

HITACHI

**MODEL V-088
VECTORSCOPE**

SERVICE MANUAL



Hitachi Denshi, Ltd.

TOKYO, JAPAN

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NOTICE

This Service Manual describes the most typical product of this model. If there are any specific differences between this Manual and the servicing unit, please contact Hitachi Denshi sales office in your area.

MODEL V-088

VECTORSCOPE

Service Manual

1. FEATURES

The Hitachi Model V-088 is a PAL system compact Vectorscope, using a 3 1/2 inch high intensity rectangular CRT display.

The V-088 Vectorscope is designed to monitor the output signal from such devices as TV cameras, VTRs, and CCTVs. It offers the following features.

- o Three units are mountable side-by-side in a standard 19-inch rack.
- o The equipment operates on three different power supplies; AC power, external DC power and the optional AD-099 battery pack.
- o Auto focus function is provided.
- o Either of two loop-through video inputs may be selected for display from the front panel.
- o A built-in test circle function enables to inspect the phase and amplitude.
- o Either internal or external synchronization is selectable from the front panel, and the external inputs are a loop-through type.

2. PRECAUTIONS

It is recommended to follow the following precautions for operating the V-088 safely and properly.

Installation site

- * Avoid installing instrument in an extremely hot or cold place.
 - o Avoid placing this instrument in a place exposed to sunlight for a long period of time, in a closed car in mid-summer, or near a room heating device such as a stove.
 - o The operating maximum ambient temperature is 40°C except AD-099 Battery Pack.
- * Do not use instrument that has been left outdoors on a cold winter day. The operating ambient temperature is 0°C or more.

- * Avoid moving the instrument rapidly from a hot place to a cold place of vice versa, or condensation may form on inside of the instrument.
- * Keep the instrument away from damp air, water, and dust.
Unexpected trouble may be caused when the instrument is placed in a damp or dusty place. The operating ambient humidity is 35-85%. Since an accidental intrusion of water may also cause troubles, do not place a water-filled containers such as a vase on the instrument.
- * Do not place the instrument in a place where vibration is strong. Avoid using the instrument at a place vibrating violently. Since the V-088 is a precision instrument, excessively strong vibrations may cause damage.
- * Do not place the instrument near a magnet or magnetic body. This instrument is an equipment using electron beam. Therefore, do not bring a magnet close to the instrument or do not use the instrument near an equipment generating strong magnetic force.

Handling

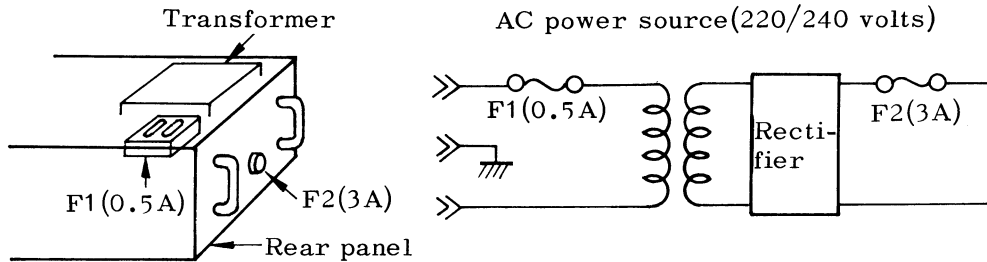
- * Do not put a heavy objects on the instrument.
Do not block the ventilation holes.
- * Do not apply a heavy shock to the instrument.
- * Do not insert a wire, pin, etc. through the ventilation hole.
- * Do not drag the set, leaving the cables attached to it.
- * Do not leave a hot soldering iron on the cabinet or the screen.
- * Do not try to turn the instrument upside down. Otherwise, knobs may be broken.
- * Do not use the instrument upright, leaving cables connected to VIDEO INPUT, EXT SYNC INPUT, and EXT DC IN on the rear panel. Otherwise, the cable may be damaged.

When operation is faulty

- * Recheck the operating procedure and if problem persists, contact a nearby service station or agent.

- * Only our authorized service man can provide the repair and recalibration except exchanging the fuses.

Fuse location and procedures for
exchanging the fuses



- F1(0.5A) : Remove the cover of the fuseholder and put on after exchanging the fuse.
- F2(3A) : Remove the cap of the fuseholder by turning counter-clockwise (against the arrow).
- [Disconnect any power source before exchanging the fuses.]

Care and repair

- * Removal of stain from the case
 - o When the outside of the case is stained, remove the stain by first wiping it lightly with a cloth moistened with neutral washing agent and then wipe the surface with a dry cloth.
 - o When the panel surface is stained, remove the stain in similar way with a clean, soft cloth. When heavy stains are present, first remove the stains by wiping the surface lightly with a cloth moistened with diluted neutral washing agent and then wipe thoroughly with a dry cloth.
 - o When dust has accumulated on the inside, remove it by using a dry brush, or by using the exhaust of a compressor or a vacuum cleaner.
- NOTE: Before removing the covers, disconnect any power source beforehand without fail. Dangerous voltage, capable of causing death, are present in the V-088.

Use extreme caution when handling without the cover. When cleaning the inside, insure beforehand that no electricity remains in the capacitors of the power supply circuit.

* Cleaning of external graticule

Dirty surface of external graticule tends to cause measuring errors. Remove the stains on external graticule by using a clean and soft cloth, paying attention not to impair them.

When the stain is extremely heavy, wash them with neutral washing agent and then leave them stand until the moisture is removed naturally.

- o If the screen is installed while it is moistened, water rings may be formed and the waveform may be blurred to become hard to observe. Pay attention not to leave finger prints on it.

Cautions before operating

* Check the power source

The operating voltage range of this instrument is as follows. Check the power source voltage without fail before connecting to any power source.

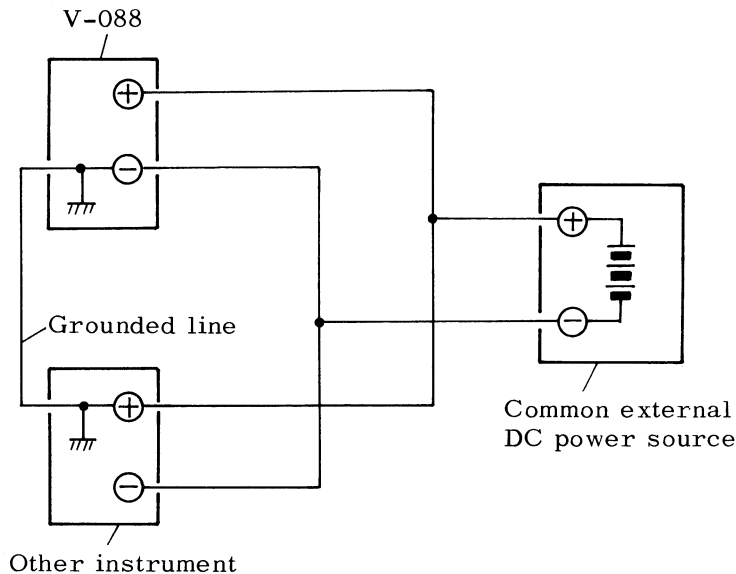
AC power source voltage	220: 198-242 volts
	240: 216-264 volts
External DC power source voltage (at EXT DC IN terminals)	11.5-14 volts

* Use only specified fuses

In order to protect the circuit against overcurrent, a 0.5 A (in primary side of power circuit) and 3 A (in secondary side of power circuit) are used. When the fuses blow out, check thoroughly the cause, repair any faulty point present, and then replace with a specified fuse. Do not try to use the fuse other than the specified ones. Otherwise, fault may be caused or danger may be invited. (Particularly, do not use a fuse different from the specified one in current capacity and in length.) The standards of the fuses are as follows.

	Shape (Diameter length)mm	JIS type name
3A (secondary)	6.35 ϕ x 31.8	MF61NM250V 3A AC
0.5A (primary)	6.35 ϕ x 31.8	MF61NM250V 0.5A AC

- * - (negative) terminal of EXT DC IN is inside connected to case ground.
Do not connect - (negative) terminal of the V-088 to the + (positive) grounded case of other instruments with common external DC power source to the V-088. If not, it is very dangerous because a large current flows through the grounded line.



[DANGEROUS CONNECT]

- * Do not apply reverse polarities to EXT DC IN.
- * Do not increase the brightness too much. Your eyes may be strained and the fluorescent surface of CRT may be burnt.
- * Do not apply an excessive voltage.
The maximum voltage of each input is as follows.

Never apply a voltage higher than specified.

VIDEO INPUT	+5 volts DC
EXT SYNC INPUT	+5 volts DC

Calibration interval

To maintain instrument accuracy, perform the calibration of the V-088 at least every 1000 hours of operation, or every six months if used infrequently.

3. COMPOSITION

Composition of the Model V-088 is as follows.

- | | | |
|-----|-------------------------|---|
| (1) | V-088 vectorscope | 1 |
| (2) | AC power cable | 1 |
| (3) | Fuse 250 V 3 A | 1 |
| | 250 V 0.5 A | 1 |
| (4) | Operation manual | 1 |

4. ADJUSTMENT

4. 1 Test equipment required

No.	Name	Minimum Specification	Purpose	Equipment used
1	Digital voltmeter	0.1%	Lower-voltage Power supply	
2	High-voltage probe	1000 x, 3%	High-voltage Power supply	
3	Sine-wave generator	Frequency range; 50kHz to 5MHz	Phase shift	
4	Video signal generator Color bar output	Accurate color bar for PAL standard	Compensation Burst gate Gain	
5	DC power supply	10V-15V, 2A min.	Alarm voltage	
6	Oscilloscope (With 10x probe)	50MHz, 5mV/div Capable of tracing difference between CH1 and CH2	Frequency response adjustment	V-650F (Hitachi) V-1050F (Hitachi)
7	Return loss bridge		Return loss	015-0149-00 (TEK)
8	Return loss bridge		"	011-0103-01 (TEK)
9	Sine-wave generator (SG)	Frequency range; 25Hz to 10MHz	"	
10	Terminal converter (50Ω to 75Ω)		Return loss	011-0057-00 (TEK)
11	75Ω end-line termination		Usual use	011-0103-02 (TEK)
12	75Ω coaxial cable		Usual use	
13	50Ω coaxial cable		Return loss	


4. 2 Initial setting

- ① Turn POWER/INTENSITY control counterclockwise fully.
- ② Set POWER SOURCE switch to AC (TRICKLE CHG).
- ③ Check that AC source is 120 V $\pm 10\%$.
- ④ Connect power cable of the V-088 to AC source.
- ⑤ Turn the POWER/INTENSITY control clockwise fully (to power switch ON).
- ⑥ Warm up the V-088 for 15 minutes.

