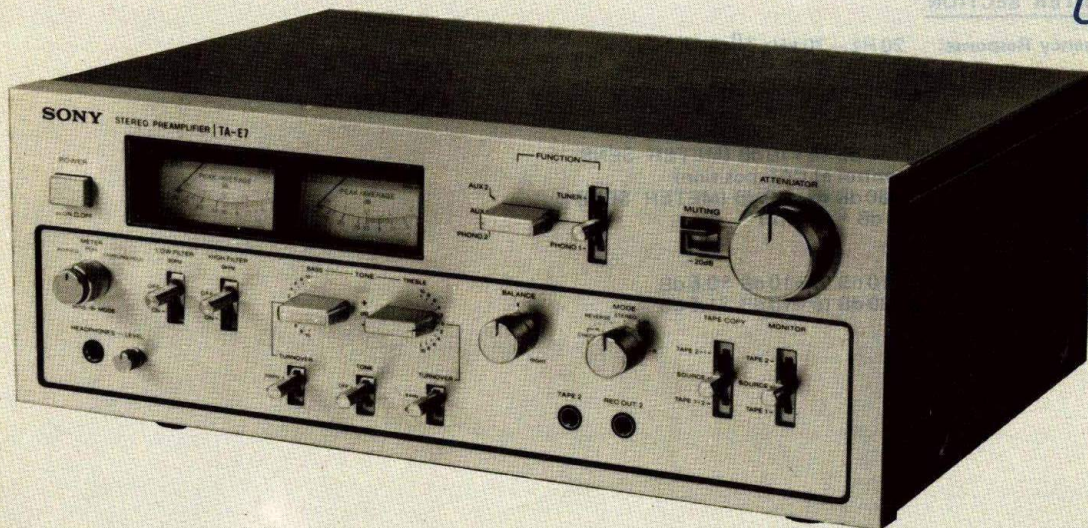


TA-E7

AEP Model
UK Model



STEREO PREAMPLIFIER

SPECIFICATIONS

GENERAL

- Power Requirements:** 110, 120, 220 or 240 V ac adjustable, 50/60 Hz
- Power Consumption:** 22 W
- Dimensions:** Approx. 430 (w) x 170 (h) x 320 (d) mm
16⁷/₈ (w) x 6³/₄ (h) x 12⁵/₈ (d) inches
Including projecting parts and controls
- Weight:** Approx. 11.2 kg, 24 lb 11 oz (net)
Approx. 13.4 kg, 29 lb 9 oz
(with shipping carton)

AMPLIFIER SECTION

Inputs:

	Sensitivity	Impedance	Maximum Input Capability (0.03% distortion, 1 kHz)	S/N (weighting network, input level)
PHONO 1	2.5 mV (-50dB)	50k Ω	250 mV (-10 dB)	85dB (A, 2.5mV)
PHONO 2		50k Ω /100k Ω		
HEAD AMP	0.125mV (-76dB)	25 Ω (at "3 Ω ") 100 Ω (at "40 Ω ")	12.5mV (-36 dB)	75dB (A, 0.125mV)
TUNER AUX 1, 2 TAPE 1, 2	150mV (-15.5dB)	50k Ω	—	105dB (A, 150mV)

Outputs:

0 dB = 0.775 V

	Output Level	Impedance
REC OUT 1, 2	150mV (max. 15V) (-15.5dB)	1 k Ω
OUTPUT 1, 2	1.5V (max. 10V) (5.5dB)	1.5k Ω
HEADPHONE	10mW (8 Ω)	3.3 Ω

Harmonic Distortion: Less than 0.003% at 1.5 V output

IM Distortion: Less than 0.003% at 1.5 V output
(60 Hz: 7 kHz=4:1)

Frequency Response: PHONO 1, 2 RIAA equalization curve ± 0.2 dB
TUNER
AUX 1, 2 } 1 Hz–150 kHz ± 0 dB
TAPE 1, 2 } ± 1 dB

Tone Controls: BASS ± 10 dB at 30 Hz
(TURNOVER FREQ 150 Hz)
 ± 10 dB at 60 Hz
(TURNOVER FREQ 300 Hz)
TREBLE ± 10 dB at 20 kHz
(TURNOVER FREQ 4 kHz)
 ± 10 dB at 40 kHz
(TURNOVER FREQ 8 kHz)

— Continued on page 2 —

SAFETY-RELATED COMPONENT WARNING!!

