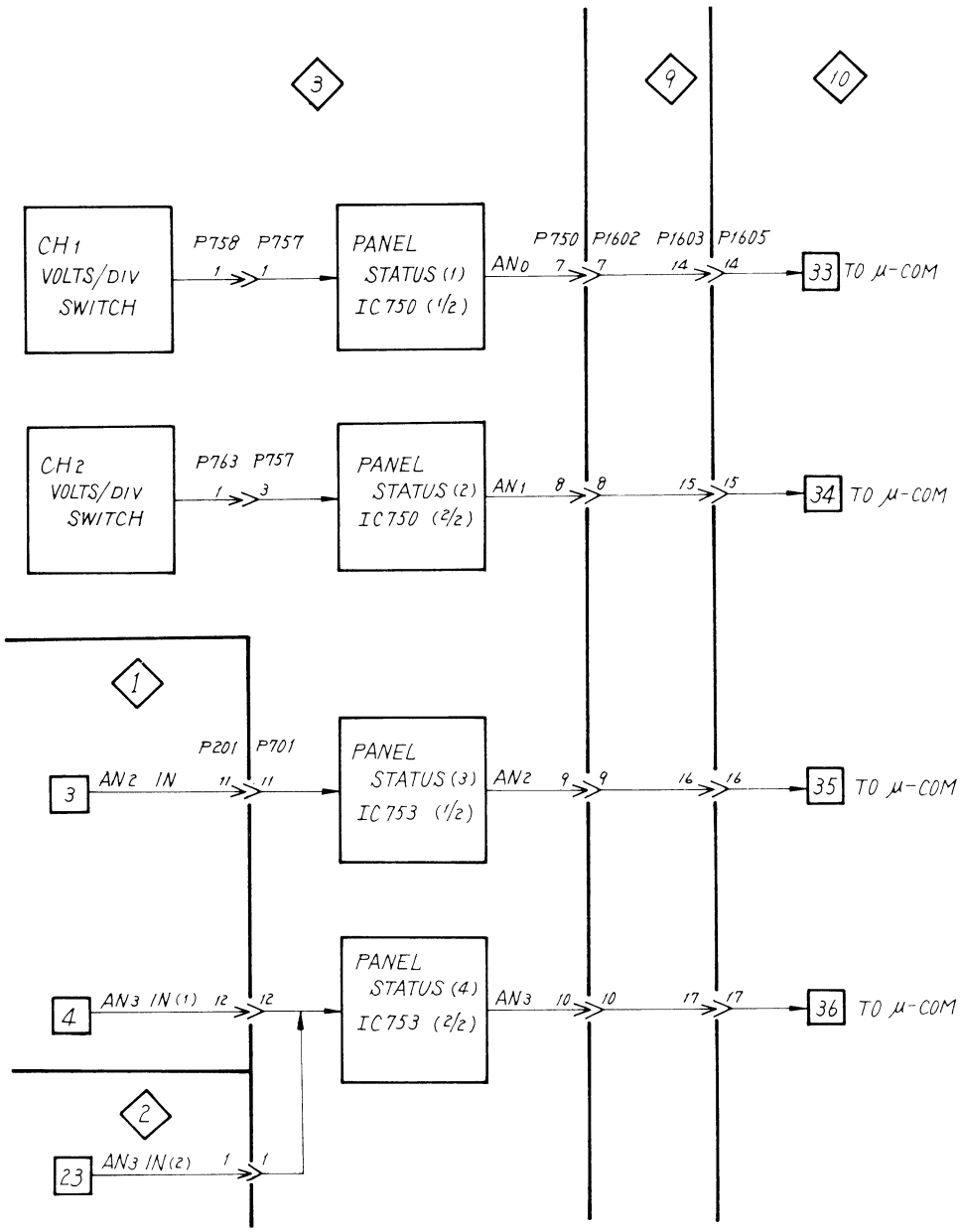


Fig.6-5

6.4 ◇4◇ VERTICAL OUTPUT & TRIGGER PICKOFF CIRCUIT (PEF-710, 711) (Including ◇7◇ 2/3)

Figure 6-6 is a detailed block diagram of the VERTICAL OUTPUT & TRIGGER PICKOFF circuit.
The vertical signals supplied from [16] and [17] are amplified by the DIFF. AMP (1) consisting of TR505 and TR506 and further by the DIFF. AMP (2) consisting of TR518 and TR519, and are supplied to the VERTICAL OUTPUT AMP.

The vertical signals are amplified to a voltage level enough to drive the vertical deflection. The amplified signals are applied to the vertical deflection plate of the CRT via peaking coils L555 and L556.

CV509, CV521, and CV534 are variable capacitors for high frequency compensation. D532, D543, and D544 are Zener diodes which allow the base current of the transistors to flow with low impedance to maintain each bias voltage of transistors constant.
The TRACE FIND function reduces the bias currents of the HORIZONTAL AMP and the VERTICAL AMP to control their amplitudes so that their maximum amplitudes are within the screen on the CRT.

TR1494 in circuit ◇7◇ is normally on. It is off when the TRACE FIND switch is pressed, and the bias current of the DIFF AMP (2) flows through R1494. Then, the bias current of the DIFF AMP (2) is reduced to limit the maximum amplitude of the vertical signal.

TR1493 is normally off. It becomes on when the TRACE FIND switch is pressed, and the bias current flows in the opposite direction through the H. AMP X1, H. AMP X10, or H. AMP CHR-X to limit the maximum amplitude of the horizontal signal.

CH1 TRIG PICK OFF TR201 is an emitter follower circuit, and is used as a buffer circuit for supplying the CH1 SIG fed from [5] to the DIFF. AMP (3) at the next stage.
CH1 TRIG DC LEVEL TR202 is a circuit for compensating for a level change of the DC offset voltage due to temperature. CH1 TRIG DC LEVEL RV207 adjusts the DC offset voltage and decides the DC level of the CH1 TRIG signal.

CH2 TRIG PICKOFF TR211 is an emitter follower circuit, and is used as a buffer circuit for supplying the CH2 SIG fed from [6] to the DIFF. AMP (4) at the next stage.
CH2 TRIG DC LEVEL TR212 is a circuit for compensating for the level change of the DC offset voltage due to temperature. CH2 TRIG DC LEVEL RV217 adjusts the DC offset voltage and decodes the DC level of the CH2 TRIG signal. The CH3 SIG is supplied to the DIFF. AMP (5) directly from [9] .

The CH1 SIG fed from CH1 TRIG PICKOFF TR201 is supplied to the DIFF. AMP (3) consisting of TR238 and TR239, and is converted from a single-ended signal to a paraphase signal. The CH2 SIG and the CH3 SIG are also converted from a single-ended signal to a paraphase signal in the DIFF. AMP (4) and the DIFF. AMP (5), respectively.

One of the DIFF. AMPs (3), (4), and (5) is selected by the CURRENT SWITCH (TR237, TR241, TR231), and the signal from the selected AMP is supplied to the BUFFER.
The voltage (point (b)) at the base of TR237 is always constant. The voltage at the base of TR241 depends on the voltage at point (a) . The voltage at point (a) is decided by a combination of the signals from [18] , [30] , and [32] . The voltage at the base of TR231 is decided by the EXT signal from [31] .

That is, the transistor whose base voltage is the highest among the three transistors becomes on, and allows a bias current to flow into the DIFF. AMP connected to the transistor. The output of the AMP is supplied to the BUFFER.

The output signal from the BUFFER is supplied to the DIFF. AMP (6) consisting of TR270 and TR271, and is converted from a paraphase signal to a single-ended signal.

The single-ended signal is supplied to the negative feedback AMP (TR277, TR263, TR294). Since both of the input and the output impedances of the feedback AMP are low, the signal flows in the direction of (1) → (2) → (3) , and is supplied from [35] as a TRIG signal (an X SIG at the X-Y operation). Part of the signal is fed back to the base of TR277 through R291 as shown with a dotted line.

CH3 TRIG DC LEVEL RV293 should be adjusted so that the output signal from 35 becomes zero when the CH3 input signal is zero.
CH1 TRIG DC LEVEL RV207 should be adjusted so that the output signal from 35 becomes zero when the CH1 input signal is zero.
CH2 TRIG DC LEVEL RV217 should be adjusted so that the output signal from 35 becomes zero when the CH2 input signal is zero.

Part of the output signal from the CH1 TRIG PICK OFF is supplied to the CH1 SIG OUTPUT AMP consisting of TR601, TR607, TR608, and D607.
The signal flows in the direction of ① → ② → ③ , and is fed out from the CH1 OUT connector (J608).

Part of the signal is fed back to negative feedback AMP TR601 through R605 as shown with a dotted line.
The input impedance of TR601 is high and the output impedance is low.
TR608 is an emitter follower, and the voltage at the emitter is kept constant by Zener diode D607.

CH1 OUT DC LEVEL RV603 is adjusted so that the output signal from the CH1 OUT connector becomes zero when the CH1 input signal is zero.

A symmetrical square wave of 1 kHz is fed out from CLOCK GENERATOR IC650 to switching transistor TR605. Adjust CAL GAIN control RV655 to obtain a signal of 0.5 V at the CAL 0.5 V connector (J656).

When pins 1 and 2 of plug jack P654 are short-circuited, the DC output signal is obtained at J656 and the voltage of the CAL signal can be measured with a digital multi meter.

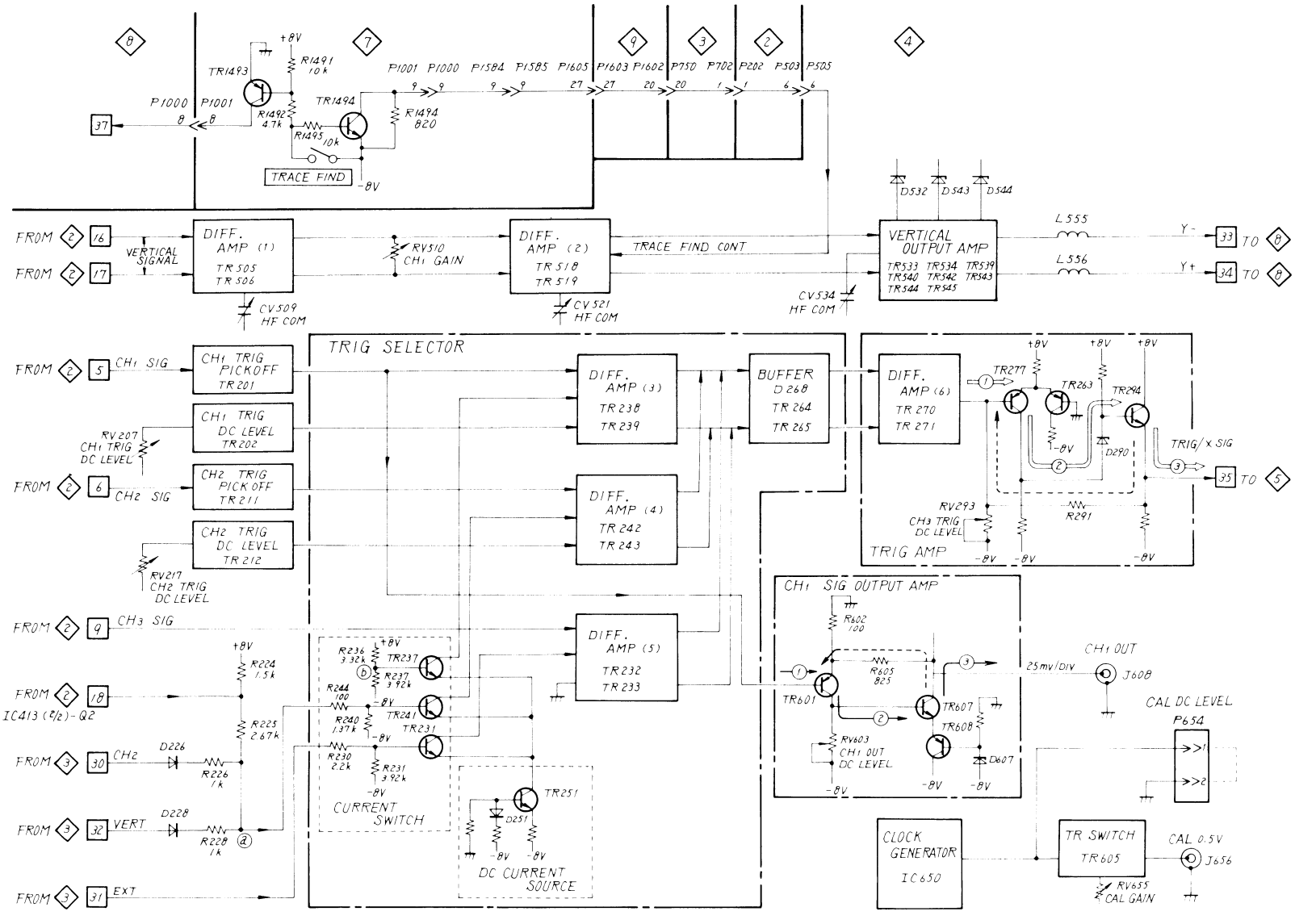

TRIG SELECTOR
DIFF. AMP (1) TR505 TR506
DIFF. AMP (2) TR518 TR519
DIFF. AMP (3) TR238 TR239
DIFF. AMP (4) TR242 TR243
DIFF. AMP (5) TR232 TR233
DIFF. AMP (6) TR270 TR271
BUFFER D268 TR264 TR265
VERTICAL OUTPUT AMP TR533 TR534 TR539 TR540 TR542 TR543 TR544 TR545
CH1 TRIG PICKOFF TR201
CH1 TRIG DC LEVEL TR202
CH2 TRIG PICKOFF TR211
CH2 TRIG DC LEVEL TR212
TRACE FIND
TRACE FIND CONT
CURRENT SWITCH
DC CURRENT SOURCE
TRIG AMP
CH1 SIG OUTPUT AMP
CLOCK GENERATOR IC650
TR SWITCH TR605
CH1 OUT
CAL DC LEVEL
CAL 0.5V
FROM 2 16 VERTICAL SIGNAL
FROM 2 17
FROM 2 5 CH1 SIG
FROM 2 6 CH2 SIG
FROM 2 9 CH3 SIG
FROM 2 18 IC413 (8/2)-Q2
FROM 3 30 CH2
FROM 3 32 VERT
FROM 3 31 EXT
TO 8
TO 5
TRIG/X SIG
25mv/DIV
P654
J608
J656

Fig.6-6

6.5 ◇5◇ A/B SWEEP GENERATOR (1) (PEF-712, 716)

Outline

Figure 6-7 is a detailed block diagram of the A/B SWEEP GENERATOR (1) circuit. The TRIG signal (X SIG in the X-Y operation mode) from [35] is supplied to emitter follower (E.F (1)) TR830, and is fed to the E.F (2), the SYNC SEPARATOR, and the E.F (3). Part of the TRIG signal is supplied to the circuit ◇6◇ from [36] to be used as the X SIG in the X-Y operation mode.

The TRIG signal from E.F (2) is supplied to the A TRIG SHAPER to generate a TRIG pulse for A SWEEP. The A TRIG SHAPER is a positive feedback amplifier with a hysteresis characteristic, and supplies either a trigger pulse SS1 (+) with the same polarity as that of the input signal SS1, or a trigger pulse SS1 (-) with the opposite polarity.

The setting positions of the A TRIG MODE switch and the ⊕/⊖ slope switch decide an output signal of the A TRIG SELECT LOGIC. This output signal selects the SS1 (+) pulse or the SS1 (-) pulse. A TRIG LEVEL control RV840 controls the triggering level of the selected signal.

The SYNC SEPARATOR becomes on when the A TRIG MODE switch is set to TV, separates a sync component from the TRIG signal SS2 (composite TV signal) and supplies the SS2 (-) to the A TRIG SELECTOR.

The TRIG signal SS3 from the E.F (3) is supplied to the B TRIG SHAPER to generate a TRIG pulse SS3 (+) or SS3 (-) for B SWEEP. The circuit operation is same as that for A SWEEP. The setting positions of the B SLOPE switch and the B AUTO/NORM switch decide the output signal of the B TRIG SELECT LOGIC.

The A TRIG SELECTOR selects a TRIG pulse SS1 (+), SS1 (-), or SS2 (-), and supplies it to the A SWEEP GATE. The A TRIG SELECT LOGIC selects the output signal.

The A GATE and the $\overline{\text{A GATE}}$ signals from the A GATE SWEEP become "H" and "L", respectively, at the leading edge of the selected TRIG pulse. The HOLD OFF circuit controls the timing for switching the A GATE signal from "H" to "L" and the $\overline{\text{A GATE}}$ signal from "L" to "H".

The "H" duration of the A GATE signal is the unblanking period and the "L" duration is the blanking period.
The output signal from the HOLDOFF is decided by the $\overline{\text{RESET}}$, $\overline{\text{HOLDOFF}}$, and $\overline{\text{A RS}}$ signals.

When the A TRIG MODE switch is set to SINGLE, the SINGLE SWEEP CONTROL circuit makes the HOLD OFF circuit disable. Consequently, the hold off state is not released and the ready state for a trigger signal is not established until the RESET switch is pressed.
When the trigger signal is supplied to the A SWEEP GATE, the single sweep operation is performed to display a waveform and characters on the CRT. The microcomputer acknowledges by the SINGLE signal from 37 that the SINGLE mode is selected.

The B TRIG SELECTOR selects a TRIG pulse SS3 (+), SS3 (-), or SS2 (-). The selected TRIG pulse is supplied to the B SWEEP GATE only when the B AUTO/NORM switch is set to NORM. At the AUTO position, the B SWEEP GATE is controlled by the output signal from the B SWEEP GATE CONTROL.

The CH3 SIG from CH3 IN connector J805 and the LINE SIG from 38 are supplied to the CH3 INPUT AMP via S801a and S801b switches.

When S801a and 8012b switches are set at the AC or DC position, the CH3 SIG is supplied to the CH3 INPUT AMP via S801a. At the DC÷10 position, CH3 SIG which is attenuated to 1/10 is supplied to the CH3 INPUT AMP via S801a and S801b. At the LINE position, the LINE SIG is supplied to the CH3 INPUT AMP via S801b.

TR810 is a dual FET for compensating for a drift in temperature. D810 protects TR810 from the minus surge input. D815 compensates for a loss of the temperature characteristics of TR821. D821 protects TR821.

Main operations in this circuit are described below by using Figure 6-8.

Route of the TRIG signal/pulse

The route of the TRIG signal or the TRIG pulse depends on the oscilloscope operation mode and the trigger mode as follows:

(1) Trigger mode: NORM
A SLOPE : ⊕

Point ⓐ is "L" and point ⓑ is "H" in this condition. Since point ⓒ is "L," D961 becomes off. Mark + in parentheses represents that the polarity of an input signal is same as that of an output signal. Mark - in parentheses represents that the polarity of an input signal is opposite to that of an output signal. Mark # denotes pin number of ICs.

Therefore, the TRIG signal or the TRIG pulse flows as follows:

SS1 → pin 13 of IC849 (4/4) → pin 11 of IC849 (4/4) → pin 2 of IC849 (1/4) → pin 3 of IC849 (1/4) → SS1 (+)

(2) Trigger mode: NORM
A SLOPE : ⊖

Point ⓐ is "H" and point ⓑ is "L" in this condition. Since point ⓒ is "L", D961 becomes off. Therefore, the TRIG signal or the TRIG pulse flows as follows:

SS1 → pin 10 of IC849 (3/4) → pin 8 of IC849 (3/4) → pin 6 of IC849 (2/4) → D849 → pin 1 of IC849 (1/4) → pin 3 of IC849 (1/4) → SS1 (-)

(3) Trigger mode: $\overline{\text{TV}}$
A SLOPE : $\overline{\text{TV-H}}$

Both of points ⓐ and ⓑ are "L", D849 is off, and pin 2 of IC849 (1/4) is "H" in this condition.
Since point ⓒ is "L", D961 becomes off, and pin 9 of IC949 (3/4) becomes "H". Therefore, the TRIG signal and the TRIG pulse flows as follows:

SS2 → SYNC SEPARATOR → R854 → pin 10 of IC949 (3/4) → pin 8 of IC949 (3/4) → D860 → pin 1 of IC849 (1/4) → pin 3 of IC849 (1/4) → SS2 (-)
(Both of the horizontal and the vertical sync signals are included.)

(4) Trigger mode: $\overline{\text{TV}}$
A SLOPE : $\overline{\text{TV-V}}$

Both points ⓐ and ⓑ are "L", D849 becomes off, and pin 2 of IC849

(1/4) becomes "H". Since point Ⓒ is "L", D947 and D948 become on, D962 becomes off, and pin 12 of IC962 (4/4) becomes "H".
Since C854 is connected to GND, R854 and C854 function as a filter.
Then, the TRIG signal or the TRIG pulse flows as follows:

SS2 —— SYNC SEPARATOR —┬— R854/C854 —— pin 10 of IC949 (3/4) ——
pin 8 of IC949 (3/4) —— D860 —— pin 1
of IC849 (1/4) —— pin 3 of IC849 (1/4)
—— SS2 (-)
(Only the vertical sync signal is included.)

└— pin 13 of IC949 (4/4) —— pin 11 of IC949
(4/4) —— D961 —— pin 13 of IC962 (4/4)
—— pin 11 of IC962 (4/4) —— SS2 (-)
(Both of the horizontal and the vertical
sync signals are included.)

In the case of (1) and (2), input signal SS2 is null. In the case of (3) and (4), input signals SS1 and SS3 are null.

SINGLE mode

In the SINGLE mode the base of TR1362 is "L." Then, TR1362 becomes off, and its collector becomes "H". D1346 becomes off and D1432 becomes on.

If the $\overline{\text{A GATE}}$ signal is "H" (blanking period), pin 12 of IC1345 (4/4) becomes "H" since D134 and D1347 are off. Therefore, the level of the signal at pin 11 of IC1345 (4/4) is decided by only an input signal to pin 13 of IC1345 (4/4).

If the $\overline{\text{A GATE}}$ signal is "L" (unblanking period, i.e. sweep period), pin 11 of IC1345 (4/4) becomes "H", and D1355 becomes off. At the time, the READY lamp does not light up.

Since D1432 is on, the base of TR1343 becomes "H". Then, the emitter of TR1343 becomes "H" to set D1345 to off.
Therefore, the HOLD OFF circuit stops operating, and the hold-off state cannot be automatically released.

If the $\overline{\text{HOLD OFF}}$ signal from 43 becomes "L" in the modes other than the

SINGLE mode, TR1343 becomes off, the base of TR1343 becomes "L," D1345 becomes on, pin 9 of IC1345 (3/4) becomes "L", pin 8 of IC1345 (3/4) becomes "H", and R2 becomes "H". (S2 is "H" in the normal state since pin 2 of IC1345 (1/4) is "L".)

Then, IC870 (2/2) is ready to receive the trigger pulse. When the trigger pulse is supplied, the sweep operation starts at the leading edge of the pulse.

In the SINGLE mode, however, the hold-off state is not released until the RESET switch on the front panel is pressed. When the RESET switch is pressed, the $\overline{\text{RESET}}$ signal from [42] becomes "L" to set D1344 to on. Pin 9 of IC1345 (3/4) becomes "L", pin 8 of IC1345 (3/4) becomes "H", and R2 becomes "H".

Then, IC870 (2/2) is ready to receive the trigger pulse (READY state). At the time the READY lamp lights since pin 13 of IC1345 (4/4) becomes "H", and pin 11 of IC1345 (4/4) becomes "L" to set D1355 to on.

When pin 8 of IC1345 (3/4) becomes "H", TR1372 becomes on to set the $\overline{\text{READY}}$ signal from [41] to "L". Then, the microcomputer acknowledges that the READY mode is selected.
The $\overline{\text{A RS}}$ signal from [44] is normally "H", and becomes "L" only in the moment when the voltage is maximum.
Then, pin 10 of IC1345 (3/4) becomes "H". Pin 8 of IC1345 (3/4) becomes "L" since pin 9 is set to "H" by R1345.

As a result, IC870 (2/2) is reset, and Q2 and $\overline{\text{Q2}}$ become "L" and "H", respectively.

At the X-Y operation, IC870 (2/2) is also reset since the $\overline{\text{X-Y}}$ signal from [24] is "L".

AUTO mode

When the TRIG MODE switch is set to AUTO, point ⓓ always becomes "L." However, TR873 does not always become off. A voltage at point ⓔ decides whether TR873 is on or off.
When TR873 becomes on, C870 is discharged in the route of C870 ⟶ TR873 ⟶ GND, R1 becomes "L" to set Q1 to "L". Then, TR873 becomes off.

When TR873 becomes off, C870 is charged in the route of +5 V —— R870 —— C870, and electric potential of R1 increases gradually.

On the other hand, electric potential at point (f) is lower than that of R1 by the sum of V_{BE} of TR870 plus the voltage dropped by R871.

Then, point (f) does not rapidly become "H", and continues to be "L".
In the normal operation, the trigger pulse is supplied to T1 before point (f) changes from "L" to "H" (in this case, R1 is "H".), and Q1 changes from "L" to "H" to set TR873 to on.

In the trigger sweep as a normal sweep operation, the above operation is repeated. In this case, S2 is always "H" since point (f) is "L".
The signals from R2 and T2 decide the start and stop of sweep operation.

However, if the trigger pulse is not supplied to T1 though point (f) changes from "L" to "H", the signal level of S2 depends on the signal supplied to point (g) at a cycle set by the TIME/DIV switch.

The self-oscillating state at the cycle set by the TIME/DIV switch is called the AUTO FREE RUN mode.

B AUTO/NORM, B SWEEP GATE, B SWEEP GATE CONTROL

When the B AUTO/NORM switch is set to B AUTO, point (i) becomes "H".
Then, the state of IC980 (1/2) is decided by the signal at point (h) .
When the DLY TRIG pulse is supplied from [15], point (h) becomes "H".
R3 becomes "H", S3 becomes "L", and Q3 and $\overline{Q3}$ become "H" and "L," respectively.
Then, the B SWEEP operation starts.

When the B AUTO/NORM switch is set to B NORM, point (i) becomes "L".
S3 is always "H".
A sweep operation starts when the pulse is supplied to T3.

When the sweep end information signal of either A SWEEP or B SWEEP is supplied to R3, the B SWEEP operation stops. The signal supplied is decided by the value set by the DLY POSITION control. (Normally the B SWEEP end information is supplied.)

When the A SWEEP operation is completed, the $\overline{\text{A RS}}$ signal from [44] be-

comes "H", and sets R4 and point (h) to "L" via R882 and D892.
When the voltage for the B SWEEP operation reaches the level for ending the sweep operation, the $\overline{\text{B RS}}$ signal from [47] becomes "L", point (h) becomes "L", and the B SWEEP is completed.

The $\overline{\text{A}}$ signal from [46] becomes "L" at the A SWEEP operation and R4 and point (h) are set to "L" so that the B SWEEP operation does not function.

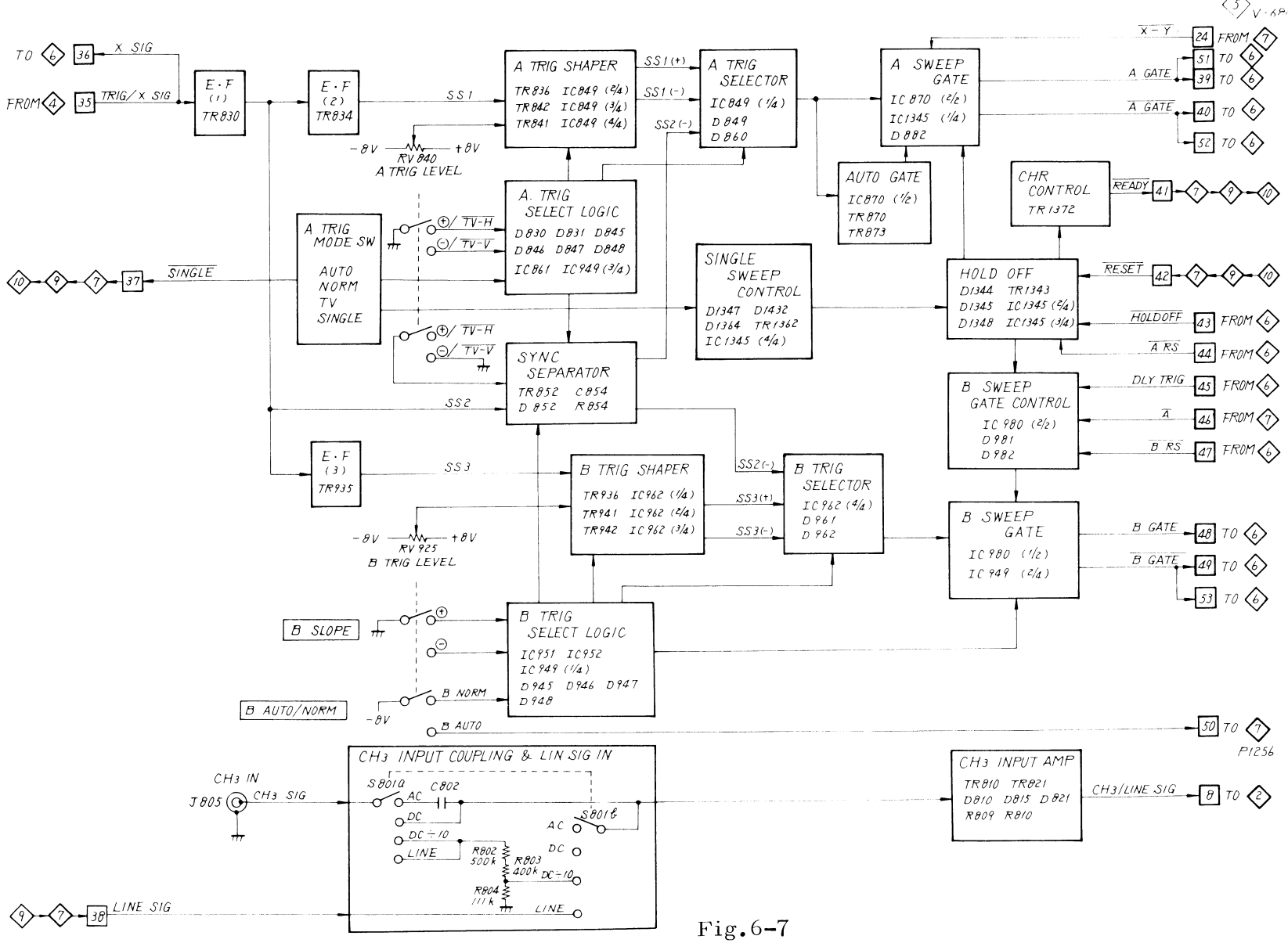

TO 6 36 X SIG
FROM 4 35 TRIG/X SIG
E·F (1) TR830
E·F (2) TR834
E·F (3) TR935
SS1
SS2
SS3
-8V +8V RV840 A TRIG LEVEL
-8V +8V RV925 B TRIG LEVEL
A TRIG SHAPER
TR836 IC849 (2/4)
TR842 IC849 (3/4)
TR841 IC849 (4/4)
SS1(+)
SS1(-)
SS2(-)
A TRIG SELECTOR
IC849 (1/4)
D849
D860
A SWEEP GATE
IC870 (2/2)
IC1345 (1/4)
D882
X-Y
A GATE
AUTO GATE
IC870 (1/2)
TR870
TR873
CHR CONTROL
TR1372
READY 41
A TRIG SELECT LOGIC
D830 D831 D845
D846 D847 D848
IC861 IC949 (3/4)
A TRIG MODE SW
AUTO
NORM
TV
SINGLE
10 9 7 37 SINGLE
⊕/ TV-H
⊖/ TV-V
SINGLE SWEEP CONTROL
D1347 D1432
D1364 TR1362
IC1345 (4/4)
HOLD OFF
D1344 TR1343
D1345 IC1345 (2/4)
D1348 IC1345 (3/4)
RESET 42
HOLDOFF 43
A RS 44
SYNC SEPARATOR
TR852 C854
D852 R854
B SWEEP GATE CONTROL
IC980 (2/2)
D981
D982
DLY TRIG 45
Ā 46
B RS 47
B TRIG SHAPER
TR936 IC962 (1/4)
TR941 IC962 (2/4)
TR942 IC962 (3/4)
SS3(+)
SS3(-)
B TRIG SELECTOR
IC962 (4/4)
D961
D962
B SWEEP GATE
IC980 (1/2)
IC949 (2/4)
B GATE 48
B GATE 49
53
B SLOPE
B AUTO/NORM
B NORM
B AUTO
B TRIG SELECT LOGIC
IC951 IC952
IC949 (1/4)
D945 D946 D947
D948
50 TO 7
P1256
CH3 IN
J805
CH3 SIG
CH3 INPUT COUPLING & LIN SIG IN
S801a C802
AC
DC
DC÷10
LINE
S801b
R802 500k
R803 400k
R804 111k
CH3 INPUT AMP
TR810 TR821
D810 D815 D821
R809 R810
CH3/LINE SIG 8 TO 2
9 7 38 LINE SIG

Fig.6-7

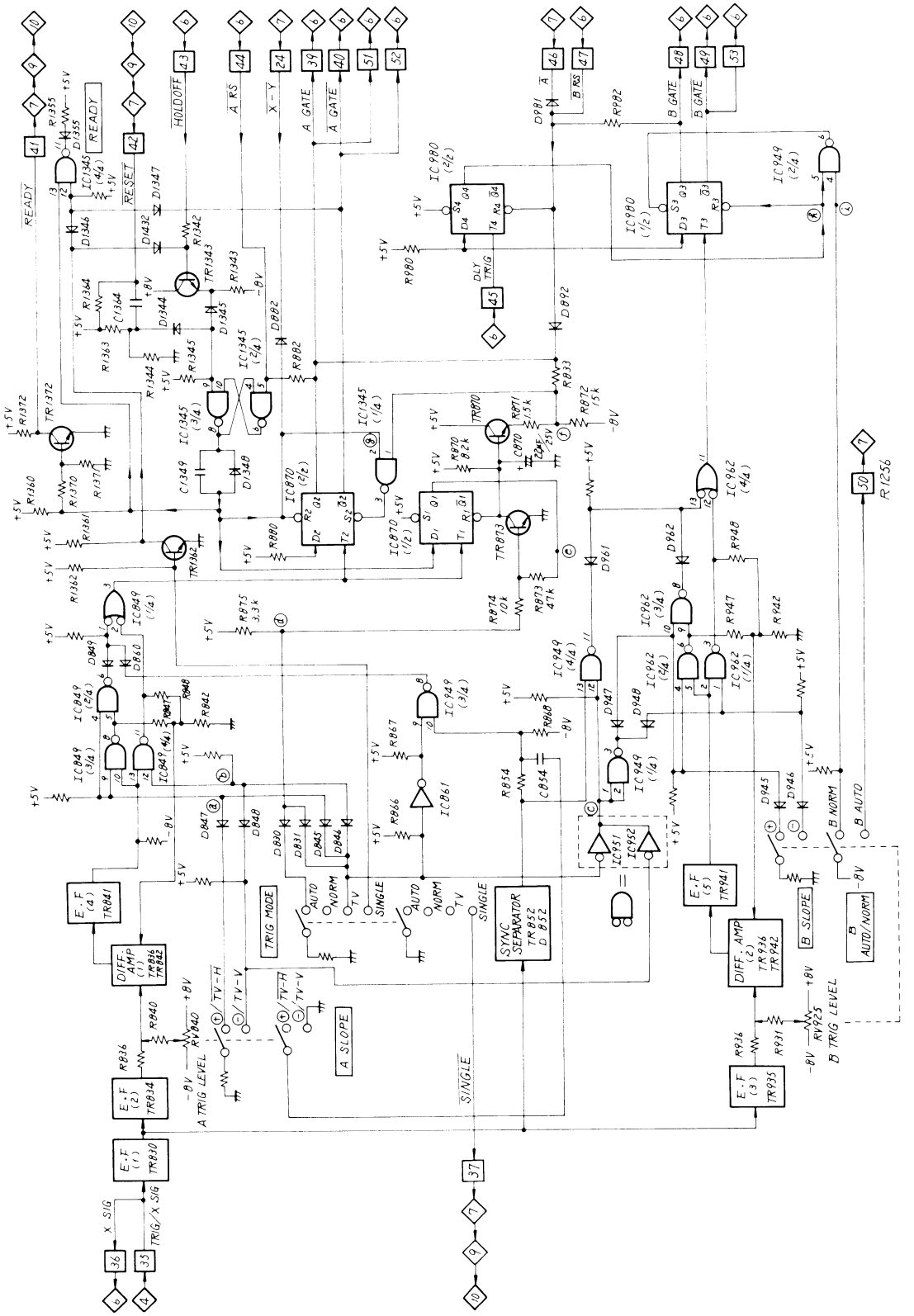

READY
RESET
HOLDOFF
A RS
X - Y
A GATE
B GATE
SINGLE
A TRIG LEVEL
B TRIG LEVEL
A SLOPE
B SLOPE
TRIG MODE
SYNC SEPARATOR TR852 D852
DIFF. AMP (1) TR836 TR842
DIFF. AMP (2) TR936 TR942
E.F (1) TR830
E.F (2) TR834
E.F (3) TR935
E.F (4) TR841
E.F (5) TR941
A AUTO/NORM
B AUTO/NORM
A NORM
B NORM
A AUTO
B AUTO
TV
SINGLE
X SIG
TRIG/X SIG

Fig. 6-8

6.6 ◇6◇ A/B SWEEP GENERATOR (2) (PEF-712)

Figure 6-9 is a detailed block diagram of the A/B SWEEP GENERATOR (2). Figure 6-10 is a schematic diagram illustrating the information necessary for understanding the operation of this circuit. Waveform examples are shown in Figure 6-11.

SWEEP GENERATOR (Refer to Figures 6-8, 6-9, 6-10 and 6-11.)

The A SWEEP GENERATOR and the B SWEEP GENERATOR are shown with alternate a long and short dash lines in Figure 6-9. They are Miller integrator circuits, by which a sawtooth wave with good linearity can be obtained. When a sweep operation starts, the A GATE signal from [39] is changed from "L" to "H" and the $\overline{\text{A GATE}}$ signal from [40] is changed from "H" to "L". When the $\overline{\text{A GATE}}$ signal becomes "L", D884, D885, and D888 become off.

As a result, the TIMING CAPACITOR (A) is charged by a time constant set by the setting position of the TIME/DIV switch, and a sawtooth wave is supplied from the INVERTING AMP (A).

Part of the sawtooth wave is supplied to TR889 to decide the maximum voltage of the sawtooth wave (the voltage corresponding to the rightmost point of the x-axis on the CRT). The maximum voltage allows the voltage at the base of TR889 to be 0.7 V approx. When the base voltage becomes 0.7 V. TR889 becomes on. Then, the collector voltage of TR889 becomes "L" and the $\overline{\text{A RS}}$ signal supplied from [62] becomes "L". When the $\overline{\text{A RS}}$ signal becomes "L", pin 10 of IC1345 (3/4) in circuit ◇5◇ becomes "H" so that the output level at pin 8 of IC1345 (3/4) is decided by the input signal to pin 9 of IC1345 (3/4). (See Figure 6-8.)

On the other hand, TR1343 in circuit ◇5◇ is always active, and supplies the voltage proportional to the base voltage to the emitter.