Adjust the controls on the front panel as shown below.

POSITION ( • Horizontal) ; Mid position

SYNC ; INT side

POSITION ( • Vertical) ; Mid position

PULL VAR GAIN ; Press

4. 3 Power supply system

NOTE

Before you begin, see Adjustment Locations in the pullout pages and preset the controls as shown in the Preliminary Control Setting.

- ① a. Adjust the 10x probe from the test oscilloscope to collector of TR1101 on the PEF-615.
- b. Adjust RV1101 on the PEF-615 unit so that oscillation frequency is 17.5 kHz (57 μ s). (See Fig. 4-1)

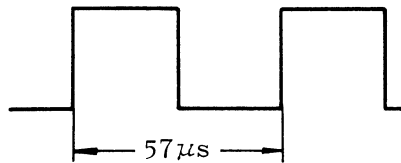


Fig. 4-1

- ② Adjust - 1900 V
 - a. Connect a DC voltmeter via a x1000 high voltage probe between test point of "-1.9 kV" and chassis ground.
 - b. Adjust RV1005 so that -1900 V is applied at the test point.

- ③ Adjust +200 V
 - a. Connect the digital volt-meter between +200 V test point and chassis ground.
 - b. Adjust RV1103 on the PEF-615 so that +200 V \pm 1 V is applied at the test point.
- ④ Check of low-voltage source
 - a. Connect the digital volt-meter between each test point and chassis ground.
 - b. Check - Meter reading.
 - * +5 V power supply; +5 V \pm 0.25 V
 - * +8 V power supply; +8 V \pm 0.4 V
 - * -8 V power supply; -8 V \pm 0.4 V
 - * +12 V power supply; +12 V \pm 0.6 V
- ⑤ Adjustment of alarm voltage
 - a. Set the POWER SOURCE control to EXT DC.
 - b. Connect the external DC source and digital volt-meter to EXT DC in.
 - c. Set the DC source that the digital volt-meter indicates 11.0 V.
 - d. Adjust RV1102 to the point where POWER lamp (green LED on the front panel) starts to light.
 - e. Set the POWER SOURCE control to AC (TRICKLE CHG).
- ⑥ Adjust - grid bias
 - a. Set the POWER/INTENSITY control as shown in Fig. 4-2.

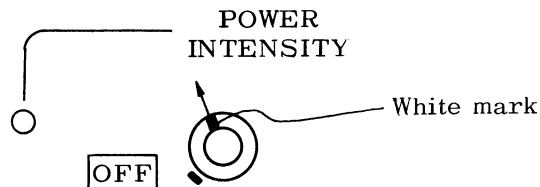


Fig. 4-2

- b. Adjust - RV1002 at the point where a trace starts to appear.
- c. The trace disappears completely by setting the POWER/INTENSITY control to the minimum.

- ⑦ Adjust - focus and astigmatism
 - a. Set the INPUT switch to A side so as to monitor a bright spot on the screen.
 - b. Adjust - FOCUS control and RV1003 alternately to obtain the sharpest bright spot.
 - c. Check - Focusing is automatically corrected when the INTENSITY control is turned.

4. 4 Signal system

- ⑧ Adjust - Compensation of VIDEO INPUT A
 - a. Take the connections as shown in Fig. 4-3.
 - * Connect a 75 Ω coaxial cable between VIDEO OUT of Video Signal Generator and the upper connector of VIDEO INPUT A.
 - * Connect a 75 Ω coaxial cable between the lower connector of VIDEO INPUT A and the upper connector of VIDEO INPUT B.
 - * Connect a 75 Ω termination to the lower connector of VIDEO INPUT B.

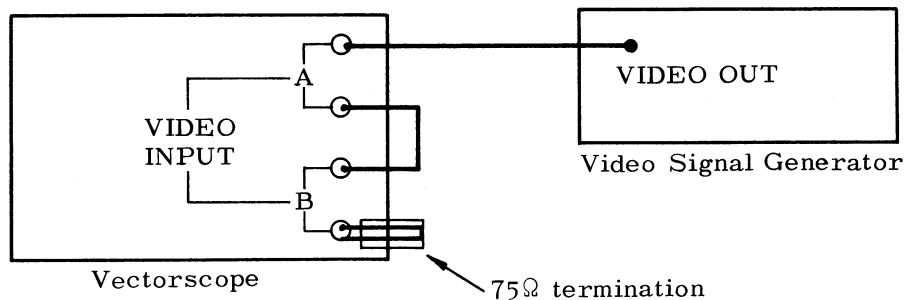


Fig. 4-3 Connections for Adjustment ⑧ and ⑨

- b. Apply color bar signal to the output of the video signal generator.
- c. Connect a 10x probe from the oscilloscope to the emitter of TR3 on the PEF-615 unit.
- d. Adjust CV1 so that the every top level of the white bar signal is even. (See Fig. 4-4.)

- e. Change the connections of the 10x probe connected with oscilloscope from emitter of TR3 to emitter of TR211 on the PEF-615.
- f. Adjust CV201 so that the every top level of the white bar signal is even. (See Fig. 4-4.)

⑨

- Adjust - Compensation of VIDEO INPUT B
- a. Take the connections as shown in Fig. 4-3.
 - b. Apply color bar signal to the output of the video signal generator.
 - c. Connect a 10x probe from the oscilloscope to the emitter of TR103 on the PEF-615 unit.
 - d. Adjust CV101 so that the every top level of the white bar signal is even. (See Fig. 4-4.)
 - e. Change the connections of the probe connected with oscilloscope from emitter of TR103 to emitter of TR211 on the PEF-615.
 - f. Adjust CV204 so that the every top level of the white bar signal is even. (See Fig. 4-4.)

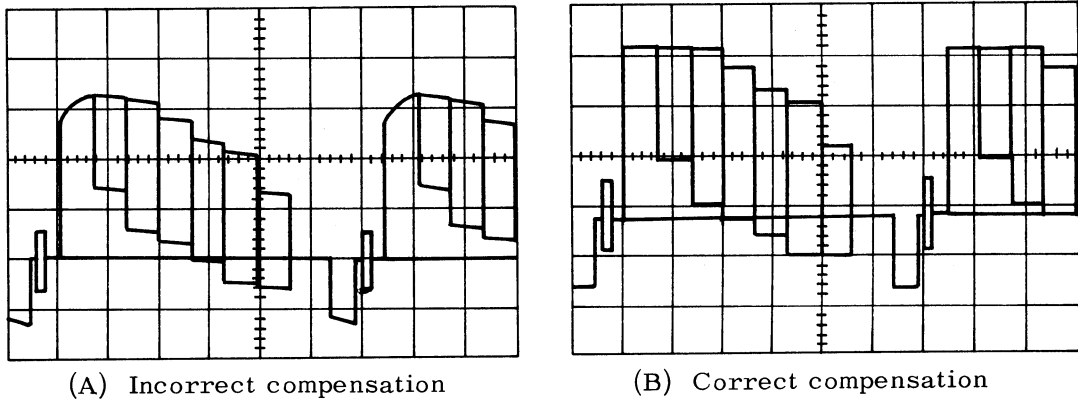


Fig. 4-4

⑩

- Adjust - VAR gain
- a. Connect the external output of sine-wave generator with the upper connector of VIDEO INPUT A.
 - b. Pull the PULL VAR control and rotate it to fully clockwise.
 - c. Connect the 10x probe from the oscilloscope with emitter of TR211 on the PEF-615.

- f. Adjust CV207 on the PEF-616 unit so as to maintain same amplitude when PHASE FINE control is turned to fully clockwise and counterclockwise.
 - g. Connect the probe from the oscilloscope to the emitter of TR209.
 - h. Adjust CV208 so as to be same amplitude when PHASE FINE control is turned to fully clockwise and counterclockwise.
 - i. Connect the probe from the oscilloscope to the emitter of TR210.
 - j. Adjust CV209 so as to be same amplitude when PHASE FINE control is turned to fully clockwise and counterclockwise.
 - k. Remove the probe.
- ⑫ Adjust - Burst gate pulse
- a. Take the connections as shown in Fig. 4-3.
 - b. Apply the color bar signal to the output of the video signal generator.
 - c. Connect the probe from CH1 and the probe from CH2 of the oscilloscope to pin ① of plug P203 and pin ③ of P203 respectively.
 - d. Adjust RV209 on the PEF-616 so that the leading edge of the burst gate pulse meets rise time of the burst signal.
(See Fig. 4-5.)
 - e. Adjust RV208 so that the burst gate pulse width is $2.8 \mu s$.

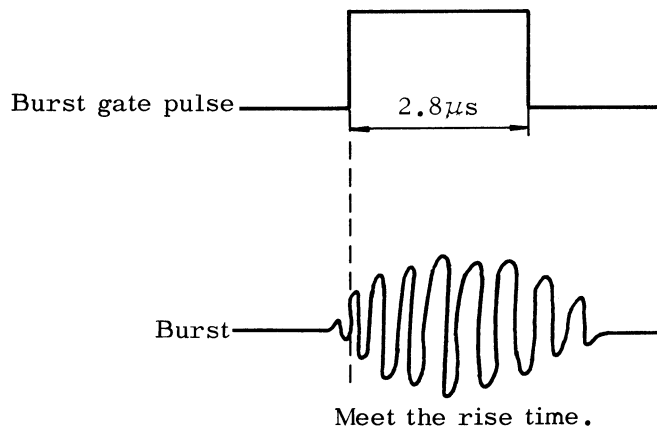


Fig.4-6 Burst gate pulse

Vectorscope

This displays the amplitudes and the phases of chrominance signals, using the R-Y and B-Y axes on the CRT.

The proper ranges for the phases and amplitudes corresponding to the three primary colors; red, blue and green, and complimentary colors; cyan, yellow and magenta are marked on the scale screen. The inner mark \square indicate the phase within $\pm 2.5^\circ$ and the amplitude within $\pm 2.5\%$. The outer mark \square indicate their limits of allowance: $\pm 10^\circ$ for the phase and $\pm 20\%$ for amplitude.