COMPONENTS IDENTIFIED BY SHADING AND  MARK ON, THE SCHEMATIC DIAGRAMS, EXPLODED VIEWS AND IN THE PARTS LIST ARE CRITICAL TO SAFE OPERATION. REPLACE THESE COMPONENTS WITH SONY PARTS WHOSE PART NUMBERS APPEAR AS SHOWN IN THIS MANUAL OR IN SUPPLEMENTS PUBLISHED BY SONY.

SONY

SERVICE MANUAL

Filters: LOW: 12 dB/oct. below 30 Hz
HIGH: 12 dB/oct. above 9 kHz

Residual Noise: Less than 6 μ V (A-Network, IHF)

LEVEL METER SECTION

Frequency Response: 20 Hz – 70 kHz $\pm 0_{-3}$ dB

Response Time: 300 msec. in AVERAGE mode
1 msec. in PEAK mode

Response Range: –40 dB to +10 dB (METER SENS control at CAL position)
–60 dB to –10 dB (METER SENS (0 dB = 1 Vrms)

Indication Error: –10 dB to +10 dB ± 0.5 dB
–30 dB to –10 dB ± 1.5 dB

SPECIFICATIONS

Output	Impedance	Frequency Response
HEADPHONE	10mW (8 Ω)	20Hz - 70kHz $\pm 0_{-3}$ dB
OUTPUT	1.5V (8 Ω)	20Hz - 70kHz $\pm 0_{-3}$ dB
REC. OUT	100mV (15 Ω)	20Hz - 70kHz $\pm 0_{-3}$ dB

Weight	Dimensions	Power Consumption	Power Requirement
Approx. 1.5 kg (3.3 lb)	Approx. 400 mm (15.7 in) x 330 mm (13 in) x 100 mm (3.9 in)	23W	110, 120, 220 or 240 V, 50/60 Hz