The $\overline{\text{HOLDOFF}}$ signal is supplied to the base of TR1343 with the "H" level when the sawtooth wave is around maximum.

Since the emitter of TR1343 is "H", D1345 in circuit ◇5◇ becomes off. D1344 in circuit ◇5◇ is normally off. Then, pin 9 of IC1345 (3/4) in circuit

◇5◇ is "H" by the voltage of +5 V and R1345.

As a result, pin 8 of IC1345 (3/4) in circuit ◇5◇ becomes "L" to reset IC870 (2/2) in circuit ◇5◇. That is, when the sawtooth wave becomes maximum, voltage comparator TR889 becomes on, and the $\overline{\text{A RS}}$ signal becomes "L" to reset IC870 (2/2).

When IC870 (2/2) in circuit ◇5◇ is reset, the A GATE signal from 39 changes from "H" to "L", and the $\overline{\text{A GATE}}$ signal from 40 changes from "L" to "H". Then, D884 and D885 become on immediately and the TIMING CAPACITOR (A) is rapidly discharged, and the sawtooth wave voltage drops to the voltage at the starting point of a sweep operation (the voltage corresponding to the left-most point of the x-axis on the CRT).

On the other hand, D888 does not become on until the sawtooth wave voltage becomes the voltage at the starting point of the sweep operation. When D888 becomes on, the input and output signals of the INVERTING AMP (A) are short-circuited, and the sawtooth wave voltage is kept constant (the voltage level at the starting point of a sweep operation).

Part of the sawtooth wave is supplied to the holdoff circuit via D1012, and the HOLDOFF CAPACITOR is charged. D1020 is on while voltage comparator TR889 is off, and the HOLDOFF CAPACITOR continues to be charged.

When TR889 becomes on and the TIMING CAPACITOR (A) starts to be discharged, D1020 becomes off.

When D1020 becomes off, the HOLDOFF CAPACITOR is discharged at a speed slower than that of the TIMING CAPACITOR (A). The value of the HOLD-OFF CAPACITOR depends on the setting of the TIME/DIV switch in the same way as the TIMING CAPACITOR (A).

As the HOLDOFF CAPACITOR (A) is discharged, the voltage of the $\overline{\text{HOLDOFF}}$ signal from 43 becomes lower. The $\overline{\text{HOLDOFF}}$ voltage is supplied to the base of TR1343 in circuit ◇5◇.

However, TR1343 is always active, and its emitter voltage changes in proportion to the base voltage. Therefore, when the HOLDOFF CAPACITOR (A) is discharged to a certain voltage, the voltage at the emitter of TR1343 changes from "H" to "L". Then, R2 of IC870 (2/2) in circuit ◇5◇ becomes "H", and

the reset state of IC870 (2/2) is released.

The voltage at the base of TR1343 at this time is called a holdoff voltage. The period required for the base voltage of TR1343 to become the holdoff voltage after D1020 has become off is called a holdoff period.

When the trigger pulse is supplied to T2 of IC870 (2/2) in circuit ◇5◇ during the holdoff period, the pulse is null. (The trigger operation is not performed.)

When the reset state of IC870 (2/2) is released, the trigger pulse is effective, and the sweep operation starts. Then, the above mentioned operation is repeated.

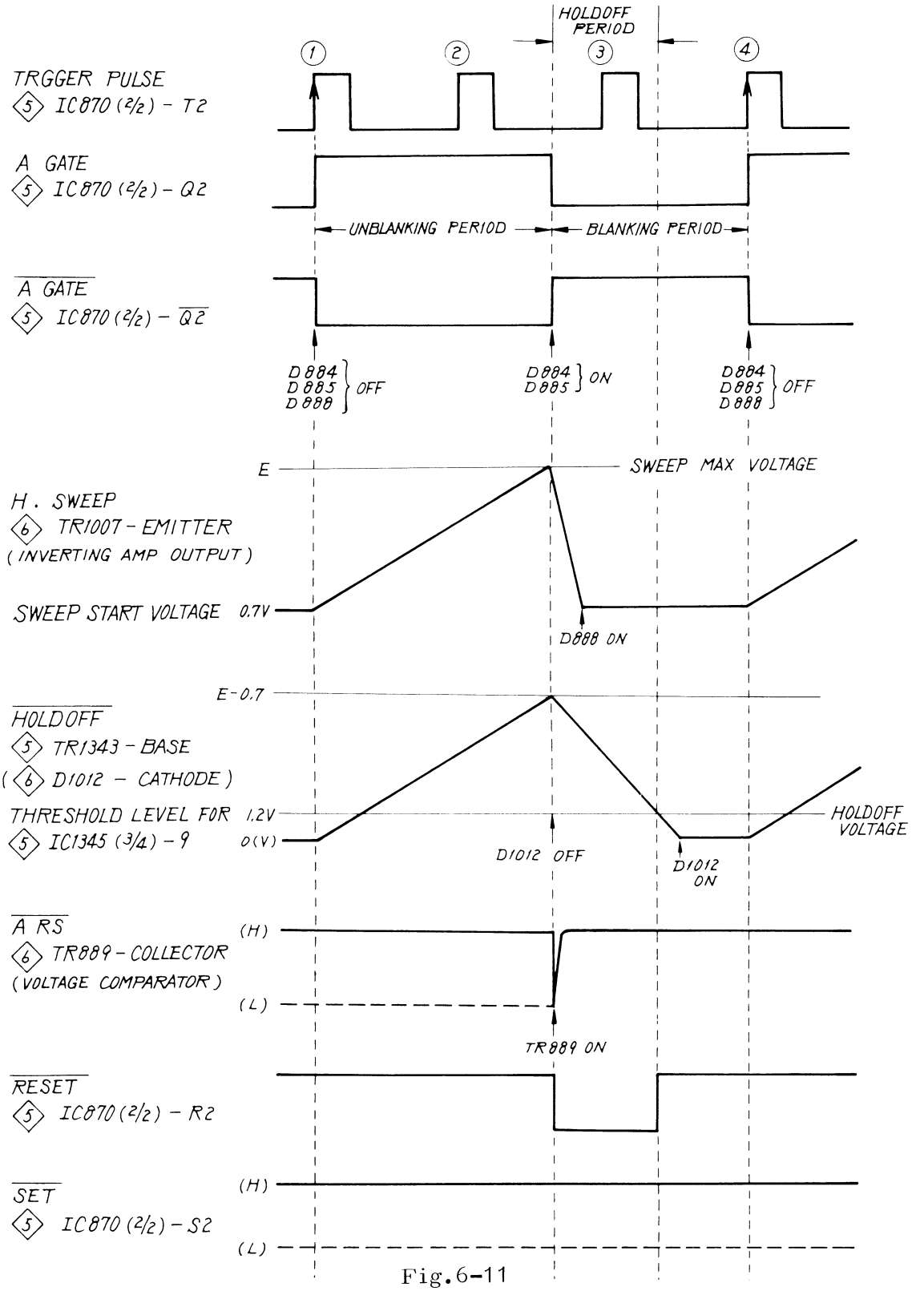

HOLDOFF PERIOD
1
2
3
4
TRGGER PULSE
5 IC870 (2/2) - T2
A GATE
5 IC870 (2/2) - Q2
UNBLANKING PERIOD
BLANKING PERIOD
A GATE
5 IC870 (2/2) - Q2
D884 D885 D888 OFF
D884 D885 ON
D884 D885 D888 OFF
E
SWEEP MAX VOLTAGE
H. SWEEP
6 TR1007 - EMITTER
(INVERTING AMP OUTPUT)
SWEEP START VOLTAGE 0.7V
D888 ON
E-0.7
HOLDOFF
5 TR1343 - BASE
(6 D1012 - CATHODE)
THRESHOLD LEVEL FOR 1.2V
5 IC1345 (3/4) - 9
0(V)
HOLDOFF VOLTAGE
D1012 OFF
D1012 ON
A RS
6 TR889 - COLLECTOR
(VOLTAGE COMPARATOR)
(H)
(L)
TR889 ON
RESET
5 IC870 (2/2) - R2
SET
5 IC870 (2/2) - S2
(H)
(L)

Fig.6-11

COMPARATOR (See Figure 6-9.)

The DLY POS signal (DC voltage) from [54] is supplied to the COMPARATOR via emitter follower TR1039. A sawtooth wave from the INVERTING AMP (A) is also supplied to the COMPARATOR. Then, the DLY TRIG pulse from the COMPARATOR is fed out to circuit ◇5◇ via [45] .

Part of the $\overline{A}$ signal from [58] is supplied to the COMPARATOR via D1031. This is achieved to prevent the DLY TRIG pulse from being supplied from the COMPARATOR when the DISPLAY switch is set at the A position. At the B or ALT position, the DLY TRIG pulse from the COMPARATOR is effective. The ALT position means the alternate switching of the A sweep and the B sweep (horizontal). This is different from the ALT mode (vertical mode).

CHANNEL SWITCH PULSE CIRCUIT (See Figure 6-9.)

The $\overline{\text{CHOP CONT}}$ signal from [60] is "L" only when the V. MODE switch is set at the CHOP position. The $\overline{\text{H ALT}}$ signal from [61] is "L" only when the DISPLAY switch is set at the ALT position.
Part of the output signal from the DISPLAY MULTIVIBRATOR is supplied to the CHANNEL SWITCH PULSE CIRCUIT.

The CHANNEL SWITCH PULSE CIRCUIT supplies the ALT SEP PULSE from [13] and the CH SW PULSE from [15] .
The ALT SEP PULSE is a signal which informs whether a current sweep is A or B.

The CH SW PULSE becomes a CHOP PULSE when the vertical mode is the CHOP. An astable multivibrator consisting of IC1113 (3/4) and IC1113 (4/4) oscillates with 500 kHz which is two times the CHOP frequency.

When the vertical mode is not in the CHOP mode, i.e., in the ALT mode, the CH SW PULSE changes in accordance with the setting of the DISPLAY switch. When the DISPLAY switch is not set to ALT (H.ALT), the CH SW PULSE becomes a gate pulse supplied every one sweep. When the switch is set to ALT (H.ALT), it becomes a gate pulse supplied every three sweeps.

DISPLAY MULTIVIBRATOR, UNBLANK CIRCUIT, and HORIZONTAL SWITCH

(See Figure 6-9.)

When the DISPLAY switch is set to A, the $\overline{A}$ signal from 58 becomes "L", and IC1031 (2/2) is set. Then, the $\overline{B\ DSP}$ and the $\overline{A\ DSP}$ signals become "H" and "L", respectively.

When the DISPLAY switch is set to B, the $\overline{B}$ signal from 59 becomes "L", and IC1031 (2/2) is reset. Then the $\overline{B\ DSP}$ and the $\overline{A\ DSP}$ signals become "L" and "H", respectively.

In the X-Y operation mode, both pins S and R of IC1031 (2/2) become "L", and both the $\overline{B\ DSP}$ and the $\overline{A\ DSP}$ signals become "H".
When the DISPLAY switch is set to ALT, IC1031 (1/2) and IC1031 (2/2) operate as JK.FFs and also operate as a ternary counter.

Part of the $\overline{B\ DSP}$ and the $\overline{A\ DSP}$ signals from the DISPLAY MULTIVIBRATOR and part of the $\overline{X\text{-}Y}$ signal from 57 are supplied to the HORIZONTAL SWITCH as control signals.

When the $\overline{B\ DSP}$ signal is "L", the B SWEEP signal is selected. When the $\overline{A\ DSP}$ signal is "L", the A SWEEP signal is selected. When the $\overline{X\text{-}Y}$ signal is "L", the X-SIG signal is selected.

The selected signal is converted from a single-ended signal to a paraphase signal by the DIFF. AMP (1), and fed out from 63 and 64 via the DIFF. AMP (2).
The UNBLANK CIRCUIT produces an unblanking signal from the $\overline{X\text{-}Y}$, $\overline{B\ DSP}$, $\overline{A\ DSP}$, $\overline{A\ RS}$, A GATE, and $\overline{B\ GATE}$, in accordance with each sweep and each display mode, and feeds it out as an $\overline{UNBLANK}$ signal from 62 .

SHIFT RESISTOR (See Figure 6-9.)

Each logic level of the S CLK-1 signal from 55 and the S DATA signal from 56 is shifted by TR1153 and TR1150, and is supplied to the SHIFT RESISTOR. The SHIFT RESISTOR (2) and the SHIFT RESISTOR (1) are used for the A SWEEP operation and the B SWEEP operation, respectively.

The output signal from the SHIFT RESISTOR controls the CURRENT SOURCE, the VOLTAGE TO CURRENT INVERTER, the TIMING CAPACITOR, and the

HOLDOFF CAPACITOR according to the setting position of the TIME/DIV switch.

$\overline{\text{A RS}}$ and $\overline{\text{B RS}}$ signals (See Figure 6-9.)

TR989 becomes on when the sawtooth wave of the A SWEEP is maximum, and sets the $\overline{\text{A RS}}$ signal from 44 to "L". The same operation is applied to TR989, the B SWEEP signal, and the $\overline{\text{B RS}}$ signal. Refer to the circuit description ◇5◇ for understanding the above mentioned circuit operation.

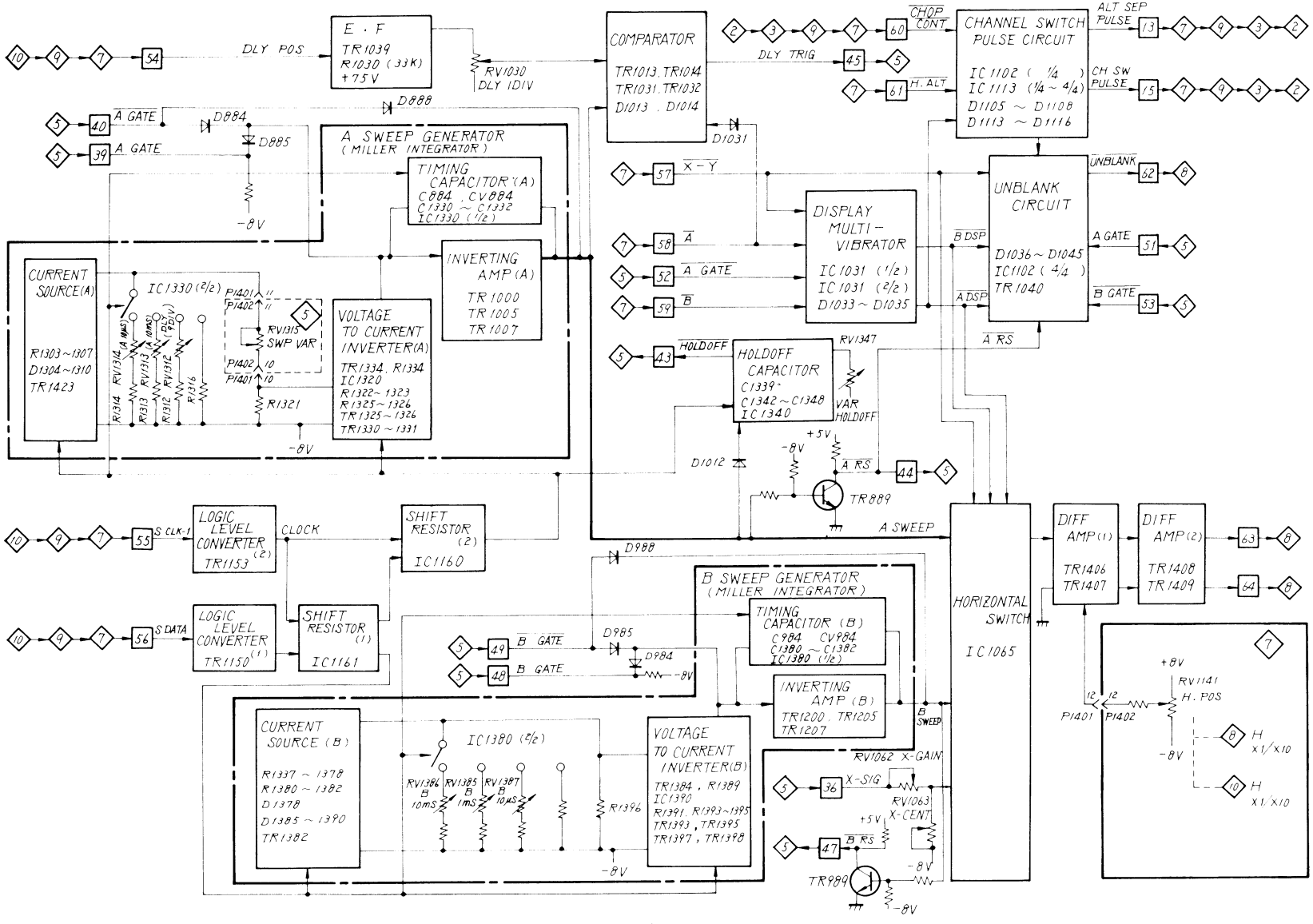

DLY POS
E・F
TR1039
R1030 (33K)
+75V
RV1030
DLY IDIV
COMPARATOR
TR1013, TR1014
TR1031, TR1032
D1013 , D1014
D1031
CHOP CONT
DLY TRIG
H. ALT
CHANNEL SWITCH
PULSE CIRCUIT
IC1102 (1/4)
IC1113 (1/4 ~ 4/4)
D1105 ~ D1108
D1113 ~ D1116
ALT SEP PULSE
CH SW PULSE
A GATE
A SWEEP GENERATOR
(MILLER INTEGRATOR)
TIMING CAPACITOR (A)
C884 , CV884
C1330 ~ C1332
IC1330 (1/2)
INVERTING AMP (A)
TR1000
TR1005
TR1007
CURRENT SOURCE (A)
R1303 ~ 1307
D1304 ~ 1310
TR1423
IC1330 (2/2)
RV1315 SWP VAR
VOLTAGE TO CURRENT INVERTER (A)
TR1334 , R1334
IC1320
R1322 ~ 1323
R1325 ~ 1326
TR1325 ~ 1326
TR1330 ~ 1331
R1321
X - Y
A
B
DISPLAY MULTI - VIBRATOR
IC1031 (1/2)
IC1031 (2/2)
D1033 ~ D1035
UNBLANK CIRCUIT
D1036 ~ D1045
IC1102 (4/4)
TR1040
UNBLANK
B DSP
A DSP
A RS
B GATE
HOLDOFF
HOLDOFF CAPACITOR
C1339
C1342 ~ C1348
IC1340
RV1347 VAR HOLDOFF
D1012
TR889
A SWEEP
HORIZONTAL SWITCH
IC1065
DIFF AMP (1)
TR1406
TR1407
DIFF AMP (2)
TR1408
TR1409
S CLK-1
LOGIC LEVEL CONVERTER (2)
TR1153
CLOCK
SHIFT RESISTOR (2)
IC1160
S DATA
LOGIC LEVEL CONVERTER (1)
TR1150
SHIFT RESISTOR (1)
IC1161
B SWEEP GENERATOR
(MILLER INTEGRATOR)
TIMING CAPACITOR (B)
C984 CV984
C1380 ~ C1382
IC1380 (1/2)
INVERTING AMP (B)
TR1200 , TR1205
TR1207
B SWEEP
CURRENT SOURCE (B)
R1337 ~ 1378
R1380 ~ 1382
D1378
D1385 ~ 1390
TR1382
IC1380 (2/2)
VOLTAGE TO CURRENT INVERTER (B)
TR1384 , R1389
IC1390
R1391 , R1393 ~ 1395
TR1393 , TR1395
TR1397 , TR1398
R1396
RV1062 X-GAIN
X-SIG
RV1063 X-CENT
B RS
TR989
RV1141 H. POS
H x1/x10
H x1 /x10
-8V
+5V
+8V

Fig.6-9

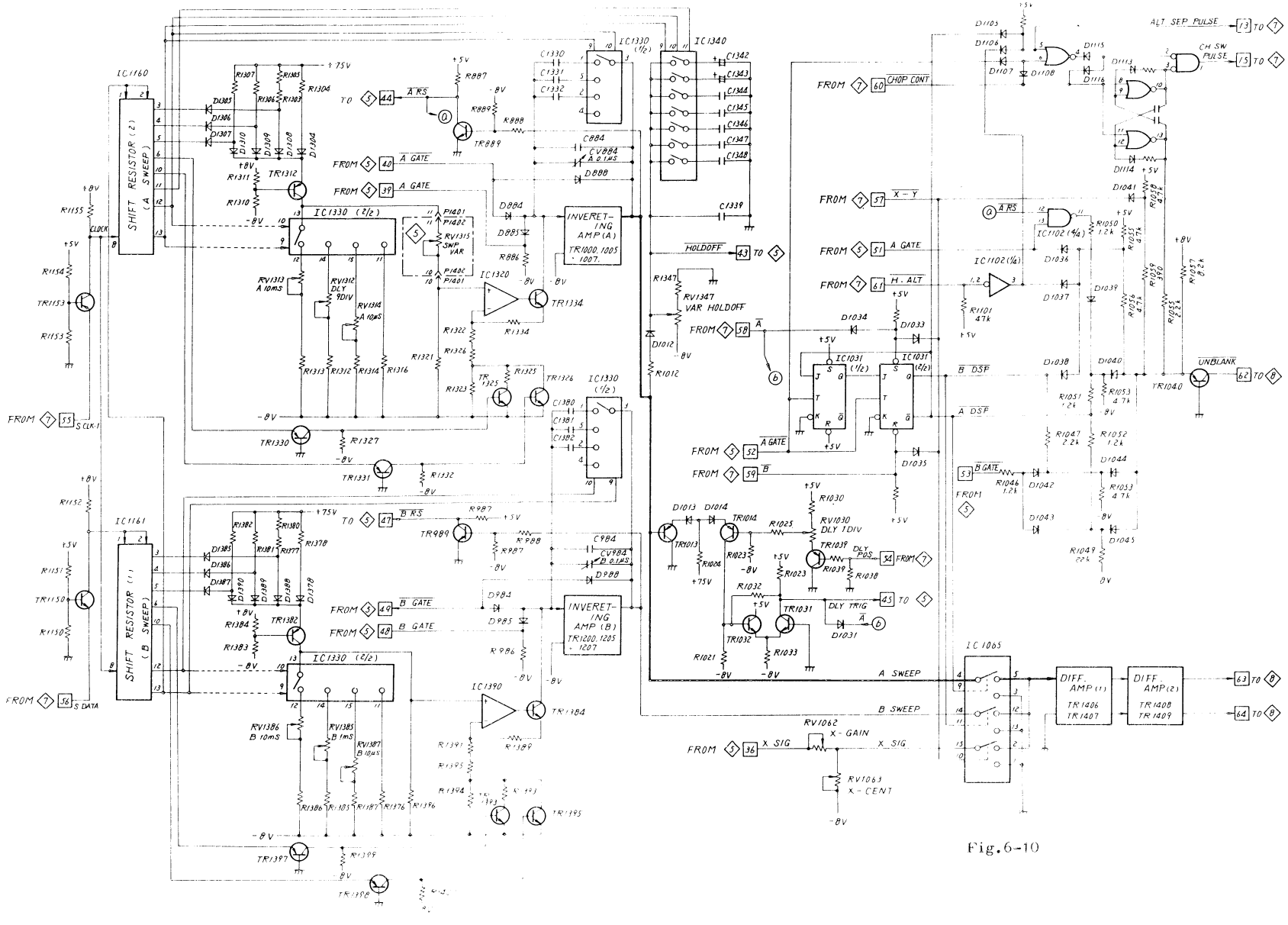

IC1160
SHIFT RESISTOR (2) (A SWEEP)
IC1161
SHIFT RESISTOR (1) (B SWEEP)
IC1330 (2/2)
IC1330 (1/2)
IC1340
INVERETING AMP (A) TR1000, 1005, 1007
INVERETING AMP (B) TR1200, 1205, 1207
IC1320
IC1390
IC1031 (1/2)
IC1031 (2/2)
IC1102 (1/4)
IC1065
DIFF AMP (1) TR1406 TR1407
DIFF AMP (2) TR1408 TR1409
RV1313 A 10mS
RV1312 DLY 9DIV
RV1314 A 10nS
RV1315 SWP VAR
RV1347 VAR HOLDOFF
RV1030 DLY 1DIV
RV1062 X-GAIN
RV1063 X-CENT
RV1386 B 10mS
RV1385 B 1mS
RV1387 B 10nS
A RS
B RS
A GATE
B GATE
HOLDOFF
CHOP CONT
X-Y
H. ALT
A DSP
B DSP
UNBLANK
ALT SEP PULSE
CH SW PULSE
A SWEEP
B SWEEP
X SIG
S CLK
S DATA
CLOCK

Fig.6-10

6.7 ◇8◇ HORIZONTAL OUTPUT AMP, HIGH VOLTAGE, CRT (PEF-712/721) (Including ◇7◇ 3/3, ◇9◇ 1/2)

Figure 6-13 is a detailed block diagram of this circuit.
Figure 6-14 illustrates the information necessary for understanding the operation of this circuit.

Outline

This circuit consists of:
(1) Bias circuit for electrodes of the CRT
(2) Z-AXIS AMP
(3) H. AMP and
(4) Switching circuit

The voltages of +14 V and -14 V are supplied to the DC/DC CONVERTER.
The voltage of +10 kV which is applied to the 3rd anode P3 and the voltage of -1650 V applied to the cathode K are fed out from the DC/DC CONVERTER.
The Z-AXIS AMP amplifies the unblanking signal to the amplitude (+5 V to +60 V) needed for the control of the grid G1 of the CRT.

The DC level of the output signal from the Z-AXIS AMP is shifted to the negative voltage by the CHOPPER circuit and the DC RESTORER circuit with respect to the cathode voltage (-1650 V), and the voltage of -1670 V to -1720 V is applied to G1. The electron beams are thus controlled. The voltage (-1300 V to -1450 V) applied to the focus electrode P1 is produced by utilizing the cathode voltage. Further, the voltages applied to G2, the post deflection shield (PDS), and the 2nd anode P2 are produced from +75 V by using resistors and Zener diodes.
The electron beams flow to the CRT only in the unblanking period (sweep period) by adjusting the output voltage of the Z-AXIS AMP and the intensity of the CRT increases so that the unblanking voltage turns to be positive. In the other periods the voltages are blanked.

The AUTO FOCUS circuit feeds out the correction signal so that optimum focus is obtained automatically for a change in intensity.
The TRACE ROTATION circuit consisting of TR1270 and TR1271 functions to rotate the entire waveform displayed on the CRT.
This circuit is needed for the correction of:

(i) error caused during the production of CRT and
(ii) effect of earth magnetism

The direction of the rotation can be changed by changing the direction of the current flowing to the rotation coil, and the angle of rotation can be changed by adjusting the amount of the current.

DC/DC CONVERTER

The OSC circuit consisting of TR1560 and T1560 is a Hartley oscillation circuit of the emitter-grounded type. When the voltages of +14 V and -14 V are supplied to this circuit, the self-oscillation is executed and the sine wave outputs of 300 Vp-p, 3.4 kVp-p and 5 kVp-p are available.

The 300 Vp-p output is fed to the CHOPPER circuit and serves for producing the G1 voltage. The 3.4 kVp-p output is fed to the HALF-WAVE RECTIFIER circuit to produce the cathode voltage (-1650 V).

This cathode voltage is also fed to the DC RESTORER circuit and serves for producing the G1 voltage. The 5 kVp-p output is fed to the VOLTAGE MULTIPLIER circuit to produce the voltage of +10 kV for the 3rd anode P3.

The ERROR DETECTOR AMP circuit functions to maintain the output voltage of the HALF WAVE RECTIFIER circuit at the constant voltage (-1650 V) and the reference voltage is +75 V.
The change in the output voltage of the HALF WAVE RECTIFIER circuit is detected by the ERROR DETECTOR AMP circuit via feedback resistor R1561 and the bias current flowing through the OSC circuit is controlled.
Thus the amplitude of the OSC output becomes constant and the output of the HALF WAVE RECTIFIER circuit is also constant.

DC RESTORER and CHOPPER

These circuits are provided to produce the voltage applied to G1 of the CRT.
There are two conditions necessary for G1 bias:

(1) The G1 voltage is lower than the cathode voltage, and can be adjusted in accordance with the cutoff voltage of the CRT, and
(2) The output voltage of the Z-AXIS AMP circuit which is fed to G1 should include the DC component.

The above conditions (1) and (2) can not be realized merely by DC-coupling the output of the Z-AXIS AMP circuit to G1 or by AC-coupling the output to G1 by a capacitor.

This is because the potential difference between the output voltage of the Z-AXIS AMP circuit and the G1 voltage is too large and causes troubles like

(i) problem of power

(ii) difficulty of the transmission of change at high speed

Further, in case of a capacitor-coupling, the brightness changes due to sag

(A) in the slow sweep mode, and

(B) when the same waveform is observed at different time ranges.

Consequently, the method that the DC component is restored after the voltage has been changed to AC is adopted. This is the reason why the CHOPPER circuit and the DC RESTORER circuit are provided.

Z-AXIS AMP

The unblanking signal from 62 and the unblanking signal for characters from the CHR UNBLANK circuit are fed to the Z-AXIS AMP SWITCH (1) circuit and the Z-AXIS AMP SWITCH (2) circuit, respectively. In case of the waveform display, the output signal of the Z-AXIS AMP SWITCH (1) is fed to the Z-AXIS AMP via the LIMITTER circuit. In case of the character display, the output signal of the Z-AXIS AMP SWITCH (2) is fed to the Z-AXIS AMP via the LIMITTER circuit. The Z-AXIS AMP LOGIC circuit controls the selection of the two output signals. Since the both switch circuits are base-grounded, they serve as switching circuits as well as buffer circuits.

In other words,

(1) The input voltage (emitter voltage) does not change when the input current (unblanking signal) changes, and

(2) The emitter voltage does not change due to the operation of the LIMITTER circuit when the collector voltage changes.

The blanking level side of the output is not saturated, since the LIMITTER circuit controls the input signal to the Z-AXIS AMP. D1511 and TR1511 are provided for protection. The DC component and the low frequency component of the output signal of the Z-AXIS AMP circuit is applied to G1 of the CRT via C1567. In the meantime, the AC component is applied to G1 via C1568.

Z-AXIS AMP SWITCH LOGIC (See Figures 6-13 and 6-14.)

(1) Waveform display

The $\overline{\text{CHR-EN}}$ signal from 66 is "H" and the CHR-Z signal from 67 is "L". As a result, D1520, D1521 and TR1521 become off and TR1501 becomes on. Further, TR1502 becomes on, since TR1526 and D1502 becomes off, since TR1526 and D1502 become on. Accordingly, the Z-AXIS AMP SWITCH (1) circuit becomes on and the Z-AXIS AMP SWITCH (2) circuit becomes off. The CHR INTEN signal does not give any effect, since CHR UNBLANK circuit TR1534 becomes off.

(2) Character display

The $\overline{\text{CHR-EN}}$ signal is "L" and the CHR-Z signal is "H". Consequently, the Z-AXIS AMP SWITCH (1) becomes off and the Z-AXIS AMP SWITCH (2) becomes on. Since CHR UNBLANK circuit TR1534 becomes on, the CHR INTEN signal is affected, though the INTEN signal has no effect.

H AMP (See Figures 6-13 and 6-14.)

The CURRENT SWITCH circuit and the H AMP SWITCH circuit select the waveform display and the character display. (The two switches improve separation.)

One of the three transistors which constitute the CURRENT SWITCH circuit becomes on and either of the X1 AMP circuit, the X10 AMP circuit and the CHR AMP is selected.

When TR1448, D1442 and D1443 are off and D1440, TR1442 and TR1443 are on, the H AMP SWITCH circuit is on. If the on and off of these components are reversed, the H AMP SWITCH circuit is off.

A constant current H-CS flows to the CURRENT SWITCH circuit by the operation of the CURRENT SOURCE circuit. When the TRACE FIND switch is pressed, SWITCH TR circuit TR1493 becomes on and the current flows to the CURRENT SWITCH circuit in the opposite direction with the H-CS current. Thus, the maximum amplitude of the output of the X1 AMP circuit, the X10 AMP circuit or the CHR AMP circuit is controlled. As for the TRACE FIND circuit, refer to the description of the circuit ◇4◇.

(1) Waveform display

① H X1/X10 : X1

Since TR1480 is on and TR1481 and TR1484 are off, only the X1 AMP circuit becomes on. (The X10 AMP circuit and the CHR AMP circuit are off.) The H AMP SWITCH circuit is on, too.

② H X1/X10 : X10

Since TR1481 is on and TR1480 and TR1484 are off, only the X10 AMP circuit is on. The H AMP SWITCH circuit is on, too.

(2) Character display

Since TR1484 is on and TR1480 and TR1481 are off, only the CHR AMP circuit is on. The H AMP SWITCH circuit is off.

The CHR-X signal from 68 is an analog signal, which includes the information on the X direction of characters. The CHR-X signal is converted from a single-ended signal to a paraphase signal in the CHR AMP circuit.

Each output of the X1 AMP circuit, the X10 AMP circuit and the CHR AMP circuit is applied to the horizontal deflection plate after amplified to the voltage needed for the horizontal deflection.

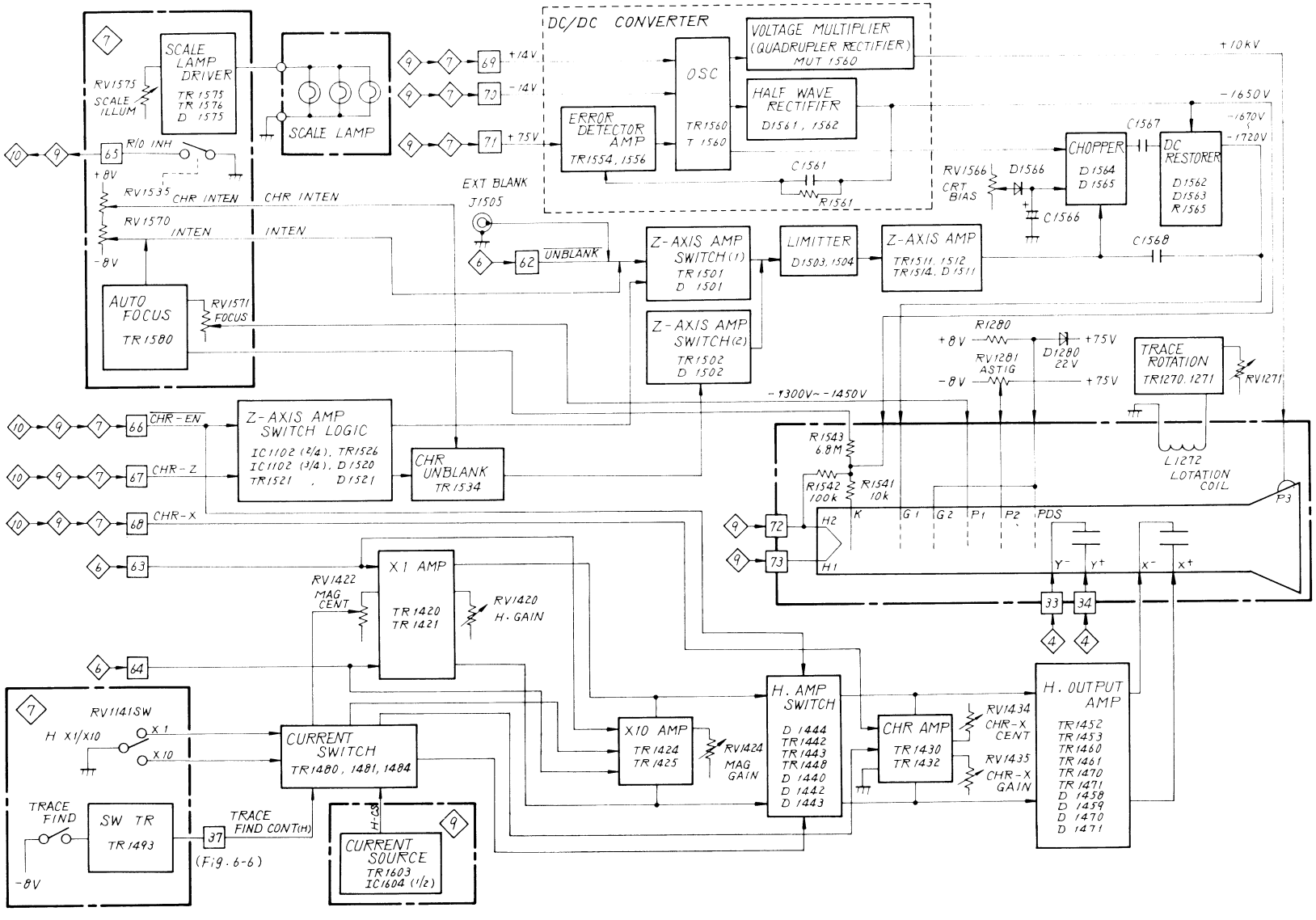

DC/DC CONVERTER
VOLTAGE MULTIPLIER (QUADRUPLER RECTIFIER) MUT 1560
OSC TR1560 T 1560
HALF WAVE RECTIFIER D1561, 1562
ERROR DETECTOR AMP TR1554, 1556
+10KV
-1650V
-1670V ~ -1720V
SCALE LAMP DRIVER TR 1575 TR 1576 D 1575
RV1575 SCALE ILLUM
SCALE LAMP
+14V
-14V
+75V
R/O INH
+8V
-8V
RV1535 CHR INTEN
RV1570 INTEN
CHR INTEN
INTEN
EXT BLANK J1505
UNBLANK
AUTO FOCUS TR1580
RV1571 FOCUS
Z-AXIS AMP SWITCH(1) TR1501 D 1501
Z-AXIS AMP SWITCH(2) TR1502 D 1502
LIMITTER D1503, 1504
Z-AXIS AMP TR1511, 1512 TR1514, D1511
CHOPPER D1564 D1565
DC RESTORER D1562 D1563 R1565
C1567
C1568
C1566
C1561
R1561
RV1566 CRT BIAS
D1566
R1280
D1280 22V
RV1281 ASTIG
TRACE ROTATION TR1270. 1271
RV1271
L1272 LOTATION COIL
-1300V~-1450V
CHR-EN
CHR-Z
CHR-X
Z-AXIS AMP SWITCH LOGIC IC1102 (2/4), TR1526 IC1102 (3/4), D1520 TR1521 , D1521
CHR UNBLANK TR1534
R1543 6.8M
R1542 100k
R1541 10k
H2
H1
K
G1
G2
P1
P2
PDS
P3
Y-
Y+
X-
X+
X1 AMP TR1420 TR1421
RV1422 MAG CENT
RV1420 H. GAIN
X10 AMP TR1424 TR1425
RV1424 MAG GAIN
H. AMP SWITCH D1444 TR1442 TR1443 TR1448 D1440 D1442 D1443
CHR AMP TR1430 TR1432
RV1434 CHR-X CENT
RV1435 CHR-X GAIN
H. OUTPUT AMP TR1452 TR1453 TR1460 TR1461 TR1470 TR1471 D1458 D1459 D1470 D1471
RV1141SW
H X1/X10
X1
X10
CURRENT SWITCH TR1480, 1481, 1484
TRACE FIND
SW TR TR1493
TRACE FIND CONT(H)
(Fig. 6-6)
CURRENT SOURCE TR1603 IC1604 (1/2)
-8V

Fig.6-13

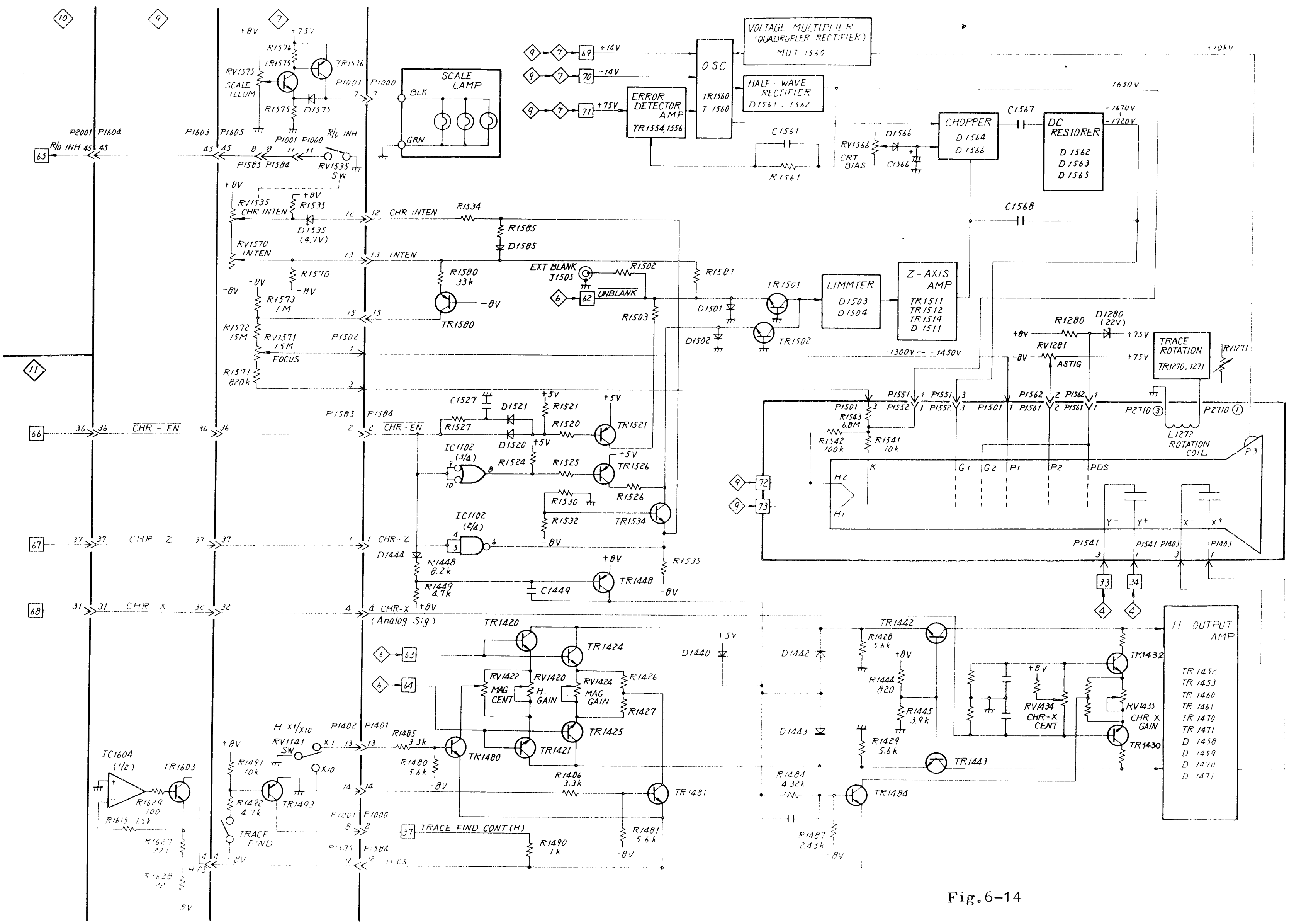

VOLTAGE MULTIPLIER (QUADRUPLER RECTIFIER) MUT 1560
OSC
HALF-WAVE RECTIFIER D1561, 1562
ERROR DETECTOR AMP TR1554, 1556
CHOPPER D1564 D1566
DC RESTORER D1562 D1563 D1565
SCALE LAMP
LIMMTER D1503 D1504
Z-AXIS AMP TR1511 TR1512 TR1514 D1511
TRACE ROTATION TR1270, 1271
L1272 ROTATION COIL
EXT BLANK J1505
UNBLANK
CHR INTEN
INTEN
FOCUS
ASTIG
CRT BIAS
SCALE ILLUM
CHR-EN
CHR-Z
CHR-X (Analog Sig)
MAG CENT
H. GAIN
MAG GAIN
CHR-X CENT
CHR-X GAIN
H OUTPUT AMP
TRACE FIND
TRACE FIND CONT (H)
H x1/x10 SW

Fig.6-14

6.8 ◇9◇ POWER SUPPLIES & OTHERS 2/2 (PEF-729)

Figure 6-15 is a detailed block diagram of POWER SUPPLIES & OTHERS circuit. As for the horizontal current source circuit consisting of TR1603 and IC1604 (1/2), see Figures 6-13 and 6-14 of ◇8◇ .