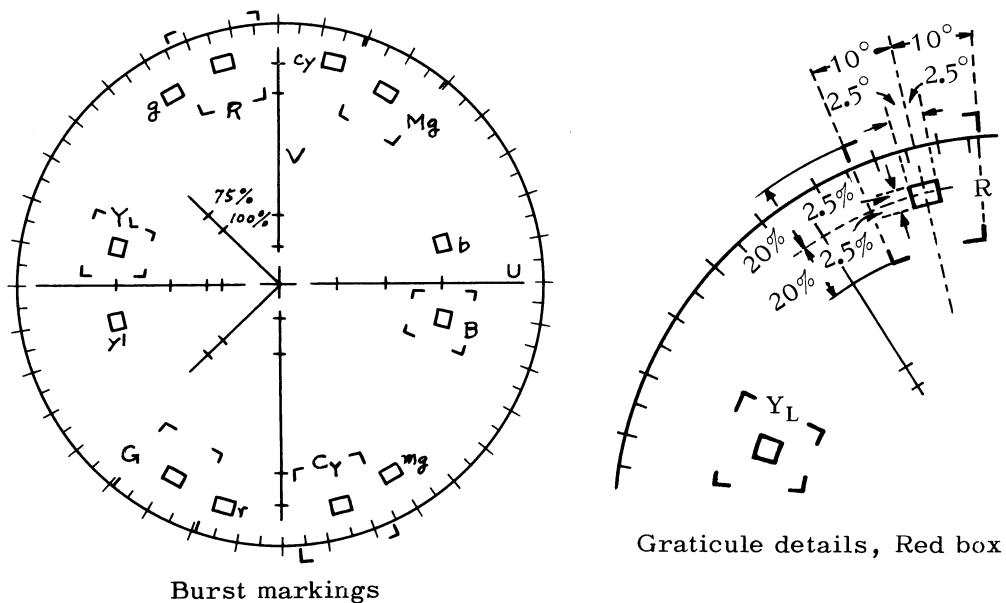


Fig. 4-7

- ⑬ Adjust - DC balance
 - a. Connect the digital voltmeter between pins ⑨ and ⑩ of IC205.
 - b. Adjust RV205 so that the potential difference between pins ⑨ and ⑩ of IC205 is 0 V.
- ⑭ Adjust - Gain and phase
 - a. Make the connections as shown in Fig. 4-3.

- b. Apply color bar signal to the output of video signal generator.
- c. Adjust RV301 to obtain vertical gain.
- d. Adjust RV801 to obtain horizontal gain.
- e. Adjust CV203 to obtain quadrature phase.
- f. Adjust them so that chrominance signals R,B,G, C_Y , Y_L and M_G are as follows:

Amplitude errors ; $\pm 2\%$

Phase errors ; $\pm 2^\circ$

⑮ Adjust - Test circle

- a. Set the VIDEO INPUT switch to A side and adjust POSITION control so that the center bright spot comes to the center on the screen.
- b. Set the INPUT switch to TEST CIRCUIT.
- c. Adjust RV304 on the PEF-615 unit so that test circle comes onto the center in the horizontal direction.
- d. Adjust RV804 on the PEF-615 unit so that test circle comes onto the center in the vertical direction.
- e. Adjust RV1201 so that the width of the test circle coincide with the horizontal scale on the screen.
- f. Adjust RV305 so that the height of the test circle coincide with the vertical scale on the screen.

⑯ Adjust - Subcarrier frequency

- a. Make the connections as shown in Fig. 4-3.
- b. Apply color bar signal to the output of the video signal generator.
- c. Check the phase-locking range with turning CV202 on the PEF-615 unit.
- d. Adjust CV202 so that phase is locked at the mid-position in the range.

⑰ Adjust - Chroma band width

- a. Make the connections as shown in Fig. 4-3.
- b. Apply color bar signal to the output of the video signal generator.
- c. Adjust CV206 and CV210 on the PEF-615 unit alternately so that the best linearity of each vector is obtained on the screen.

- ⑱ Adjust - ϕ REF band width
- Connect the sine-wave generator and set the generator output to be 3.58 MHz and 1 Vp-p.
 - Connect the 10x probe from the oscilloscope to L211 on the PEF-616 unit.
 - Adjust CV205 on the PEF-616 unit so that the width is the maximum.

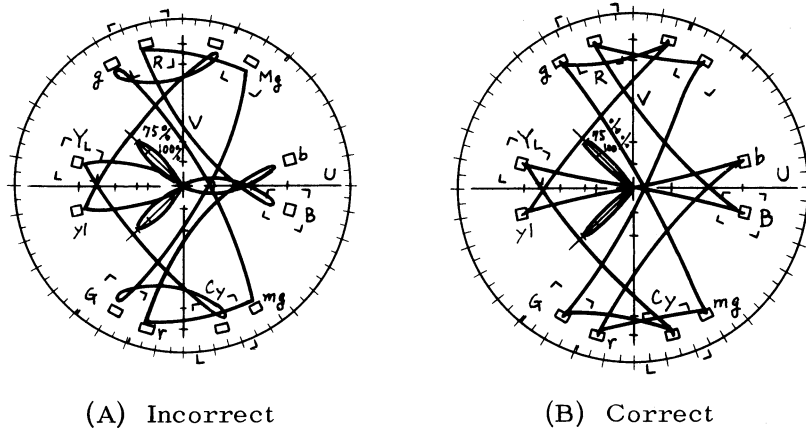


Fig. 4-8

- ⑲ Check - Return loss
- Connect the return loss bridge (015-0149-00, Tektronix) to the input of the oscilloscope.
 - Connect the 75 Ω to 50 Ω min loss attenuator to the input of the return loss bridge.
 - Connect the 50 Ω coaxial cable between the sine-wave generator set to 4 MHz and 1 Vp-p approx. and the return loss bridge.
 - Terminate two cables of the return loss bridge with 75 Ω terminator.
 - Set CH1 and CH2 on the oscilloscope to 0.2 V/div. Set the MODE to the differential comparator channel (CH1 - CH2) and free run in the mode.
 - Remove one 75 Ω terminator from the return loss bridge and set the output of sine-wave generator to 0.5 Vp-p and 4 MHz by the

oscilloscope. This amplitude is to be monitored by CH1 or CH2.
(Do not observe it by the differential comparator mode.)

Reconnect the 75 Ω terminator to the return loss bridge.

- g. Set the oscilloscope VOLTS/DIV to 5 mV/div and set AC-GND-DC selectors CH1 and CH2 to AC.

Set V MODE to CH1-CH2 and make sweep in 20 μ s/div.

- h. Check that amplitude of waveforms on the oscilloscope screen is less than 1 mV when input sine-wave is changed from 25 Hz to 4 MHz by the generator.

- i. Remove the one 75 Ω terminator from the return loss bridge and connect it to the upper connector of VIDEO INPUT A on the V-089.

Connect the removed 75 Ω terminator to the lower connector of VIDEO INPUT A.

- j. Change the frequency of the sine-wave generator from 25 Hz to 4 MHz.

- k. Confirm that the amplitude of the waveform on the oscilloscope screen is less than the resultant value that 5 mV minus amplitude displayed at item h.

- l. If not, manage to do so by adjusting coil mounted on the input BNC connector.

- m. Take the same confirmation and adjustment for VIDEO INPUT B as VIDEO INPUT A.

- n. Take the same confirmation and adjustment for SYNC as VIDEO INPUT A. In case of SYNC, set it alternately to INT or EXT.

6. ELECTRICAL PARTS LIST

PEF-615 PCB

Part Code	Symbol	Description	Remarks
<u>Capacitors</u>			
CEC0391	C 1	AL Elyc 50V 1 μ F \pm 20%	
CEC0160	2	AL Elyc 16V 10 μ F \pm 20%	
CEC0160	3	AL Elyc 16V 10 μ F \pm 20%	
CEC0391	C 101	AL Elyc 50V 1 μ F \pm 20%	
CEC0160	102	AL Elyc 16V 10 μ F \pm 20%	
CEC0160	103	AL Elyc 16V 10 μ F \pm 20%	
CQC0416	C 201	Plastic 125V 100 pF \pm 10%	
CQC0416	202	Plastic 125V 100 pF \pm 10%	
CQA0093	203	Plastic 50V 0.0022 μ F \pm 10%	
CCC1002	204	Ceramic 125V 7 pF \pm 10%	
CQC0410	205	Plastic 125V 12 pF \pm 5%	
CCC1026	206	Ceramic 125V 150 pF \pm 5%	
CQA0097	C 231	Plastic 50V 0.01 μ F \pm 10%	
CQA0097	232	Plastic 50V 0.01 μ F \pm 10%	
CES0037	233	AL Elyc 50V 1 μ F \pm 20%	
CQA0097	234	Plastic 50V 0.01 μ F \pm 10%	
CQA0097	235	Plastic 50V 0.01 μ F \pm 10%	
CQA0097	236	Plastic 50V 0.01 μ F \pm 10%	
CQA0097	237	Plastic 50V 0.01 μ F \pm 10%	
CEC0161	238	AL Elyc 16V 100 μ F \pm 10%	
CCC1032	239	Ceramic 125V 82 pF \pm 10%	
CCC1002	240	Ceramic 50V 10 pF \pm 5%	
CQC0412	241	Plastic 125V 22 pF \pm 10%	
CQA0097	242	Plastic 50V 0.01 μ F \pm 10%	
CQA0097	243	AL Elyc 25V 4.7 μ F \pm 20%	
CQC0410	C 245	Plastic 125V 12 pF \pm 20%	
CQC0410	246	Plastic 125V 12 pF \pm 20%	
CEC0160	251	AL Elyc 16V 10 μ F \pm 10%	
CCC1002	267	Ceramic 50V 10 pF \pm 10%	
CCC1026	268	Ceramic 50V 150 pF \pm 10%	
CCC1163	269	Ceramic 50V 680 pF \pm 10%	
CES0029	C 301	AL Elyc 10V 100 μ F \pm 20%	
CQA0097	303	Plastic 50V 0.01 μ F \pm 10%	
CCC1025	304	Ceramic 50V 100 pF \pm 10%	
CEC0391	305	AL Elyc 50V 1 μ F \pm 20%	
CES0029	306	AL Elyc 6.3V 100 μ F \pm 20%	
CEC0160	307	AL Elyc 16V 10 μ F \pm 20%	
CCC1356	308	Ceramic 50V 470 pF \pm 10%	
CES0029	C 801	AL Elyc 10V 100 μ F \pm 20%	
CQA0097	803	Plastic 50V 0.01 μ F \pm 10%	
CCC1025	804	Ceramic 50V 100 pF \pm 10%	
CEC0391	805	AL Elyc 50V 1 μ F \pm 20%	
CES0029	806	AL Elyc 6.3V 100 μ F \pm 20%	
CEC0160	807	AL Elyc 16V 10 μ F \pm 20%	
CQC0418	808	Plastic 125V 560 pF \pm 10%	
CEC0400	C 1001	AL Elyc 160V 3.3 μ F \pm 20%	
CQX0274	1002	Plastic 650V 0.01 μ F \pm 10%	
CCD0231	1003	Ceramic 2000V 4700 pF \pm 20%	
CCD0231	1004	Ceramic 2000V 4700 pF \pm 20%	
CCD0231	1005	Ceramic 2000V 4700 pF \pm 20%	