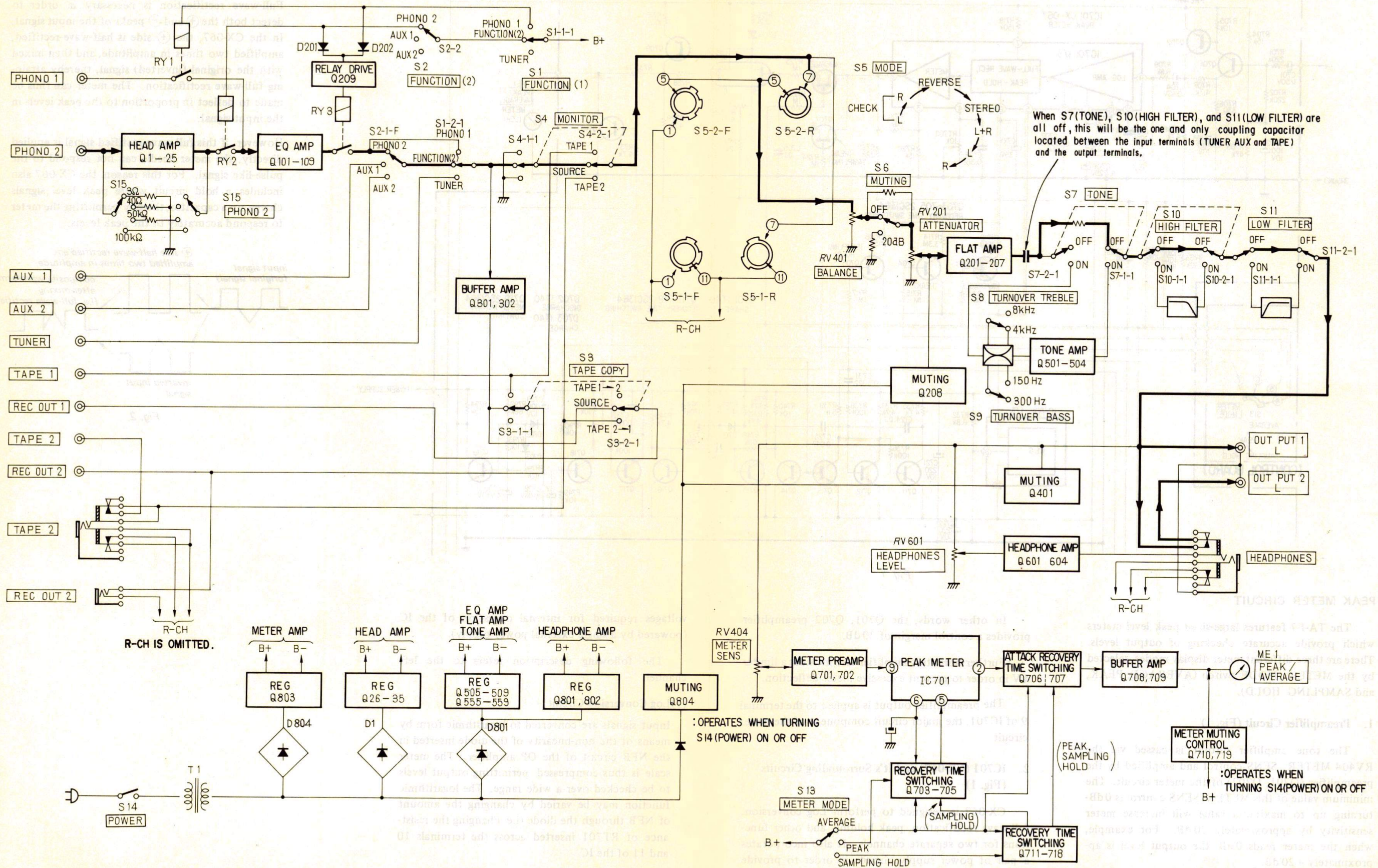
AMPLIFIER SECTION

Frequency Response	Maximum Output Power	Distortion	Input Impedance
20Hz - 70kHz $\pm 0_{-3}$ dB	10mW (8 Ω)	0.03% (10mW, 10kHz)	15 Ω