This power supply circuit produces the following voltages.

(1) AC : 6.3 V .... Heater voltage of CRT

(2) Unregulated voltage : +125 V, +14 V, -14 V

Note : The voltage of +125 V is obtained by adding the voltage of +50 V obtained by the half-wave rectifier consisting of D1601 and C1601 to the voltage of +75 V.

(3) Regulated voltage : +5 V, +75 V, +8 V, -8 V, -15 V

The voltage of -8 V is produced at the reference of +8 V. The voltages of +5 V and +75 V are produced at the reference of -8 V.

Consequently, if the voltage of +8 V is not correct, all the voltages are deviated. If the voltage of -8 V drops, the voltage of +8 V will be around the +8 V.

D1615 is provided to maintain the COM voltage of +5 V REG (IC1605) below 0.7 V. D1616, D1602, D1610 and D1614 are diodes which protect the power supplies from shorting of a load.

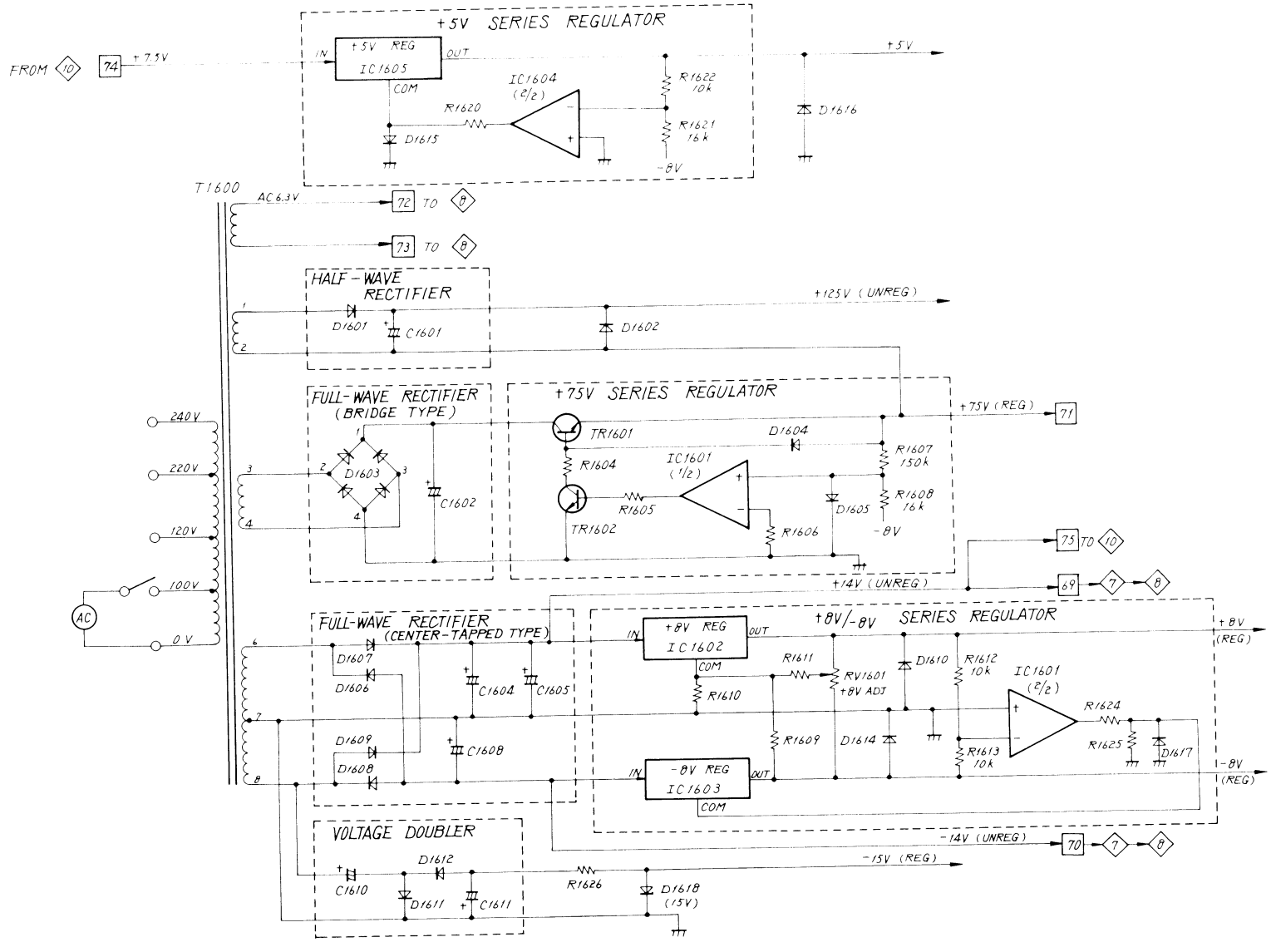

+5V SERIES REGULATOR
FROM 10
74
+7.5V
+5V REG IC1605
IN
OUT
COM
IC1604 (2/2)
R1620
D1615
R1622 10k
R1621 16k
-8V
+5V
D1616
T1600
AC 6.3V
72 TO 8
73 TO 8
HALF-WAVE RECTIFIER
D1601
C1601
+125V (UNREG)
D1602
FULL-WAVE RECTIFIER (BRIDGE TYPE)
D1603
C1602
+75V SERIES REGULATOR
TR1601
TR1602
D1604
R1604
R1605
IC1601 (1/2)
R1606
D1605
R1607 150k
R1608 16k
-8V
+75V (REG)
71
240V
220V
120V
100V
0V
AC
75 TO 10
69
7
8
+14V (UNREG)
FULL-WAVE RECTIFIER (CENTER-TAPPED TYPE)
D1607
D1606
D1609
D1608
C1604
C1605
C1608
+8V/-8V SERIES REGULATOR
+8V REG IC1602
-8V REG IC1603
R1610
R1611
RV1601 +8V ADJ
D1610
R1612 10k
R1613 10k
R1609
D1614
IC1601 (2/2)
R1624
R1625
D1617
+8V (REG)
-8V (REG)
VOLTAGE DOUBLER
C1610
D1612
D1611
C1611
R1626
D1618 (15V)
-15V (REG)
-14V (UNREG)
70

Fig.6-15

6.9 ⟨10⟩ READOUT CONTROL CIRCUIT (1) (PEF-770 1/2)

Figure 6-15 is a detailed block diagram of the READOUT CONTROL CIRCUIT (1).

The information on each circuit state is supplied to pins AN0 through AN7 of the microcomputer as analog signals. To pins PA0 through PA6, the information on the setting condition of the TIME/DIV, the DLY, and the R/O INH switches, and the $\overline{\text{READY}}$ signal are supplied as digital signals.

When the power of the oscilloscope is turned on, C2051 is charged in the route of the voltage of +5 V ⟶ R2070 ⟶ C2051, and the electric potential at point ⓐ increases with a time constant of R2070 x C2051.

Since the potential at point ⓐ is "L" immediately after the power is turned on, the output signal from the WAVEFORM SHAPER is "L" so that the microcomputer is reset. When the potential at point ⓐ becomes "H", the reset state is released.

D2053 is a diode for speeding up a discharge of C2051.

The CLK OSC is a 12 MHz oscillator to generate a clock pulse. LATCH IC2402 latches address information from pins PD0 through PD7 of the microcomputer at the leading edge of the pulse fed to pin CLK.

Since the signal at pin $\overline{\text{OC}}$ of IC2402 is always "L", the latched address is directly supplied to ROM IC IC2401. The ROM IC has a program and supplies the data corresponding to the address from pins D0 through D7 to pins PD0 through PD7 of the microcomputer when the signal at pin $\overline{\text{RD}}$ of the microcomputer is "L".

The data for specifying the character pattern stored in ROM IC in the circuit ⟨11⟩ is supplied from pins PB0 through PB6 of the microcomputer. The information on the cursor display is supplied from pin PB7.

The S DATA (serial data) is supplied from pin PC0 to the SHIFT REGISTER (1) and (2) for the A sweep and B sweep operations in circuit ⟨6⟩.

The S DATA decides the slant of the sawtooth waves of both A and B sweeps. Part of the S DATA is also supplied to circuit ⟨11⟩.

From pin PC2 of the microcomputer, the S CLK (serial clock) is supplied to

the GATE 1 and the GATE 2. The GATE 1 and the GATE 2 are opened and closed by the control pulses GATE PULSE 1 and GATE PULSE 2, respectively. The GATE 1 and the GATE 2 supply the S CLK-1 and the S CLK-2 signals, respectively.

The S CLK-1 signal decides the timing for latching data by means of the SHIFT REGISTER (1) and (2).

The pulse which changes its duty in accordance with digital values in the microcomputer is supplied from pin PC7 of the microcomputer.

This pulse is supplied to C MOS IC IC2164 (4/4), and the constant "H" level and "L" level are obtained.

Then, the pulse is supplied to the FILTER circuit consisting of two integral circuits and the BUFFER circuit and the DC voltage proportional to the pulse duty is produced, and supplied from 54 as a DLY POS signal.

D2114 is a diode for compensating for a temperature drift of V_{BE} in TR2114.

The information on the DLY/V/T switch and the △/REF switch is supplied to pins PC1 and PC3, respectively. These signals control the cursor display.

The voltage of +14 V (UNREG) from 75 is supplied to the SWITCHING REGULATOR consisting of the SW TR and the CONTROLLER to produce the voltage of 7.5 V and to supply it from 74 . Part of the voltage of 7.5 V is supplied to VOLTAGE REGULATOR IC2002 to produce the voltage of +5 V (d) which is used as a power supply for the digital circuits such as the microcomputer.

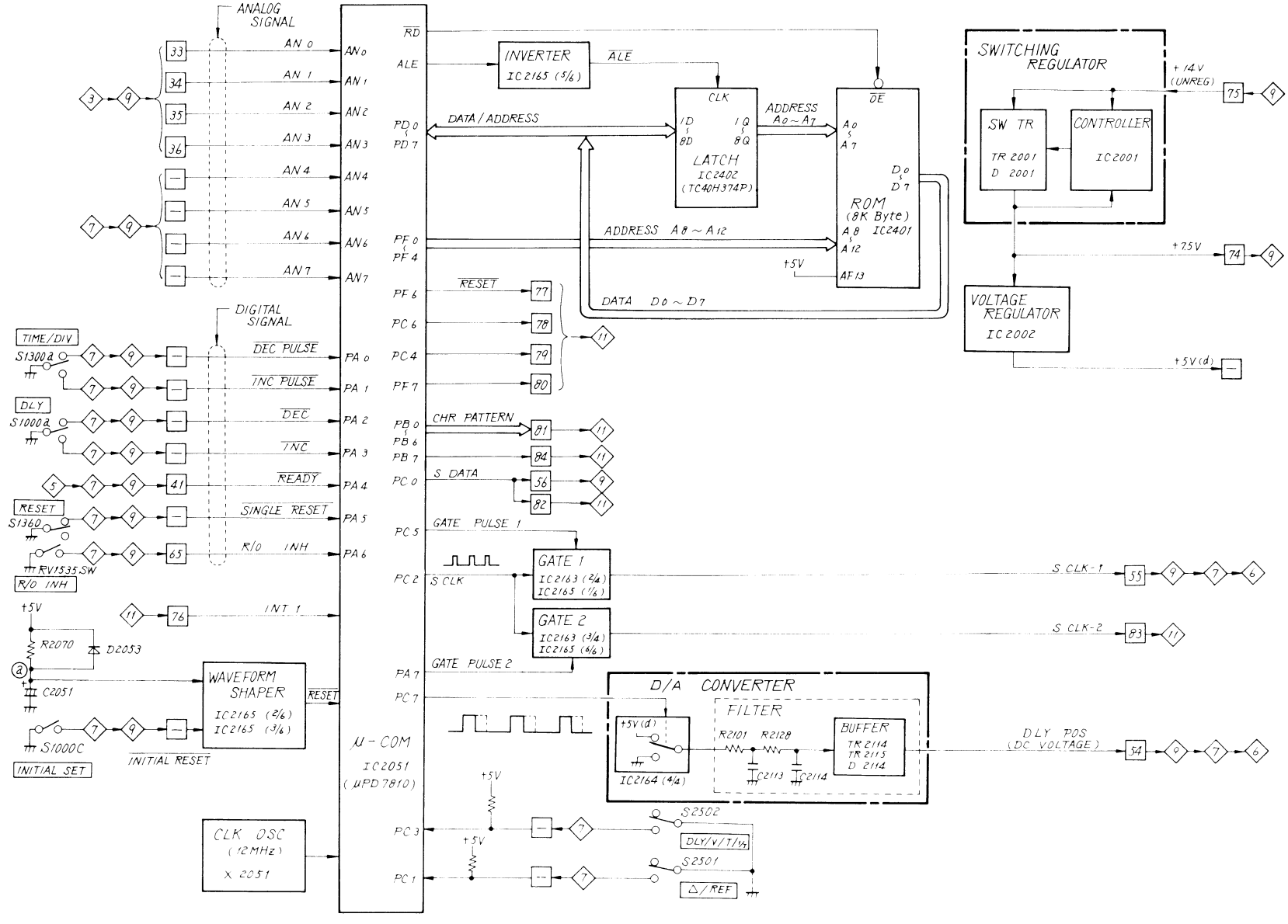

ANALOG SIGNAL
AN 0
AN 1
AN 2
AN 3
AN 4
AN 5
AN 6
AN 7
DIGITAL SIGNAL
TIME/DIV
S1300a
DLY
S1000a
RESET
S1360
RV1535 SW
R/O INH
DEC PULSE
INC PULSE
DEC
INC
READY
SINGLE RESET
R/O INH
INT 1
+5V
R2070
D2053
C2051
S1000C
INITIAL SET
INITIAL RESET
WAVEFORM SHAPER
IC2165 (2/6)
IC2165 (3/6)
RESET
CLK OSC
(12MHz)
X 2051
μ-COM
IC2051
(μPD7810)
RD
ALE
PD 0 ~ PD 7
PF 0 ~ PF 4
PF 6
PC 6
PC 4
PF 7
PB 0 ~ PB 6
PB 7
PC 0
PC 5
PC 2
PA 7
PC 7
PC 3
PC 1
INVERTER
IC2165 (5/6)
DATA / ADDRESS
CLK
LATCH
IC2402
(TC40H374P)
ADDRESS A0 ~ A7
OE
ROM
(8K Byte)
IC2401
ADDRESS A8 ~ A12
DATA D0 ~ D7
RESET
CHR PATTERN
S DATA
GATE PULSE 1
S CLK
GATE 1
IC2163 (2/4)
IC2165 (1/6)
GATE 2
IC2163 (3/4)
IC2165 (6/6)
GATE PULSE 2
D/A CONVERTER
FILTER
IC2164 (4/4)
R2101
R2128
C2113
C2114
BUFFER
TR 2114
TR 2115
D 2114
DLY POS
(DC VOLTAGE)
S CLK-1
S CLK-2
S2502
DLY/V/T/1/4
S2501
Δ/REF
SWITCHING REGULATOR
SW TR
TR 2001
D 2001
CONTROLLER
IC2001
+14V
(UNREG)
+7.5V
VOLTAGE REGULATOR
IC2002
+5V(d)

Fig.6-16

6-10 ◇11◇ READOUT CONTROL CIRCUIT (2) (PEF-770 2/2)

Figure 6-17 is a detailed block diagram of this circuit.

ROM IC2259 stores the patterns of characters. Since terminal A12 is grounded, the IC has a capacity of 4 kbytes.

The CHR PATTERN signal of 7 bits fed to this IC from the microcomputer via [81] selects the character to be displayed.

The signals, 5 bits in total, from terminals QA1 through QD1 and QA2 of the BINARY COUNTER IC2255 control the dots composing a character.

When the signal from [78] is "H", the BINARY COUNTER is reset and a zero address is fed out from the output terminal. During the reset period, dots are not displayed and the address of the character to be displayed next is fed to ROM IC2259 via [81] of the microcomputer.

At the same time, the position data (S DATA) which assigns a character position on the screen is fed to SHIFT REGISTER IC2256/IC2257 from the microcomputer via [82] . The clock pulse of the SHIFT REGISTER is the S CLK-2 pulse supplied from [83] .

The 4-bit signal fed from D0 through D3 of ROM IC2259 is a data of the X direction component of a character and routed to the D/A CONVERTER 1 via IC2166. The H and L with constant level are ensured by C-MOS IC IC2166.

The 3-bit signal fed from D4 through D6 of IC2259 is a data of the Y direction component of a character and fed to the D/A CONVERTER 2.

The 2-bit signal composed by the signals from QD1 and QA2 of the BINARY COUNTER and the signal fed from [84] is fed to the D/A CONVERTER 1. This 2-bit signal is used in case of feeding out the pattern for a cursor continuously.

The signal, 6 bits in total, fed from the D/A CONVERTER 1 shows the X direction of a character, while the 3-bit signal supplied to the D/A CONVERTER 2 shows the Y direction of a character. The signal, 9 bits in total, fed to the two converters composes a data of a character.

The 6-bit signal fed from QC through QH of IC2256 is a data for the X direction component of a character display position and fed to the D/A CONVERTER 3.

The 2-bit signal fed from QA and QB of IC2256 and the 8-bit signal fed from QA through QH of IC2257 are the data for the Y direction component of a character display position.

The signal of 10 bits in total is fed to the D/A CONVERTER 4. The signals, 16 bits in total, fed to the D/A CONVERTER 3 and the D/A CONVERTER 4 are the data of the display position.
The outputs from the D/A CONVERTER 1 and the D/A CONVERTER 3 are added at R2272 and fed to terminal X of ANALOG SWITCH IC2235. The outputs of the D/A CONVERTER 2 and the D/A CONVERTER 4 are also added at R2266 and fed to terminal Y of the ANALOG SWITCH.

When the ANALOG SWITCH is set to Xo and Yo, characters or horizontal cursors are displayed. In this case the output of the D/A CONVERTER 3 is fed out as a CHR-X signal from 68 via the BUFFER (X), while the output of the D/A CONVERTER 4 is fed out as a $\overline{\text{CHR-Y}}$ signal from 11 via the BUFFER (Y). When the switch is set to X_1 and Y_1, vertical cursors are displayed. In this case, the output of the D/A CONVERTER 3 is fed out as a $\overline{\text{CHR-Y}}$ signal from 11 via the BUFFER (Y), while the output of the D/A CONVERTER 4 is fed out as a CHR-X signal from 68 via the BUFFER (X). The signal from 80 is the control signal of the ANALOG SWITCH. When this control signal is "L", the ANALOG SWITCH is set to Xo and Yo. When it is "H", the switch is set to X_1 and Y_1.

D2252 and D2253 in the buffer circuits are for temperature compensation.

Dots are produced at the fall position of the signal fed to the CHR LOGIC from the microcomputer via 79 . The CHR LOGIC consists of monostable multivibrator IC2201, gate IC2164 (1/4, 3/4) and an integral circuit (C2233, R2233) delivers $\overline{\text{CHR-EN}}$ and CHR-Z signals. The CHR LOGIC is controlled by the signals ① and ② .

When either of the two signals is "H", an output signal is not delivered.
Part of the CHR-Z signal from the CHR LOGIC is fed, as a clock signal, to terminal A1 of BINARY COUNTER IC2255. This clock signal advances the counter one bit at a time.

When the display of a character is completed, the end flag with an "H" level is fed from D7 of ROM IC2259. Namely, when the INT 1 signal fed from 76 changes from "L" to "H", the display of a character finishes. When this INT 1 signal is fed to the microcomputer, the signal fed to 78 from the microcomputer changes from "L" to "H". Thus, the BINARY COUNTER returns to the reset state described at the beginning.

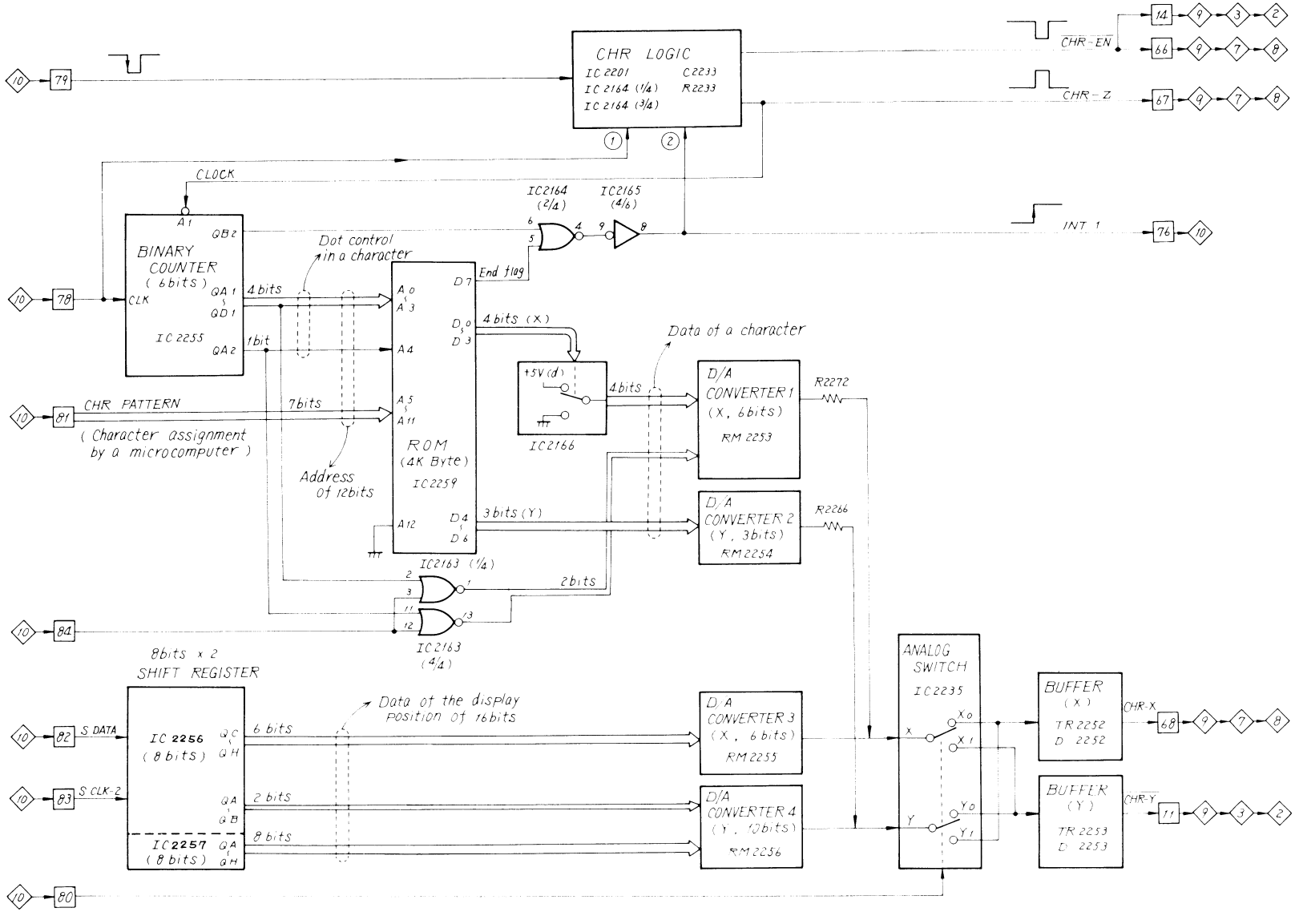
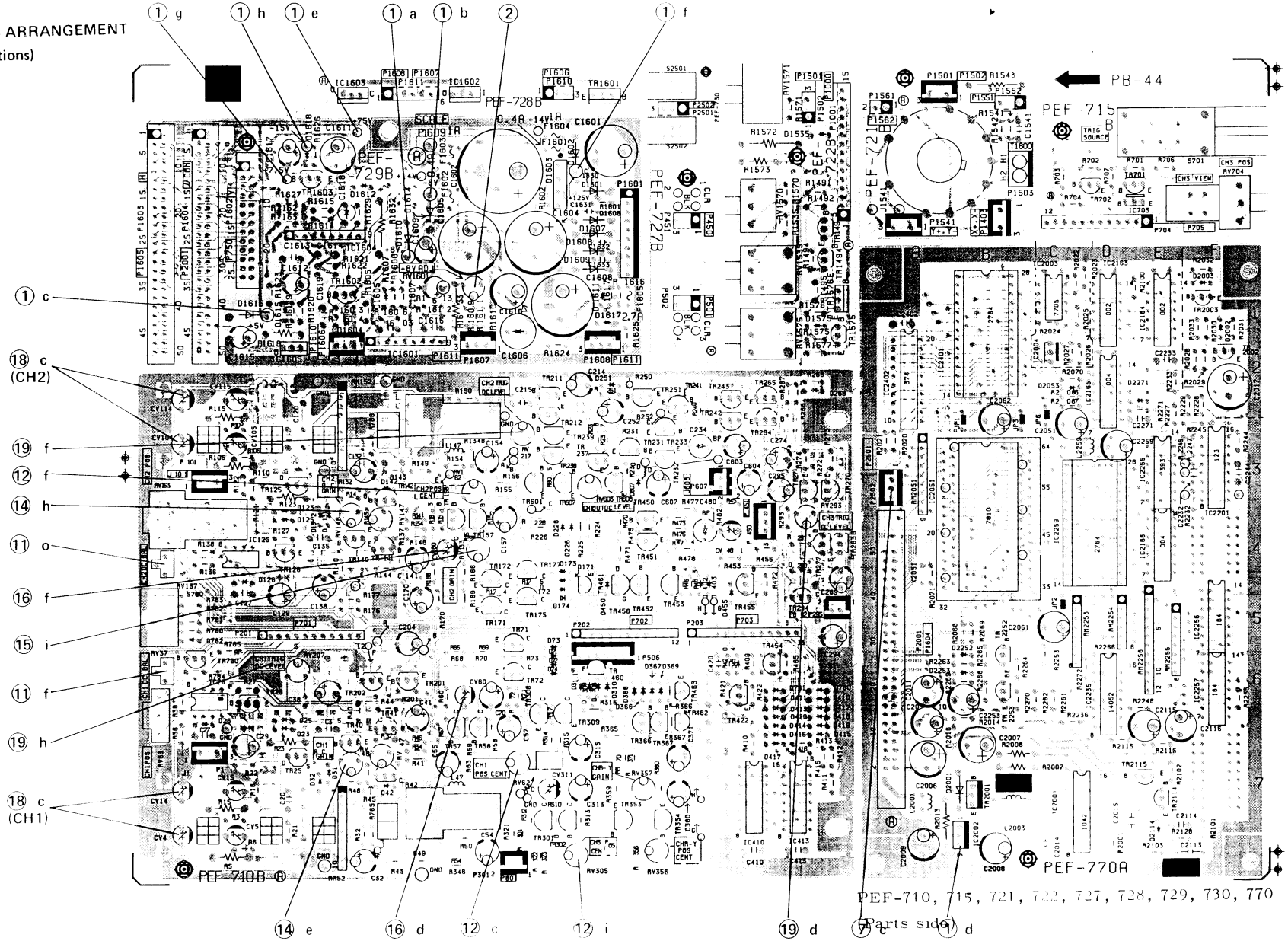
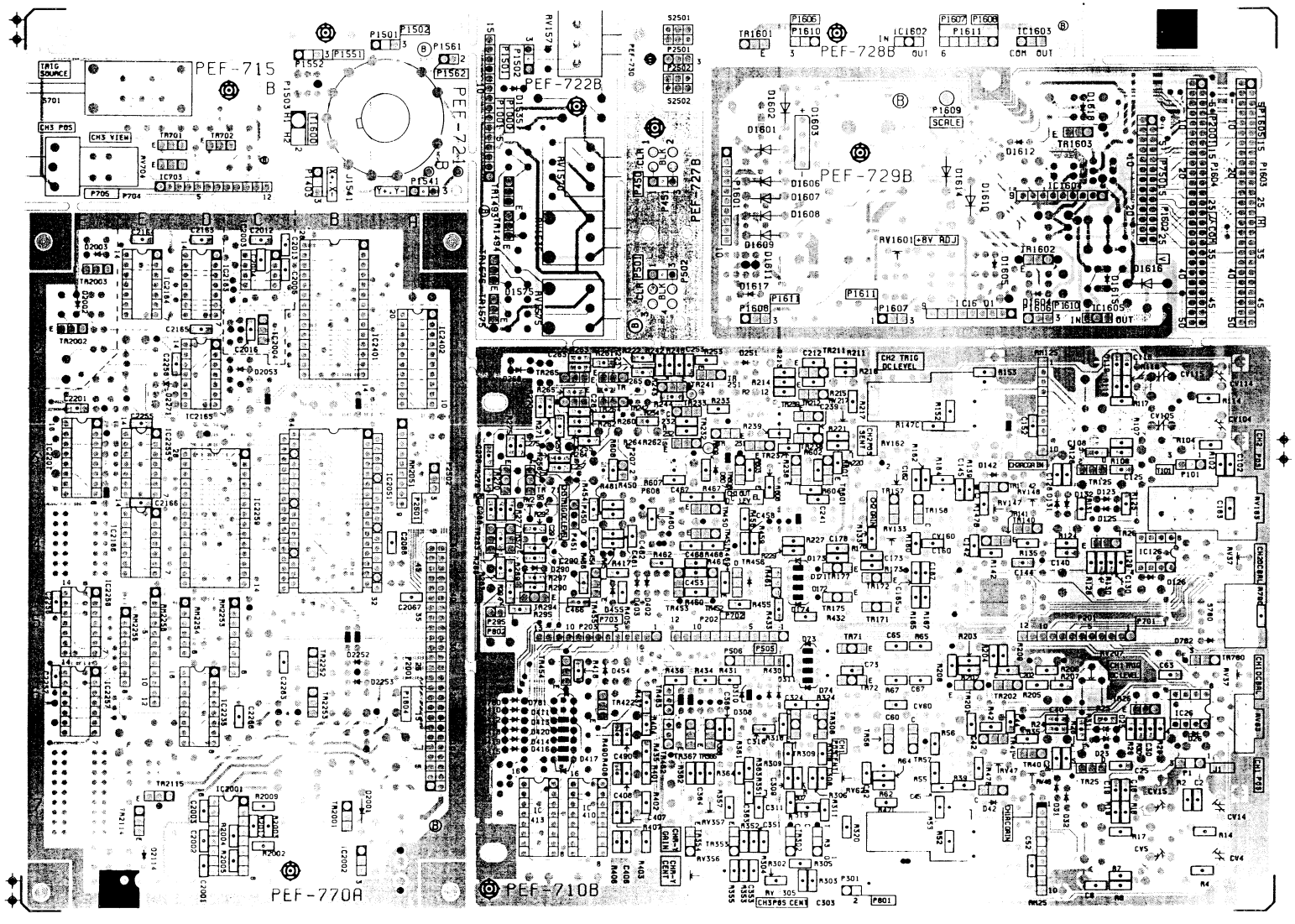

CHR LOGIC
IC 2201
IC 2164 (1/4)
IC 2164 (3/4)
C2233
R2233
CHR-EN
CHR-Z
INT 1
CLOCK
IC2164 (2/4)
IC2165 (4/6)
BINARY COUNTER (6 bits)
IC 2255
Dot control in a character
End flag
4 bits
1 bit
4 bits (X)
Data of a character
+5V (d)
IC2166
D/A CONVERTER 1 (X, 6 bits) RM 2253
R2272
CHR PATTERN
7 bits
(Character assignment by a microcomputer)
Address of 12 bits
ROM (4K Byte) IC2259
3 bits (Y)
D/A CONVERTER 2 (Y, 3 bits) RM 2254
R2266
IC2163 (1/4)
2 bits
IC2163 (4/4)
8 bits x 2 SHIFT REGISTER
S DATA
S CLK-2
IC 2256 (8 bits)
IC 2257 (8 bits)
6 bits
2 bits
8 bits
Data of the display position of 16 bits
D/A CONVERTER 3 (X, 6 bits) RM 2255
D/A CONVERTER 4 (Y, 10 bits) RM 2256
ANALOG SWITCH IC 2235
BUFFER (X) TR 2252 D 2252
BUFFER (Y) TR 2253 D 2253
CHR-X
CHR-Y

Fig.6-17

LECTRICAL PARTS ARRANGEMENT
(With adjustment locations)

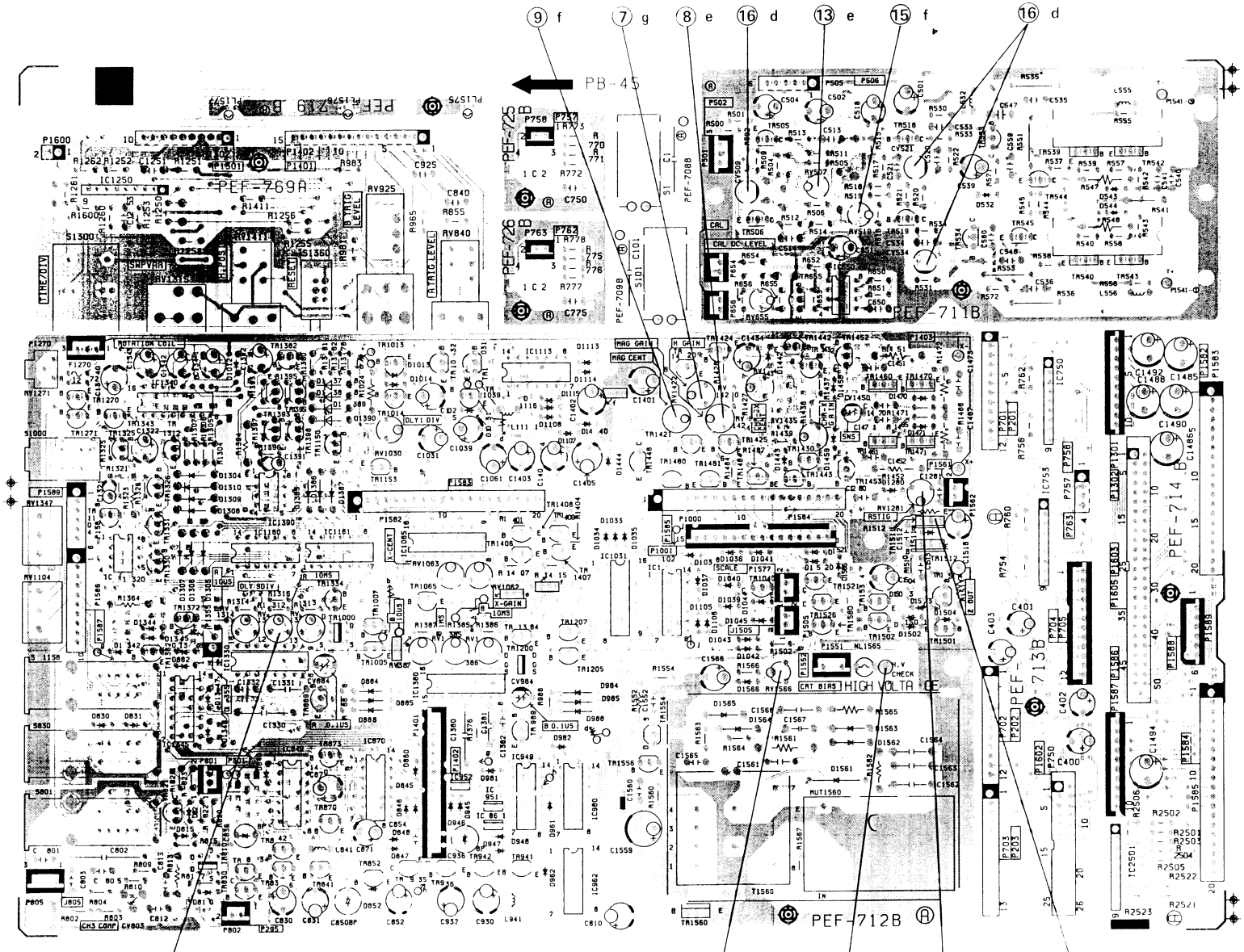


PEF-710, 715, 721, 722, 727, 728, 729, 730, 770
(Parts side)