Part Code	Symbol	Description	Remarks
CCD0231	C 1006	Ceramic 2000V 4700 pF \pm 20%	
CCD0231	1007	Ceramic 2000V 4700 pF \pm 20%	
CCD0231	1008	Ceramic 2000V 4700 pF \pm 20%	
CCD0231	1009	Ceramic 2000V 4700 pF \pm 20%	
CQX0274	1010	Plastic 650V 0.01 μ F \pm 10%	
CCD0231	1011	Ceramic 2000V 4700 pF \pm 20%	
CQA0097	1012	Plastic 50V 0.01 μ F \pm 10%	
CCD0231	1013	Ceramic 2000V 4700 pF \pm 20%	
CCD0231	1014	Ceramic 2000V 4700 pF \pm 20%	
CQX0274	1015	Plastic 650V 0.01 μ F \pm 10%	
CEC0400	1101	AL Elyc 160V 3.3 μ F \pm 20%	
CEC0403	1102	AL Elyc 350V 3.3 μ F \pm 20%	
CEC0403	1103	AL Elyc 350V 3.3 μ F \pm 20%	
CEC0161	1105	AL Elyc 16V 100 μ F \pm 20%	
CEC0161	1106	AL Elyc 16V 100 μ F \pm 20%	
CEC0161	1107	AL Elyc 16V 100 μ F \pm 20%	
CEC0161	1108	AL Elyc 16V 100 μ F \pm 20%	
CEC0161	1109	AL Elyc 16V 100 μ F \pm 20%	
CQC0416	1110	Plastic 125V 100 pF \pm 10%	
CEC0391	C 1113	AL Elyc 50V 1 μ F \pm 20%	
CEC0391	1114	AL Elyc 50V 1 μ F \pm 20%	
CEC0189	1115	AL Elyc 25V 470 μ F \pm 20%	
CEC0153	1117	AL Elyc 10V 100 μ F \pm 20%	
CEC0205	1119	AL Elyc 35V 220 μ F \pm 20%	
CEC0160	1120	AL Elyc 16V 10 μ F \pm 20%	
CQA0009	1121	Plastic 50V 0.01 μ F \pm 10%	
CEC0160	1122	AL Elyc 16V 10 μ F \pm 20%	
CEC0391	1124	AL Elyc 50V 1 μ F \pm 20%	
CQA0096	1129	Plastic 50V 0.0068 μ F \pm 10%	
CQA0096	1130	Plastic 50V 0.0068 μ F \pm 10%	
CQA0098	1131	Plastic 50V 0.0015 μ F \pm 10%	
CQA0097	1132	Plastic 50V 0.01 μ F \pm 10%	
CCC1002	C 1201	Ceramic 50V 10 pF \pm 10%	
CQA0091	1202	Plastic 50V 0.001 μ F \pm 10%	
CQA0097	1203	Plastic 50V 0.01 μ F \pm 10%	
CEC0160	1204	AL Elyc 16V 10 μ F \pm 20%	
CEC0160	1205	AL Elyc 16V 10 μ F \pm 20%	
<u>Var. Capacitors</u>			
CVE0025	CV 1	ECV-1ZW10x40	
CVE0024	CV 101	ECV-1ZW10x40	
CVE0012	CV 201	ECV-1ZW50x44	
CVE0024	202	ECV-1ZW10x40	
CVE0024	203	ECV-1ZW10x44	
CVE0012	204	ECV-1ZW50x44	
CVE0012	206	ECV-1ZW50x44	
CVE0024	210	ECV-1ZW10x40	
<u>Diodes</u>			
HDS0250	D 1001	1SS83	
HDY0031	1002	Y10GA	
HDY0031	1003	Y10GA	
HDY0031	1004	Y10GA	

Part Code	Symbol	Description	Remarks
HDS0250	D 1005	1SS83	
HDY0031	1006	Y10GA	
HDS0250	1007	1SS83	
HDY0031	1008	Y10GA	
HDY0031	1009	Y10GA	
HDS0250	D 1101	1SS83	
HDS0250	1102	1SS83	
HDX0045	1107	11DQ03	
HDX0045	1108	11DQ03	
HDX0045	1109	11DQ03	
HDX0045	1110	11DQ03	
HDS0108	1111	1S2075K	
HDS0108	1112	1S2075K	
HDS0108	1113	1S2075K	
HDS0108	1116	1S2075K	
HDU0038	1117	U15B	
HDX0046	1118	31DQ03	
<u>IC's</u>			
IDH0802	IC 201	Digital HD14053BP (MC14053BCP)	
IDH0742	202	Digital HD14066BP (MC14066BCP)	
IDH0802	203	Digital HD14053BP (MC14053BCP)	
IDH0057	205	Digital TA7193P	
ILT0050	IC 1101	Analog TL072CP	
IDL0004	1102	Digital LM393P	
IDH0804	1103	Digital HD14069UBP (MC14069UBCF)	
IDH0798	1104	Digital HD14046BP (MC14046BCP)	
8338426A	1105	Analog HA17805P	
ILH0109	1106	Analog HA17808P	
ILM0342	1107	Analog μ A7908UC	
<u>Coils</u>			
TLF0018	L 201	FL-5H 56 μ H \pm 5%	
TLF0063	202	FL-3H 6.8 μ H \pm 5%	
TLF0104	209	FL-5H 680 μ H \pm 5%	
TLF0104	210	FL-5H 680 μ H \pm 5%	
TLF0067	301	FL-5H 100 μ H \pm 5%	
TLF0067	L 801	FL-5H 100 μ H \pm 5%	
TLF0104	L 1101	FL-5H 680 μ H \pm 5%	
TLF0067	1102	FL-5H 100 μ H \pm 5%	
TLS0071	1103	SR-02-025	
TLS0071	1104	SR-02-025	
<u>Resistors</u>			
RCR3106	R 1	Carbon 1/4W 1M Ω \pm 5%	
RCR3106	2	Carbon 1/4W 1M Ω \pm 5%	
RCR3049	3	Carbon 1/4W 750 Ω \pm 5%	
RME0666	4	Metal 1/4W 1.5k Ω \pm 1%	
RME0666	5	Metal 1/4W 1.5k Ω \pm 1%	
RCR3070	6	Carbon 1/4W 5.6k Ω \pm 5%	
RCR3056	7	Carbon 1/4W 1.5k Ω \pm 5%	
RCR3012	8	Carbon 1/4W 22 Ω \pm 5%	
RCR3012	9	Carbon 1/4W 22 Ω \pm 5%	
R 101	R 101	Carbon 1/4W 1M Ω \pm 5%	
R 102	R 102	Carbon 1/4W 1M Ω \pm 5%	
R 103	R 103	Carbon 1/4W 750 Ω \pm 5%	
R 104	R 104	Metal 1/4W 1.5k Ω \pm 1%	
R 105	R 105	Metal 1/4W 1.5k Ω \pm 1%	
R 106	R 106	Carbon 1/4W 5.6k Ω \pm 5%	

Part Code	Symbol	Description	Remarks
R 107	R 107	Carbon 1/4W 1.5k Ω \pm 5%	
R 108	R 108	Carbon 1/4W 22 Ω \pm 5%	
R 109	R 109	Carbon 1/4W 22 Ω \pm 5%	
R 201	R 201	Metal 1/4W 8.25k Ω \pm 5%	
R 202	R 202	Metal 1/4W 8.25k Ω \pm 5%	
R 204	R 204	Metal 1/4W 8.25k Ω \pm 5%	
R 205	R 205	Metal 1/4W 8.25k Ω \pm 5%	
R 207	R 207	Carbon 1/4W 1.2k Ω \pm 5%	
R 208	R 208	Carbon 1/4W 2.2M Ω \pm 5%	
R 209	R 209	Metal 1/4W 28k Ω \pm 1%	
R 210	R 210	Carbon 1/4W 2.7k Ω \pm 5%	
R 211	R 211	Carbon 1/4W 2.2k Ω \pm 5%	
R 212	R 212	Carbon 1/4W 68 Ω \pm 5%	
R 213	R 213	Metal 1/4W 1.82k Ω \pm 1%	
R 214	R 214	Metal 1/4W 1.1k Ω \pm 1%	
R 215	R 215	Carbon 1/4W 820 Ω \pm 5%	
R 216	R 216	Carbon 1/4W 180 Ω \pm 5%	
R 217	R 217	Carbon 1/4W 68 Ω \pm 5%	
R 219	R 219	Metal 1/4W 1.24k Ω \pm 1%	
R 257	R 257	Carbon 1/4W 100k Ω \pm 5%	
R 258	R 258	Carbon 1/4W 100k Ω \pm 5%	
R 262	R 262	Metal 1/4W 953 Ω \pm 1%	
R 263	R 263	Carbon 1/4W 820 Ω \pm 5%	
R 264	R 264	Carbon 1/4W 12k Ω \pm 5%	
R 265	R 265	Carbon 1/4W 75k Ω \pm 5%	
R 267	R 267	Carbon 1/4W 27k Ω \pm 5%	
R 268	R 268	Carbon 1/4W 470 Ω \pm 5%	
R 269	R 269	Carbon 1/4W 470 Ω \pm 5%	
R 270	R 270	Carbon 1/4W 8.2k Ω \pm 5%	
R 271	R 271	Carbon 1/4W 470 Ω \pm 5%	
R 272	R 272	Carbon 1/4W 470 Ω \pm 5%	
R 273	R 273	Metal 1/4W 221 Ω \pm 1%	
R 274	R 274	Carbon 1/4W 100k Ω \pm 5%	
R 275	R 275	Carbon 1/4W 100k Ω \pm 5%	
R 276	R 276	Carbon 1/4W 100k Ω \pm 5%	
R 278	R 278	Carbon 1/4W 100k Ω \pm 5%	
R 279	R 279	Carbon 1/4W 100k Ω \pm 5%	
R 280	R 280	Metal 1/4W 11.3k Ω \pm 1%	
R 294	R 294	Carbon 1/4W 330 Ω \pm 5%	
R 296	R 296	Carbon 1/4W 1k Ω \pm 5%	
R 297	R 297	Carbon 1/4W 33k Ω \pm 5%	
R 301	R 301	Metal 1/4W 1.82k Ω \pm 1%	
R 302	R 302	Carbon 1/4W 10k Ω \pm 5%	
R 303	R 303	Carbon 1/4W 470 Ω \pm 5%	
R 304	R 304	Solid 1/4W 10M Ω \pm 5%	
R 305	R 305	Carbon 1/4W 1M Ω \pm 5%	
R 307	R 307	Metal 1/2W 47.5k Ω \pm 1%	
R 308	R 308	Metal 1/2W 47.5k Ω \pm 1%	
R 309	R 309	Metal 1/4W 392 Ω \pm 5%	
R 310	R 310	Metal 1/4W 392 Ω \pm 5%	
R 311	R 311	Metal 1/4W 1.24k Ω \pm 1%	
R 312	R 312	Metal 1/4W 2.94k Ω \pm 1%	
R 313	R 313	Carbon 1/4W 1.5k Ω \pm 5%	
R 314	R 314	Carbon 1/4W 12k Ω \pm 5%	
R 315	R 315	Carbon 1/4W 330 Ω \pm 5%	
R 316	R 316	Carbon 1/4W 330 Ω \pm 5%	
R 317	R 317	Carbon 1/4W 2.2 Ω \pm 5%	
R 318	R 318	Carbon 1/4W 2.2 Ω \pm 5%	
R 319	R 319	Carbon 1/4W 560 Ω \pm 5%	
R 320	R 320	Carbon 1/4W 1k Ω \pm 5%	
R 266	R 266	Carbon 1/4W 1.2k Ω \pm 5%	
R 801	R 801	Metal 1/4W 1.82k Ω \pm 1%	