SECTION 1

BLOCK DIAGRAM

1-1. BLOCK DIAGRAM



1-2. CIRCUIT DESCRIPTIONS

Meter Mode Switch (S13) Set to AVERAGE Position

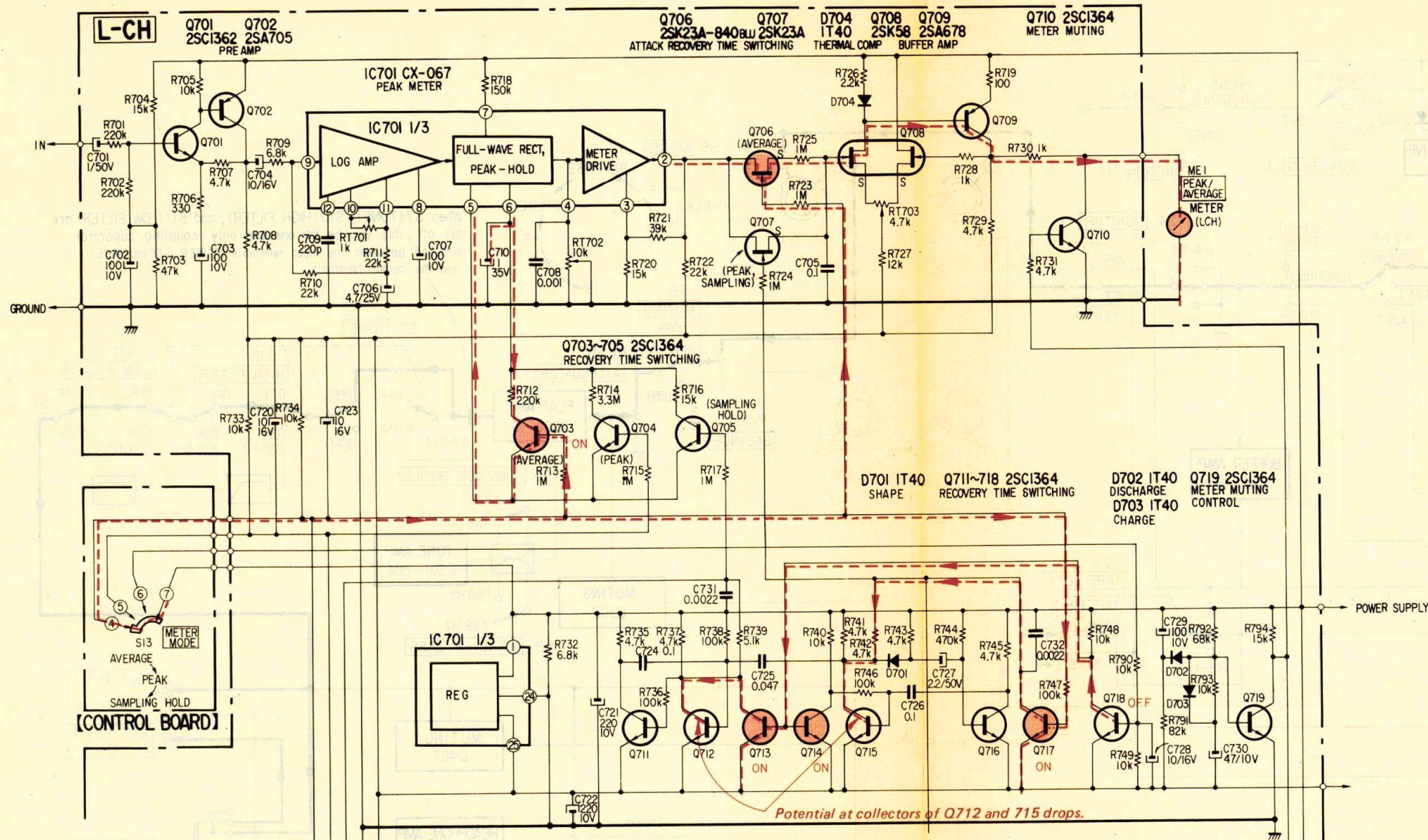


Fig. 1

PEAK METER CIRCUIT

The TA-E7 features large-sized peak level meters which provide accurate checking of output levels. There are three different meter display modes, selected by the METER MODE switch (AVERAGE, PEAK, and SAMPLING HOLD).

1. Preamplifier Circuit (Fig. 1)

The tone amplifier output is passed via the RV404 METER SENS control and amplified by the preamplifier (Q701, Q702) of the meter circuit. The minimum value of this METER SENS control is 0dB—turning up to maximum value will increase meter sensitivity by approximately 20 dB. For example, when the meter reads 0dB, the output level is approximately -20 dB.

In other words, the Q701, Q702 preamplifier provides a control margin of 20 dB.

Furthermore, this amplifier also includes a limiter 4 V in order to prevent excessive meter deflection.

The preamplifier output is applied to the terminal 9 of IC701, the major circuit component of the meter circuit.

2. IC701 (CX-067) and It's Surrounding Circuits (Fig. 1)

CX-067 is designed to perform Log conversion, full-wave rectification, peak holding, and other functions for two separate channels. It also incorporates a pair of power supply circuits in order to provide

(2) Full-Wave Rectifier Circuit

Full-wave rectification is necessary in order to detect both the $\oplus$ and $\ominus$ peaks of the input signal. In the CX-067, the $\oplus$ side is half-wave-rectified, amplified two times in amplitude, and then mixed with the original (inverted) signal, thereby attaining full-wave rectification. The meter can thus be made to deflect in proportion to the peak levels in the input signal.

However, if this full-wave-rectified signal is applied directly, the meter needle can not respond to the pulse-like signal. For this reason, the CX-067 also includes a hold circuit where peak level signals charge up a capacitor, thereby permitting the meter to respond accurately to the peak levels.

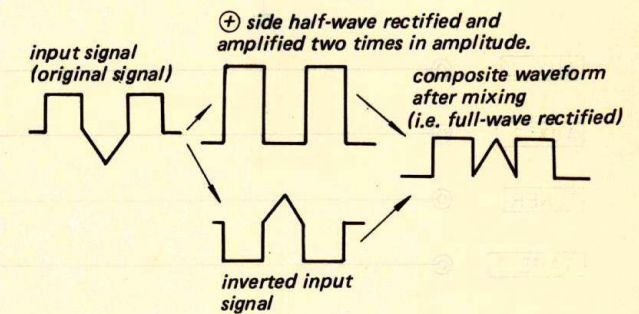


Fig. 2

voltages required for internal operation of the IC (powered by a single external power supply).

The following description refers to the left channel.