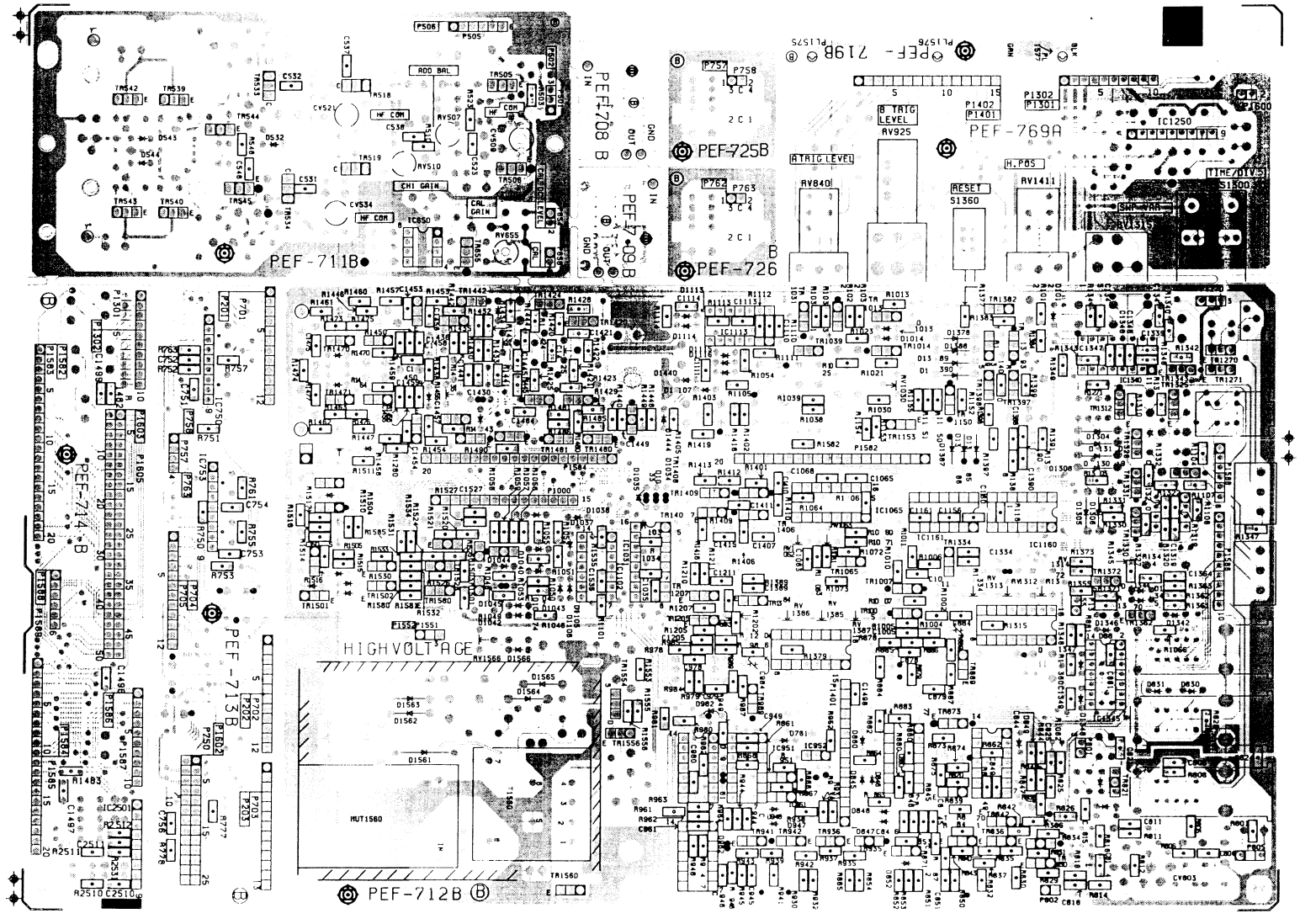


PEF-710, 715, 721, 722, 727, 728, 729, 730, 770

(Soldering side)



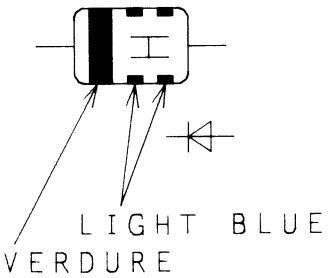
PEF-708, 709, 711, 712, 713, 714, 719, 725, 726, 769
(Parts side)



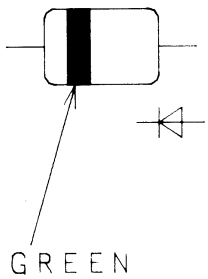
PEF-708, 709, 711, 712, 713, 714, 719, 725, 726, 769
(Soldering side)

8. ELECTRICAL PARTS LEAD CONFIGURATIONS

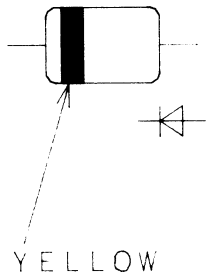
1SS83



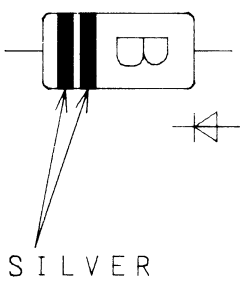
1SS110



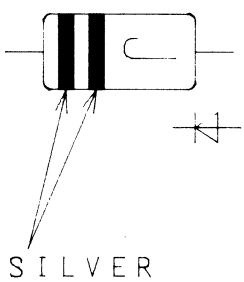
1SS133



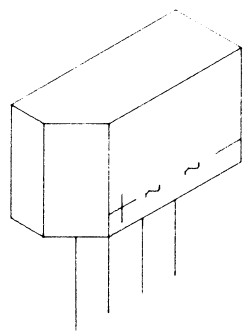
S5566B



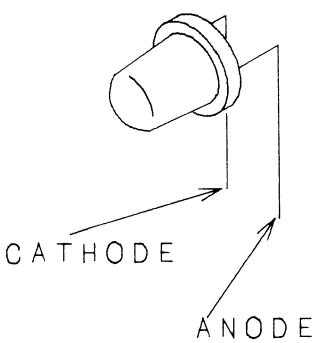
S5566J



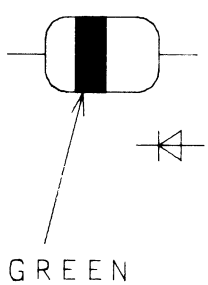
DBA10C



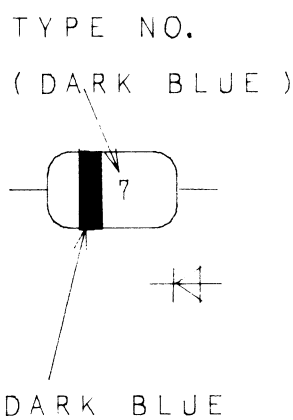
LN31GPHL



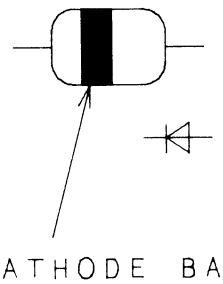
MA161



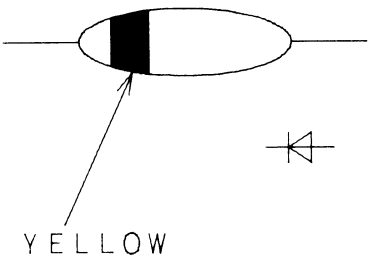
MTZ-SERIES



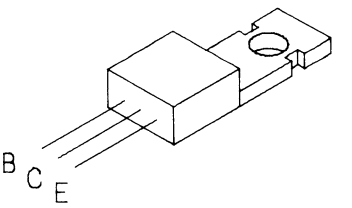
RK14



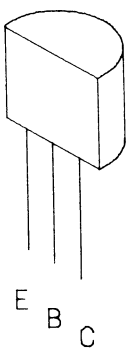
Y-10GA



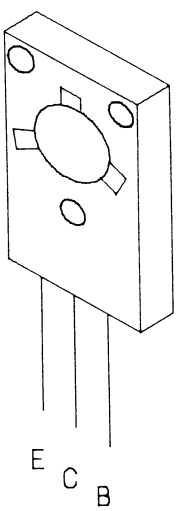
2SA1012Y



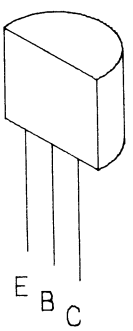
2SA1206



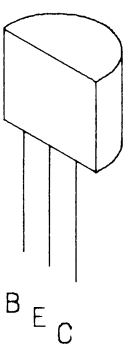
2SA1210S
2SC2912S



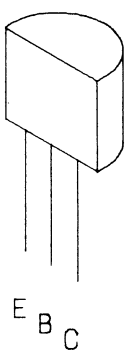
2SA778AK 2SC458C
2SA1029D 2SC535C
2SC641KC
2SC1906
2SC2909S



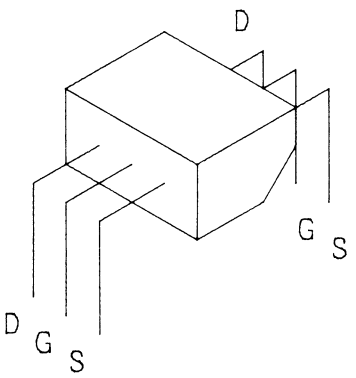
2SC2408



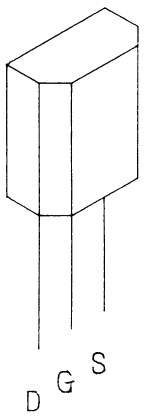
2SC2901T



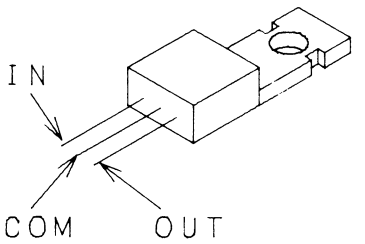
2SK332E



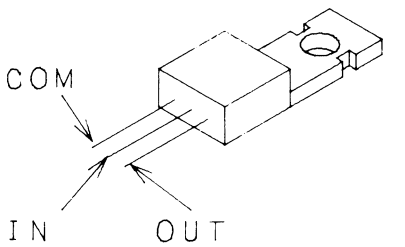
2SK404



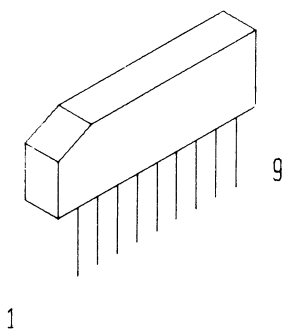
HA17805
HA17808



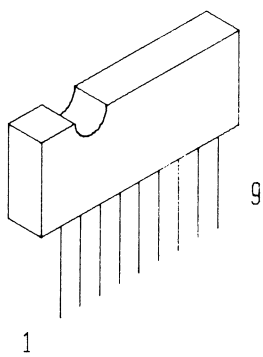
μPC7908



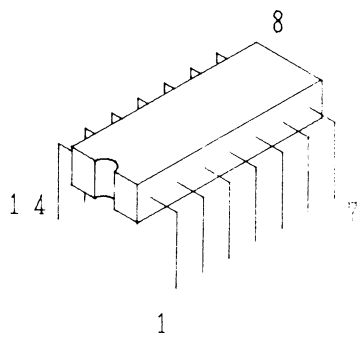
NJM072S



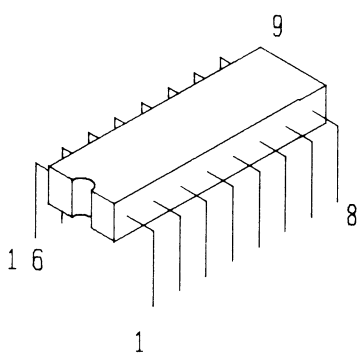
BA715



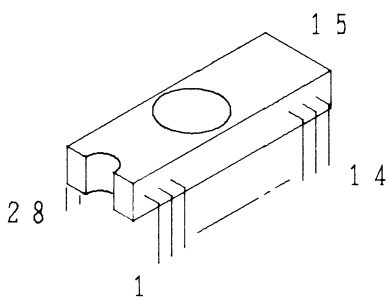
HD74S74
HD74LS00P
HD74LS02P



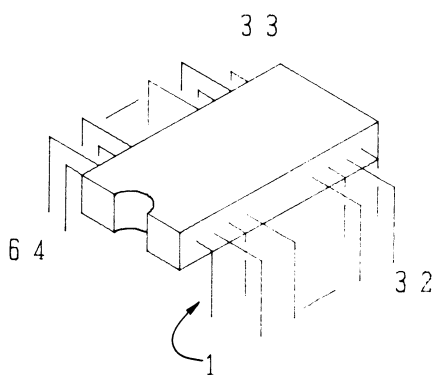
HD14053BP
HD74LS157P



HN482764G-4



μPD7810G



9. ELECTRICAL PARTS LIST

PEF-708 CH1 INPUT

Symbol	Part Code	Description	Q'ty
C1	CQX0068	C, Plastic 400V 0.047μF ±10%	1
S1	8393985	SW, Lever SLE623	1

PEF-709 CH2 INPUT

Symbol	Part Code	Description	Q'ty
C101	CQX0068	C, Plastic 400V 0.047μF ±10%	1
S101	8393985	SW, Lever SLE623	1

PEF-710 CH1 - CH3 AMP, CH SW

Symbol	Part Code	Description	
ATT1	8402067	SW, Rotary ADR-255S-2A	1
ATT101	8402067	SW, Rotary ADR-255S-2A	1
C 2	CCG0130	C, Ceramic, Chip 50V 18pF ±5%	1
C 8	CCG0139	C, Ceramic, Chip 50V 47pF ±5%	1
C 18	CCG0144	C, Ceramic, Chip 50V 220pF ±5%	1
C 19	CCG0142	C, Ceramic, Chip 50V 82pF ±5%	1
C 20	CCD0286	C, Ceramic 500V 1000pF +100% - 0%	1
C 25	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C 26	CCG0139	C, Ceramic, Chip 50V 47pF ±5%	1
C 27	CQA0091	C, Plastic 50V 1000pF ±10%	1
C 29	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 30	CCG0143	C, Ceramic, Chip 50V 100pF ±5%	1
C 32	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 35	CCC1001	C, Ceramic 50V 8pF ±0.5pF	1
C 38	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 40	CCG0143	C, Ceramic, Chip 50V 100pF ±5%	1
C 41	CES0133	C, AL Elyc 16V 4.7μF ±20%	1
C 42	CCG0176	C, Ceramic, Chip 50V 1pF ±0.25pF	1
C 44	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C 45	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C 52	CCG0130	C, Ceramic, Chip 50V 18pF ±5%	1
C 54	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 55	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 57	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 60	CCG0176	C, Ceramic, Chip 50V 1pF ±0.25pF	1
C 62	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C 63	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C 65	CCG0203	C, Ceramic, Chip 50V 680pF ±5%	1
C 67	CCG0203	C, Ceramic, Chip 50V 680pF ±5%	1
C 70	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 73	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C 102	CCG0136	C, Ceramic, Chip 50V 33pF ±5%	1
C 108	CCG0139	C, Ceramic, Chip 50V 47pF ±5%	1
C 118	CCG0144	C, Ceramic, Chip 50V 220pF ±5%	1
C 119	CCG0142	C, Ceramic, Chip 50V 82pF ±5%	1
C 120	CCD0286	C, Ceramic 500V 1000pF +100% - 0%	1
C 125	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C 126	CCG0139	C, Ceramic, Chip 50V 47pF ±5%	1
C 127	CQA0091	C, Plastic 50V 1000pF ±10%	1
C 129	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 130	CCG0143	C, Ceramic, Chip 50V 100pF ±5%	1
C 132	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 135	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 138	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 140	CCG0143	C, Ceramic, Chip 50V 100pF ±5%	1
C 141	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 142	CCG0176	C, Ceramic, Chip 50V 1pF ±0.25pF	1
C 144	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C 145	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C 152	CCG0130	C, Ceramic, Chip 50V 18pF ±5%	1
C 154	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 157	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 160	CCG0176	C, Ceramic, Chip 50V 1pF ±0.25pF	1
C 162	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C 163	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C 165	CCG0203	C, Ceramic, Chip 50V 680pF ±5%	1
C 167	CCG0203	C, Ceramic, Chip 50V 680pF ±5%	1
C 170	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 173	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C 178	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C 202	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C 204	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 212	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C 214	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 215	CCC1030	C, Ceramic 50V 10000pF +80% -20%	1
C 232	CCG0136	C, Ceramic, Chip 50V 33pF ±5%	1
C 234	CEX0189	C, AL Elyc 16V 10μF BP	1
C 239	CCG0140	C, Ceramic, Chip 50V 56pF ±5%	1
C 241	CCG0205	C, Ceramic, Chip 50V 1000pF ±10%	1
C 252	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 253	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C 257	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C 262	CCG0203	C, Ceramic, Chip 50V 680pF ±5%	1
C 263	CCG0203	C, Ceramic, Chip 50V 680pF ±5%	1
C 274	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 275	CCG0132	C, Ceramic, Chip 50V 22pF ±5%	1
C 276	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C 288	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C 289	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 290	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C 291	CCG0116	C, Ceramic, Chip 50V 2pF ±0.25pF	1
C 294	CES0133	C, AL Elyc 16V 47μF ±20%	1
C 295	CES0133	C, AL Elyc 16V 47μF ±20%	1

Symbol	Part Code	Description	Q'ty
C303	CCG0203	C, Ceramic 50V 680pF ±5%	1
C308	CCG0203	C, Ceramic, Chip 50V 680pF ±5%	1
C309	CCG0203	C, Ceramic, Chip 50V 680pF ±5%	1
C311	CCG0124	C, Ceramic, Chip 50V 10pF ±0.5pF	1
C313	CES0133	C, AL Elyc 16V 47μF ±20%	1
C315	CES0133	C, AL Elyc 16V 47μF ±20%	1
C318	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C321	CCG0139	C, Ceramic, Chip 50V 47pF ±5%	1
C351	CCG0194	C, Ceramic, Chip 50V 120pF ±5%	1
C353	CCG0194	C, Ceramic, Chip 50V 120pF ±5%	1
C360	CES0133	C, AL Elyc 16V 47μF ±20%	1
C363	CCG0203	C, Ceramic, Chip 50V 680pF ±5%	1
C364	CCG0203	C, Ceramic, Chip 50V 680pF ±5%	1
C368	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C371	CES0133	C, AL Elyc 16V 47μF ±20%	1
C406	CCG0141	C, Ceramic, Chip 50V 68pF ±5%	1
C407	CCG0141	C, Ceramic, Chip 50V 68pF ±5%	1
C408	CCG0141	C, Ceramic, Chip 50V 68pF ±5%	1
C410	CCC1030	C, Ceramic 50V 10000pF +80% -20%	1
C413	CCC1030	C, Ceramic 50V 10000pF +80% -20%	1
C420	CCC1007	C, Ceramic 50V 22pF ±5%	1
C453	CCG0144	C, Ceramic, Chip 50V 220pF ±5%	1
C454	CCG0119	C, Ceramic, Chip 50V 5pF ±0.25pF	1
C458	CCG0117	C, Ceramic, Chip 50V 3pF ±0.25pF	1
C466	CCG0213	C, Ceramic, Chip 50V 0.1μF +80% -20%	1
C467	CCG0116	C, Ceramic, Chip 50V 2pF ±0.25pF	1
C468	CCG0116	C, Ceramic, Chip 50V 2pF ±0.25pF	1
C480	CEX0189	C, AL Elyc 16V 10μF BP	1
C481	CCG0203	C, Ceramic, Chip 50V 680pF ±5%	1
C482	CCG0213	C, Ceramic, Chip 50V 0.1μF +80% -20%	1
C490	CCG0141	C, Ceramic, Chip 50V 68pF ±5%	1
C603	CES0133	C, AL Elyc 16V 47μF ±20%	1
C604	CES0133	C, AL Elyc 16V 47μF ±20%	1
C607	CES0133	C, AL Elyc 16V 47μF ±20%	1
CV 4	CVE0059	C, Variable ECR-HA010A41	1
CV 5	CVE0065	C, Variable ECR-HA007A41	1
CV14	CVE0059	C, Variable ECR-HA010A41	1
CV15	CVE0064	C, Variable ECR-HA003A41	1
CV60	CVE0062	C, Variable ECR-HA040E41	1
CV104	CVE0059	C, Variable ECR-HA010A41	1
CV105	CVE0065	C, Variable ECR-HA007A41	1
CV114	CVE0059	C, Variable ECR-HA010A41	1
CV115	CVE0064	C, Variable ECR-HA003A41	1
CV160	CVE0062	C, Variable ECR-HA040E41	1
CV311	CVE0062	C, Variable ECR-HA040E41	1
D23	HDS0477	Diode 1SS10	1
D25	HDS0476	Diode 1SS110	1
D26	HDS0437	Diode 1SS133	1
D31	HDS0477	Diode 1SS110	1
D32	HDS0477	Diode 1SS110	1
D42	HDS0437	Diode 1SS133	1
D71	HDS0437	Diode 1SS133	1
D72	HDS0437	Diode 1SS133	1
D73	HDS0437	Diode 1SS133	1
D74	HDS0437	Diode 1SS133	1

Symbol	Part Code	Description	Q'ty
D123	HDS0477	Diode 1SS110	1
D125	HDS0477	Diode 1SS110	1
D126	HDS0437	Diode 1SS133	1
D131	HDS0477	Diode 1SS110	1
D132	HDS0477	Diode 1SS110	1
D142	HDS0437	Diode 1SS133	1
D171	HDS0437	Diode 1SS133	1
D172	HDS0437	Diode 1SS133	1
D173	HDS0437	Diode 1SS133	1
D174	HDS0437	Diode 1SS133	1
D226	HDS0437	Diode 1SS133	1
D228	HDS0437	Diode 1SS133	1
D251	HDS0437	Diode 1SS133	1
D268	HDS0437	Diode 1SS133	1
D290	HDM0140	Diode MTZ 4.7JB	1
D308	HDS0437	Diode 1SS133	1
D309	HDS0437	Diode 1SS133	1
D310	HDS0437	Diode 1SS133	1
D311	HDS0437	Diode 1SS133	1
D366	HDS0437	Diode 1SS133	1
D367	HDS0437	Diode 1SS133	1
D368	HDS0437	Diode 1SS133	1
D369	HDS0437	Diode 1SS133	1
D402	HDS0437	Diode 1SS133	1
D403	HDS0437	Diode 1SS133	1
D410	HDS0437	Diode 1SS133	1
D411	HDS0437	Diode 1SS133	1
D412	HDS0437	Diode 1SS133	1
D413	HDS0437	Diode 1SS133	1
D414	HDS0437	Diode 1SS133	1
D415	HDS0437	Diode 1SS133	1
D416	HDS0437	Diode 1SS133	1
D417	HDS0437	Diode 1SS133	1
D418	HDS0437	Diode 1SS133	1
D419	HDS0437	Diode 1SS133	1
D420	HDS0437	Diode 1SS133	1
D450	HDS0437	Diode 1SS133	1
D454	HDM0152	Diode MTZ 10JC	1
D455	HDM0152	Diode MTZ 10JC	1
D607	HDM0140	Diode MTZ 4.7JB	1
D780	HDS0437	Diode 1SS133	1
D781	HDS0437	Diode 1SS133	1
D782	HDS0437	Diode 1SS133	1
IC 26	8397023A	IC, Analog LF411CN	1
IC126	8397023A	IC, Analog LF411CN	1
IC410	IDH0630	IC, Digital HD74LS157P	1
IC413	IDH0713	IC, Digital HD74LS109AP	1
L 47	TLE0154	Coil ELE-Y R22 MA	1
L147	TLE0154	Coil ELE-Y R22 MA	1
P 1	JBB0021	Connector B3B-XH-A	1
P101	JBB0021	Connector B3B-XH-A	1
P201	JBX2093	Connector 1-164713-2 (8440219)	1
P202	JBX2093	Connector 1-164713-2 (8440219)	1

Symbol	Part Code	Description	Q'ty
P203	JBX2095	Connector 1-164713-3 (8440219)	1
P295	JBB0027	Connector B2B-XH-A	1
P301	JBB0027	Connector B2B-XH-A	1
P450	JBB0021	Connector B3B-XH-A	1
P506	JBB0022	Connector B6B-XH-A	1
P607	JBB0027	Connector B2B-XH-A	1
R 2	RME0860	R, Metal, Chip 1/8W 47Ω ±5%	1
R 3	RCE0749	R, Carbon 1/4W 22Ω ±5%	1
R 4	RME0852	R, Metal, Chip 1/8W 10Ω ±5%	1
R 5	RMS0043	R, Metal 1/4W 900kΩ ±0.5%	1
R 6	RME1163	R, Metal 1/4W 111kΩ ±0.5%	1
R 7	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R 8	RME0858	R, Metal, Chip 1/8W 33Ω ±5%	1
R14	RME0852	R, Metal, Chip 1/8W 10Ω ±5%	1
R15	RMS0044	R, Metal 1/4W 990kΩ ±0.5%	1
R16	RME1156	R, Metal 1/4W 10.1kΩ ±0.5%	1
R17	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R18	RME0852	R, Metal, Chip 1/8W 10Ω ±5%	1
R19	RME0856	R, Metal, Chip 1/8W 22Ω ±5%	1
R21	RME1168	R, Metal 1/4W 500kΩ ±0.5%	1
R22	RME1168	R, Metal 1/4W 500kΩ ±0.5%	1
R23	RSE0434	R, Solid 1/4W 10MΩ ±5%	1
R24	RME0873	R, Metal, Chip 1/8W 560Ω ±5%	1
R25	RME0860	R, Metal, Chip 1/8W 47Ω ±5%	1
R26	RME0862	R, Metal, Chip 1/8W 68Ω ±5%	1
R27	RCE0774	R, Carbon 1/4W 2.7kΩ ±5%	1
R28	RME0876	R, Metal, Chip 1/8W 1.0kΩ ±5%	1
R29	RME0884	R, Metal, Chip 1/8W 4.7kΩ ±5%	1
R30	RME0881	R, Metal, Chip 1/8W 2.7kΩ ±5%	1
R31	RME0868	R, Metal, Chip 1/8W 220Ω ±5%	1
R32	RCE0767	R, Carbon 1/4W 680Ω ±5%	1
R34	RME1068	R, Metal 1/4W 475Ω ±1%	1
R34B	RME1084	R, Metal 1/4W 10.0kΩ ±1%	1
R35	RME0876	R, Metal, Chip 1/8W 1.0kΩ ±5%	1
R36	RME1155	R, Metal 1/4W 4.00kΩ ±0.5%	1
R37	RME1106	R, Metal 1/4W 75.0Ω ±1%	1
R38	RCE0743	R, Carbon 1/4W 4.7Ω ±5%	1
R39	RME0852	R, Metal, Chip 1/8W 10Ω ±5%	1
R40	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R41	RCE0753	R, Carbon 1/4W 47Ω ±5%	1
R42	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R43	RCE0745	R, Carbon 1/4W 10Ω ±5%	1
R44	RCE0772	R, Carbon 1/4W 1.8kΩ ±5%	1
R45	RCE0765	R, Carbon 1/4W 470Ω ±5%	1
R46	RME1064	R, Metal 1/4W 221Ω ±1%	1
R47B	RME0856	R, Metal, Chip 1/8W 22Ω ±5%	1
R47C	RME0852	R, Metal, Chip 1/8W 10Ω ±5%	1
R48	RCE0760	R, Carbon 1/4W 180Ω ±5%	1
R49	RME1157	R, Metal 1/4W 16.0kΩ ±0.5%	1
R50	RME1162	R, Metal 1/4W 80.0kΩ ±0.5%	1
R52	RME0874	R, Metal, Chip 1/8W 680Ω ±5%	1
R53	RME0871	R, Metal, Chip 1/8W 390Ω ±5%	1
R54	RME1084	R, Metal 1/4W 10.0kΩ ±1%	1
R55	RME0900	R, Metal, Chip 1/8W 100kΩ ±5%	1
R56	RME0888	R, Metal, Chip 1/8W 10kΩ ±5%	1
R57	RME1075	R, Metal 1/4W 1.82kΩ ±1%	1
R58	RME1075	R, Metal 1/4W 1.82kΩ ±1%	1
R59	RME1056	R, Metal 1/4W 47.5Ω ±1%	1
R60	RCE0743	R, Carbon 1/4W 4.7Ω ±5%	1
R62	RME0889	R, Metal, Chip 1/8W 12kΩ ±5%	1
R63	RME1125	R, Metal 1/4W 5.11kΩ ±1%	1

Symbol	Part Code	Description	Q'ty
R64	RME0862	R, Metal, Chip 1/8W 68Ω ±5%	1
R65	RME0860	R, Metal, Chip 1/8W 47Ω ±5%	1
R66	RME1117	R, Metal 1/4W 750Ω ±1%	1
R67	RME0860	R, Metal, Chip 1/8W 47Ω ±5%	1
R68	RME1117	R, Metal 1/4W 750Ω ±1%	1
R69	RME1065	R, Metal 1/4W 267Ω ±1%	1
R70	RME1065	R, Metal 1/4W 267Ω ±1%	1
R71	RME1076	R, Metal 1/4W 2.21kΩ ±1%	1
R72	RME1078	R, Metal 1/4W 3.32kΩ ±1%	1
R73	RCE0753	R, Carbon 1/4W 47Ω ±5%	1
R102	RME0858	R, Metal, Chip 1/8W 33Ω ±5%	1
R102	RME0858	R, Metal 1/8W 33Ω ±5%	1
R103	RCE0749	R, Carbon 1/4W 22Ω ±5%	1
R104	RME0852	R, Metal, Chip 1/8W 10Ω ±5%	1
R105	RMS0043	R, Metal 1/4W 900kΩ ±0.5%	1
R106	RME1163	R, Metal 1/4W 111kΩ ±0.5%	1
R107	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R108	RME0858	R, Metal, Chip 1/8W 33Ω ±5%	1
R114	RME0852	R, Metal, Chip 1/8W 10Ω ±5%	1
R115	RMS0044	R, Metal 1/4W 990kΩ ±0.5%	1
R116	RME1156	R, Metal 1/4W 10.1kΩ ±0.5%	1
R117	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R118	RME0852	R, Metal, Chip 1/8W 10Ω ±5%	1
R119	RME0858	R, Metal, Chip 1/8W 33Ω ±5%	1
R121	RME1168	R, Metal 1/4W 500kΩ ±0.5%	1
R122	RME1168	R, Metal 1/4W 500kΩ ±0.5%	1
R123	RSE0434	R, Solid 1/4W 10MΩ ±5%	1
R124	RME0873	R, Metal, Chip 1/8W 560Ω ±5%	1
R125	RME0860	R, Metal, Chip 1/8W 47Ω ±5%	1
R126	RME0862	R, Metal, Chip 1/8W 68Ω ±5%	1
R127	RCE0774	R, Carbon 1/4W 2.7kΩ ±5%	1
R128	RME0876	R, Metal, Chip 1/8W 1.0kΩ ±5%	1
R129	RME0884	R, Metal, Chip 1/8W 4.7kΩ ±5%	1
R130	RME0881	R, Metal, Chip 1/8W 2.7kΩ ±5%	1
R131	RME0868	R, Metal, Chip 1/8W 220Ω ±5%	1
R132	RCE0767	R, Carbon 1/4W 680Ω ±5%	1
R133	RME0863	R, Metal, Chip 1/8W 82Ω ±5%	1
R134	RME1068	R, Metal 1/4W 475Ω ±1%	1
R134B	RME1084	R, Metal 1/4W 10.0kΩ ±1%	1
R135	RME0876	R, Metal, Chip 1/8W 1.0kΩ ±5%	1
R136	RME1155	R, Metal 1/4W 4.00kΩ ±0.5%	1
R137	RME1106	R, Metal 1/4W 75.0Ω ±1%	1
R138	RCE0743	R, Carbon 1/4W 4.7Ω ±5%	1
R139	RME0852	R, Metal, Chip 1/8W 10Ω ±5%	1
R140	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R141	RCE0753	R, Carbon 1/4W 47Ω ±5%	1
R142	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R143	RCE0745	R, Carbon 1/4W 10Ω ±5%	1
R144	RCE0772	R, Carbon 1/4W 1.8kΩ ±5%	1
R145	RCE0765	R, Carbon 1/4W 470Ω ±5%	1
R146	RME1064	R, Metal 1/4W 221Ω ±1%	1
R147B	RME0856	R, Metal, Chip 1/8W 22Ω ±5%	1
R147C	RME0852	R, Metal, Chip 1/8W 10Ω ±5%	1
R148	RCE0760	R, Carbon 1/4W 180Ω ±5%	1
R149	RME1157	R, Metal 1/4W 16.0kΩ ±0.5%	1
R150	RME1162	R, Metal 1/4W 80.0kΩ ±0.5%	1
R152	RME0874	R, Metal, Chip 1/8W 680Ω ±5%	1
R153	RME0871	R, Metal, Chip 1/8W 390Ω ±5%	1
R154	RME1084	R, Metal 1/4W 10.0kΩ ±1%	1
R155	RCE0793	R, Carbon 1/4W 100kΩ ±5%	1
R156	RCE0781	R, Carbon 1/4W 10kΩ ±5%	1
R157	RME0667	R, Metal 1/4W 1.82kΩ ±1%	1
R158	RME0667	R, Metal 1/4W 1.82kΩ ±1%	1

Symbol	Part Code	Description	Q'ty
R159	RME1058	R, Metal, 1/4W 68.1Ω ±1%	1
R160	RME0850	R, Metal, Chip 1/8W 4.7Ω ±10%	1
R162	RME0889	R, Metal, Chip 1/8W 12kΩ ±5%	1
R163	RME1125	R, Metal 1/4W 5.11kΩ ±1%	1
R164	RME0862	R, Metal, Chip 1/8W 68Ω ±5%	1
R165	RME0860	R, Metal, Chip 1/8W 47Ω ±5%	1
R166	RME1117	R, Metal 1/4W 750Ω ±1%	1
R167	RME0860	R, Metal, Chip 1/8W 47Ω ±5%	1
R168	RME1117	R, Metal 1/4W 750Ω ±1%	1
R169	RME1065	R, Metal 1/4W 267Ω ±1%	1
R170	RME1065	R, Metal 1/4W 267Ω ±1%	1
R173	RME0860	R, Metal, Chip 1/8W 47Ω ±5%	1
R174	RME1076	R, Metal 1/4W 2.21kΩ ±1%	1
R175	RME1076	R, Metal 1/4W 2.21kΩ ±1%	1
R176	RME1078	R, Metal 1/4W 3.32kΩ ±1%	1
R177	RME1078	R, Metal 1/4W 3.32kΩ ±1%	1
R178	RME0860	R, Metal, Chip 1/8W 47Ω ±5%	1
R201	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R202	RME0852	R, Metal, Chip 1/8W 10Ω ±5%	1
R203	RME0878	R, Metal, Chip 1/8W 1.5kΩ ±5%	1
R204	RME0878	R, Metal, Chip 1/8W 1.5kΩ ±5%	1
R205	RME0852	R, Metal, Chip 1/8W 10Ω ±5%	1
R206	RME0865	R, Metal, Chip 1/8W 120Ω ±5%	1
R207	RME0892	R, Metal, Chip 1/8W 22kΩ ±5%	1
R208	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R209	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R211	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R212	RME0852	R, Metal, Chip 1/8W 10Ω ±5%	1
R213	RME0878	R, Metal, Chip 1/8W 1.5kΩ ±5%	1
R214	RME0878	R, Metal, Chip 1/8W 1.5kΩ ±5%	1
R215	RME0866	R, Metal, Chip 1/8W 150Ω ±5%	1
R216	RME0858	R, Metal, Chip 1/8W 33Ω ±5%	1
R217	RME0885	R, Metal, Chip 1/8W 5.6kΩ ±5%	1
R220	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R221	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R222	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R223	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R224	RME1074	R, Metal 1/4W 1.50kΩ ±1%	1
R225	RME1077	R, Metal 1/4W 2.67kΩ ±1%	1
R226	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R227	RME0900	R, Metal, Chip 1/8W 100kΩ ±5%	1
R228	RME1077	R, Metal 1/4W 2.67kΩ ±1%	1
R229	RME0900	R, Metal, Chip 1/8W 100kΩ ±5%	1
R230	RCE0773	R, Carbon 1/4W 2.2kΩ ±5%	1
R231	RME1079	R, Metal 1/4W 3.92kΩ ±1%	1
R232	RME0857	R, Metal, Chip 1/8W 27Ω ±5%	1
R233	RME0857	R, Metal, Chip 1/8W 27Ω ±5%	1
R234	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R236	RME1078	R, Metal 1/4W 3.32kΩ ±1%	1
R237	RME1079	R, Metal 1/4W 3.92kΩ ±1%	1
R238	RME0859	R, Metal, Chip 1/8W 39Ω ±5%	1
R239	RME0859	R, Metal, Chip 1/8W 39Ω ±5%	1
R240	RME1221	R, Metal 1/4W 1.37kΩ ±1%	1
R242	RME0859	R, Metal, Chip 1/8W 39Ω ±5%	1
R243	RME0859	R, Metal, Chip 1/8W 39Ω ±5%	1
R244	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R248	RME0860	R, Metal, Chip 1/8W 47Ω ±5%	1
R250	RME1077	R, Metal 1/4W 2.67kΩ ±1%	1
R251	RME1072	R, Metal 1/4W 1.00kΩ ±1%	1
R252	RME1064	R, Metal 1/4W 221Ω ±1%	1
R253	RME0912	R, Metal, Chip Zero Ohm Resistor	1
R255	RME0879	R, Metal, Chip 1/8W 1.8kΩ ±5%	1