Part Code	Symbol	Description	Remarks
R	802	Carbon 1/4W 10kΩ ±5%	
R	803	Carbon 1/4W 1.2kΩ ±5%	
R	804	Solid 1/4W 10MΩ ±5%	
R	805	Carbon 1/4W 2.2MΩ ±5%	
R	807	Metal 1/2W 63.4kΩ ±1%	
R	808	Metal 1/2W 63.4kΩ ±1%	
R	809	Metal 1/4W 215Ω ±1%	
R	810	Metal 1/4W 215Ω ±1%	
R	811	Carbon 1/4W 12kΩ ±5%	
R	812	Metal 1/4W 825Ω ±1%	
R	813	Metal 1/4W 6.81kΩ ±1%	
R	814	Carbon 1/4W 330Ω ±5%	
R	815	Carbon 1/4W 330Ω ±5%	
R	816	Carbon 1/4W 15kΩ ±5%	
R	817	Carbon 1/4W 15kΩ ±5%	
R	818	Metal 1/2W 63.4kΩ ±1%	
R	819	Metal 1/2W 63.4kΩ ±1%	
R	820	Carbon 1/4W 330Ω ±5%	
R	1001	Carbon 1/4W 100kΩ ±5%	
R	1002	Carbon 1/4W 82kΩ ±5%	
R	1003	Carbon 1/4W 100kΩ ±5%	
R	1004	Carbon 1/4W 100kΩ ±5%	
R	1005	Carbon 1/4W 330kΩ ±5%	
R	1006	Carbon 1/4W 1.5MΩ ±5%	
R	1007	Carbon 1/4W 1.5MΩ ±5%	
R	1008	Carbon 1/4W 1.5MΩ ±5%	
R	1009	Metal 1/2W 12MΩ ±5%	
R	1010	Carbon 1/4W 1.8MΩ ±5%	
R	1011	Carbon 1/4W 470kΩ ±5%	
R	1012	Carbon 1/4W 100kΩ ±5%	
R	1013	Metal 1/4W 15MΩ ±5%	
R	1014	Metal 1/4W 16.9kΩ ±1%	
R	1015	Metal 1/4W 4.75kΩ ±1%	
R	1016	Carbon 1/4W 4.7kΩ ±5%	
R	1017	Carbon 1/4W 4.7kΩ ±5%	
R	1018	Carbon 1/4W 4.7MΩ ±5%	
R	1019	Carbon 1/4W 15kΩ ±5%	
R	1020	Carbon 1/4W 100kΩ ±5%	
R	1021	Metal 1/2W 22.1MΩ ±1%	
R	1022	Carbon 1/4W 560kΩ ±5%	
R	1023	Carbon 1/4W 270kΩ ±5%	
R	1024	Carbon 1/4W 82kΩ ±5%	
R	1025	Carbon 1/4W 4.7MΩ ±5%	
R	1101	Carbon 1/4W 39kΩ ±5%	
R	1102	Carbon 1/4W 560kΩ ±5%	
R	1103	Carbon 1/4W 220kΩ ±5%	
R	1104	Carbon 1/4W 56kΩ ±5%	
R	1105	Carbon 1/4W 120kΩ ±5%	
R	1106	Carbon 1/4W 470Ω ±5%	
R	1107	Carbon 1/4W 470Ω ±5%	
R	1110	Carbon 1/4W 4.7kΩ ±5%	
R	1111	R. Wire 1/2W 0.3Ω ±10%	
R	1112	Carbon 1/4W 33kΩ ±5%	
R	1113	Carbon 1/4W 8.2kΩ ±5%	
R	1114	Carbon 1/4W 10kΩ ±5%	
R	1115	Carbon 1/4W 10kΩ ±5%	
R	1116	Carbon 1/4W 47kΩ ±5%	
R	1117	Carbon 1/4W 4.7kΩ ±5%	
R	1118	Carbon 1/4W 220Ω ±5%	
R	1119	Metal 1/4W 5.62kΩ ±1%	

Part Code	Symbol	Description	Remarks
R	1120	Metal 1/4W 2kΩ ±1%	
R	1121	Carbon 1/4W 4.7kΩ ±5%	
R	1122	Carbon 1/4W 4.7kΩ ±5%	
R	1123	Carbon 1/4W 39kΩ ±5%	
R	1124	Carbon 1/4W 100kΩ ±5%	
R	1125	Carbon 1/4W 2.7kΩ ±5%	
R	1126	Carbon 1/4W 4.7kΩ ±5%	
R	1127	Metal 3W 3Ω ±5%	
R	1128	Metal 3W 3Ω ±5%	
R	1129	Metal 3W 2Ω ±5%	
R	1201	Carbon 1/4W 4.7kΩ ±5%	
R	1202	Carbon 1/4W 1.5kΩ ±5%	
R	1203	Carbon 1/4W 10kΩ ±5%	
R	1204	Carbon 1/4W 2.2kΩ ±5%	
R	1205	Carbon 1/4W 12kΩ ±5%	
R	1206	Metal 1/4W 82.5Ω ±1%	
R	1207	Metal 1/4W 100Ω ±1%	
R	1208	Carbon 1/4W 22Ω ±5%	
R	1209	Carbon 1/4W 22Ω ±5%	
R	1210	Carbon 1/4W 100kΩ ±5%	
<u>Switches</u>			
S	202	Lever SLR-043	
S	204	Lever SLR-022	
<u>Thermistors</u>			
TH	201	112-302-2	
TH	301	112-203-2	
<u>Transistors</u>			
TR	1	2SK30AY	
TR	2	2SA781K	
TR	3	2SC458C	
TR	101	2SK30AY	
TR	102	2SA781K	
TR	103	2SC458C	
TR	201	2SC458C	
TR	202	2SC458C	
TR	203	2SA1210S	
TR	203	2SA741H	
TR	208	2SC1906	
TR	209	2SC1906	
TR	210	2SC458C	
TR	211	2SC458C	
TR	301	2SC1514	
TR	302	2SC1514	
TR	303	2SC458C	
TR	304	2SK30AY	
TR	305	2SA1029 D	
TR	306	2SC1906	
TR	1201	2SC458C	
TR	1202	2SC458C	
TR	1203	2SC458C	
TR	801	2SC1514	
TR	802	2SC1514	
TR	803	2SC458C	

Part Code	Symbol	Description	Remarks
HTK0011	TR 804	2SK30AY	
HTA0224	805	2SA1029 D	
HTC0148	806	2SC1906	
HTC0649	TR 1001	2SC2610	
HTC0649	1002	2SC2610	
HTA0104	1003	2SA778AK	
HTD0151	TR 1101	2SD768K	
HTD0151	1102	2SD768K	
HTB0135	1103	2SB676	
HTA0224	1104	2SA1029 D	
<u>X'tals</u>			
8397026	X'tal 1	HC43/u 4.405 MHz	
8339470B	X'tal 2	HC43/u 4.433618 MHz	
<u>Var. Resistors</u>			
RNE0024	RV 202	Metal EVN-32C A00 B12 (100 Ω)	
	203	Metal EVH-YK3325 B500 Ω	
RNE0029	205	Metal EVN-32C A00 B53 (5k Ω)	
RNE0024	206	Metal EVN-32C A00 B12 (100 Ω)	
RNE0027	RV 301	Metal EVN-32C A00 B13 (1k Ω)	
RDE0053	303	Carbon EWK-ANAS97355	
RNE0029	304	Metal EVN-32C A00 B53 (5k Ω)	
RNE0027	305	Metal EVN-32C A00 B13 (1k Ω)	
RNE0027	RV 801	Metal EVN-32C A00 B13 (1k Ω)	
RDE0053	803	Carbon EWK-ANAS97355	
RNE0029	804	Metal EVN-32C A00 B53 (5k Ω)	
RNT0236	RV 1002	Metal TM64K (PH) 100k Ω	
RNT0236	1003	Metal TM64K (PH) 100k Ω	
RNT0235	1005	Metal TM64K (PH) 5k Ω	
RNT0236	RV 1101	Metal TM64K (PH) 100k Ω	
RNT0235	1102	Metal TM64K (PH) 5k Ω	
RNT0237	1103	Metal TM64K (PH) 1k Ω	
RNT0236	1104	Metal TM64K (PH) 100k Ω	
RNT0234	RV 1201	Metal TM64K (PH) 200 Ω	