(1) Log Conversion Circuit

Input signals are converted to logarithmic form by means of the non-linearity of the diode inserted in the NFB circuit of the OP amplifier. The meter scale is thus compressed, permitting output levels to be checked over a wide range. The logarithmic function may be varied by changing the amount of NFB through the diode (i.e. changing the resistance of RT701 inserted across the terminals 10 and 11 of the IC).

(3) Hold Circuit and Attack Circuits

The three selectable meter modes are:

- Average ordinary response time, the same as ordinary VU meters.
- Peak extremely rapid response time, capable of responding to pulse-like signals. (minimum detectable pulse width 1 ms).
- Sampling hold ... maximum peak level detected every 0.5 sec (approx.) and held for about 0.5 sec.

The hold and attack circuits are employed for easy reading the meter values.

1) Hold circuit

The capacitor C710 connected to terminal 6 of IC701 is charged up by the full-wave-rectified signal.

The charging amplifier is also used as the full-wave rectification circuit. Due to the voltage on C710, an NFB is applied to this full-wave rectification circuit, thereby determining meter hold time.

This hold time is determined by the discharge time of C710. For peak and average meter modes, the respective discharge resistors R712 and R714 are switched over by the transistor switches Q703 and Q704.

- * During peak mode, Q704 is turned on (see Fig. 4), and C710 discharges through R714 (3.3 M Ω) taking approximately five times longer than during average mode (see Fig. 3).
- * During average mode, Q703 is turned on (see Fig. 1), and C710 discharges relatively rapidly through R712 (220 k Ω) (see Fig. 3).
- * During sampling hold mode, Q705 turns on every 0.5 seconds, and C710 discharges immediately through R716 (15 k Ω) (see Fig. 5).