Symbol	Part Code	Description	Q'ty
R256	RME0880	R, Metal, Chip 1/8W 2.2k ±5%	1
R257	RME0852	R, Metal, Chip 1/8W 10 ±5%	1
R260	RME0874	R, Metal, Chip 1/8W 680 ±5%	1
R261	RME0874	R, Metal, Chip 1/8W 680 ±5%	1
R262	RME0860	R, Metal, Chip 1/8W 47 ±5%	1
R263	RME0860	R, Metal, Chip 1/8W 47 ±5%	1
R264	RME0870	R, Metal, Chip 1/8W 330 ±5%	1
R265	RME0870	R, Metal, Chip 1/8W 330 ±5%	1
R266	RME1061	R, Metal 1/4W 121 ±1%	1
R267	RME1061	R, Metal 1/4W 121 ±1%	1
R268	RCE0759	R, Carbon 1/4W 150 ±5%	1
R270	RME0864	R, Metal, Chip 1/8W 100 ±5%	1
R271	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R272	RME1061	R, Metal 1/4W 121Ω ±1%	1
R273	RME1073	R, Metal 1/4W 1.21kΩ ±1%	1
R274	RME1073	R, Metal 1/4W 1.21kΩ ±1%	1
R275	RME0852	R, Metal, Chip 1/8W 10Ω ±5%	1
R276	RME0870	R, Metal, Chip 1/8W 330Ω ±5%	1
R277	RME0870	R, Metal, Chip 1/8W 330Ω ±5%	1
R286	RME0852	R, Metal, Chip 1/8W 10Ω ±5%	1
R287	RME0873	R, Metal, Chip 1/8W 560Ω ±5%	1
R288	RME0852	R, Metal, Chip 1/8W 10Ω ±5%	1
R289	RME0873	R, Metal, Chip 1/8W 560Ω ±5%	1
R290	RME0880	R, Metal, Chip 1/8W 2.2kΩ ±5%	1
R291	RME1070	R, Metal 1/4W 681Ω ±1%	1
R292	RME0873	R, Metal, Chip 1/8W 560Ω ±5%	1
R293	RME1074	R, Metal 1/4W 1.50kΩ ±1%	1
R294	RME0852	R, Metal, Chip 1/8W 10Ω ±5%	1
R295	RME0860	R, Metal, Chip 1/8W 47Ω ±5%	1
R297	RME0875	R, Metal, Chip 1/8W 820Ω ±5%	1
R301	RCE0750	R, Carbon 1/4W 27Ω ±5%	1
R302	RME0852	R, Carbon 1/4W 10Ω ±5%	1
R303	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R304	RME0886	R, Metal, Chip 1/8W 6.8kΩ ±5%	1
R305	RME0892	R, Metal, Chip 1/8W 22kΩ ±5%	1
R306	RME0874	R, Metal, Chip 1/8W 680Ω ±5%	1
R307	RME0874	R, Metal, Chip 1/8W 680Ω ±5%	1
R308	RME0860	R, Metal, Chip 1/8W 47Ω ±5%	1
R309	RME0860	R, Metal, Chip 1/8W 47Ω ±5%	1
R310	RME1058	R, Metal 1/4W 68.1Ω ±1%	1
R311	RME0852	R, Metal, Chip 1/8W 10Ω ±5%	1
R312	RME1075	R, Metal 1/4W 1.82kΩ ±1%	1
R313	RME1075	R, Metal 1/4W 1.82kΩ ±1%	1
R314	RME1065	R, Metal 1/4W 267Ω ±1%	1
R315	RME1065	R, Metal 1/4W 267Ω ±1%	1
R316	RME1076	R, Metal 1/4W 2.21kΩ ±1%	1
R317	RME1078	R, Metal 1/4W 3.32kΩ ±1%	1
R318	RME0860	R, Metal, Chip 1/8W 47Ω ±5%	1
R319	RME0877	R, Metal, Chip 1/8W 1.2kΩ ±5%	1
R320	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R321	RCE0750	R, Carbon 1/4W 27Ω ±5%	1
R322	RME1072	R, Metal 1/4W 1.00kΩ ±1%	1
R323	RME1107	R, Metal 1/4W 86.6Ω ±1%	1
R324	RME0872	R, Metal, Chip 1/8W 470Ω ±5%	1
R351	RME0876	R, Metal, Chip 1/8W 1.0kΩ ±5%	1
R352	RME0876	R, Metal, Chip 1/8W 1.0kΩ ±5%	1
R353	RME0876	R, Metal, Chip 1/8W 1.0kΩ ±5%	1
R355	RME0868	R, Metal, Chip 1/8W 220Ω ±5%	1
R356	RCE0780	R, Carbon 1/4W 8.2kΩ ±5%	1
R357	RME0868	R, Metal, Chip 1/8W 220Ω ±5%	1
R359	RCE0773	R, Carbon 1/4W 2.2kΩ ±5%	1
R360	RCE0773	R, Carbon 1/4W 2.2kΩ ±5%	1

Symbol	Part Code	Description	Q'ty
R361	RME0874	R, Metal, Chip 1/8W 680Ω ±5%	1
R362	RME0874	R, Metal, Chip 1/8W 680Ω ±5%	1
R363	RME0860	R, Metal, Chip 1/8W 47Ω ±5%	1
R364	RME0860	R, Metal, Chip 1/8W 47Ω ±5%	1
R365	RCE0749	R, Carbon 1/4W 22Ω ±5%	1
R366	RCE0765	R, Carbon 1/4W 470Ω ±5%	1
R367	RCE0775	R, Carbon 1/4W 3.3kΩ ±5%	1
R368	RME0860	R, Metal, Chip 1/8W 47Ω ±5%	1
R370	RME1067	R, Metal 1/4W 392Ω ±1%	1
R371	RME1067	R, Metal 1/4W 392Ω ±1%	1
R401	RME0876	R, Metal, Chip 1/8W 1.0kΩ ±5%	1
R402	RME0876	R, Metal, Chip 1/8W 1.0kΩ ±5%	1
R403	RME0876	R, Metal, Chip 1/8W 1.0kΩ ±5%	1
R404	RME0876	R, Metal, Chip 1/8W 1.0kΩ ±5%	1
R405	RME0884	R, Metal, Chip 1/8W 4.7kΩ ±5%	1
R406	RME0854	R, Metal, Chip 1/8W 15Ω ±5%	1
R407	RME0854	R, Metal, Chip 1/8W 15Ω ±5%	1
R408	RME0854	R, Metal, Chip 1/8W 15Ω ±5%	1
R409	RCE0783	R, Carbon 1/4W 15kΩ ±5%	1
R410	RCE0745	R, Carbon 1/4W 10Ω ±5%	1
R411	RCE0785	R, Carbon 1/4W 22kΩ ±5%	1
R412	RCE0785	R, Carbon 1/4W 22kΩ ±5%	1
R413	RCE0745	R, Carbon 1/4W 10Ω ±5%	1
R415	RCE0785	R, Carbon 1/4W 22kΩ ±5%	1
R416	RCE0785	R, Carbon 1/4W 22kΩ ±5%	1
R417	RME0852	R, Metal, Chip 1/8W 10Ω ±5%	1
R418	RME0885	R, Metal, Chip 1/8W 5.6kΩ ±5%	1
R420	RCE0783	R, Carbon 1/4W 15kΩ ±5%	1
R421	RCE0781	R, Carbon 1/4W 10kΩ ±5%	1
R422	RCE0772	R, Carbon 1/4W 1.8kΩ ±5%	1
R430	RME0884	R, Metal, Chip 1/8W 4.7kΩ ±5%	1
R431	RME0880	R, Metal, Chip 1/8W 2.2kΩ ±5%	1
R432	RME0884	R, Metal, Chip 1/8W 4.7kΩ ±5%	1
R433	RME0880	R, Metal, Chip 1/8W 2.2kΩ ±5%	1
R434	RME0884	R, Metal, Chip 1/8W 4.7kΩ ±5%	1
R435	RME0880	R, Metal, Chip 1/8W 2.2kΩ ±5%	1
R436	RME0884	R, Metal, Chip 1/8W 4.7kΩ ±5%	1
R437	RME0880	R, Metal, Chip 1/8W 2.2kΩ ±5%	1
R450	RME0873	R, Metal, Chip 1/8W 560Ω ±5%	1
R451	RME0873	R, Metal, Chip 1/8W 560Ω ±5%	1
R452	RME1107	R, Metal 1/4W 86.6Ω ±1%	1
R453	RME1107	R, Metal 1/4W 86.6Ω ±1%	1
R454	RME0870	R, Metal, Chip 1/8W 330Ω ±5%	1
R455	RME0883	R, Metal, Chip 1/8W 3.9kΩ ±5%	1
R456	RCE0745	R, Carbon 1/4W 10Ω ±5%	1
R458	RME0872	R, Metal, Chip 1/8W 470Ω ±5%	1
R459	RME0872	R, Metal, Chip 1/8W 470Ω ±5%	1
R460	RME0872	R, Metal, Chip 1/8W 470Ω ±5%	1
R461	RME0868	R, Metal, Chip 1/8W 220Ω ±5%	1
R462	RME0868	R, Metal, Chip 1/8W 220Ω ±5%	1
R463	RME1389	R, Metal 1/4W 7.5kΩ ±1%	1
R464	RME1389	R, Metal 1/4W 7.5kΩ ±1%	1
R465	RCE0775	R, Carbon 1/4W 3.3kΩ ±5%	1
R466	RME0880	R, Metal, Chip 1/8W 2.2kΩ ±5%	1
R467	RME0860	R, Metal, Chip 1/8W 47Ω ±5%	1
R468	RME0860	R, Metal, Chip 1/8W 47Ω ±5%	1
R469	RME0882	R, Metal, Chip 1/8W 3.3kΩ ±5%	1
R470	RME1071	R, Metal 1/4W 825Ω ±1%	1
R471	RME1071	R, Metal 1/4W 825Ω ±1%	1
R472	RME1112	R, Metal 1/4W 301Ω ±1%	1
R473	RME1062	R, Metal 1/4W 150Ω ±1%	1
R474	RME1062	R, Metal 1/4W 150Ω ±1%	1

Symbol	Part Code	Description	Q'ty
R475	RME1062	R, Metal 1/4W 150Ω ±1%	1
R476	RME1062	R, Metal 1/4W 150Ω ±1%	1
R477	RME1063	R, Metal 1/4W 182Ω ±1%	1
R478	RME1063	R, Metal 1/4W 182Ω ±1%	1
R480	RME0900	R, Metal, Chip 1/8W 100kΩ ±5%	1
R481	RME0888	R, Metal, Chip 1/8W 10kΩ ±5%	1
R482	RCE0796	R, Carbon 1/4W 180kΩ ±5%	1
R490	RME0854	R, Metal, Chip 1/8W 15Ω ±5%	1
R601	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R602	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R603	RME0874	R, Metal, Chip 1/8W 680Ω ±5%	1
R604	RME0879	R, Metal, Chip 1/8W 1.8kΩ ±5%	1
R605	RME1071	R, Metal 1/4W 825Ω ±1%	1
R606	RME0874	R, Metal, Chip 1/8W 680Ω ±5%	1
R607	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R608	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R609	RME0884	R, Metal, Chip 1/8W 4.7kΩ ±5%	1
R765	RME1162	R, Metal 1/4W 80.0kΩ ±0.5%	1
R766	RME1091	R, Metal 1/4W 39.2kΩ ±1%	1
R780	RCE0792	R, Carbon 1/4W 82kΩ ±5%	1
R781	RME1091	R, Metal 1/4W 39.2kΩ ±1%	1
R782	RME1089	R, Metal 1/4W 26.7kΩ ±1%	1
R783	RME1212	R, Metal 1/4W 20.0kΩ ±0.5%	1
R784	RCE0789	R, Carbon 1/4W 47kΩ ±5%	1
R785	RCE0789	R, Carbon 1/4W 47kΩ ±5%	1
RM 52	3173846B	R, Block For ATT	1
RM152	3173846B	R, Block For ATT	1
RV 37	RNE0057	VR, Metal EVN 49C00YB53 (5K)	1
RV 47	RNE0049	VR, Metal EVN 39C00YB12 (100)	1
RV 48	RNE0048	VR, Metal EVN 39C00YB22 (200)	1
RV 62	RNE0047	VR, Metal EVN 39C00YB54 (50K)	1
RV 63	8348452	VR, Carbon EVH-CCAK20B11 (10K)	1
RV133	RNE0049	VR, Metal EVN 39C00YB12 (100)	1
RV137	RNE0057	VR, Metal EVN 49C00YB54 (50K)	1
RV147	RNE0049	VR, Metal EVN 39C00YB12 (100)	1
RV148	RNE0048	VR, Metal EVN 39C00YB22 (200)	1
RV162	RNE0047	VR, Metal EVN 39C00YB54 (50K)	1
RV163	RDE0003	VR, Carbon EVH-YK3325B14 (10K)	1
RV207	RNE0051	VR, Metal EVN 39C00YB14 (10K)	1
RV217	RNE0051	VR, Metal EVN 39C00YB14 (10K)	1
RV293	RNE0058	VR, Metal EVN 39C00YB13 (1K)	1
RV305	RNE0047	VR, Metal EVN 39C00YB54 (50K)	1
RV356	RNE0051	VR, Metal EVN 39C00YB14 (10K)	1
RV357	RNE0050	VR, Metal EVN 39C00YB52 (500)	1
RV603	RNE0050	VR, Metal EVN 39C00YB52 (500)	1
S780	3165210B	SW, Rotary SBU1025 (N)	1
TR25	HTK0099	Transistor 2SK404E	1
TR26	HTC0168	Transistor 2SC535-C-	1
TR40	HTC0168	Transistor 2SC535-C-	1
TR41	HTC0168	Transistor 2SC535-C-	1
TR42	HTC0814	Transistor 2SC3355	1
TR57	HTC0814	Transistor 2SC3355	1
TR58	HTC0814	Transistor 2SC3355	1
TR71	HTA0290	Transistor 2SA1206	1
TR72	HTA0290	Transistor 2SA1206	1

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Symbol	Part Code	Description	Q'ty
TR125	HTK0099	Transistor 2SK404E	1
TR126	HTC0168	Transistor 2SC535-C-	1
TR140	HTC0168	Transistor 2SC535-C-	1
TR141	HTC0168	Transistor 2SC535-C-	1
TR142	HTC0814	Transistor 2SC3355?	1
TR157	HTC0814	Transistor 2SC3355	1
TR158	HTC0814	Transistor 2SC3355	1
TR171	HTA0290	Transistor 2SA1206	1
TR172	HTA0290	Transistor 2SA1206	1
TR175	HTA0290	Transistor 2SA1206	1
TR177	HTA0290	Transistor 2SA1206	1
TR201	HTC0168	Transistor 2SC535-C-	1
TR202	HTC0168	Transistor 2SC535-C-	1
TR211	HTC0148	Transistor 2SC458-C-	1
TR212	HTC0148	Transistor 2SC458-C-	1
TR231	HTC0192	Transistor 2SC641K-C	1
TR232	HTC0168	Transistor 2SC535-C-	1
TR233	HTC0168	Transistor 2SC535-C-	1
TR237	HTC0192	Transistor 2SC641K-C	1
TR238	HTC0168	Transistor 2SC535-C-	1
TR239	HTC0168	Transistor 2SC535-C-	1
TR241	HTC0192	Transistor 2SC641K-C	1
TR242	HTC0168	Transistor 2SC535-C-	1
TR243	HTC0168	Transistor 2SC535-C-	1
TR251	HTC0168	Transistor 2SC535-C-	1
TR263	HTA0224	Transistor 2SA1029 D	1
TR264	HTA0224	Transistor 2SA1029 D	1
TR265	HTA0224	Transistor 2SA1029 D	1
TR270	HTA0290	Transistor 2SA1206	1
TR271	HTA0290	Transistor 2SA1206	1
TR277	HTA0224	Transistor 2SA1029 D	1
TR294	HTC0721	Transistor 2SC2901	1
TR301	HTC0814	Transistor 2SC3355	1
TR302	HTC0814	Transistor 2SC3355	1
TR308	HTA0290	Transistor 2SA1206	1
TR309	HTA0290	Transistor 2SA1206	1
TR353	HTC0148	Transistor 2SC458-C-	1
TR354	HTC0148	Transistor 2SC458-C-	1
TR366	HTA0224	Transistor 2SA1029 D	1
TR367	HTA0224	Transistor 2SA1029 D	1
TR422	HTC0192	Transistor 2SC641K-C	1
TR450	HTC0338	Transistor 2SC1906	1
TR451	HTC0338	Transistor 2SC1906	1
TR452	HTC0148	Transistor 2SC458-C-	1
TR453	HTC0148	Transistor 2SC458-C-	1
TR454	HTC0192	Transistor 2SC641K-C	1
TR456	HTK0116	Transistor 2SK336	1
TR460	HTA0224	Transistor 2SA1029 D	1
TR461	HTA0224	Transistor 2SA1029 D	1
TR462	HTA0224	Transistor 2SA1029 D	1
TR463	HTA0224	Transistor 2SA1029 D	1
TR601	HTA0224	Transistor 2SA1029 D	1
TR607	HTC0338	Transistor 2SC1906	1
TR608	HTA0224	Transistor 2SA1029 D	1
TR780	HTC0148	Transistor 2SC458-C-	1

Symbol	Part Code	Description	Q'ty
C501	CET0033	C, AL Elyc 160V 1μF	1
C502	CES0133	C, AL Elyc 16V 47μF ±20%	1
C504	CES0133	C, AL Elyc 16V 47μF ±20%	1
C513	CCC1182	C, Ceramic 50V 1000pF ±10%	1
C514	CCC1182	C, Ceramic 50V 1000pF ±10%	1
C518	CES0133	C, AL Elyc 16V 47μF ±20%	1
C520	CCC1013	C, Ceramic 50V 39pF ±5%	1
C521	CCC1002	C, Ceramic 50V 10pF ±5%	1
C523	CCG0139	C, Ceramic, Chip 50V 47pF ±5%	1
C531	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C532	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C533	CCC1005	C, Ceramic 50V 18pF ±5%	1
C534	CCC1002	C, Ceramic 50V 10pF ±5%	1
C535	CCD0273	C, Ceramic 500V 2pF ±0.25pF	1
C536	CCD0273	C, Ceramic 500V 2pF ±0.25pF	1
C537	CCG0116	C, Ceramic, Chip 50V 2pF ±0.25pF	1
C538	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C539	CES0133	C, AL Elyc 16V 47μF ±20%	1
C540	CQA0037	C, Plastic 250V 0.01μF ±10%	1
C541	CCD0287	C, Ceramic 500V 4700pF +100% -0%	1
C546	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C547	CQA0037	C, Plastic 250V 0.01μF ±10%	1
C548	CQA0037	C, Plastic 250V 0.01μF ±10%	1
C559	CCD0287	C, Ceramic 500V 4700pF +100% -0%	1
C560	CCD0287	C, Ceramic 500V 4700pF +100% -0%	1
C650	CCC1027	C, Ceramic 50V 220pF ±10%	1
C651	CES0133	C, AL Elyc 16V 47μF ±20%	1
CV509	CVE0057	C, Variable ECR-HC020D11	1
CV521	CVE0058	C, Variable ECR-HC040E11	1
CV534	CVE0057	C, Variable ECR-HC020D11	1
D532	HDM0140	Diode MTZ 4.7JB	1
D543	HDM0140	Diode MTZ 4.7JB	1
D544	HDM0141	Diode MTZ 7.5JC	1
IC650	IDM0539	IC, Digital MN3102	1
L532	TLE0058	Coil EL0606SK1 100K	1
L555	TLE0109	Inductor ELE-Y R68 MA	1
L556	TLE0109	Inductor ELE-Y R68 MA	1
P501	JBB0021	Connector B3B-XH-A	1
P654	JBB0027	Connector B2B-XH-A	1
P656	JBB0027	Connector B2B-XH-A	1
R500	RCE0745	R, Carbon 1/4W 10Ω ±5%	1
R501	RME1060	R, Metal 1/4W 100Ω ±1%	1
R502	RME1060	R, Metal 1/4W 100Ω ±1%	1
R503	RME0884	R, Metal, Chip 1/8W 4.7kΩ ±5%	1
R504	RME1106	R, Metal 1/4W 75.0Ω ±1%	1
R505	RCE0763	R, Carbon 1/4W 330Ω ±5%	1
R506	RCE0763	R, Carbon 1/4W 330Ω ±5%	1
R509	RCE0752	R, Carbon 1/4W 39Ω ±5%	1
R510	RME0868	R, Metal, Chip 1/8W 220Ω ±5%	1
R511	RME1060	R, Metal 1/4W 100Ω ±1%	1

Symbol	Part Code	Description	Q'ty
R512	RME1060	R, Metal 1/4W 100Ω ±1%	1
R513	RCE0749	R, Carbon 1/4W 22Ω ±1%	1
R514	RCE0749	R, Carbon 1/4W 22Ω ±5%	1
R515	RME1063	R, Metal 1/4W 182Ω ±1%	1
R516	RME1063	R, Metal 1/4W 182Ω ±1%	1
R517	RME1058	R, Metal 1/4W 68.1Ω ±1%	1
R518	RCE0764	R, Carbon 1/4W 390Ω ±5%	1
R519	RCE0764	R, Carbon 1/4W 390Ω ±5%	1
R520	RCE0770	R, Carbon 1/4W 1.2kΩ ±5%	1
R521	RCE0767	R, Carbon 1/4W 680Ω ±5%	1
R522	RCE0772	R, Carbon 1/4W 1.8kΩ ±5%	1
R523	RME0886	R, Metal, Chip 1/8W 6.8kΩ ±5%	1
R530	RME1007	R, Metal 1/8W 200Ω ±1%	1
R531	RME1007	R, Metal 1/8W 200Ω ±1%	1
R533	RME1118	R, Metal 1/4W 909Ω ±1%	1
R534	RME1118	R, Metal 1/4W 909Ω ±1%	1
R535	RME1382	R, Metal 1W 6.8kΩ ±5%	1
R536	RME1382	R, Metal 1W 6.8kΩ ±5%	1
R537	RCE0749	R, Carbon 1/4W 22Ω ±5%	1
R538	RCE0749	R, Carbon 1/4W 22Ω ±5%	1
R539	RCE0753	R, Carbon 1/4W 47Ω ±5%	1
R540	RCE0753	R, Carbon 1/4W 47Ω ±5%	1
R541	RCE0717	R, Carbon 1/2W 10.0kΩ ±5%	1
R542	RCE0753	R, Carbon 1/4W 47Ω ±5%	1
R543	RCE0753	R, Carbon 1/4W 47Ω ±5%	1
R544	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R545	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R546	RME0850	R, Metal, Chip 1/8W 4.7Ω ±10%	1
R547	RZZ0048	R, Fusing 1/2W 180Ω ±5%	1
R548	RZZ0048	R, Fusing 1/2W 180Ω ±5%	1
R551	RME1382	R, Metal 1W 6.8kΩ ±5%	1
R553	RME1382	R, Metal 1W 6.8kΩ ±5%	1
R555	RCE0758	R, Carbon 1/4W 120Ω ±5%	1
R556	RCE0758	R, Carbon 1/4W 120Ω ±5%	1
R557	RCE0749	R, Carbon 1/4W 22Ω ±5%	1
R558	RCE0749	R, Carbon 1/4W 22Ω ±5%	1
R571	RCE0791	R, Carbon 1/4W 68kΩ ±5%	1
R572	RCE0791	R, Carbon 1/4W 68kΩ ±5%	1
R650	RCE0802	R, Carbon 1/4W 1.0MΩ ±5%	1
R651	RCE0798	R, Carbon 1/4W 330kΩ ±5%	1
R652	RCE0781	R, Carbon 1/4W 10kΩ ±5%	1
R653	RCE0781	R, Carbon 1/4W 10kΩ ±5%	1
R654	RCE0781	R, Carbon 1/4W 10kΩ ±5%	1
R655	RME1174	R, Metal 1/4W 2.00kΩ ±1%	1
R656	RME1065	R, Metal 1/4W 267Ω ±1%	1
RV507	RNE0048	VR, Metal EVN 39C00YB22 (200)	1
RV510	RNE0052	VR, Metal EVN 39C00YB23 (2K)	1
RV655	RNE0058	VR, Metal EVN 39C00YB13 (1K)	1
TR505	HTA0290	Transistor 2SA1206	1
TR506	HTA0290	Transistor 2SA1206	1
TR518	HTC0768	Transistor 2SC2408	1
TR519	HTC0768	Transistor 2SC2408	1
TR533	HTC0768	Transistor 2SC2408	1
TR534	HTC0768	Transistor 2SC2408	1
TR539	HTC0839	Transistor 2SC3596	1
TR540	HTC0839	Transistor 2SC3596	1
TR542	HTA0315	Transistor 2SA1402	1
TR543	HTA0315	Transistor 2SA1402	1

Symbol	Part Code	Description	Q'ty
TR544	HTA0290	Transistor 2SA1206	1
TR545	HTA0290	Transistor 2SA1206	1
TR655	HTA0224	Transistor 2SA1029 D	1

PEF-712 SWEEP, TRIG, HV

Symbol	Part Code	Description	Q'ty
C802	CQX0068	C, Plastic 400V 0.047μF ±10%	1
C803	CCD0275	C, Ceramic 500V 5pF ±0.25pF	1
C805	CCD0277	C, Ceramic 500V 10pF ±0.25pF	1
C806	CCG0142	C, Ceramic, Chip 50V 82pF ±5%	1
C808	CCG0217	C, Ceramic, Chip 50V 0.047μF ±10%	1
C810	CES0133	C, AL Elyc 16V 47μF ±20%	1
C811	CCG0132	C, Ceramic, Chip 50V 22pF ±5%	1
C813	CCG0286	C, Ceramic 500V 1000pF +100% -0%	1
C814	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C818	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C821	CCG0205	C, Ceramic, Chip 50V1000pF ±10%	1
C825	CCG0143	C, Ceramic, Chip 50V 100pF ±5%	1
C830	CES0133	C, AL Elyc 16V 47μF ±20%	1
C831	CES0133	C, AL Elyc 16V 47μF ±20%	1
C836	CEX0189	C, AL Elyc 16V 10μF BP	1
C844	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C845	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C846	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C849	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C850	CEX0189	C, AL Elyc 16V 10μF BP	1
C851	CCG0141	C, Ceramic, Chip 50V 68pF ±5%	1
C852	CES0133	C, AL Elyc 16V 47μF ±20%	1
C854	CQA0129	C, Plastic 50V 22000pF ±10%	1
C870	CES0036	C, AL Elyc 25V 22μF ±20%	1
C871	CES0133	C, AL Elyc 16V 47μF ±20%	1
C880	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C881	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C884	CCG0136	C, Ceramic, Chip 50V 33pF ±5%	1
C930	CES0133	C, AL Elyc 16V 47μF ±20%	1
C932	CES0133	C, AL Elyc 16V 47μF ±20%	1
C936	CEX0189	C, AL Elyc 16V 10μF BP	1
C944	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C945	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C946	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C949	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C961	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C980	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C984	CCG0136	C, Ceramic, Chip 50V 33pF ±5%	1
C1005	CCG0124	C, Ceramic, Chip 50V 10pF ±0.5pF	1
C1011	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C1025	CES0133	C, AL Elyc 16V 47μF ±20%	1
C1031	CES0133	C, AL Elyc 16V 47μF ±20%	1
C1035	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C1039	CES0133	C, AL Elyc 16V 47μF ±20%	1
C1061	CES0133	C, AL Elyc 16V 47μF ±20%	1
C1063	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C1065	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C1068	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C1110	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C1111	CCG0144	C, Ceramic, Chip 50V 220pF ±5%	1
C1113	CCG0139	C, Ceramic, Chip 50V 47pF ±5%	1
C1114	CCG0144	C, Ceramic, Chip 50V 220pF ±5%	1
C1156	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C1160	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C1161	CCG0139	C, Ceramic, Chip 50V 47pF ±5%	1
C1205	CCG0124	C, Ceramic, Chip 50V 10pF ±0.5pF	1
C1211	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C1280	CCD0287	C, Ceramic 500V 4700pF +100% -0%	1
C1281	CCD0287	C, Ceramic 500V 4700pF +100% -0%	1
C1319	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C1320	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C1321	CES0134	C, AL Elyc 50V 1μF ±20%	1
C1322	CET0033	C, AL Elyc 160V 1μF ±20%	1

Symbol	Part Code	Description	Q'ty
C1330	CQE0078	C, Plastic ECQ-E1225JN(JNB) Type-1	1
C1331	CQE0107	C, Plastic ECQ-K1223GZ(100V 0.022μF)	1
C1332	CMV0053	C, Mica 50V 180pF ±5%	1
C1334	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C1339	CCG0139	C, Ceramic, Chip 50V 47pF ±5%	1
C1340	CES0133	C, AL Elyc 16V 47μF ±20%	1
C1341	CES0133	C, AL Elyc 16V 47μF ±20%	1
C1342	CES0227	C, AL Elyc 50V 10μF ±20%	1
C1343	CES0134	C, AL Elyc 50V 1μF ±20%	1
C1344	CCG0213	C, Ceramic, Chip 50V 0.1μF +80% -20%	1
C1345	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C1346	CCG0205	C, Ceramic, Chip 50V 1000pF ±10%	1
C1347	CCG0143	C, Ceramic, Chip 50V 100pF ±5%	1
C1349	CCG0194	C, Ceramic, Chip 50V 120pF ±5%	1
C1364	CCG0205	C, Ceramic, Chip 50V 1000pF ±10%	1
C1380	CQE0078	C, Plastic ECQ-E1225JN(JNB) Type-1	1
C1381	CQE0107	C, Plastic ECQ-K1223GZ (100V 0.022μF)	1
C1382	CMV0053	C, Mica 50V 180pF ±5%	1
C1388	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C1389	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C1390	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C1391	CES0134	C, AL Elyc 50V 1μF ±20%	1
C1392	CET0033	C, AL Elyc 160V 1μF ±20%	1
C1401	CES0133	C, AL Elyc 16V 47μF ±20%	1
C1402	CES0133	C, AL Elyc 16V 47μF ±20%	1
C1403	CES0133	C, AL Elyc 16V 47μF ±20%	1
C1404	CES0133	C, AL Elyc 16V 47μF ±20%	1
C1405	CES0031	C, AL Elyc 10V 220μF ±20%	1
C1407	CCG0116	C, Ceramic, Chip 50V 2pF ±0.25pF	1
C1410	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C1411	CCG0134	C, Ceramic, Chip 50V 27pF ±5%	1
C1415	CCG0116	C, Ceramic, Chip 50V 2pF ±0.25pF	1
C1421	CCG0128	C, Ceramic, Chip 50V 15pF ±5%	1
C1430	CCG0205	C, Ceramic, Chip 50V 1000pF ±10%	1
C1431	CES0133	C, AL Elyc 16V 47μF ±20%	1
C1441	CCG0205	C, Ceramic, Chip 50V 1000pF ±10%	1
C1445	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C1451	CCD0273	C, Ceramic 500V 2pF ±0.25pF	1
C1452	CCD0273	C, Ceramic 500V 2pF ±0.25pF	1
C1453	CCG0128	C, Ceramic, Chip 50V 15pF ±5%	1
C1454	CCG0128	C, Ceramic, Chip 50V 15pF ±5%	1
C1458	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C1459	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C1467	CQA0037	C, Plastic 250V 0.01μF ±10%	1
C1470	CQA0037	C, Plastic 250V 0.01μF ±10%	1
C1471	CQA0037	C, Plastic 250V 0.01μF ±10%	1
C1473	CQA0037	C, Plastic 250V 0.01μF ±10%	1
C1475	CCG0205	C, Ceramic, Chip 50V 1000pF ±10%	1
C1484	CCG0132	C, Ceramic, Chip 50V 22pF ±5%	1
C1498	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C1504	CES0133	C, AL Elyc 16V 47μF ±20%	1
C1512	CCD0287	C, Ceramic 500V 4700pF +100% -0%	1
C1513	CCD0271	C, Ceramic 500V 0.5pF ±0.25pF	1
C1518	CET0033	C, AL Elyc 160V 1μF ±20%	1
C1527	CCG0201	C, Ceramic, Chip 50V 470pF ±5%	1
C1535	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C1552	CQA0129	C, Plastic 50V 22000pF ±10%	1
C1559	CES0035	C, AL Elyc 50V 47μF ±20%	1
C1560	CQA0122	C, Plastic 50V 47000pF ±10%	1
C1561	CCD0245	C, Ceramic 2000V 100pF ±10%	1
C1562	CCD0231	C, Ceramic 2000V 4700pF +80% -20%	1

Symbol	Part Code	Description			Q'ty
C1563	CCD0231	C, Ceramic	2000V	4700pF	+80% -20%	1
C1564	CCD0231	C, Ceramic	2000V	4700pF	+80% -20%	1
C1564	CCD0286	C, Ceramic	500V	1000pF	+100% -0%	1
C1566	CET0033	C, AL Elyc	160V	1μF	±20%	1
C1567	CCD0246	C, Ceramic	2kV	1000pF	±10%	1
C1568	CCD0231	C, Ceramic	2000V	4700pF	+80% -20%	1
CV 803	CVE0026	C, Variable	ECV-1ZW20X60			1
CV 884	CVE0060	C, Variable	ECR-HA020D41			1
CV 984	CVE0060	C, Variable	ECR-HA020D41			1
CV1450	CVE0060	C, Variable	ECR-HA020D41			1
D810	HDS0477	Diode	1SS110			1
D815	HDS0477	Diode	1SS110			1
D821	HDS0437	Diode	1SS133			1
D830	HDS0437	Diode	1SS133			1
D831	HDS0437	Diode	1SS133			1
D845	HDS0437	Diode	1SS133			1
D846	HDS0437	Diode	1SS133			1
D847	HDS0437	Diode	1SS133			1
D848	HDS0437	Diode	1SS133			1
D849	HDS0437	Diode	1SS133			1
D852	HDS0437	Diode	1SS133			1
D860	HDS0437	Diode	1SS133			1
D882	HDS0437	Diode	1SS133			1
D884	HDM0051	Diode	MA161			1
D885	HDM0051	Diode	MA161			1
D888	HDM0051	Diode	MA161			1
D945	HDS0437	Diode	1SS133			1
D946	HDS0437	Diode	1SS133			1
D947	HDS0437	Diode	1SS133			1
D948	HDS0437	Diode	1SS133			1
D961	HDS0437	Diode	1SS133			1
D962	HDS0437	Diode	1SS133			1
D981	HDS0437	Diode	1SS133			1
D982	HDS0437	Diode	1SS133			1
D984	HDM0051	Diode	MA161			1
D985	HDM0051	Diode	MA161			1
D988	HDM0051	Diode	MA161			1
D1012	HDS0437	Diode	1SS133			1
D1013	HDS0437	Diode	1SS133			1
D1014	HDS0437	Diode	1SS133			1
D1031	HDS0437	Diode	1SS133			1
D1033	HDS0437	Diode	1SS133			1
D1034	HDS0437	Diode	1SS133			1
D1035	HDS0437	Diode	1SS133			1
D1036	HDS0437	Diode	1SS133			1
D1037	HDS0437	Diode	1SS133			1
D1038	HDS0437	Diode	1SS133			1
D1039	HDS0437	Diode	1SS133			1
D1040	HDS0437	Diode	1SS133			1
D1041	HDS0437	Diode	1SS133			1
D1042	HDS0437	Diode	1SS133			1
D1043	HDS0437	Diode	1SS133			1
D1044	HDS0437	Diode	1SS133			1
D1045	HDS0437	Diode	1SS133			1
D1105	HDS0437	Diode	1SS133			1
D1106	HDS0437	Diode	1SS133			1
D1107	HDS0437	Diode	1SS133			1

Symbol	Part Code	Description		Q'ty
D1108	HDS0437	Diode	1SS133	1
D1113	HDS0437	Diode	1SS133	1
D1114	HDS0437	Diode	1SS133	1
D1115	HDS0437	Diode	1SS133	1
D1116	HDS0437	Diode	1SS133	1
D1280	HDM0144	Diode	MTZ 22JD	1
D1304	HDM0051	Diode	MA161	1
D1305	HDM0051	Diode	MA161	1
D1306	HDM0051	Diode	MA161	1
D1307	HDM0051	Diode	MA161	1
D1308	HDM0051	Diode	MA161	1
D1309	HDM0051	Diode	MA161	1
D1310	HDM0051	Diode	MA161	1
D1342	HDS0437	Diode	1SS133	1
D1344	HDS0437	Diode	1SS133	1
D1345	HDS0437	Diode	1SS133	1
D1346	HDS0437	Diode	1SS133	1
D1347	HDS0437	Diode	1SS133	1
D1348	HDS0437	Diode	1SS133	1
D1378	HDM0051	Diode	MA161	1
D1385	HDM0051	Diode	MA161	1
D1386	HDM0051	Diode	MA161	1
D1387	HDM0051	Diode	MA161	1
D1388	HDM0051	Diode	MA161	1
D1389	HDM0051	Diode	MA161	1
D1390	HDM0051	Diode	MA161	1
D1440	HDS0437	Diode	1SS133	1
D1442	HDS0437	Diode	1SS133	1
D1443	HDS0437	Diode	1SS133	1
D1444	HDM0140	Diode	MTZ 4.7JB	1
D1458	HDM0141	Diode	MTZ 7.5JC	1
D1459	HDM0141	Diode	MTZ 7.5JC	1
D1470	HDS0437	Diode	1SS133	1
D1471	HDS0437	Diode	1SS133	1
D1501	HDS0437	Diode	1SS133	1
D1502	HDS0437	Diode	1SS133	1
D1503	HDS0437	Diode	1SS133	1
D1504	HDS0437	Diode	1SS133	1
D1511	HDS0437	Diode	1SS133	1
D1520	HDS0437	Diode	1SS133	1
D1521	HDS0437	Diode	1SS133	1
D1561	HDY0031	Diode	Y106A	1
D1562	HDS0250	Diode	1SS83	1
D1563	HDS0250	Diode	1SS83	1
D1564	HDS0250	Diode	1SS83	1
D1565	HDS0250	Diode	1SS83	1
D1566	HDM0145	Diode	MTZ 33JD	1
D1585	HDS0437	Diode	1SS133	1
F1270	EFZ0013	IC Protect	ICP-F10 (0.4A)	1
F1270	EFZ0013	IC Protect	ICP-F10 (0.4A)	1
IC849	IDH0403	IC, Digital	HD74S00P	1
IC861	ILU0010	IC, Analog	UN4213	1
IC870	IDH0429	IC, Digital	HD74S74P	1
IC949	IDH0467	IC, Digital	HD74LS00P	1
IC951	ILU0010	IC, Analog	UN4213	1
IC952	ILU0010	IC, Analog	UN4213	1
IC962	IDH0403	IC, Digital	HD74S00P	1
IC980	IDH0429	IC, Digital	HD74S74P	1
IC1031	IDH0713	IC, Digital	HD74LS109AP	1
IC1065	IDH0802	IC, Digital	HD14053BP	1
IC1102	IDH0467	IC, Digital	HD74LS00P	1