Part Code	Symbol	Description	Remarks
CQA0097	C 220	Plastic 50V 0.01 μ F \pm 10%	
CEC0391	221	AL Elyc 50V 1 μ F \pm 20%	
CEC0391	222	AL Elyc 50V 1 μ F \pm 20%	
CEC0166	C 226	AL Elyc 16V 33 μ F \pm 20%	
CQA0097	227	Plastic 50V 0.01 μ F \pm 10%	
CQC0416	228	Plastic 125V 100pF \pm 10%	
CMD0359	229	Mica 300V 680pF \pm 10%	
CEC0160	C 248	AL Elyc 16V 10 μ F \pm 20%	
CQC0413	249	Plastic 125V 33pF \pm 20%	
CQC0417	250	Plastic 125V 240pF \pm 10%	
CEC0160	254	AL Elyc 16V 10 μ F \pm 20%	
CQC0416	255	Plastic 125V 100pF \pm 10%	
CQA0097	256	Plastic 50V 0.01 μ F \pm 10%	
CQA0097	257	Plastic 50V 0.01 μ F \pm 10%	
CQC0418	258	Plastic 125V 560pF \pm 10%	
CEC0160	260	AL Elyc 16V 10 μ F \pm 20%	
CEC0160	261	AL Elyc 16V 10 μ F \pm 20%	
CQA0097	262	Plastic 50V 0.01 μ F \pm 10%	
CQC0414	263	Plastic 125V 56pF \pm 10%	
CQA0097	264	Plastic 50V 0.01 μ F \pm 10%	
CCC1356	265	Ceramic 50V 470pF \pm 10%	
CEC0153	C 1126	AL Elyc 10V 100 μ F \pm 20%	
CEC0153	1127	AL Elyc 10V 100 μ F \pm 20%	
CEC0160	1128	AL Elyc 16V 10 μ F \pm 20%	
CEC0161	1133	AL Elyc 16V 100 μ F \pm 20%	
<u>Var. Capacitors</u>			
CVE0012	CV 205	ECV-1ZW50x44	
CVE0024	207	ECV-1ZW10x40	
CVE0024	208	ECV-1ZW10x40	
CVE0024	209	ECV-1ZW10x40	
CVE0024	CV 601	ECV-1ZW10x40	
<u>Resistors</u>			
RCR3054	R 220	Carbon 1/4W 1.2k Ω \pm 5%	
RCR3050	221	Carbon 1/4W 820 Ω \pm 5%	
RCR3028	228	Carbon 1/4W 100 Ω \pm 5%	
RCR3100	230	Carbon 1/4W 100k Ω \pm 5%	
RCR3106	231	Carbon 1/4W 1M Ω \pm 5%	
RCR3078	232	Carbon 1/4W 12k Ω \pm 5%	
RCR3100	233	Carbon 1/4W 100k Ω \pm 5%	
RCR3054	234	Carbon 1/4W 1.2k Ω \pm 5%	
RCR3022	235	Carbon 1/4W 56 Ω \pm 5%	
RCR3100	236	Carbon 1/4W 100k Ω \pm 5%	
RCR3106	237	Carbon 1/4W 1M Ω \pm 5%	
RCR3078	238	Carbon 1/4W 12k Ω \pm 5%	
RCR3100	239	Carbon 1/4W 100k Ω \pm 5%	
RCR3054	240	Carbon 1/4W 1.2k Ω \pm 5%	
RCR3022	241	Carbon 1/4W 56 Ω \pm 5%	
RCR3100	242	Carbon 1/4W 100k Ω \pm 5%	
RCR3106	243	Carbon 1/4W 1M Ω \pm 5%	
RCR3078	244	Carbon 1/4W 12k Ω \pm 5%	
RCR3100	245	Carbon 1/4W 100k Ω \pm 5%	
RCR3054	246	Carbon 1/4W 1.2k Ω \pm 5%	
RCR3080	247	Carbon 1/4W 15k Ω \pm 5%	
RME1020	R 259	Metal 1/4W 2.74k Ω \pm 1%	
RCE3044	261	Carbon 1/4W 470 Ω \pm 5%	
RCR3060	277	Carbon 1/4W 2.2k Ω \pm 5%	

PEF-616 PCB

Part Code	Symbol	Description	Remarks
<u>Capacitors</u>			
CQA0097	C 208	Plastic 50V 0.01 μ F \pm 10%	
CQC0416	209	Plastic 125V 100pF \pm 10%	
CQA0097	210	Plastic 50V 0.01 μ F \pm 10%	
CQA0097	212	Plastic 50V 0.01 μ F \pm 10%	
CQC0414	213	Plastic 125V 68pF \pm 10%	
CQA0097	214	Plastic 50V 0.01 μ F \pm 10%	
CQA0097	216	Plastic 50V 0.01 μ F \pm 10%	
CQC0415	217	Plastic 125V 82pF \pm 10%	
CQA0097	218	Plastic 50V 0.01 μ F \pm 10%	

Part Code	Symbol	Description	Remarks
RME0670	R 281	Metal 1/4W 3.32kΩ ±1%	
RME0677	282	Metal 1/4W 12.1kΩ ±1%	
RCR3052	283	Carbon 1/4W 1kΩ ±5%	
RCR3052	284	Carbon 1/4W 1kΩ ±5%	
RCR3420	285	Carbon 1/4W 180kΩ ±5%	
RME0673	286	Metal 1/4W 5.62kΩ ±1%	
RCR3056	287	Carbon 1/4W 1.5kΩ ±5%	
RCR3068	288	Carbon 1/4W 4.7kΩ ±5%	
RCR3096	290	Carbon 1/4W 68kΩ ±5%	
RCR3045	293	Carbon 1/4W 10kΩ ±5%	
RCR3046	296	Carbon 1/4W 560Ω ±5%	
RCR3088	297	Carbon 1/4W 33kΩ ±5%	
RCR3070	R 601	Carbon 1/4W 5.6kΩ ±5%	
RCR3038	602	Carbon 1/4W 270Ω ±5%	
RCR3060	603	Carbon 1/4W 2.2kΩ ±5%	
RCR3042	604	Carbon 1/4W 390Ω ±5%	
RCR3044	605	Carbon 1/4W 470Ω ±5%	
RCR3052	606	Carbon 1/4W 1kΩ ±5%	
RCR3052	607	Carbon 1/4W 1kΩ ±5%	
RCR3044	608	Carbon 1/4W 470Ω ±5%	
RCR3052	609	Carbon 1/4W 1kΩ ±5%	
RCR3052	610	Carbon 1/4W 1kΩ ±5%	
RCR3044	611	Carbon 1/4W 470Ω ±5%	
RCR3054	612	Carbon 1/4W 1.2kΩ ±5%	
RCR3012	613	Carbon 1/4W 22Ω ±5%	
RCR3012	614	Carbon 1/4W 22Ω ±5%	
RCR3062	615	Carbon 1/4W 2.7kΩ ±5%	
RCR3062	616	Carbon 1/4W 27kΩ ±5%	
RCR3028	617	Carbon 1/4W 100Ω ±5%	
RCR3100	618	Carbon 1/4W 100kΩ ±5%	
RCR3106	619	Carbon 1/4W 1MΩ ±5%	
RCR3078	620	Carbon 1/4W 12kΩ ±5%	
RCR3076	621	Carbon 1/4W 10kΩ ±5%	
RCR3054	622	Carbon 1/4W 1.2kΩ ±5%	
RCR3068	623	Carbon 1/4W 4.7kΩ ±5%	
RCR3076	624	Carbon 1/4W 10kΩ ±5%	
RCR3060	625	Carbon 1/4W 2.2kΩ ±5%	
RCR3068	626	Carbon 1/4W 4.7kΩ ±5%	
RCR3076	627	Carbon 1/4W 10kΩ ±5%	
RCR3068	628	Carbon 1/4W 2.2kΩ ±5%	
RCR3076	629	Carbon 1/4W 10kΩ ±5%	
RCR3064	630	Carbon 1/4W 3.3kΩ ±5%	
RCR3058	633	Carbon 1/4W 1.8kΩ ±5%	
RCR3100	R 1130	Carbon 1/4W 100kΩ ±5%	
RCR3062	1131	Carbon 1/4W 2.7kΩ ±5%	
RCR3062	1132	Carbon 1/4W 2.7kΩ ±5%	
RCR3062	1133	Carbon 1/4W 27kΩ ±5%	
RCR3076	1134	Carbon 1/4W 10kΩ ±5%	
RCR3100	1135	Carbon 1/4W 10kΩ ±5%	
RCR3102	1136	Carbon 1/4W 220kΩ ±5%	
RCR3092	1137	Carbon 1/4W 47kΩ ±5%	
RCR3092	1138	Carbon 1/4W 47kΩ ±5%	
RMR2814	1139	Metal 3W 47Ω ±5%	
RMR3760	1140	Metal 3W 2Ω ±5%	
<u>Var. Resistors</u>			
RDE0053	RV 204	Carbon EWK-ANAS97355	
RDE0030	208	Metal EVN-32C A00 B14(10kΩ)	
RNE0031	209	Metal EVN-32C A00 B24(24kΩ)	

Part Code	Symbol	Description	Remarks
<u>Diodes</u>			
HDS0353	D 201	1SV55	
HDS0353	202	1SV55	
HDS0353	203	1SV55	
HDS0108	D 210	1S2075K	
HDS0108	211	1S2075K	
HDS0108	212	1S2075K	
HDS0353	214	1SV55	
HDS0108	D 1119	1S2075K	
HDS0108	2210	1S2075K	
HDH0029	1121	HZ5B (4.6 V - 5.0 V)	
HDS0108	1122	1S2075K	
HDS0108	1125	1S2075K	
<u>IC</u>			
IDL0006	IC 204	Digital LA1460	
<u>Coils</u>			
TLF0018	L 203	FL-5H 56μH ±10%	
TLF0019	204	FL-5H 33μH ±10%	
TLF0019	205	FL-5H 33μH ±10%	
TLF0019	206	FL-5H 33μH ±10%	
TLF0029	L 211	FL-4H 6.8μH ±10%	
TLF0029	212	FL-4H 6.8μH ±10%	
TLF0019	213	FL-5H 33μH ±10%	
<u>Lamps</u>			
ELL0019	NE 1001	NE-2	
ELL0019	1002	NE-2	
<u>Switch</u>			
SSL0059	S 203	SLR=022	
<u>Thermistor</u>			
HDX	TH 203	112-503-2	
<u>Transistors</u>			
HTC0148	TR 204	2SC458C	
HTC0338	208	2SC1906	
HTC0338	209	2SC1906	
HTC0338	210	2SC1906	
HTC0146	212	2SC458C	
HTA0224	213	2SA1029 D	
HTC0338	214	2SC1906	
HTC0338	215	2SC1906	
HTC0338	216	2SC1906	
HTC0338	217	2SC1906	
HTC0148	218	2SC458C	
HTC0148	219	2SC458C	
HTA0224	TR 1105	2SA1029 D	
HTA0224	1106	2SA1029 D	
HTA0085	1107	2SA673C	