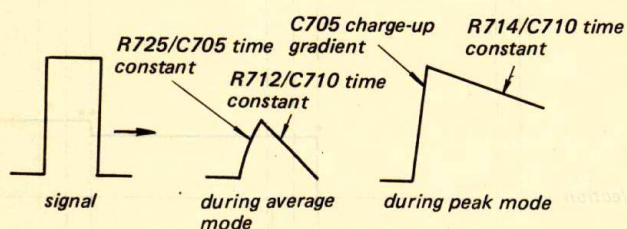


Fig. 3

Meter Mode Switch (S13) Set to PEAK Position

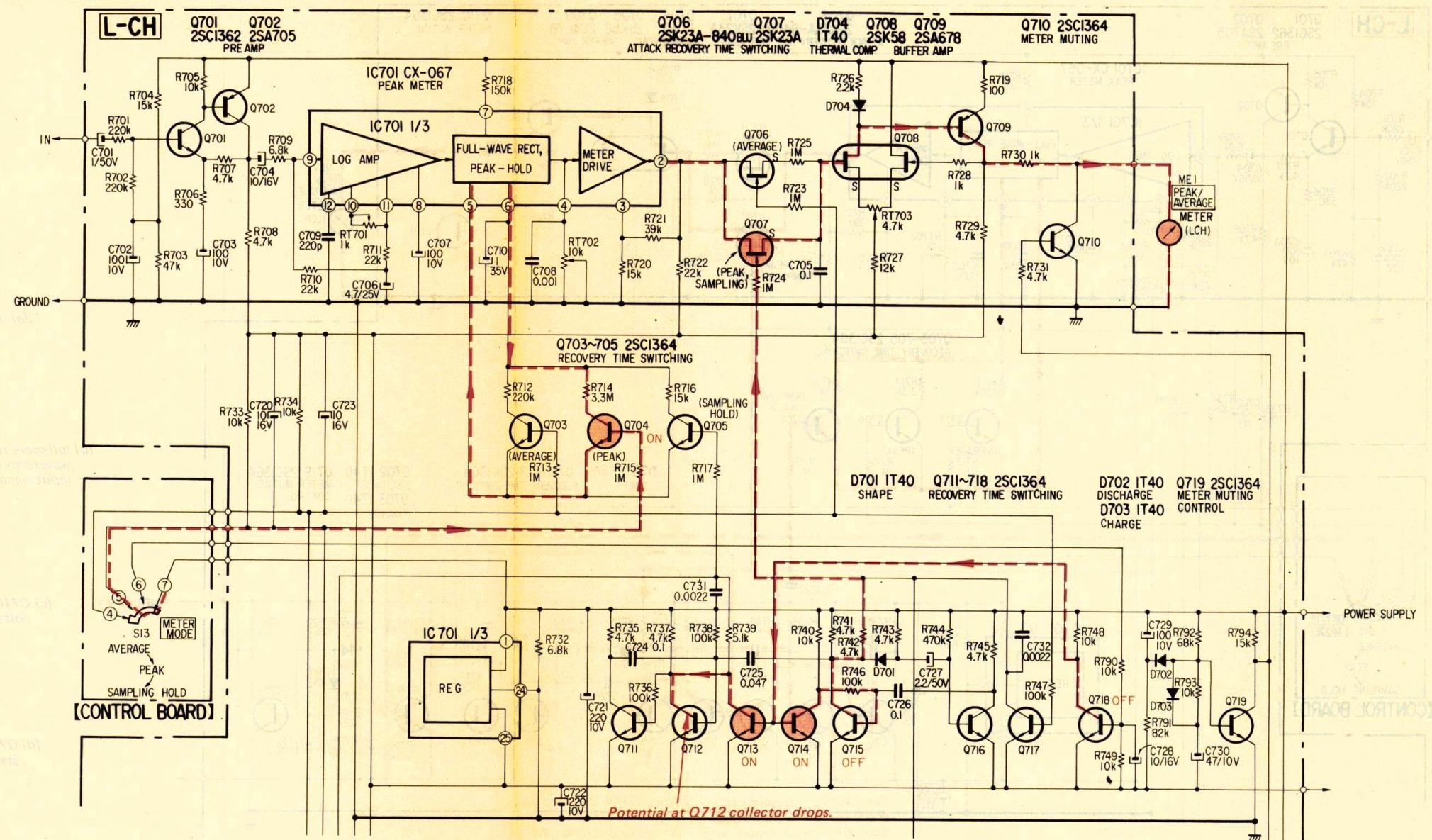


Fig. 4

2) Attack circuit

This circuit makes it possible to use ordinary level meters as peak level meters since the meter is overdriven (kicked) by the input signal and the differential value of the input signal.

The output signal from the hold circuit is gain-adjusted (RT702) by the drive amplifier, passed through FET switch Q706 or Q707, and applied to capacitor C705.

- * During average mode, Q706 is turned on (Fig. 1) and current passed through R725, charges C705. Charge-up time is thus determined by the C705/R725 time constant. (Fig. 3).

- * During peak mode, Q707 is turned on (Fig. 4), but since there is no resistor connected in series, C705 will charge up immediately (Fig. 3).
- * During sampling hold mode, Q707 is turned on (Fig. 5) resulting in the same rapid charge-up time as during peak mode.