Symbol	Part Code	Description	Q'ty
IC1113	IDH0646	IC, Digital HD74LS02P	1
IC1160	IDT0049	IC, Digital TC40H164P	1
IC1161	IDT0049	IC, Digital TC40H164P	1
IC1320	8397023A	IC, Analog LF111CN	1
IC1330	IDH0801	IC, Digital HD14052BP	1
IC1340	IDH0800	IC, Digital HD14051BP	1
IC1345	IDH0467	IC, Digital HD74LS00P	1
IC1380	IDH0801	IC, Digital HD14052BP	1
IC1390	8397023A	IC, Analog LF111CN	1
L 841	TLE0120	Inductor ELE-Y 6R8 KA	1
L 941	TLE0120	Inductor ELE-Y 6R8 KA	1
L1111	TLE0063	Coil EL0606SK1 330K	1
MUT1560	3180009	Multiplier 10KV X5	1
NL 1565	ELS0032	Lamp SA-200DSS-ON-1	1
P 801	JBB0027	Connector B2B-XH-A	1
P 802	JBB0027	Connector B2B-XH-A	1
P 805	JBB0021	Connector B3B-XH-A	1
P1000	JBB0024	Connector B15B-XH-A	1
P1270	JBB0021	Connector B3B-XH-A	1
P1401	JBB0024	Connector B15B-XH-A	1
P1505	JBB0027	Connector B2B-XH-A	1
P1551	JBB0021	Connector B3B-XH-A	1
P1562	JBB0027	Connector B2B-XH-A	1
P1577	JBB0027	Connector B2B-XH-A	1
P1582	JBX2097	Connector 2-164713-0 (8440219)	1
P1584	JBX2097	Connector 2-164713-0 (8440219)	1
R801	RME0856	R, Metal, Chip 1/8W 22Ω ±5%	1
R802	RME1168	R, Metal 1/4W 500kΩ ±0.5%	1
R803	RME1373	R, Metal 1/4W 400kΩ ±0.5%	1
R804	RME1163	R, Metal 1/4W 111kΩ ±0.5%	1
R805	RME0912	R, Metal, Chip Zero Ohm Resistor	1
R806	RME0859	R, Metal, Chip 1/8W 39Ω ±5%	1
R808	RME0894	R, Metal, Chip 1/8W 33kΩ ±5%	1
R809	RME1168	R, Metal 1/4W 500kΩ ±0.5%	1
R810	RME1168	R, Metal 1/4W 500kΩ ±0.5%	1
R811	RME0860	R, Metal, Chip 1/8W 47Ω ±5%	1
R813	RCE0733	R, Carbon 1/2W 470kΩ ±5%	1
R814	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R815	RME1060	R, Metal 1/4W 100Ω ±1%	1
R816	RME0874	R, Metal, Chip 1/8W 680Ω ±5%	1
R817	RME1060	R, Metal 1/4W 100Ω ±1%	1
R818	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R820	RCE0768	R, Carbon 1/4W 820Ω ±5%	1
R821	RCE0763	R, Carbon 1/4W 330Ω ±5%	1
R822	RME1061	R, Metal 1/4W 121Ω ±1%	1
R823	RME1107	R, Metal 1/4W 86.6Ω ±1%	1
R825	RME0868	R, Metal, Chip 1/8W 220Ω ±5%	1
R828	RME0860	R, Metal, Chip 1/8W 47Ω ±5%	1
R830	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R831	RME0880	R, Metal, Chip 1/8W 2.2kΩ ±5%	1
R832	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R834	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R835	RME0880	R, Metal, Chip 1/8W 2.2kΩ ±5%	1
R836	RME0876	R, Metal, Chip 1/8W 1.0kΩ ±5%	1

Symbol	Part Code	Description	Q'ty
R837	RME0875	R, Metal, Chip 1/8W 820Ω ±5%	1
R838	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R839	RME0881	R, Metal, Chip 1/8W 2.7kΩ ±5%	1
R840	RME0885	R, Metal, Chip 1/8W 5.6kΩ ±5%	1
R841	RME0871	R, Metal, Chip 1/8W 390Ω ±5%	1
R842	RME0860	R, Metal, Chip 1/8W 47Ω ±5%	1
R843	RME0880	R, Metal, Chip 1/8W 2.2kΩ ±5%	1
R844	RME0896	R, Metal, Chip 1/8W 47kΩ ±5%	1
R845	RME0896	R, Metal, Chip 1/8W 47kΩ ±5%	1
R846	RME0896	R, Metal, Chip 1/8W 47kΩ ±5%	1
R847	RME0881	R, Metal, Chip 1/8W 2.7kΩ ±5%	1
R848	RME0881	R, Metal, Chip 1/8W 2.7kΩ ±5%	1
R849	RME0852	R, Metal, Chip 1/8W 10Ω ±5%	1
R850	RME0869	R, Metal, Chip 1/8W 270Ω ±5%	1
R851	RME0896	R, Metal, Chip 1/8W 47kΩ ±5%	1
R852	RME0876	R, Metal, Chip 1/8W 1.0kΩ ±5%	1
R853	RME0892	R, Metal, Chip 1/8W 22kΩ ±5%	1
R854	RME0880	R, Metal, Chip 1/8W 2.2kΩ ±5%	1
R860	RME0896	R, Metal, Chip 1/8W 47kΩ ±5%	1
R861	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R862	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R864	RME0888	R, Metal, Chip 1/8W 10kΩ ±5%	1
R865	RME0876	R, Metal, Chip 1/8W 1.0kΩ ±5%	1
R866	RME0898	R, Metal, Chip 1/8W 68kΩ ±5%	1
R867	RME0896	R, Metal, Chip 1/8W 47kΩ ±5%	1
R868	RME0888	R, Metal, Chip 1/8W 10kΩ ±5%	1
R870	RME0887	R, Metal, Chip 1/8W 8.2kΩ ±5%	1
R871	RME0878	R, Metal, Chip 1/8W 1.5kΩ ±5%	1
R872	RME0890	R, Metal, Chip 1/8W 15kΩ ±5%	1
R873	RME0884	R, Metal, Chip 1/8W 4.7kΩ ±5%	1
R874	RME0888	R, Metal, Chip 1/8W 10kΩ ±5%	1
R875	RME0882	R, Metal, Chip 1/8W 3.3kΩ ±5%	1
R880	RME0852	R, Metal, Chip 1/8W 10Ω ±5%	1
R881	RME0852	R, Metal, Chip 1/8W 10Ω ±5%	1
R882	RME0896	R, Metal, Chip 1/8W 47kΩ ±5%	1
R883	RME0888	R, Metal, Chip 1/8W 10kΩ ±5%	1
R884	RME0876	R, Metal, Chip 1/8W 1.0kΩ ±5%	1
R885	RME0880	R, Metal, Chip 1/8W 2.2kΩ ±5%	1
R886	RME0891	R, Metal, Chip 1/8W 18kΩ ±5%	1
R887	RME0880	R, Metal, Chip 1/8W 2.2kΩ ±5%	1
R888	RME1174	R, Metal 1/4W 2.00kΩ ±1%	1
R889	RME0882	R, Metal, Chip 1/8W 3.3kΩ ±5%	1
R930	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R931	RME0885	R, Metal, Chip 1/8W 5.6kΩ ±5%	1
R932	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R935	RME0880	R, Metal, Chip 1/8W 2.2kΩ ±5%	1
R936	RME0876	R, Metal, Chip 1/8W 1.0kΩ ±5%	1
R937	RME0875	R, Metal, Chip 1/8W 820Ω ±5%	1
R938	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R939	RME0881	R, Metal, Chip 1/8W 2.7kΩ ±5%	1
R941	RME0871	R, Metal, Chip 1/8W 390Ω ±5%	1
R942	RME0860	R, Metal, Chip 1/8W 47Ω ±5%	1
R943	RME0880	R, Metal, Chip 1/8W 2.2kΩ ±5%	1
R944	RME0896	R, Metal, Chip 1/8W 47kΩ ±5%	1
R945	RME0896	R, Metal, Chip 1/8W 47kΩ ±5%	1
R946	RME0896	R, Metal, Chip 1/8W 47kΩ ±5%	1
R947	RME0881	R, Metal, Chip 1/8W 2.7kΩ ±5%	1
R948	RME0881	R, Metal, Chip 1/8W 2.7kΩ ±5%	1
R949	RME0852	R, Metal, Chip 1/8W 10Ω ±5%	1
R951	RME0896	R, Metal, Chip 1/8W 47kΩ ±5%	1
R952	RME0896	R, Metal, Chip 1/8W 47kΩ ±5%	1
R961	RME0852	R, Metal, Chip 1/8W 10Ω ±5%	1
R962	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1

Symbol	Part Code	Description	Q'ty
R964	RME0896	R, Metal, Chip 1/8W 47kΩ ±5%	1
R980	RME0852	R, Metal, Chip 1/8W 10Ω ±5%	1
R984	RME0876	R, Metal, Chip 1/8W 1.0kΩ ±5%	1
R985	RME0880	R, Metal, Chip 1/8W 2.2kΩ ±5%	1
R986	RME0891	R, Metal, Chip 1/8W 18kΩ ±5%	1
R987	RME0880	R, Metal, Chip 1/8W 2.2kΩ ±5%	1
R988	RME1174	R, Metal 1/4W 2.00kΩ ±1%	1
R989	RME0882	R, Metal, Chip 1/8W 3.3kΩ ±5%	1
R1002	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R1004	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R1005	RME0852	R, Metal, Chip 1/8W 10Ω ±5%	1
R1006	RME0896	R, Metal, Chip 1/8W 47kΩ ±5%	1
R1007	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R1010	RME0880	R, Metal, Chip 1/8W 2.2kΩ ±5%	1
R1011	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R1012	RME0872	R, Metal, Chip 1/8W 470Ω ±5%	1
R1013	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R1021	RME0881	R, Metal, Chip 1/8W 2.7kΩ ±5%	1
R1022	RME0873	R, Metal, Chip 1/8W 560Ω ±5%	1
R1023	RME0894	R, Metal, Chip 1/8W 33kΩ ±5%	1
R1024	RCE0721	R, Carbon 1/2W 22kΩ ±5%	1
R1025	RME0880	R, Metal, Chip 1/8W 2.2kΩ ±5%	1
R1030	RME0894	R, Metal, Chip 1/8W 33kΩ ±5%	1
R1031	RME0876	R, Metal, Chip 1/8W 1.0kΩ ±5%	1
R1032	RME0878	R, Metal, Chip 1/8W 1.5kΩ ±5%	1
R1033	RME0876	R, Metal, Chip 1/8W 1.0kΩ ±5%	1
R1034	RME0892	R, Metal, Chip 1/8W 22kΩ ±5%	1
R1035	RME0892	R, Metal, Chip 1/8W 22kΩ ±5%	1
R1038	RME0896	R, Metal, Chip 1/8W 47kΩ ±5%	1
R1039	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R1046	RME0877	R, Metal, Chip 1/8W 1.2kΩ ±5%	1
R1047	RME0880	R, Metal, Chip 1/8W 2.2kΩ ±5%	1
R1048	RME0884	R, Metal, Chip 1/8W 4.7kΩ ±5%	1
R1049	RME0892	R, Metal, Chip 1/8W 22kΩ ±5%	1
R1050	RME0877	R, Metal, Chip 1/8W 1.2kΩ ±5%	1
R1051	RME0877	R, Metal, Chip 1/8W 1.2kΩ ±5%	1
R1052	RME0880	R, Metal, Chip 1/8W 2.2kΩ ±5%	1
R1053	RME0884	R, Metal, Chip 1/8W 4.7kΩ ±5%	1
R1054	RME0880	R, Metal, Chip 1/8W 2.2kΩ ±5%	1
R1055	RME0884	R, Metal, Chip 1/8W 4.7kΩ ±5%	1
R1056	RME0884	R, Metal, Chip 1/8W 4.7kΩ ±5%	1
R1057	RME0887	R, Metal, Chip 1/8W 8.2kΩ ±5%	1
R1058	RME0884	R, Metal, Chip 1/8W 4.7kΩ ±5%	1
R1059	RME0871	R, Metal, Chip 1/8W 390Ω ±5%	1
R1060	RME0884	R, Metal, Chip 1/8W 4.7kΩ ±5%	1
R1061	RME0884	R, Metal, Chip 1/8W 4.7kΩ ±5%	1
R1062	RME0872	R, Metal, Chip 1/8W 470Ω ±5%	1
R1063	RME0888	R, Metal, Chip 1/8W 10kΩ ±5%	1
R1064	RME0876	R, Metal, Chip 1/8W 1.0kΩ ±5%	1
R1065	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R1066	RME0896	R, Metal, Chip 1/8W 47kΩ ±5%	1
R1101	RME0896	R, Metal, Chip 1/8W 47kΩ ±5%	1
R1104	RME0868	R, Metal, Chip 1/8W 220Ω ±5%	1
R1105	RME0882	R, Metal, Chip 1/8W 3.3kΩ ±5%	1
R1106	RME0868	R, Metal, Chip 1/8W 220Ω ±5%	1
R1107	RME0883	R, Metal, Chip 1/8W 3.9kΩ ±5%	1
R1110	RME0852	R, Metal, Chip 1/8W 10Ω ±5%	1
R1111	RME0872	R, Metal, Chip 1/8W 470Ω ±5%	1
R1112	RME0890	R, Metal, Chip 1/8W 15kΩ ±5%	1
R1113	RME0876	R, Metal, Chip 1/8W 1.0kΩ ±5%	1
R1114	RME0883	R, Metal, Chip 1/8W 3.9kΩ ±5%	1
R1150	RME0888	R, Metal, Chip 1/8W 10kΩ ±5%	1

Symbol	Part Code	Description	Q'ty
R1151	RME0888	R, Metal, Chip 1/8W 10kΩ ±5%	1
R1152	RME0888	R, Metal, Chip 1/8W 10kΩ ±5%	1
R1153	RME0888	R, Metal, Chip 1/8W 10kΩ ±5%	1
R1154	RME0888	R, Metal, Chip 1/8W 10kΩ ±5%	1
R1155	RME0888	R, Metal, Chip 1/8W 10kΩ ±5%	1
R1161	RME0852	R, Metal, Chip 1/8W 10Ω ±5%	1
R1202	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R1204	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R1205	RME0852	R, Metal, Chip 1/8W 10Ω ±5%	1
R1206	RME0896	R, Metal, Chip 1/8W 47kΩ ±5%	1
R1207	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R1210	RME0880	R, Metal, Chip 1/8W 2.2kΩ ±5%	1
R1211	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R1272	RCE0749	R, Carbon 1/4W 22Ω ±5%	1
R1280	RME0896	R, Metal, Chip 1/8W 47kΩ ±5%	1
R1303	RME0882	R, Metal, Chip 1/8W 3.3kΩ ±5%	1
R1304	RME1168	R, Metal 1/4W 500kΩ ±0.5%	1
R1305	RME1097	R, Metal 1/4W 121kΩ ±1%	1
R1306	RME1102	R, Metal 1/4W 332kΩ ±1%	1
R1307	RME1168	R, Metal 1/4W 500kΩ ±0.5%	1
R1310	RME0898	R, Metal, Chip 1/8W 68kΩ ±5%	1
R1311	RME0891	R, Metal, Chip 1/8W 18kΩ ±5%	1
R1312	RME1083	R, Metal 1/4W 8.25kΩ ±1%	1
R1313	RME1083	R, Metal 1/4W 8.25kΩ ±1%	1
R1314	RME1083	R, Metal 1/4W 8.25kΩ ±1%	1
R1315	RME0876	R, Metal, Chip 1/8W 1.0kΩ ±5%	1
R1316	RME1193	R, Metal 1/4W 11.0kΩ ±1%	1
R1319	RME0860	R, Metal, Chip 1/8W 47Ω ±5%	1
R1320	RME0876	R, Metal, Chip 1/8W 1.0kΩ ±5%	1
R1321	RME1096	R, Metal 1/4W 100kΩ ±1%	1
R1322	RME0860	R, Metal, Chip 1/8W 47Ω ±5%	1
R1323	RMS0051	R, Metal 1/4W 600kΩ ±0.5%	1
R1325	RME1381	R, Metal 1/4W 60.0kΩ ±0.5%	1
R1326	RME1283	R, Metal 1/4W 6.00kΩ ±0.5%	1
R1327	RME0887	R, Metal, Chip 1/8W 8.2kΩ ±5%	1
R1330	RME0882	R, Metal, Chip 1/8W 3.3kΩ ±5%	1
R1331	RME0882	R, Metal, Chip 1/8W 3.3kΩ ±5%	1
R1332	RME0887	R, Metal, Chip 1/8W 8.2kΩ ±5%	1
R1334	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R1340	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R1341	RME0876	R, Metal, Chip 1/8W 1.0kΩ ±5%	1
R1342	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R1343	RME0884	R, Metal, Chip 1/8W 4.7kΩ ±5%	1
R1344	RME0880	R, Metal, Chip 1/8W 2.2kΩ ±5%	1
R1345	RME0896	R, Metal, Chip 1/8W 47kΩ ±5%	1
R1346	RME0896	R, Metal, Chip 1/8W 47kΩ ±5%	1
R1347	RME0887	R, Metal, Chip 1/8W 8.2kΩ ±5%	1
R1348	RME0898	R, Metal, Chip 1/8W 68kΩ ±5%	1
R1355	RME0870	R, Metal, Chip 1/8W 330Ω ±5%	1
R1360	RME0882	R, Metal, Chip 1/8W 3.3kΩ ±5%	1
R1361	RME0892	R, Metal, Chip 1/8W 22kΩ ±5%	1
R1362	RME0892	R, Metal, Chip 1/8W 22kΩ ±5%	1
R1363	RME0876	R, Metal, Chip 1/8W 1.0kΩ ±5%	1
R1364	RSE0434	R, Solid 1/4W 10MΩ ±5%	1
R1370	RME0888	R, Metal, Chip 1/8W 10kΩ ±5%	1
R1371	RME0884	R, Metal, Chip 1/8W 4.7kΩ ±5%	1
R1372	RME0884	R, Metal, Chip 1/8W 4.7kΩ ±5%	1
R1373	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R1376	RME1193	R, Metal 1/4W 11.0kΩ ±1%	1
R1377	RME0882	R, Metal, Chip 1/8W 3.3kΩ ±5%	1
R1378	RME1168	R, Metal 1/4W 500kΩ ±0.5%	1
R1379	RME0876	R, Metal, Chip 1/8W 1.0kΩ ±5%	1
R1380	RME1097	R, Metal 1/4W 121kΩ ±1%	1

Symbol	Part Code	Description	Q'ty
R1381	RME1102	R, Metal 1/4W 332k Ω ±1%	1
R1382	RME1168	R, Metal 1/4W 500k Ω ±0.5%	1
R1383	RME0898	R, Metal, Chip 1/8W 68k Ω ±5%	1
R1384	RME0891	R, Metal, Chip 1/8W 18k Ω ±5%	1
R1385	RME1083	R, Metal 1/4W 8.25k Ω ±1%	1
R1386	RME1083	R, Metal 1/4W 8.25k Ω ±1%	1
R1387	RME1083	R, Metal 1/4W 8.25k Ω ±1%	1
R1388	RME0876	R, Metal, Chip 1/8W 1.0k Ω ±5%	1
R1389	RME0864	R, Metal, Chip 1/8W 100 Ω ±5%	1
R1390	RME0860	R, Metal, Chip 1/8W 47 Ω ±5%	1
R1391	RME0860	R, Metal, Chip 1/8W 47 Ω ±5%	1
R1393	RME1381	R, Metal 1/4W 60.0k Ω ±0.5%	1
R1394	RMS0051	R, Metal 1/4W 600k Ω ±0.5%	1
R1395	RME1283	R, Metal 1/4W 6.00k Ω ±0.5%	1
R1396	RME1096	R, Metal 1/4W 100k Ω ±1%	1
R1397	RME0882	R, Metal, Chip 1/8W 3.3k Ω ±5%	1
R1398	RME0882	R, Metal, Chip 1/8W 3.3k Ω ±5%	1
R1399	RME0887	R, Metal, Chip 1/8W 8.2k Ω ±5%	1
R1400	RME0887	R, Metal, Chip 1/8W 8.2k Ω ±5%	1
R1401	RME0883	R, Metal, Chip 1/8W 3.9k Ω ±5%	1
R1402	RME0871	R, Metal, Chip 1/8W 390 Ω ±5%	1
R1403	RME0867	R, Metal, Chip 1/8W 180 Ω ±5%	1
R1404	RCE0769	R, Carbon 1/4W 1.0k Ω ±5%	1
R1405	RME0860	R, Metal, Chip 1/8W 47 Ω ±5%	1
R1406	RME0877	R, Metal, Chip 1/8W 1.2k Ω ±5%	1
R1407	RME1076	R, Metal 1/4W 2.21k Ω ±1%	1
R1410	RME0888	R, Metal, Chip 1/8W 10k Ω ±5%	1
R1412	RME0880	R, Metal, Chip 1/8W 2.2k Ω ±5%	1
R1413	RME0880	R, Metal, Chip 1/8W 2.2k Ω ±5%	1
R1415	RME1076	R, Metal 1/4W 2.21k Ω ±1%	1
R1416	RME0877	R, Metal, Chip 1/8W 1.2k Ω ±5%	1
R1418	RME0856	R, Metal, Chip 1/8W 22 Ω ±5%	1
R1419	RME0856	R, Metal, Chip 1/8W 22 Ω ±5%	1
R1420	RME0881	R, Metal, Chip 1/8W 2.7k Ω ±5%	1
R1421	RME0852	R, Metal, Chip 1/8W 10 Ω ±5%	1
R1422	RME0876	R, Metal, Chip 1/8W 1.0k Ω ±5%	1
R1423	RME0876	R, Metal, Chip 1/8W 1.0k Ω ±5%	1
R1424	RME0864	R, Metal, Chip 1/8W 100 Ω ±5%	1
R1426	RME1073	R, Metal 1/4W 1.21k Ω ±1%	1
R1427	RME1073	R, Metal 1/4W 1.21k Ω ±1%	1
R1428	RME0885	R, Metal, Chip 1/8W 5.6k Ω ±5%	1
R1429	RME0885	R, Metal, Chip 1/8W 5.6k Ω ±5%	1
R1430	RME0886	R, Metal, Chip 1/8W 6.8k Ω ±5%	1
R1431	RME0886	R, Metal, Chip 1/8W 6.8k Ω ±5%	1
R1432	RME0868	R, Metal, Chip 1/8W 220 Ω ±5%	1
R1433	RME0872	R, Metal, Chip 1/8W 470 Ω ±5%	1
R1434	RME0852	R, Metal, Chip 1/8W 10 Ω ±5%	1
R1435	RME0864	R, Metal, Chip 1/8W 100 Ω ±5%	1
R1437	RME1070	R, Metal 1/4W 681 Ω ±1%	1
R1438	RME1070	R, Metal 1/4W 681 Ω ±1%	1
R1439	RME1411	R, Metal 1/4W 9.09k Ω ±1%	1
R1440	RME0864	R, Metal, Chip 1/8W 100 Ω ±5%	1
R1441	RME0872	R, Metal, Chip 1/8W 470 Ω ±5%	1
R1442	RME0864	R, Metal, Chip 1/8W 100 Ω ±5%	1
R1443	RME0864	R, Metal, Chip 1/8W 100 Ω ±5%	1
R1444	RME0875	R, Metal, Chip 1/8W 820 Ω ±5%	1
R1445	RME0883	R, Metal, Chip 1/8W 3.9k Ω ±5%	1
R1446	RME0897	R, Metal, Chip 1/8W 56k Ω ±5%	1
R1447	RME0897	R, Metal, Chip 1/8W 56k Ω ±5%	1
R1448	RME0887	R, Metal, Chip 1/8W 8.2k Ω ±5%	1
R1449	RME0884	R, Metal, Chip 1/8W 4.7k Ω ±5%	1
R1450	RME0874	R, Metal, Chip 1/8W 680 Ω ±5%	1
R1451	RME1383	R, Metal 1W 22k Ω ±5%	1

Symbol	Part Code	Description	Q'ty
R1452	RME1383	R, Metal 1W 22k Ω ±5%	1
R1453	RME0856	R, Metal, Chip 1/8W 22 Ω ±5%	1
R1454	RME0856	R, Metal, Chip 1/8W 22 Ω ±5%	1
R1455	RME0875	R, Metal, Chip 1/8W 820 Ω ±5%	1
R1456	RME0875	R, Metal, Chip 1/8W 820 Ω ±5%	1
R1457	RME0872	R, Metal, Chip 1/8W 470 Ω ±5%	1
R1458	RME0872	R, Metal, Chip 1/8W 470 Ω ±5%	1
R1460	RME0852	R, Metal, Chip 1/8W 10 Ω ±5%	1
R1461	RME0864	R, Metal, Chip 1/8W 100 Ω ±5%	1
R1462	RME0864	R, Metal, Chip 1/8W 100 Ω ±5%	1
R1463	RME0894	R, Metal, Chip 1/8W 33k Ω ±5%	1
R1464	RME0902	R, Metal, Chip 1/8W 220k Ω ±5%	1
R1465	RCE0779	R, Carbon 1/4W 6.8k Ω ±5%	1
R1466	RZR0001	R, Fusing 1/4W 1.0k Ω ±0.5%	1
R1467	RME0912	R, Metal, Chip Zero Ohm Resistor	1
R1470	RME0902	R, Metal, Chip 1/8W 220k Ω ±5%	1
R1471	RCE0779	R, Carbon 1/4W 6.8k Ω ±5%	1
R1472	RZR0001	R, Fusing 1/4W 1.0k Ω ±0.5%	1
R1473	RME0894	R, Metal, Chip 1/8W 33k Ω ±5%	1
R1474	RCE0757	R, Carbon 1/4W 100 Ω ±5%	1
R1475	RME1286	R, Metal, Chip 1/8W 180k Ω ±5%	1
R1476	RME1286	R, Metal, Chip 1/8W 180k Ω ±5%	1
R1477	RME0894	R, Metal, Chip 1/8W 33k Ω ±5%	1
R1480	RME0885	R, Metal, Chip 1/8W 5.6k Ω ±5%	1
R1481	RME0885	R, Metal, Chip 1/8W 5.6k Ω ±5%	1
R1484	RME1412	R, Metal, Chip 1/4W 4.32k Ω ±1%	1
R1485	RME0882	R, Metal, Chip 1/8W 3.3k Ω ±5%	1
R1486	RME0882	R, Metal, Chip 1/8W 3.3k Ω ±5%	1
R1487	RME1123	R, Metal 1/4W 2.43k Ω ±1%	1
R1490	RME0876	R, Metal, Chip 1/8W 1.0k Ω ±5%	1
R1501	RME0881	R, Metal, Chip 1/8W 2.7k Ω ±5%	1
R1502	RCE0785	R, Carbon 1/4W 22k Ω ±5%	1
R1503	RME0875	R, Metal, Chip 1/8W 820 Ω ±5%	1
R1504	RME0881	R, Metal, Chip 1/8W 2.7k Ω ±5%	1
R1510	RME1175	R, Metal, Chip 1/8W 120k Ω ±5%	1
R1511	RME0889	R, Metal, Chip 1/8W 12k Ω ±5%	1
R1512	RZR0001	R, Fusing 1/4W 1.0k Ω ±0.5%	1
R1513	RCE0721	R, Carbon 1/2W 22k Ω ±5%	1
R1514	RME0864	R, Metal, Chip 1/8W 100 Ω ±5%	1
R1515	RME0897	R, Metal, Chip 1/8W 56k Ω ±5%	1
R1516	RME0878	R, Metal, Chip 1/8W 1.5k Ω ±5%	1
R1517	RME0868	R, Metal, Chip 1/8W 220 Ω ±5%	1
R1518	RME0852	R, Metal, Chip 1/8W 10 Ω ±5%	1
R1520	RME0892	R, Metal, Chip 1/8W 22k Ω ±5%	1
R1521	RME0886	R, Metal, Cnip 1/8W 6.8k Ω ±5%	1
R1524	RME0886	R, Metal, Chip 1/8W 6.8k Ω ±5%	1
R1525	RME0892	R, Metal, Chip 1/8W 22k Ω ±5%	1
R1526	RME0875	R, Metal, Chip 1/8W 820 Ω ±5%	1
R1527	RME0872	R, Metal, Chip 1/8W 470 Ω ±5%	1
R1530	RME0880	R, Metal, Chip 1/8W 2.2k Ω ±5%	1
R1531	RME0883	R, Metal, Chip 1/8W 3.9k Ω ±5%	1
R1532	RME0885	R, Metal, Chip 1/8W 5.6k Ω ±5%	1
R1533	RME0876	R, Metal, Chip 1/8W 1.0k Ω ±5%	1
R1534	RME0884	R, Metal, Chip 1/8W 4.7k Ω ±5%	1
R1535	RME0852	R, Metal, Chip 1/8W 10 Ω ±5%	1
R1552	RME1485	R, Metal 1/4W 681k Ω ±1%	1
R1553	RME0902	R, Metal, Chip 1/8W 220k Ω ±5%	1
R1554	RCE0769	R, Carbon 1/4W 1.0k Ω ±5%	1
R1555	RME0888	R, Metal, Chip 1/8W 10k Ω ±5%	1
R1556	RME0882	R, Metal, Chip 1/8W 3.3k Ω ±5%	1
R1560	RCE0760	R, Carbon 1/4W 180 Ω ±5%	1
R1561	RMV0012	R, Metal VR37 15M Ω ±1%	1
R1562	RCE0715	R, Carbon 1/2W 6.8k Ω ±5%	1

Symbol	Part Code	Description	Q'ty
R1563	RCE0798	R, Carbon 1/4W 330kΩ ±5%	1
R1564	RCE0777	R, Carbon 1/4W 4.7kΩ ±5%	1
R1565	RSE0434	R, Solid 1/4W 10MΩ ±5%	1
R1566	RCE0773	R, Carbon 1/4W 2.2kΩ ±5%	1
R1567	RCE0789	R, Carbon 1/4W 47kΩ ±5%	1
R1580	RME0894	R, Metal, Chip 1/8W 33kΩ ±5%	1
R1581	RME0881	R, Metal, Chip 1/8W 2.7kΩ ±5%	1
R1585	RME0884	R, Metal, Chip 1/8W 4.7kΩ ±5%	1
RV1030	RNE0050	VR, Metal EVN 39C00YB52 (500)	1
RV1062	RNE0058	VR, Metal EVN 39C00YB13 (1K)	1
RV1063	RNE0051	VR, Metal EVN 39C00YB14 (10K)	1
RV1104	8348452	VR, Carbon EVH-CCAK20B14 (10K)	1
RV1271	RNE0072	VR, Metal ENV 49C00YB24 (20K)	1
RV1281	RNE0054	VR, Metal EVN 39C00YB15 (100K)	1
RV1312	RNE0070	VR, Metal EVN 39C00YB53 (5K)	1
RV1313	RNE0070	VR, Metal EVN 39C00YB53 (5K)	1
RV1314	RNE0070	VR, Metal EVN 39C00YB53 (5K)	1
RV1347	RDE0036	VR, Carbon EVH-CCAK20B15 (100K)	1
RV1385	RNE0070	VR, Metal EVN 39C00YB53 (5K)	1
RV1386	RNE0070	VR, Metal EVN 39C00YB53 (5K)	1
RV1387	RNE0070	VR, Metal EVN 39C00YB53 (5K)	1
RV1420	RNE0070	VR, Metal EVN 39C00YB53 (5K)	1
RV1422	RNE0050	VR, Metal EVN 39C00YB52 (500)	1
RV1424	RNE0048	VR, Metal EVN 39C00YB22 (200)	1
RV1434	RNE0052	VR, Metal EVN 39C00YB23 (2K)	1
RV1435	RNE0048	VR, Metal EVN 39C00YB22 (200)	1
RV1566	RNE0054	VR, Metal EVN 39C00YB15 (100K)	1
S 801	8374067D	SW, Lever SLR024 (Lever 12 MM)	1
S 830	8374067D	SW, Lever SLR024 (Lever 12 MM)	1
S1000	8446916	SW, Rotary SBM2033	1
S1158	8374067D	SW, Lever SLR024 (Lever 12 MM)	1
T1560	3180008	XFMR	1
TR810	HTK0110	Transistor 2SK332E	1
TR821	HTA0290	Transistor 2SA1206	1
TR830	HTC0338	Transistor 2SC1906	1
TR834	HTA0290	Transistor 2SA1206	1
TR836	HTC0168	Transistor 2SC535-C-	1
TR841	HTC0168	Transistor 2SC535-C-	1
TR842	HTC0168	Transistor 2SC535-C-	1
TR852	HTA0224	Transistor 2SA1029 D	1
TR870	HTC0148	Transistor 2SC458-C-	1
TR873	HTC0148	Transistor 2SC458-C-	1
TR889	HTC0148	Transistor 2SC458-C-	1
TR935	HTA0290	Transistor 2SA1206	1
TR936	HTC0168	Transistor 2SC535-C-	1
TR941	HTC0168	Transistor 2SC535-C-	1
TR942	HTC0168	Transistor 2SC535-C-	1
TR989	HTC0148	Transistor 2SC458-C-	1
TR1000	HTK0110	Transistor 2SK332E	1
TR1005	HTC0148	Transistor 2SC458-C-	1
TR1007	HTC0338	Transistor 2SC1906	1
TR1013	HTA0224	Transistor 2SA1029 D	1
TR1014	HTA0224	Transistor 2SA1029 D	1
TR1031	HTC0148	Transistor 2SC458-C-	1
TR1032	HTC0148	Transistor 2SC458-C-	1
TR1039	HTA0224	Transistor 2SA1029 D	1
TR1040	HTA0290	Transistor 2SA1206	1

Symbol	Part Code	Description	Q'ty
TR1104	HTC0148	Transistor 2SC458-C-	1
TR1150	HTC0192	Transistor 2SC641K-C	1
TR1153	HTC0192	Transistor 2SC641K-C	1
TR1200	HTK0110	Transistor 2SK332E	1
TR1205	HTC0148	Transistor 2SC458-C-	1
TR1207	HTC0338	Transistor 2SC1906	1
TR1270	HTC0148	Transistor 2SC458-C-	1
TR1271	HTA0224	Transistor 2SA1029 D	1
TR1312	HTA0224	Transistor 2SA1029 D	1
TR1325	HTC0769	Transistor 2SC2001L	1
TR1326	HTC0769	Transistor 2SC2001L	1
TR1330	HTA0224	Transistor 2SA1029 D	1
TR1331	HTA0224	Transistor 2SA1029 D	1
TR1334	HTC0823	Transistor 2SC2855E	1
TR1343	HTC0148	Transistor 2SC458-C-	1
TR1362	HTC0148	Transistor 2SC458-C-	1
TR1372	HTC0192	Transistor 2SC641K-C	1
TR1382	HTA0224	Transistor 2SA1029 D	1
TR1384	HTC0823	Transistor 2SC2855E	1
TR1393	HTC0769	Transistor 2SC2001L	1
TR1395	HTC0769	Transistor 2SC2001L	1
TR1397	HTA0224	Transistor 2SA1029 D	1
TR1398	HTA0224	Transistor 2SA1029 D	1
TR1406	HTC0338	Transistor 2SC1906	1
TR1407	HTC0338	Transistor 2SC1906	1
TR1408	HTA0224	Transistor 2SA1029 D	1
TR1409	HTA0224	Transistor 2SA1029 D	1
TR1420	HTC0168	Transistor 2SC535-C-	1
TR1421	HTC0168	Transistor 2SC535-C-	1
TR1424	HTC0168	Transistor 2SC535-C-	1
TR1425	HTC0168	Transistor 2SC535-C-	1
TR1430	HTC0148	Transistor 2SC458-C-	1
TR1432	HTC0148	Transistor 2SC458-C-	1
TR1442	HTC0148	Transistor 2SC458-C-	1
TR1443	HTC0148	Transistor 2SC458-C-	1
TR1448	HTA0290	Transistor 2SA1206	1
TR1452	HTC0338	Transistor 2SC1906	1
TR1453	HTC0338	Transistor 2SC1906	1
TR1460	HTC0669	Transistor 2SC2912S	1
TR1461	HTC0669	Transistor 2SC2912S	1
TR1470	HTA0258	Transistor 2SA1210S	1
TR1471	HTA0258	Transistor 2SA1210S	1
TR1480	HTC0192	Transistor 2SC641K-C	1
TR1481	HTC0192	Transistor 2SC641K-C	1
TR1484	HTC0192	Transistor 2SC641K-C	1
TR1501	HTC0192	Transistor 2SC641K-C	1
TR1502	HTC0192	Transistor 2SC641K-C	1
TR1511	HTA0258	Transistor 2SA1210S	1
TR1512	HTC0669	Transistor 2SC2912S	1
TR1514	HTC0148	Transistor 2SC458-C-	1
TR1521	HTA0290	Transistor 2SA1206	1
TR1526	HTA0290	Transistor 2SA1206	1
TR1534	HTC0192	Transistor 2SC641K-C	1
TR1554	HTK0099	Transistor 2SK404E	1
TR1556	HTA0224	Transistor 2SA1029 D	1
TR1560	HTD0145	Transistor 2SD1267AP	1
TR1580	HTA0104	Transistor 2SA778A K	1

PEF-713 READOUT INTERFACE

Symbol	Part Code	Description	Q'ty
C400	CET0033	C, AL Elyc 160V 1μF ±20%	1
C401	CES0133	C, AL Elyc 16V 47μF ±20%	1
C402	CES0133	C, AL Elyc 16V 47μF ±20%	1
C403	CES0133	C, AL Elyc 16V 47μF ±20%	1
C751	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C752	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C753	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C754	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C756	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
IC750	ILB0010	IC, Analog BA715	1
IC753	ILB0010	IC, Analog BA715	1
P701	JBX2092	Connector 1-164711-2	1
P702	JBX2092	Connector 1-164711-2	1
P703	JBX2094	Connector 1-164711-3	1
P705	JBB0058	Connector B12B-XH-A	1
P750	JBD0002	Connector D7626-6002SC	1
R750	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R751	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R752	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R753	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R754	RME1285	R, Metal 1/4W 4.99kΩ ±0.5%	1
R755	RME0884	R, Metal, Chip 1/8W 4.7kΩ ±5%	1
R756	RME1285	R, Metal 1/4W 4.99kΩ ±0.5%	1
R757	RME0884	R, Metal, Chip 1/8W 4.7kΩ ±5%	1
R760	RME1285	R, Metal 1/4W 4.99kΩ ±0.5%	1
R761	RME0884	R, Metal, Chip 1/8W 4.7kΩ ±5%	1
R762	RME1285	R, Metal 1/4W 4.99kΩ ±0.5%	1
R763	RME0884	R, Metal, Chip 1/8W 4.7kΩ ±5%	1
R777	RME0872	R, Metal, Chip 1/8W 470Ω ±5%	1
R778	RME0876	R, Metal, Chip 1/8W 1.0kΩ ±5%	1