PEF-641 PCB

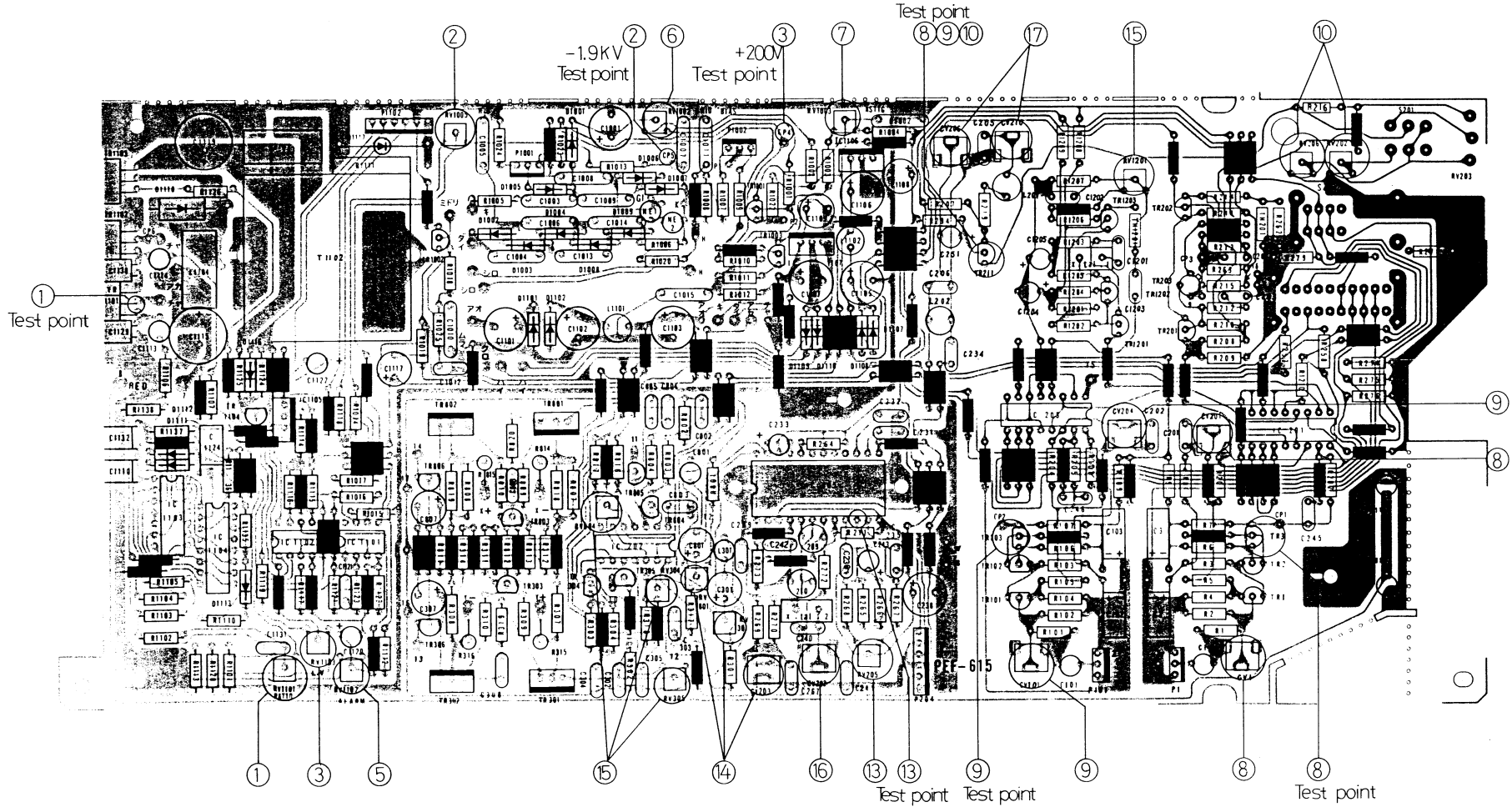
Part Code	Symbol	Description	Remarks
<u>Capacitors</u>			
CQC0391	C 1016	AL Elyc 50V 1 pF $\pm 20\%$	
CQA0097	1017	Plastic 50V 0.01 μ F $\pm 10\%$	
CQA0103	1018	Plastic 50V 0.1 μ F $\pm 10\%$	
<u>Resistors</u>			
RCR3049	R 251	Carbon 1/4W 750 Ω $\pm 5\%$	
RCR3076	R 1026	Carbon 1/4W 10k Ω $\pm 5\%$	
RCR3084	1027	Carbon 1/4W 22k Ω $\pm 5\%$	
RCR3101	1028	Carbon 1/4W 150k Ω $\pm 5\%$	
RCR3076	1029	Carbon 1/4W 10k Ω $\pm 5\%$	
<u>IC's</u>			
IDH0820	IC 206	HD74LS123P	
IDM0182	1001	MC14528BCP	
<u>Transistor</u>			
HTC0649	TR 1004	2SC2610	

CHASSIS

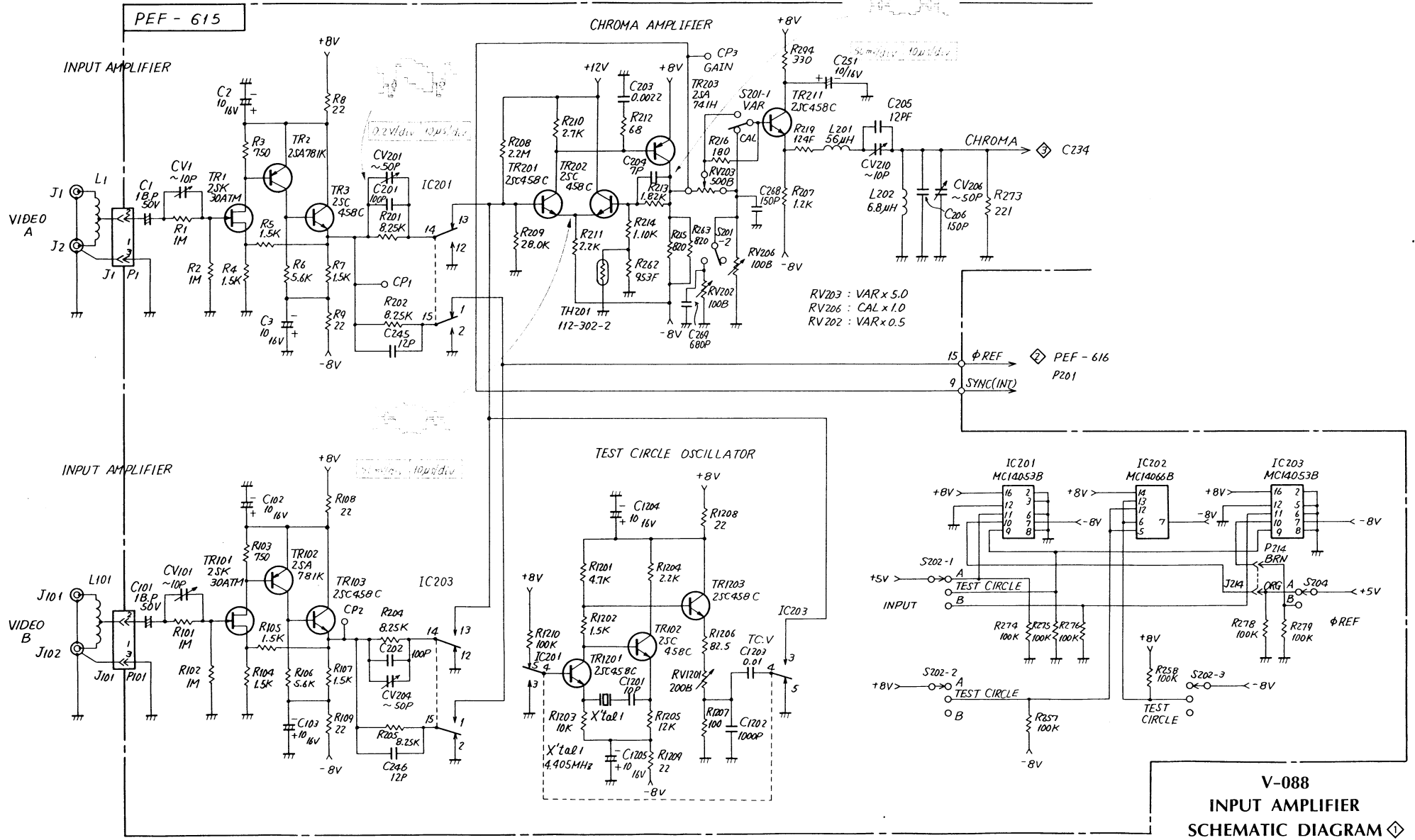
Part Code	Symbol	Description	Remarks
<u>Resistor</u>			
RME0790	R 280	Metal 1/4W 11.3k Ω $\pm 1\%$	
<u>Switches</u>			
SST0218	S 205	Lever M-2012M	
SSR0278	1101	Rotary MRX-204	
JHB0088	J 1	Coax. Con BNC071	
JHB0088	2	Coax. Con BNC071	
JHB0088	J 101	Coax. Con BNC071	
JHB0088	102	Coax. Con BNC071	
JHB0088	J 201	Coax. Con BNC071	
JHB0088	202	Coax. Con BNC071	
JJT0015	J 1102	Jack TJ-563 RED	
JJT0017	1103	Jack TJ-563 BLACK	
HDS0450	D 1123	Diode S4VB-10	
HDS0452	1124	Diode SLP223P	
JJC0026	P 1101	Jack CM3 (C-170)	
JMR0261	P 1104	Connector R03-R6M	
JSP0003		Socket PS=051B	
EFH0224	F 1101	Socket, Fus F-3294	
EFH0257	1102	Socket, Fus SN2059	
EFG0347		Fuse MF61NM 1-2 (0.5A 250V) JIS	
EFG0632		Fuse 3A (250V) 6.4x30	
8329332	PL 1101	Lamps 14V 80MA	
8329332	PL 1102	Lamps 14V 80MA	
8369267N	T 1101	XFMR TAM-021450	
8369264	T 1102	XFMR TAM=141024B	
<u>Var. Resistors</u>			
RNE0046	RV 1001	Metal EVH-CIC332B15 100k Ω	
RDF0055	RV 1004	Carbon EVTV3AS15B26 2M Ω	