PEF-714 H. CONNECTOR PCB

Symbol	Part Code	Description	Q'ty
C1485	CET0033	C, AL Elyc 160V 1μF ±20%	1
C1486	CES0133	C, AL Elyc 16V 47μF ±20%	1
C1488	CES0133	C, AL Elyc 16V 47μF ±20%	1
C1490	CES0133	C, AL Elyc 16V 47μF ±20%	1
C1492	CES0032	C, AL Elyc 25V 47μF ±20%	1
C1494	CES0133	C, AL Elyc 16V 47μF ±20%	1
C1496	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C1497	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C1499	CCG0143	C, Ceramic, Chip 50V 100pF ±5%	1
C2510	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C2511	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1

Symbol	Part Code	Description	Q'ty
IC2501	ILB0010	IC, Analog BA715	1
P1301	JBB0026	Connector B10B-XH-A	1
P1583	JBX2096	Connector 2-164711-0	1
P1585	JBX2096	Connector 2-164711-0	1
P1587	JBB0026	Connector B10B-XH-A	1
P1589	JBB0022	Connector B6B-XH-A	1
P1605	JBD0003	Connector D7650-6002SC	1
R1482	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R1483	RME0868	R, Metal, Chip 1/8W 220Ω ±5%	1
R2501	RCE0792	R, Carbon 1/4W 82kΩ ±5%	1
R2502	RME1091	R, Metal 1/4W 39.2kΩ ±1%	1
R2503	RME1089	R, Metal 1/4W 26.7kΩ ±1%	1
R2504	RME1212	R, Metal 1/4W 20.0kΩ ±0.5%	1
R2505	RME1212	R, Metal 1/4W 20.0kΩ ±0.5%	1
R2506	RME1285	R, Metal 1/4W 4.99kΩ ±0.5%	1
R2510	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R2511	RME0864	R, Metal, Chip 1/8W 100Ω ±5%	1
R2512	RME0884	R, Metal, Chip 1/8W 4.7kΩ ±5%	1
R2521	RCE0792	R, Carbon 1/4W 82kΩ ±5%	1
R2522	RME1091	R, Metal 1/4W 39.2kΩ ±1%	1
R2523	RME1285	R, Metal 1/4W 4.99kΩ ±0.5%	1
R2531	RME0884	R, Metal, Chip 1/8W 4.7kΩ ±5%	1

PEF-715 TRIG SW

Symbol	Part Code	Description	Q'ty
IC703	ILU0010	IC, Analog UN4213	1
R701	RCE0793	R, Carbon 1/4W 100kΩ ±5%	1
R702	RCE0793	R, Carbon 1/4W 100kΩ ±5%	1
R703	RCE0789	R, Carbon 1/4W 47kΩ ±5%	1
R704	RCE0789	R, Carbon 1/4W 47kΩ ±5%	1
R706	RCE0789	R, Carbon 1/4W 47kΩ ±5%	1
R707	RCE0789	R, Carbon 1/4W 47kΩ ±5%	1
RV704	RDE0003	VR, Carbon EVH-YK3325B14	1
S701	8374067D	SW, Lever SLR024 (Lever 12 MM)	1
TR701	HTA0224	Transistor 2SA1029 D	1
TR702	HTA0224	Transistor 2SA1029 D	1

PEF-769 H-POS

Symbol	Part Code	Description	Q'ty
C810	CCC1030	C, Ceramic 50V 10000pF Z	1
C925	CCC1030	C, Ceramic 50V 10000pF Z	1
C1251	CCC1030	C, Ceramic 50V 10000pF Z	1
C1253	CCC1030	C, Ceramic 50V 10000pF Z	1
IC1250	IIB0010	IC, Analog BA715	1
R855	RCE0753	R, Carbon 1/4W 47Ω ±5%	1
R965	RCE0753	R, Carbon 1/4W 47Ω ±5%	1
R981	RCE0775	R, Carbon 1/4W 3.3kΩ ±5%	1
R983	RCE0773	R, Carbon 1/4W 2.2kΩ ±5%	1
R1250	RME1285	R, Metal 1/4W 4.99kΩ ±0.5%	1
R1251	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R1252	RCE0777	R, Carbon 1/4W 4.7kΩ ±5%	1
R1253	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R1254	RCE0792	R, Carbon 1/4W 82kΩ ±5%	1
R1255	RME1091	R, Metal 1/4W 39.2kΩ ±1%	1
R1256	RME1212	R, Metal 1/4W 20.0kΩ ±0.5%	1
R1260	RCE0792	R, Carbon 1/4W 82kΩ ±5%	1
R1261	RME1285	R, Metal 1/4W 4.99kΩ ±0.5%	1
R1262	RCE0777	R, Carbon 1/4W 4.7kΩ ±5%	1
R1411	RCE0765	R, Carbon 1/4W 470Ω ±5%	1
R1600	RCE0769	R, Carbon 1/4W 1kΩ ±5%	1
RV840	RDE0003	VR, Carbon EVH-YK3325B14 10kΩ	1
RV925	8440198	VR, Carbon V16L5 S 20KC-B 10kΩ	1
RV1315	8438179	VR, Carbon V16L5 2S 20KC-B 200kΩ	1
RV1411	RDE0003	VR, Carbon EVH-YK3325B14 10kΩ	1
S1300	8446917	SW, Rotary SBU203C	1
S1360	8402061C	SW, Push SUJ1-000 Nonlock (Gray NOB)	1

PEF-719 LAMP

Symbol	Part Code	Description	Q'ty
PL1575	8400068	Lamp 4W-8 (8V 0.12A)	1
PL1576	8400068	Lamp 4W-8 (8V 0.12A)	1
PL1577	8400068	Lamp 4W-8 (8V 0.12A)	1

PEF-770 μ-COM

Symbol	Part Code	Description	Q'ty
	IYX0041	IC, Socket 10628-01-115	2
	IYT0003	Seal (ROM) 11X11MM T-Type Mat Silver	2
C2001	CCG0144	C, Ceramic, Chip 50V 220pF ±5%	1
C2002	CCG0209	C, Ceramic, Chip 50V 4700pF ±10%	1
C2003	CCG0217	C, Ceramic, Chip 50V 0.047μF ±10%	1
C2006	CES0173	C, AL Elyc 25V 47μF ±20%	1
C2007	CES0085	C, AL Elyc 16V 100μF ±20%	1
C2008	CES0133	C, AL Elyc 16V 47μF ±20%	1
C2009	CEK0078	C, AL Elyc 16V 47μF ±20%	1
C2010	CES0133	C, AL Elyc 16V 47μF ±20%	1
C2011	CES0133	C, AL Elyc 16V 47μF ±20%	1
C2014	CQA0124	C, Plastic 50V 0.1μF ±10%	1
C2015	CQE0062	C, Plastic 50V 1μF ±5%	1
C2051	CES0133	C, AL Elyc 16V 47μF ±20%	1
C2061	CES0133	C, AL Elyc 16V 47μF ±20%	1
C2062	CES0133	C, AL Elyc 16V 47μF ±20%	1
C2067	CCG0132	C, Ceramic, Chip 50V 22pF ±5%	1
C2068	CCG0132	C, Ceramic, Chip 50V 22pF ±5%	1
C2113	CQE0076	C, Plastic 50V 0.47μF ±5%	1
C2114	CQA0124	C, Plastic 50V 0.1μF ±10%	1
C2115	CES0133	C, AL Elyc 16V 47μF ±20%	1
C2116	CES0133	C, AL Elyc 16V 47μF ±20%	1
C2163	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C2164	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C2165	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C2166	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C2201	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C2232	CCC1356	C, Ceramic 50V 470pF ±10%	1
C2233	CCC1136	C, Ceramic 50V 100pF ±5%	1
C2253	CES0133	C, AL Elyc 16V 47μF ±20%	1
C2255	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C2256	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C2257	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
C2258	CCG0143	C, Ceramic, Chip 50V 100pF ±5%	1
C2259	CES0133	C, AL Elyc 16V 47μF ±20%	1
C2263	CCG0143	C, Ceramic, Chip 50V 100pF ±5%	1
C2271	CCC1036	C, Ceramic 50V 22000pF ±20%	1
C2402	CCG0211	C, Ceramic, Chip 50V 10000pF ±10%	1
D2001	HDR0213	Diode RK14	1
D2053	HDS0437	Diode 1SS133	1
D2114	HDS0437	Diode 1SS133	1
D2252	HDS0437	Diode 1SS133	1
D2253	HDS0437	Diode 1SS133	1
D2271	HDS0437	Diode 1SS133	1

Symbol	Part Code	Description	Q'ty
IC2001	HLM0319	IC, Analog μPC1042C	1
IC2002	HLH0108	IC, Analog HA17805P	1
IC2051	IDM0542	IC, Digital μPD78106	1
IC2163	IDT0047	IC, Digital TC40H002P	1
IC2164	IDT0047	IC, Digital TC40H002P	1
IC2165	IDT0048	IC, Digital TC40H004P	1
IC2166	IDT0048	IC, Digital TC40H004P	1
IC2201	IDM0515	IC, Digital MM74HC123N (MC74HC123N)	1
IC2235	IDH0801	IC, Digital HD14052BP	1
IC2255	IDT0124	IC, Digital TC74HC393P (MM/MC74HC393N)	1
IC2256	IDT0049	IC, Digital TC40H164P	1
IC2257	IDT0049	IC, Digital TC40H164P	1
IC2259	IDH0923	IC, Digital HN482764G-4	1
IC2401	IDH0923	IC, Digital HN482764G-4	1
IC2402	IDT0055	IC, Digital TC40H374P	1
L2001	TLF0004	Coil FL7H 100μH ±10%	1
L2003	8357919	Coil SN-8D-500	1
L2259	TLE0058	Coil EL0606SK1 100K	1
P2001	JBD0003	Connector D7650-6002SC	1
P2502	JBB0021	Connector B3B-XH-A	1
R2001	RCE0790	R, Carbon 1/4W 56kΩ ±5%	1
R2002	RME0881	R, Metal, Chip 1/8W 2.7kΩ ±5%	1
R2003	RME0884	R, Metal, Chip 1/8W 4.7kΩ ±5%	1
R2004	RME0900	R, Metal, Chip 1/8W 100kΩ ±5%	1
R2005	RME0888	R, Metal, Chip 1/8W 10kΩ ±5%	1
R2007	RCE0703	R, Carbon 1/2W 680Ω ±5%	1
R2008	RCE0703	R, Carbon 1/2W 680Ω ±5%	1
R2009	RME0885	R, Metal, Chip 1/8W 5.6kΩ ±5%	1
R2013	RME1484	R, Metal 1W 18Ω ±5%	1
R2014	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R2016	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R2017	RME0884	R, Metal, Chip 1/8W 4.7kΩ ±5%	1
R2020	RCE0777	R, Carbon 1/4W 4.7kΩ ±5%	1
R2021	RCE0777	R, Carbon 1/4W 4.7kΩ ±5%	1
R2070	RCE0781	R, Carbon 1/4W 10kΩ ±5%	1
R2071	RCE0802	R, Carbon 1/4W 1.0MΩ ±5%	1
R2086	RCE0781	R, Carbon 1/4W 10kΩ ±5%	1
R2087	RCE0793	R, Carbon 1/4W 100kΩ ±5%	1
R2100	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R2101	RCE0793	R, Carbon 1/4W 100kΩ ±5%	1
R2102	RCE0781	R, Carbon 1/4W 10kΩ ±5%	1
R2103	RCE0777	R, Carbon 1/4W 4.7kΩ ±5%	1
R2115	RCE0745	R, Carbon 1/4W 10Ω ±5%	1
R2116	RCE0745	R, Carbon 1/4W 10Ω ±5%	1
R2128	RME1196	R, Metal 1/4W 475kΩ ±1%	1
R2227	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R2228	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R2229	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R2232	RME1080	R, Metal 1/4W 4.75kΩ ±1%	1
R2233	RME1080	R, Metal 1/4W 4.75kΩ ±1%	1
R2236	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1

Symbol	Part Code	Description	Q'ty
R2248	RCE0772	R, Carbon 1/4W 1.8kΩ ±5%	1
R2253	RME1085	R, Metal 1/4W 12.1kΩ ±1%	1
R2255	RCE0789	R, Carbon 1/4W 47kΩ ±5%	1
R2261	RCE0796	R, Carbon 1/4W 180kΩ ±5%	1
R2262	RCE0814	R, Carbon 1/4W 270kΩ ±5%	1
R2263	RCE0777	R, Carbon 1/4W 4.7kΩ ±5%	1
R2264	RME1075	R, Metal 1/4W 1.82kΩ ±1%	1
R2265	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R2266	RCE0800	R, Carbon 1/4W 470kΩ ±5%	1
R2268	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R2269	RCE0781	R, Carbon 1/4W 10kΩ ±5%	1
R2270	RME1074	R, Metal 1/4W 1.50kΩ ±1%	1
R2271	RCE0789	R, Carbon 1/4W 47kΩ ±5%	1
R2272	RME1098	R, Metal 1/4W 150kΩ ±1%	1
RM2051	RZA0115	R, Block EXB-P8-8-473-J	1
RM2253	RZA0165	R, Block EXB-LD6-503G	1
RM2254	RCE0854	R, Block EXB-LD4-503G	1
RM2255	RZA0165	R, Block EXB-LD6-503G	1
RM2256	RZA0166	R, Block EXB-LD10-503G	1
TR2001	HTA0293	Transistor 2SA1012Y	1
TR2114	HTC0148	Transistor 2SC458-C-	1
TR2115	HTA0224	Transistor 2SA1029 D	1
TR2252	HTC0148	Transistor 2SC458-C-	1
TR2253	HTC0148	Transistor 2SC458-C-	1
X2051	EZZ0101	Extal CSA 12.0MT	1

PEF-721 CRT SOCKET

Symbol	Part Code	Description	Q'ty
J1541	8390152	Socket 1339	1
P1403	JBB0021	Connector B3B-XH-A	1
P1501	JBB0021	Connector B3B-XH-A	1
P1541	JBB0021	Connector B3B-XH-A	1
R1541	RCE0781	R, Carbon 1/4W 10kΩ ±5%	1
R1542	RCE0793	R, Carbon 1/4W 100kΩ ±5%	1
R1543	RMV0009	R, Metal 1/2W 6.8MΩ ±5%	1

PEF-722 RV/LAMP

Symbol	Part Code	Description	Q'ty
D1535	HDM0140	Diode MTZ 4.7JB	1
D1575	HDS0437	Diode 1SS133	1
R1491	RCE0781	R, Carbon 1/4W 10kΩ ±5%	1
R1492	RCE0777	R, Carbon 1/4W 4.7kΩ ±5%	1
R1494	RCE0768	R, Carbon 1/4W 820Ω ±5%	1
R1495	RCE0781	R, Carbon 1/4W 10kΩ ±5%	1
R1535	RCE0773	R, Carbon 1/4W 2.2kΩ ±5%	1
R1570	RCE0773	R, Carbon 1/4W 2.2kΩ ±5%	1
R1571	RCE0812	R, Carbon 1/4W 820kΩ ±5%	1
R1572	RMV0008	R, Metal VR37-15MΩJ	1
R1573	RCE0735	R, Carbon 1/2W 1.0MΩ ±5%	1
R1575	RCE0773	R, Carbon 1/4W 2.2kΩ ±5%	1
R1576	RCE0775	R, Carbon 1/4W 3.3kΩ ±5%	1
R1577	RCE0773	R, Carbon 1/4W 2.2kΩ ±5%	1
RV1535	8446931	VR, Carbon EWH-YDRK20B14 (10K)	1
RV1570	8348452	VR, Carbon EVH-CCAK20B14 (10K)	1
RV1571	RNE0059	VR, Metal EVM-NDG K20 B26 (2M)	1
RV1575	8446931	VR, Carbon EWH-YDRK20B14(100K)	1
TR1493	HTA0224	Transistor 2SA1029 D	1
TR1494	HTC0148	Transistor 2SC458-C-	1
TR1575	HTC0148	Transistor 2SC458-C-	1
TR1576	HTB0130	Transistor 2SB942AP	1

PEF-725 CH1 ATT

Symbol	Part Code	Description	Q'ty
C750	CCC1030	C, Ceramic 50V 10000pF Z	1
P758	JBB0027	Connector B2B-XH-A	1
R770	RME1084	R, Metal 1/4W 10.0kΩ ±1%	1
R771	RME1212	R, Metal 1/4W 20.0kΩ ±0.5%	1
R772	RME1091	R, Metal 1/4W 39.2kΩ ±1%	1
R773	RME1162	R, Metal 1/4W 80.0kΩ ±0.5%	1

PEF-726 CH2 ATT

Symbol	Part Code	Description	Q'ty
C775	CCC1030	C, Ceramic 50V 10000pF Z	1
P763	JBB0027	Connector B2B-XH-A	1
R775	RME1084	R, Metal 1/4W 10.0kΩ ±1%	1
R776	RME1212	R, Metal 1/4W 20.0kΩ ±0.5%	1
R777	RME1091	R, Metal 1/4W 39.2kΩ ±1%	1
R778	RME1162	R, Metal 1/4W 80.0kΩ ±0.5%	1

PEF-727 D.L

Symbol	Part Code	Description	Q'ty
DL1	8311698	Delay Line 758DL 100NS 1860HM	1

EF-728 POWER TR

Symbol	Part Code	Description		Q'ty
	HYP0001	Bush	P Type	2
	HYS0001	Washer	SK-16B	2
IC 1602	ILH0109	IC, Analog	HA17808P	1
IC 1603	ILM0342	IC, Analog	μPC7908	1
TR1601	HTD0145	Transistor	2SD1267AP	1

PEF-729 POWER SUPPLY

Symbol	Part Code	Description				Q'ty
C1601	CES0217	C, AL Elyc	100V	220μF	±20%	1
C1602	CES0299	C, AL Elyc	SME 160 VNSN-330 22B			1
C1603	CCC1182	C, Ceramic	50V	1000 pF	±10%	1
C1604	CEK0119	C, AL Elyc	25V	3300μF	±20%	1
C1605	CEK0119	C, AL Elyc	25V	3300μF	±20%	1
C1606	CEC0364	C, AL Elyc	16V	100μF	NP	1
C1607	CES0133	C, AL Elyc	16V	47μF	±20%	1
C1608	CEK0119	C, AL Elyc	25V	3300μF	±20%	1
C1609	CES0133	C, AL Elyc	16V	47μF	±20%	1
C1610	CES0115	C, AL Elyc	50V	100μF	±20%	1
C1611	CES0115	C, AL Elyc	50V	100μF	±20%	1
C1612	CES0133	C, AL Elyc	16V	47μF	±20%	1
C1613	CQA0124	C, Plastic	50V	0.1μF	±10%	1
C1614	CCC1182	C, Ceramic	50V	1000 pF	±10%	1
C1615	CES0133	C, AL Elyc	16V	47μF	±20%	1
C1616	CCC1182	C, Ceramic	50V	1000 pF	±10%	1
C1617	CES0033	C, AL Elyc	25V	100μF	±20%	1
C1618	CEX0230	C, AL Elyc	50V	1μF	BP	1
C1619	CCD0282	C, Ceramic	500V	47 pF	±5%	1
D1601	HDS0476	Diode	S5566J			1
D1602	HDS0475	Diode	S5566B			1
D1603	HDD0138	Diode	DBA10C			1
D1604	HDS0437	Diode	1SS133			1
D1605	HDS0437	Diode	1SS133			1
D1606	HDS0475	Diode	S5566B			1
D1607	HDS0475	Diode	S5566B			1
D1608	HDS0475	Diode	S5566B			1
D1609	HDS0475	Diode	S5566B			1
D1610	HDS0475	Diode	S5566B			1
D1611	HDS0437	Diode	1SS133			1
D1612	HDS0437	Diode	1SS133			1
D1614	HDS0475	Diode	S5566B			1
D1615	HDS0437	Diode	1SS133			1
D1616	HDS0475	Diode	S5566B			1
D1617	HDS0437	Diode	1SS133			1

Symbol	Part Code	Description				Q'ty
D1618	HDM0143	Diode	MTZ 15JC			1
F1601	EFZ0013	IC Protect	ICP-F10 (0.4A)			1
F1602	EFZ0013	IC Protect	ICP-F10 (0.4A)			1
F1603	EFZ0014	IC Protect	ICP-F25 (1A)			1
F1604	EFZ0014	IC Protect	ICP-F25 (1A)			1
F1605	EFZ0012	IC Protect	ICP-F75 (2.7A)			1
IC1601	ILB0010	IC, Analog	BA715			1
IC1604	ILB0010	IC, Analog	BA715			1
IC1605	ILH0108	IC, Analog	HA17805P			1
P1601	JBX0703	Connector	1-171825-0			1
P1606	JBB0021	Connector	B3B-XH-A			1
P1607	JBB0021	Connector	B3B-XH-A			1
P1608	JBB0021	Connector	B3B-XH-A			1
R1601	RCE0789	R, Carbon	1/4W	47kΩ	±5%	1
R1602	RCE0789	R, Carbon	1/4W	47kΩ	±5%	1
R1603	RCE0783	R, Carbon	1/4W	15kΩ	±5%	1
R1604	RCE0781	R, Carbon	1/4W	10kΩ	±5%	1
R1605	RCE0777	R, Carbon	1/4W	4.7kΩ	±5%	1
R1606	RCE0783	R, Carbon	1/4W	15kΩ	±5%	1
R1607	RME1098	R, Metal	1/4W	150kΩ	±1%	1
R1608	RME1157	R, Metal	1/4W	16.0kΩ	±0.5%	1
R1609	RCE0772	R, Carbon	1/4W	1.8kΩ	±5%	1
R1610	RCE0753	R, Carbon	1/4W	47Ω	±5%	1
R1611	RCE0767	R, Carbon	1/4W	680Ω	±5%	1
R1612	RME1084	R, Metal	1/4W	10.0kΩ	±1%	1
R1613	RME1084	R, Metal	1/4W	10.0kΩ	±1%	1
R1614	RME1075	R, Metal	1/4W	1.82kΩ	±1%	1
R1615	RCE0771	R, Carbon	1/4W	1.5kΩ	±5%	1
R1616	RCE0793	R, Carbon	1/4W	100kΩ	±5%	1
R1617	RCE0774	R, Carbon	1/4W	2.7kΩ	±5%	1
R1618	RCE0691	R, Carbon	1/2W	68Ω	±5%	1
R1619	RCE0763	R, Carbon	1/4W	330Ω	±5%	1
R1620	RCE0765	R, Carbon	1/4W	470Ω	±5%	1
R1621	RME1157	R, Metal	1/4W	16.0kΩ	±0.5%	1
R1622	RME1084	R, Metal	1/4W	10.0kΩ	±1%	1
R1623	RCE0757	R, Carbon	1/4W	100Ω	±5%	1
R1624	RCE0767	R, Carbon	1/4W	680Ω	±5%	1
R1625	RCE0757	R, Carbon	1/4W	100Ω	±5%	1
R1626	RCE0771	R, Carbon	1/4W	1.5kΩ	±5%	1

Symbol	Part Code	Description	Q'ty
R1627	RME1064	R, Metal 1/4W 221Ω ±1%	1
R1628	RCE0749	R, Carbon 1/4W 22Ω ±5%	1
R1629	RCE0757	R, Carbon 1/4W 100Ω ±5%	1
R1630	RME1084	R, Metal 1/4W 10.0k ±1%	1
R1632	RZZ0029	R, Fuse 1/2W 10Ω ±0.5%	1
R1633	RZZ0029	R, Fuse 1/2W 10Ω ±0.5%	1
RV1601	RNE0070	VR, Metal EVN 39C00YB53 (5K)	1
TR1602	HTC0722	Transistor 2SC2909S	1
TR1603	HTC0148	Transistor 2SC458-C-	1
	ETP0002	Terminal 171255-1	1
	8444253	Cable Assy	1

PEF-730 CURSOR SW

Symbol	Part Code	Description	Q'ty
S2501	8402061C	SW, Push SUJ1-000 Nonlock (Gray NOB)	1
S2502	8402061C	SW, Push SUJ1-000 Nonlock (Gray NOB)	1

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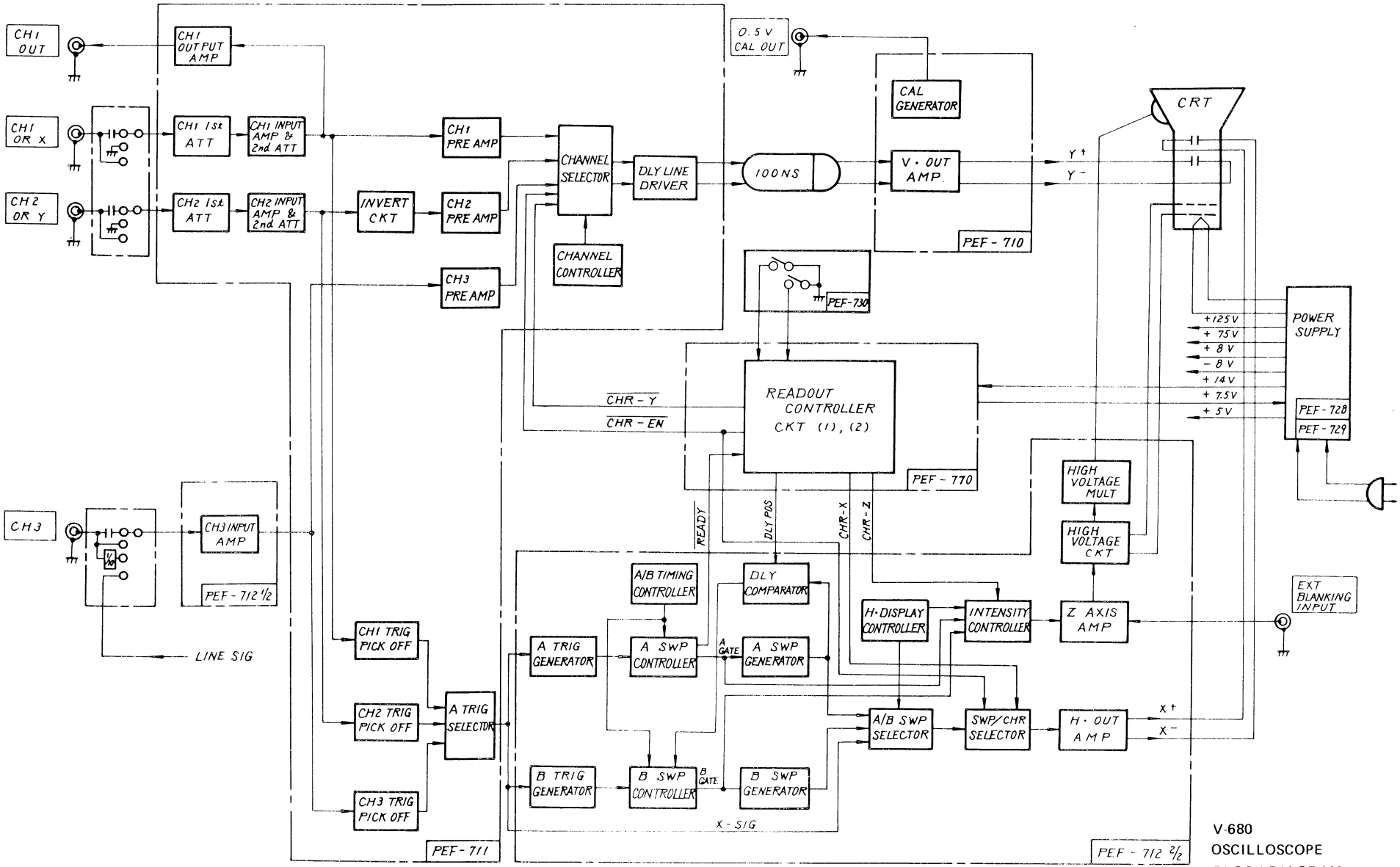
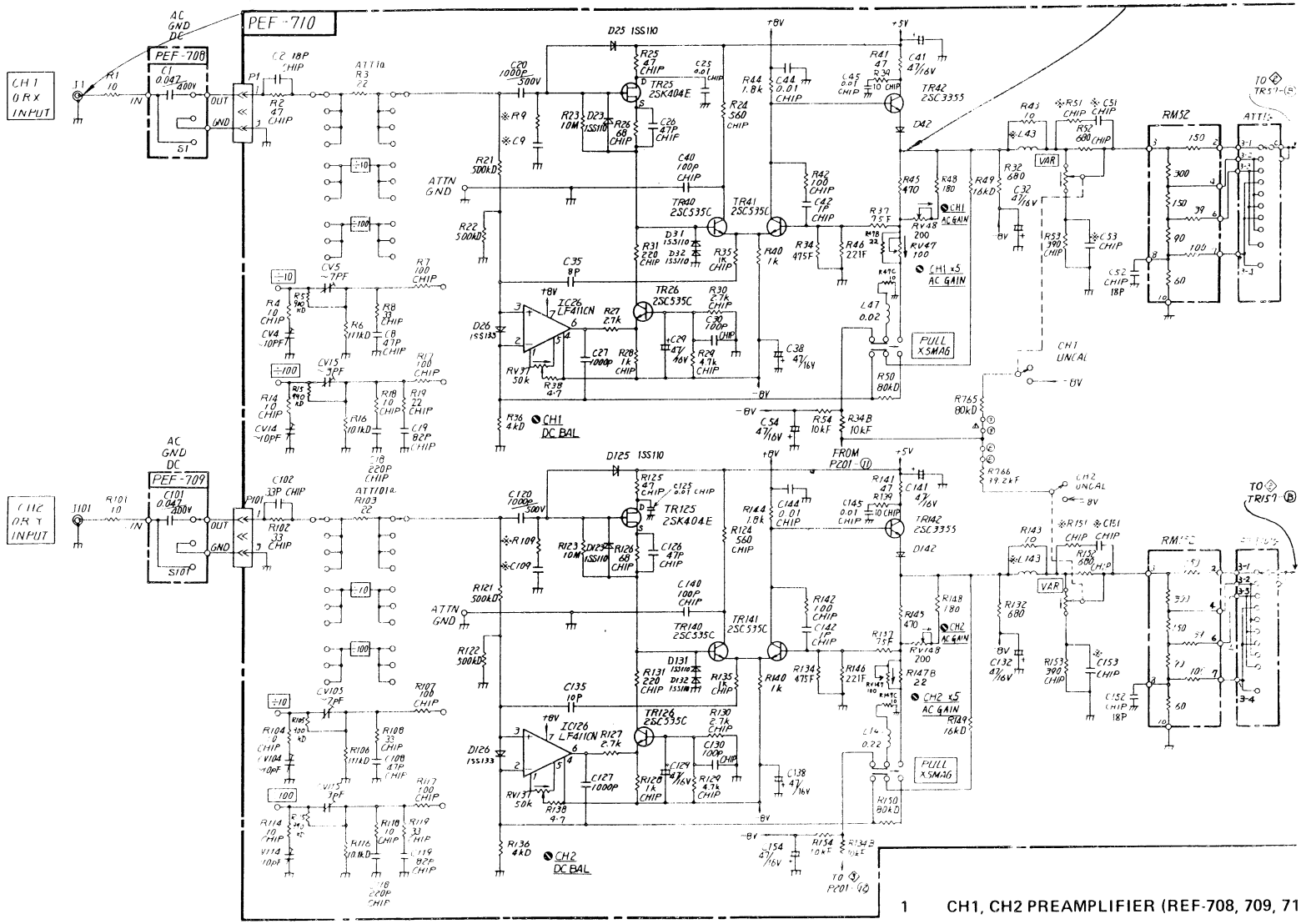
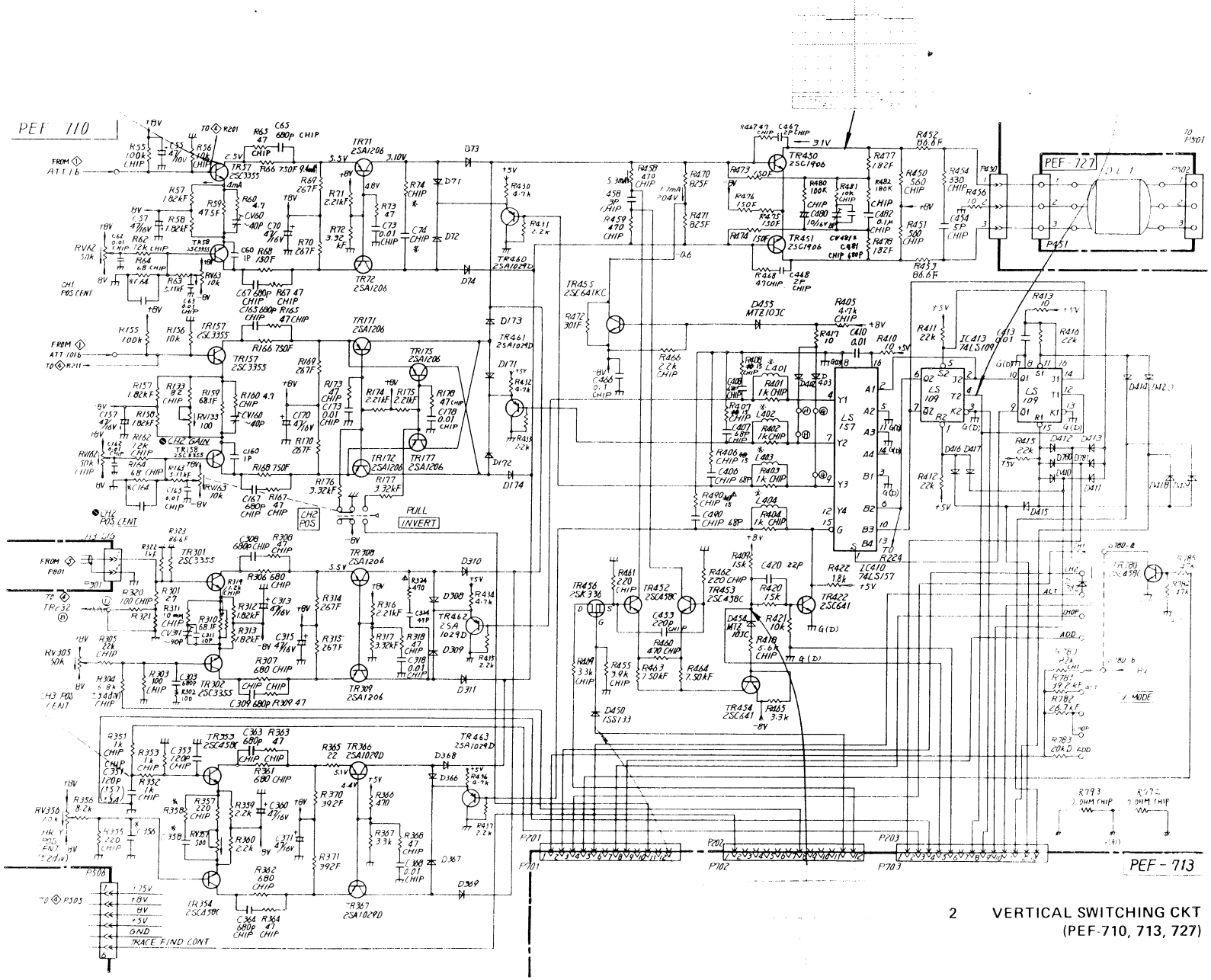
Symbol	Part Code	Description	Q'ty
	8446918	CRT 150CTB31	1
	8338351	Terminal Z-048 (Earth)	1
	8402043	Connector For Rotation-Coil	1
	3203309	Cable Assy	1
	8444254	Cable Assy	1
D1355	HDL0036	Diode LN21RPHL. HT	1
D1600	HDL0047	Diode LN31GPHL (GREEN)	1
J1	JHB0088	Coax. Con BNC071	1
J101	JHB0088	Coax. Con BNC071	1
J608	JHB0088	Coax. Con BNC071	1
J656	8397022	Test Point Z069	1
J805	JHB0088	Coax. Con BNC071	1
J1505	JHB0088	Coax. Con BNC071	1
J1601	JJC0026	Connector CM3 (C-170)	1
R1	RCE0745	R, Carbon 1/4W 10Ω ±5%	1
R101	RCE0745	R, Carbon 1/4W 10Ω ±5%	1
S1600	8400067	SW, PB SDV 3P(UL, CSA)	1
T1600	8444285	XFMR	1



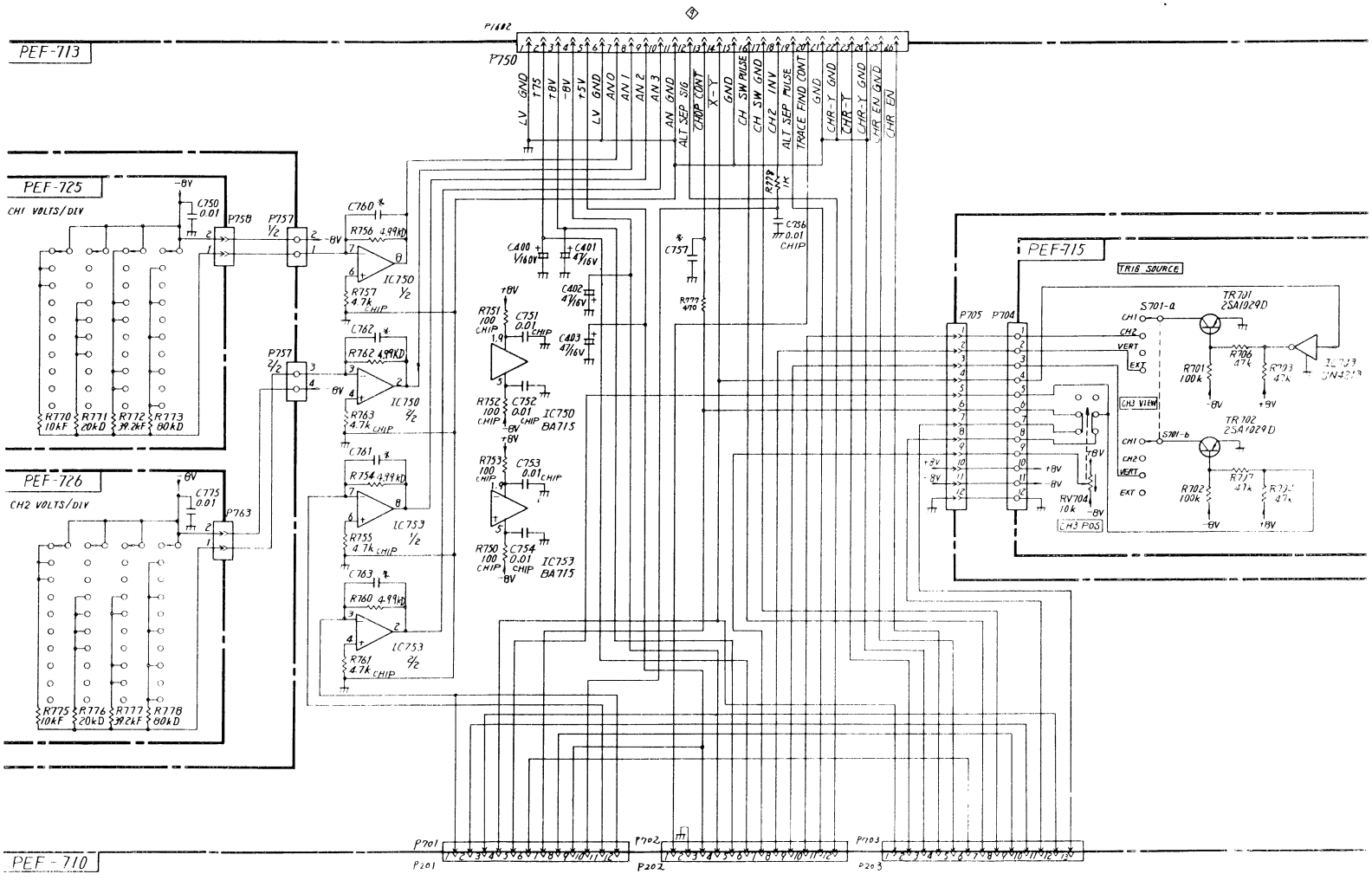
V-680
OSCILLOSCOPE
BLOCK DIAGRAM



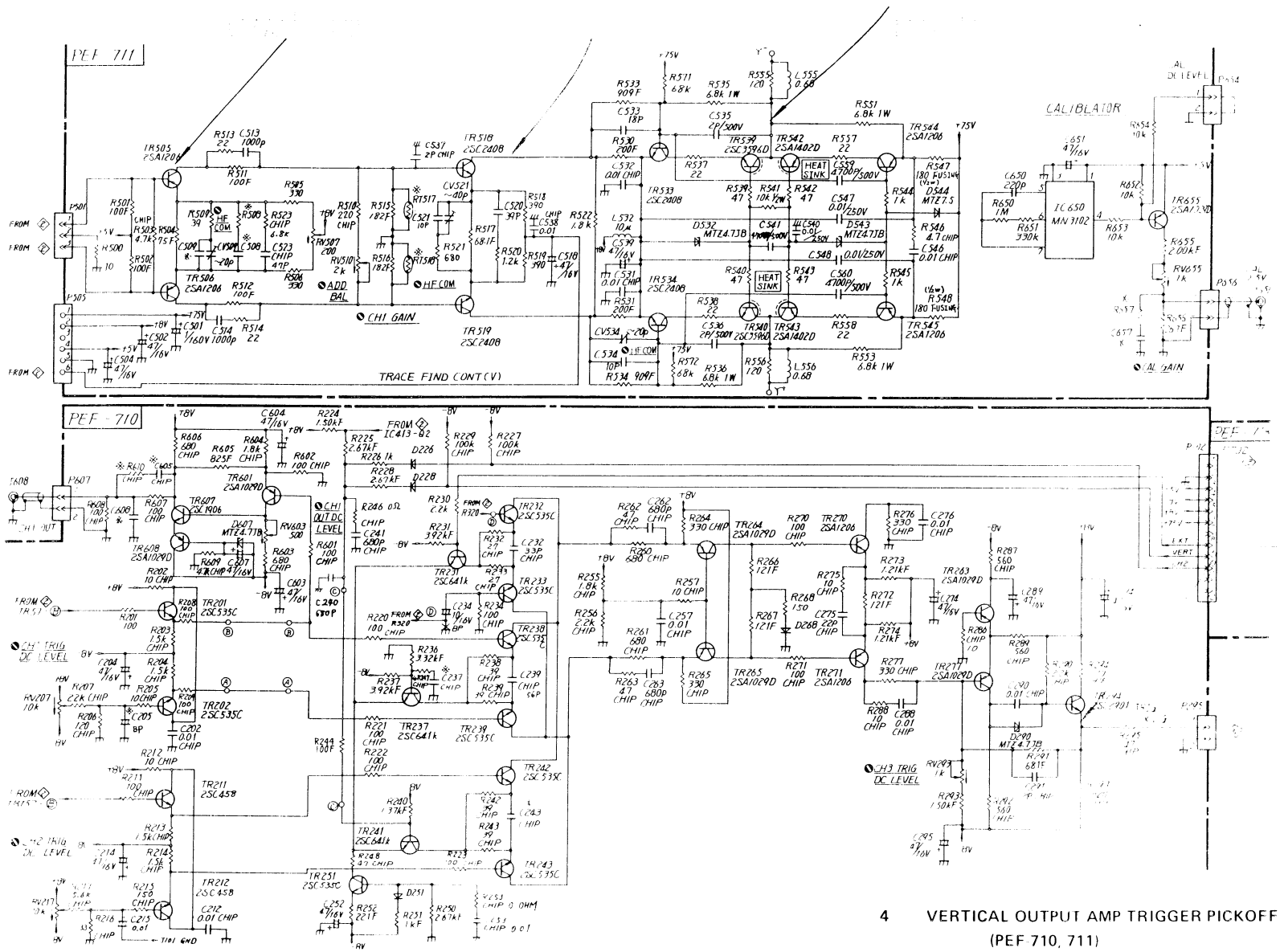
1 CH1, CH2 PREAMPLIFIER (REF-708, 709, 710)



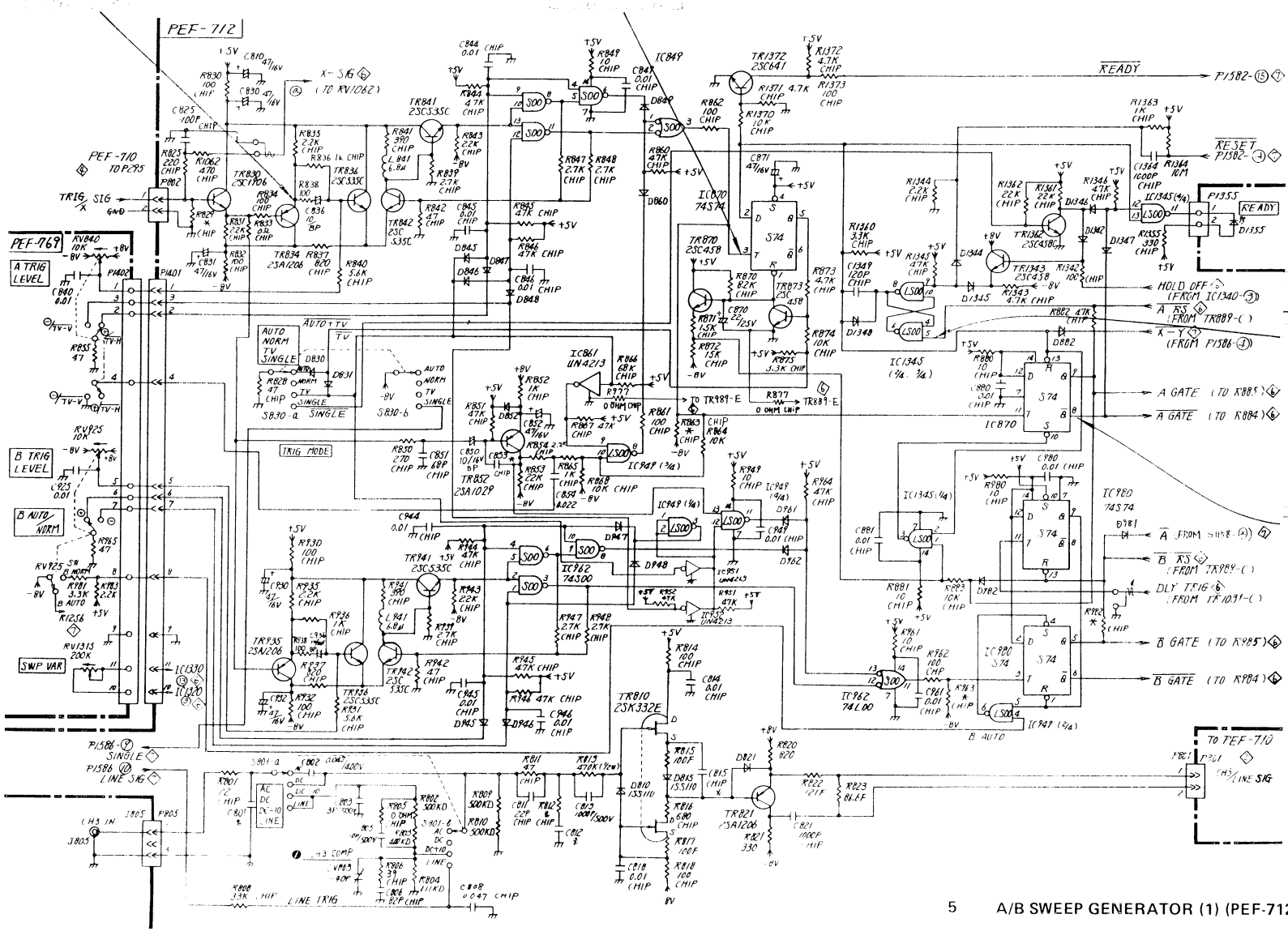
2 VERTICAL SWITCHING CKT
(PEF-710, 713, 727)



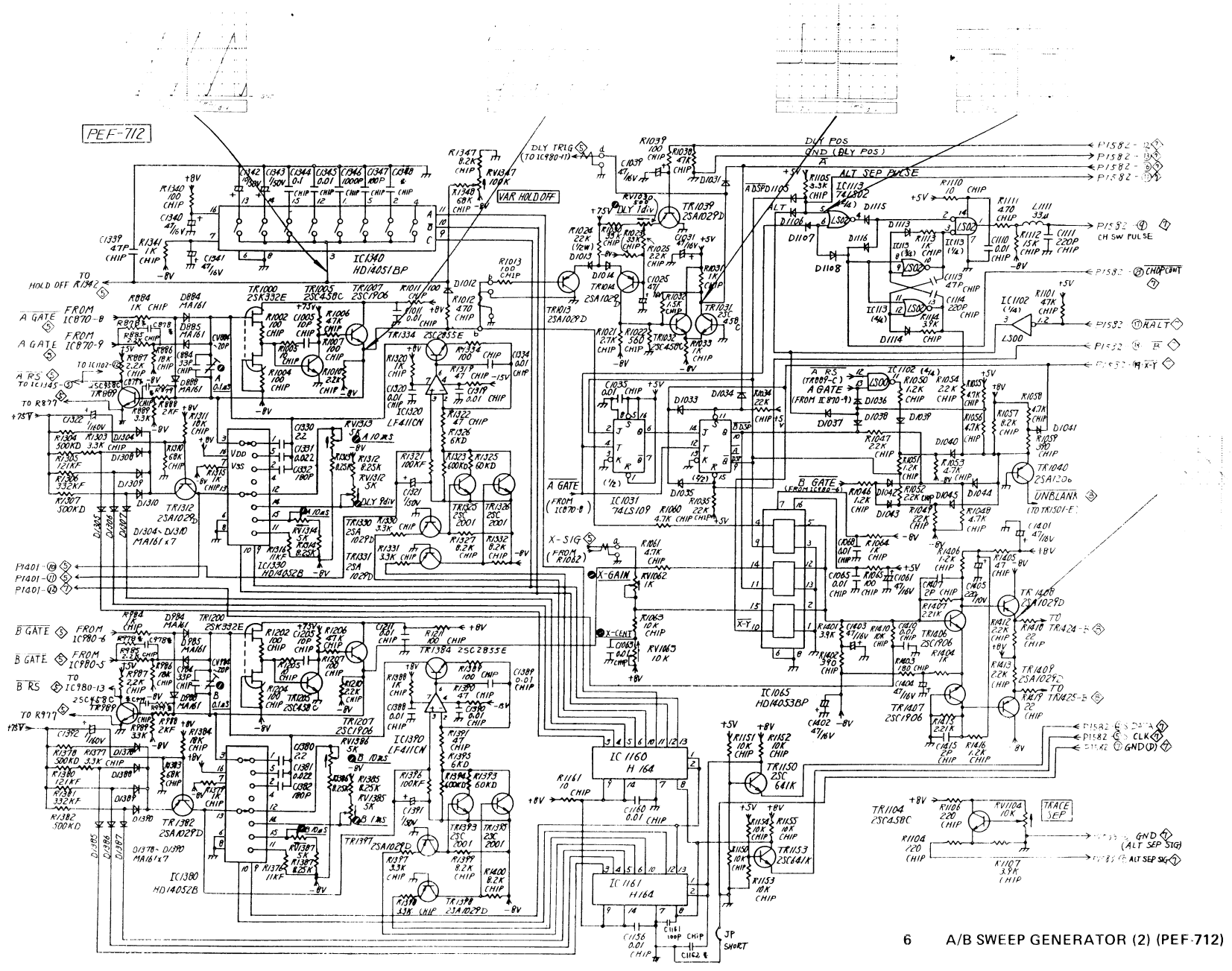
3 VOLTS/DIV SELECTOR CKT (PEF-713, 715, 725, 726)



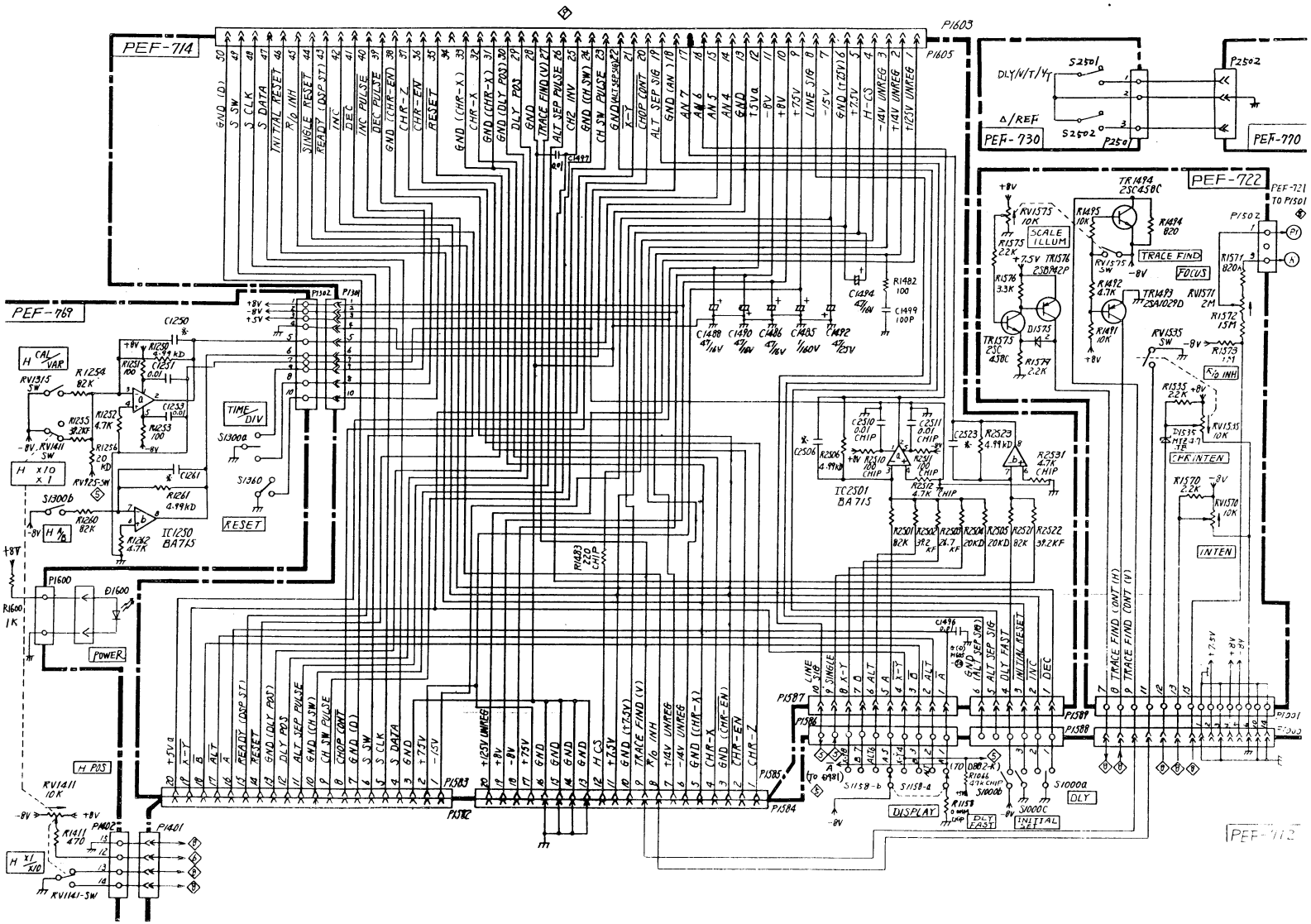
4 VERTICAL OUTPUT AMP TRIGGER PICKOFF CKT
(PEF-710, 711)



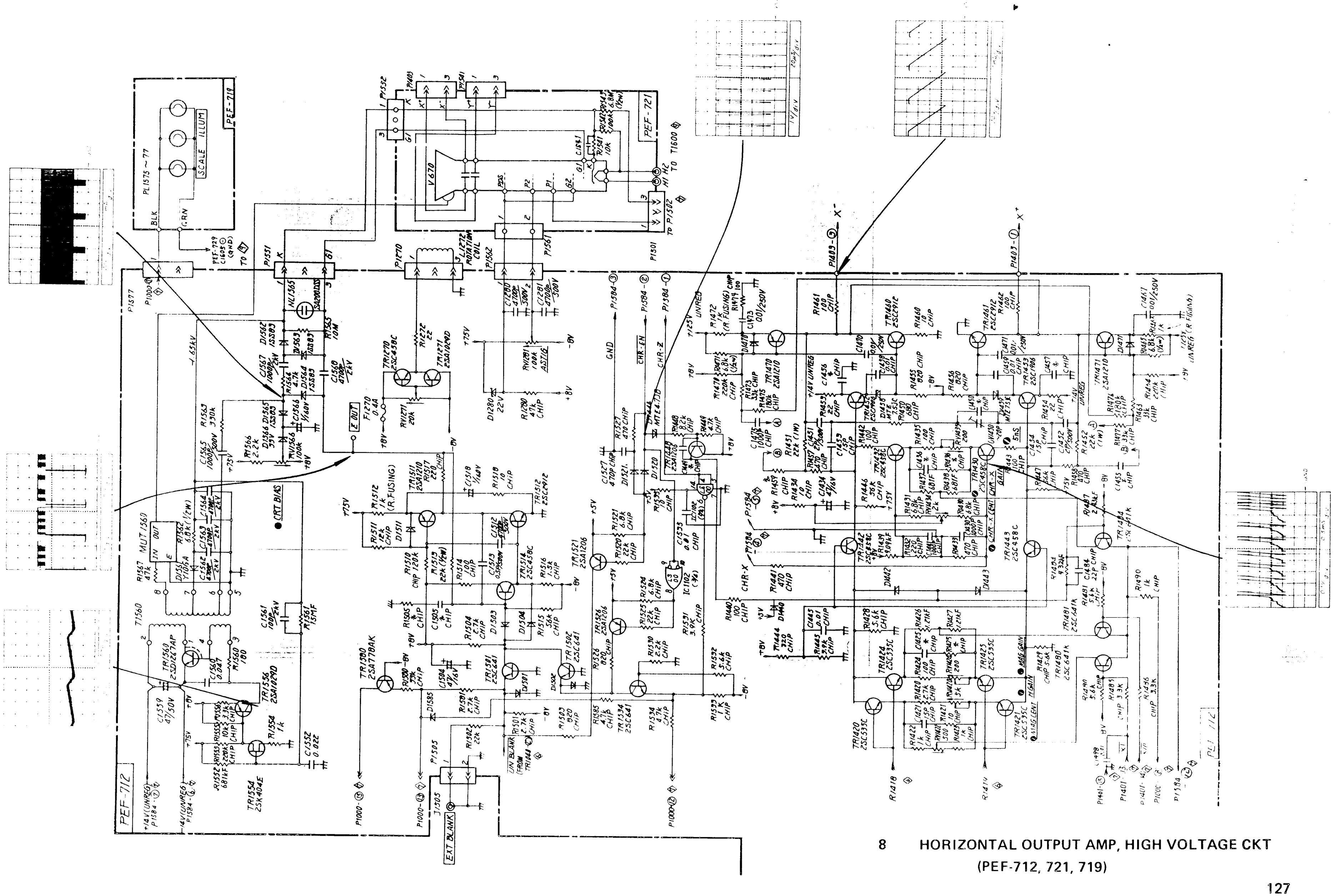
5 A/B SWEEP GENERATOR (1) (PEF-712, 769)



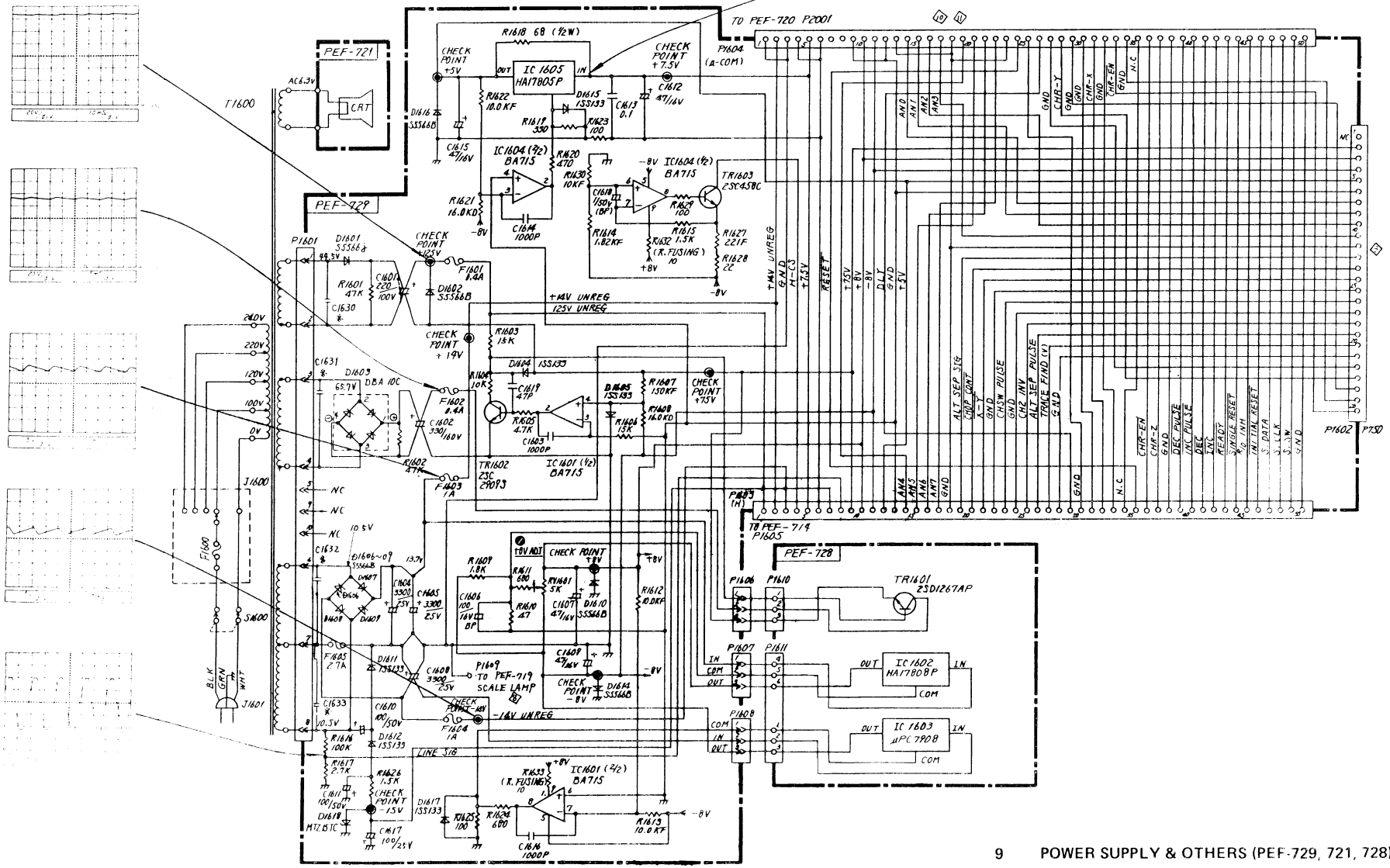
6 A/B SWEEP GENERATOR (2) (PEF-712)



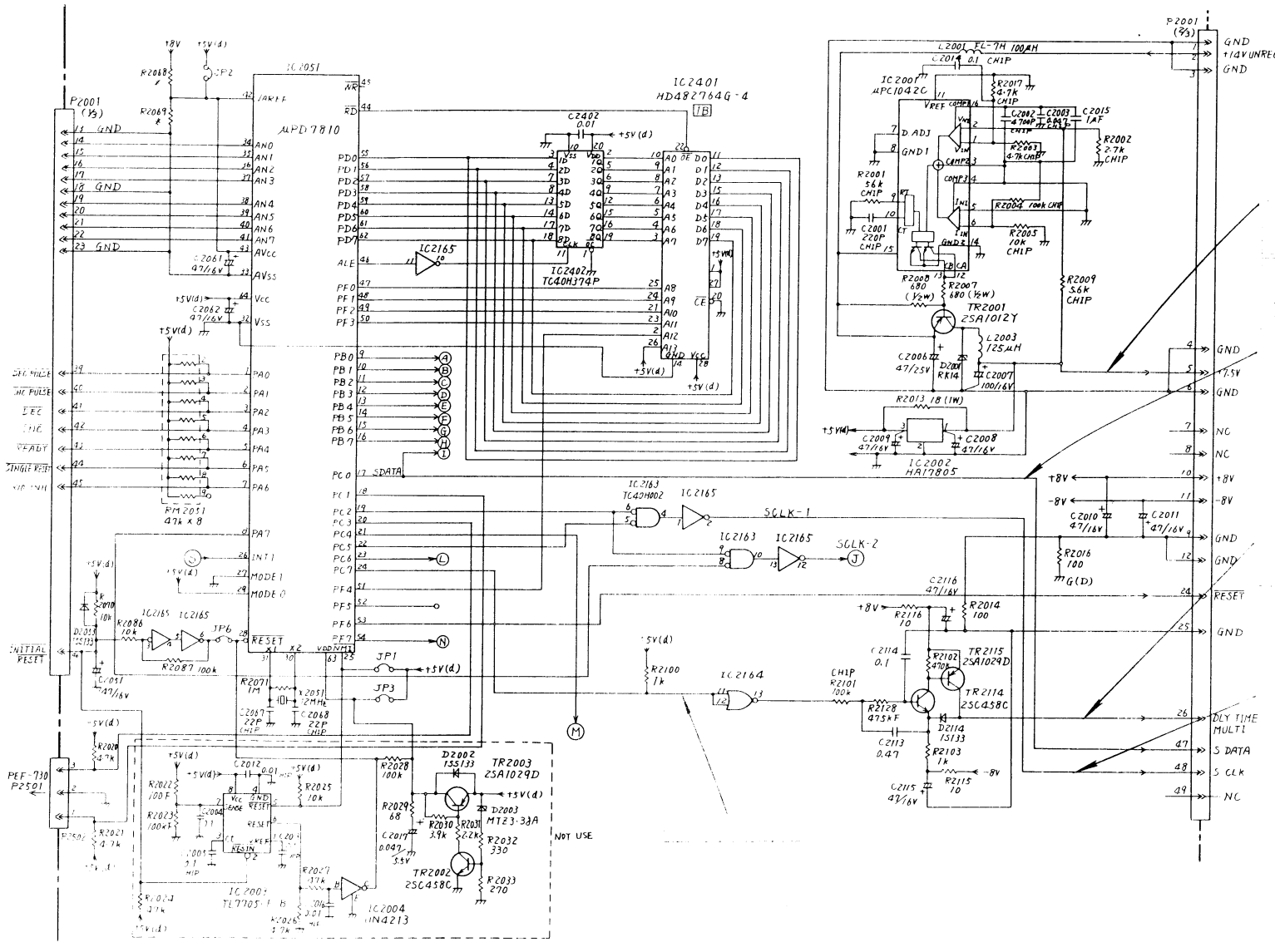
7 HORIZONTAL SELECTOR CKT (PEF-712, 714, 769, 722, 730)



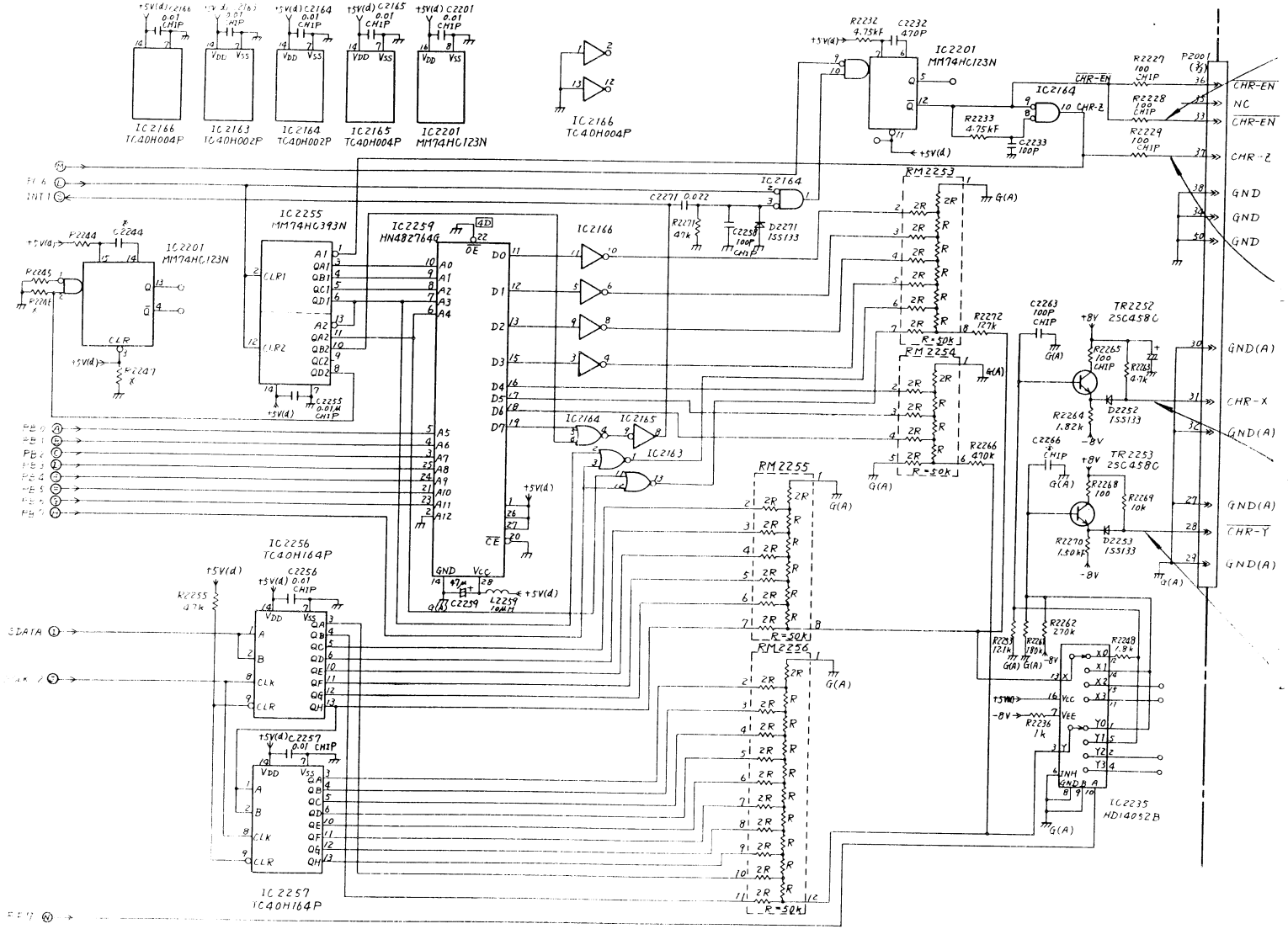
8 HORIZONTAL OUTPUT AMP, HIGH VOLTAGE CKT
(PEF-712, 721, 719)



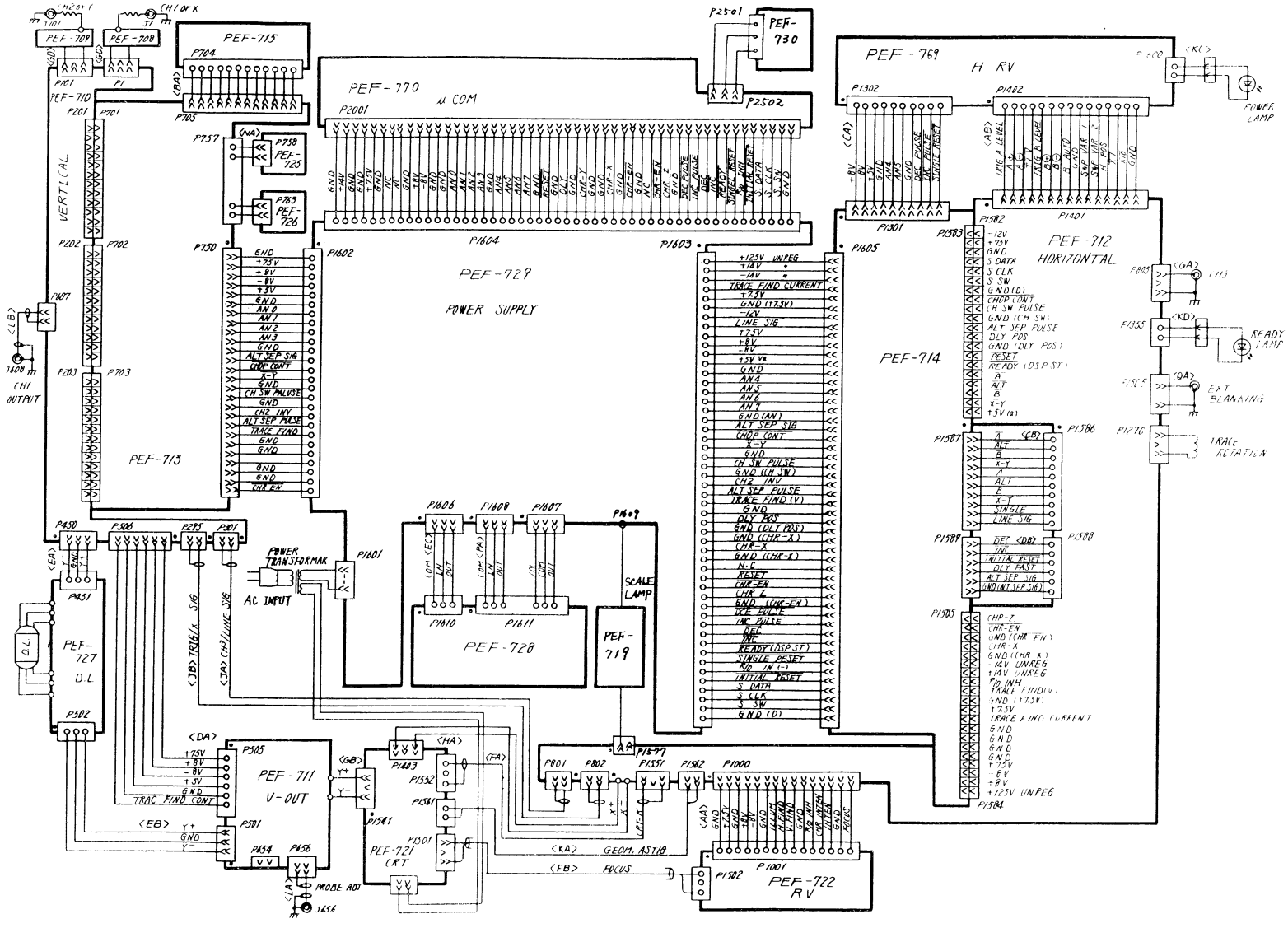
9 POWER SUPPLY & OTHERS (PEF-729, 721, 728)



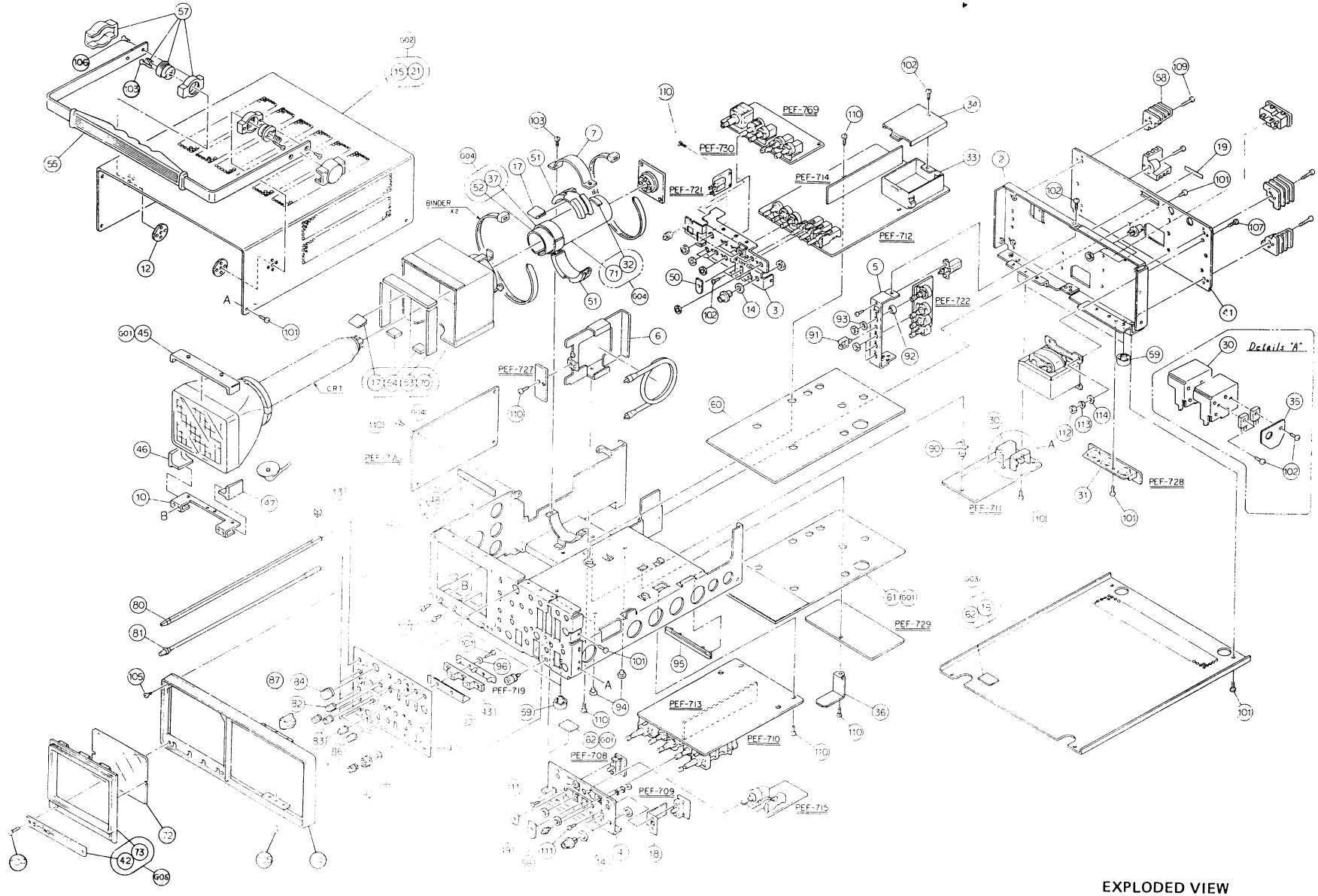
10 READOUT CONTROL CKT (1) (PEF-770)



11 READOUT CONTROL CKT (2) (PEF-770)



12 WIRING DIAGRAM



EXPLODED VIEW