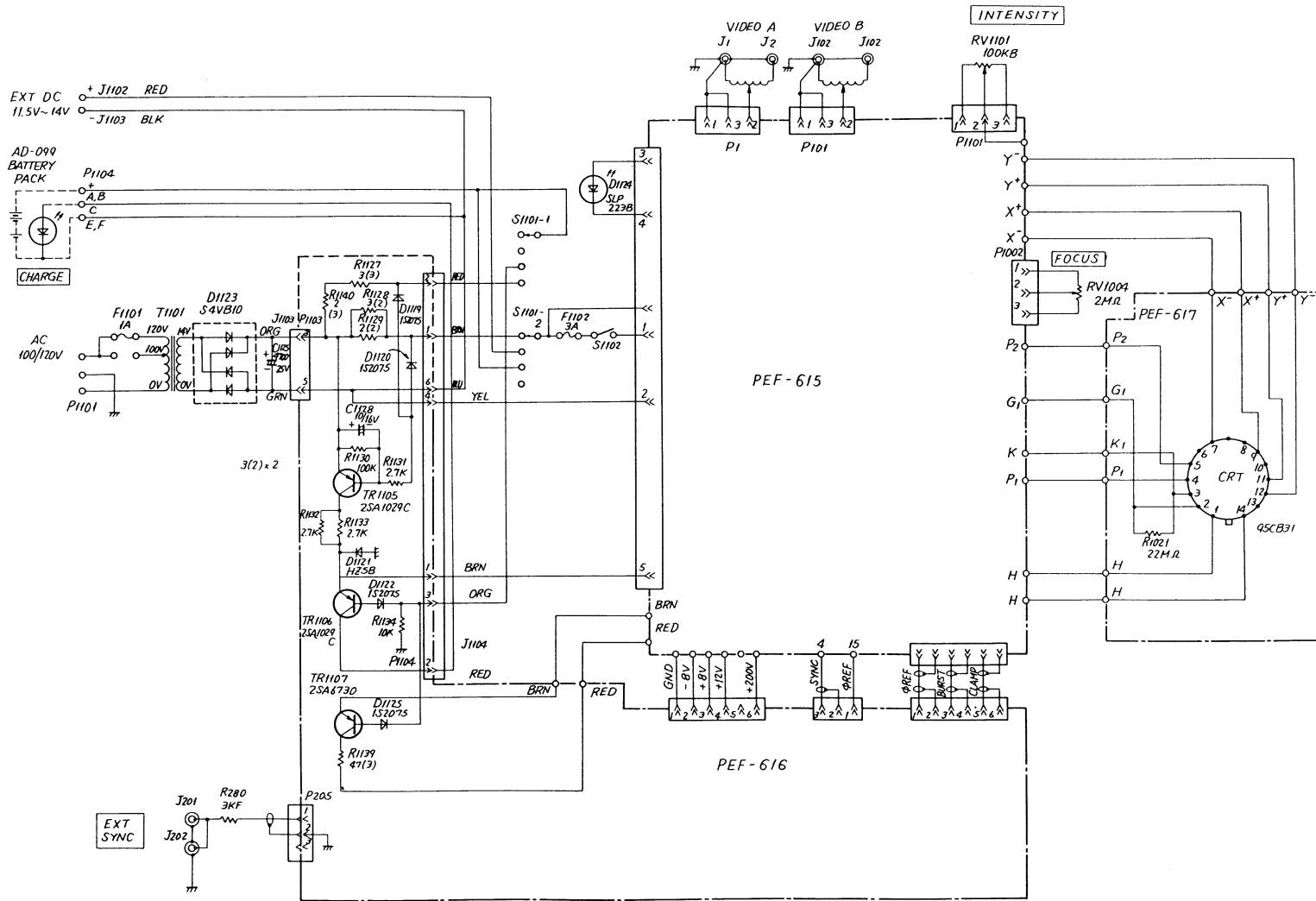
5. ELECTRICAL PARTS ARRANGEMENT
 (with Adjustment Locations)

PEF-615 PCB



7. SCHEMATIC DIAGRAMS

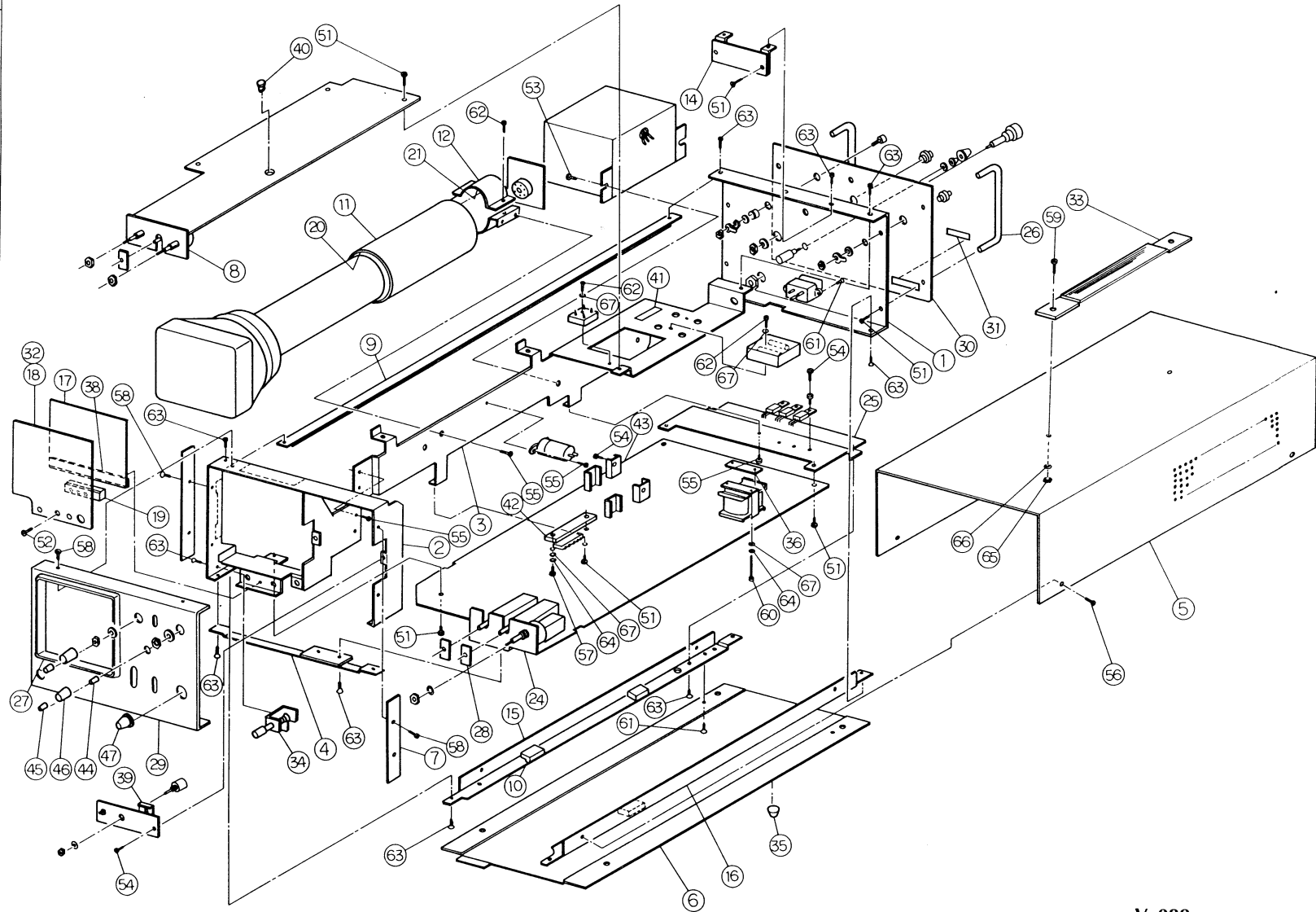




V-088
CHASSIS
WIRE CONNECTION

8. MECHANICAL PARTS LIST AND EXPLODED VIEW

Part Code	Symbol	Description	Qty	Remarks
3165880A	1	Chassis, rear	1	
3179379A	2	Chassis, front	1	
2105430A	3	Chassis	1	
8398511A	4	Bracket	1	
3165882A	5	Cover	1	
3165883A	6	Cover, bottom	1	
8368337A	7	Cover, side	2	
8398508A	8	Bracket, VR	1	
8368339A	9	Angle	1	
8398518A	10	Rubber	3	
8368341A	11	Shield band	1	
8398517A	12	CRT band	1	
8398519A	13	CRT band	1	
8368344A	14	Bracket, PC	2	
3179380A	15	Angle	1	
3179380B	16	Angle	1	
8368345A	17	Filter	1	
8398513B	18	Dial Plate	1	
8368347A	19	Plate, lamp guide	1	
8368348A	20	Rubber	1	
8398514A	21	Rubber	2	
8368350A	22	Rubber	1	
8368351A	23	Rubber	1	
8398507A	24	Bracket, VR	1	
8398510A	25	Plate	1	
8398520A	26	Handle	2	
8368343A	27	Bezel	1	
8398516A	28	Cover, SW	3	
2105428A	29	Panel, front	1	
3179378A	30	Panel, rear	1	
8369857A	31	Label, ser. No	1	
8398521A	33	Handle	1	
3165887A	34	Stopper	1	
8396865A	35	Foot	4	
8369859A	36	Plast	1	
8369860A	37	Rubber	2	
8398515A	38	Rubber	1	
8398512A	39	Bracket, SW	1	
TYPE, A	40	Rubber	3	
8398506A	42	Heat sink	1	
8398509A	43	Heat sink	4	
3149324B	44	Knob	1	S18B-N
3149324A	45	Knob	2	S18B
3149323C	46	Knob	2	URV-H
3149321A	47	Knob	1	S18
XCA0661	51	Screw, sems (SW,W)	13	M3x8
8340167G	52	Screw, sems (SW,W)	1	M3x10
8340167H	53	Screw, sems (SW,W)	2	M4x8
8340167K	54	Screw, sems (SW,W)	9	M2.6x6
XCA1598	55	Screw	7	M3x5
XCA1269	56	Screw, sems (SW,W)	4	M3x6
XCA0821	57	Screw	2	M3x18
XCA6204	58	Screw	8	M2x4
8369870A	59	Screw, flat	2	M4x14
8369869A	60	Screw	2	M3x50
XCAT306	61	Screw, flat	4	M3x6
XCA6312	62	Screw	4	M3x12
XCA6005	63	Screw, flat	17	M2.6x5
XCA1879	64	Washer, spring	4	M3
XCA1707	65	Nut	2	M4
XCA1881	66	Washer, spring	2	M4
XCA1855	67	Washer	7	M3
8398522A	41	Label	1	



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EXPLODED VIEW