Meter Mode Switch (S13) Set to SAMPLING HOLD Position

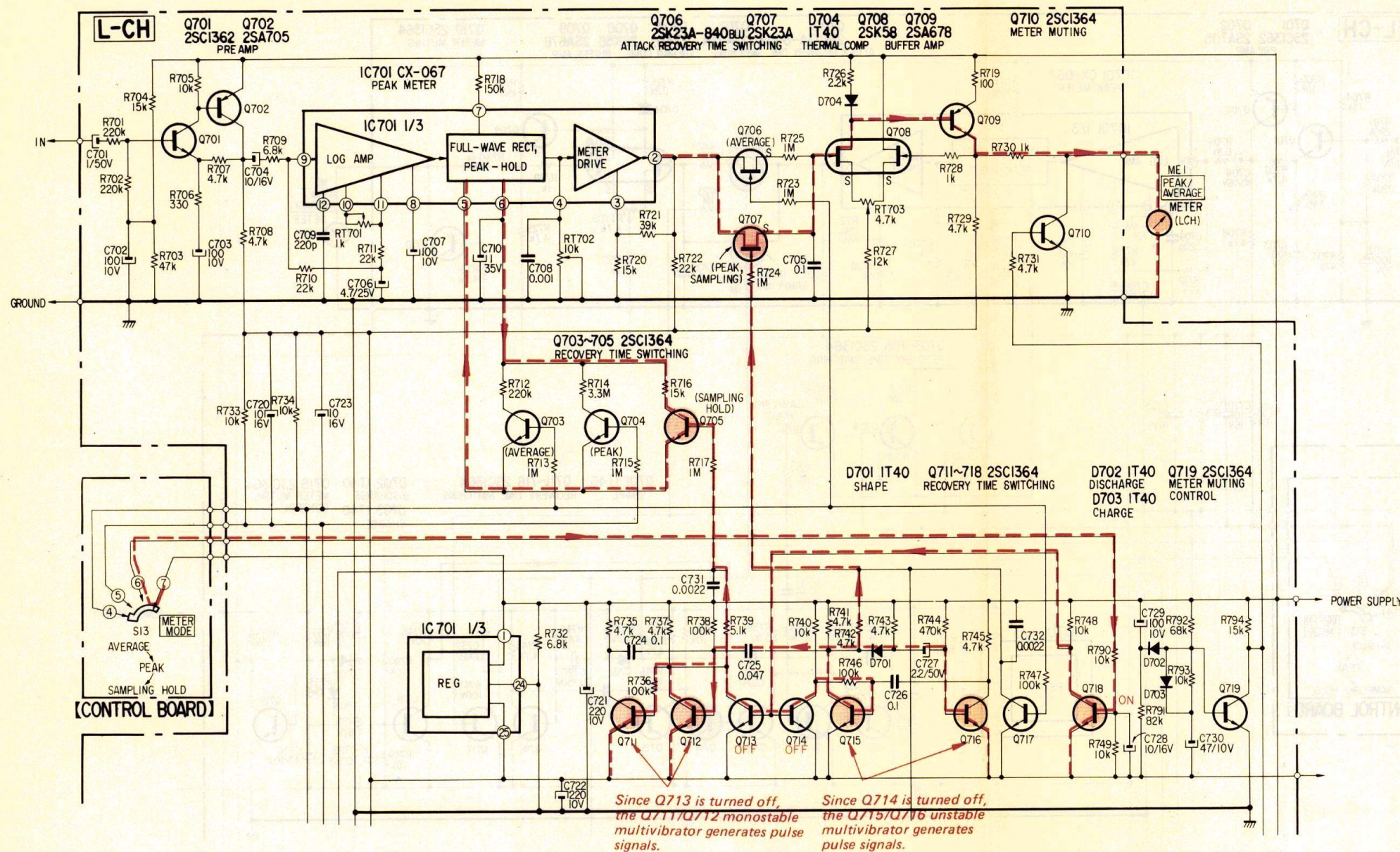


Fig. 5

3. Circuit Operation and Meter Display During Sampling Hold Mode (See Figs. 5 & 6)

Q705 is turned on at t_0 . C710 discharges rapidly through R716. Since Q705 turns off at t_1 , C710 starts to be charged up according to the input signal, and resulting in an increase of C710 terminal voltage. This terminal voltage is held at the value corresponding to the maximum peak level of the input signal between t_1 and t_3 (shown by mark *). Since the Q707 FET switch is turned on at t_2 , C705 is rapidly charged, and then Q707 turns off at t_3 , the C710 terminal voltage level is, therefore, maintained at the maximum peak voltage level (also shown by mark *), this being indicated by the meter until t_5 .

At the same time as Q707 is turned off (t_3), Q705 is turned on again, this cycle being repeated continuously. So actually, the maximum peak value in the 0.5 sec period from t_1 to t_3 (or more correctly to t_2) is indicated by the meter during the 0.5 sec period from t_2 to t_5 . If the maximum peak (shown by mark **) during the t_4 to t_6 period is even higher than the maximum peak during the previous 0.5 sec period (i.e. t_1 to t_3), C705 will be charged up further, resulting in an additional increase in the C705 terminal voltage. If, however, the following maximum peak is lower, C705 will discharge accordingly, resulting in a corresponding drop in terminal voltage, this being made possible by the bi-directional properties of the Q707 FET which permit reverse discharging.

In this sampling hold mode, the meters display the maximum peak level for every 0.5 sec, making it easier to follow the changes in peak level.

4. Meter Drive Circuit (Fig. 5)

Since the Q706 and Q707 FET switches are of high impedance, Q708 and Q709 are a buffer amplifier to drive the meter.

Q708 is a dual FET differential amplifier designed to stabilize the meter drive circuit.

5. Meter Muting Circuit (Fig. 5)

In order to prevent meter deflection caused by surge current when the power supply is turned on and off, a meter muting circuit, consisting of Q719 and Q710, is used. This surge current is used to activate Q719, which controls Q710, consequently Q710 turns on for duration of pulse caused by the surge current to mute the meter signal.

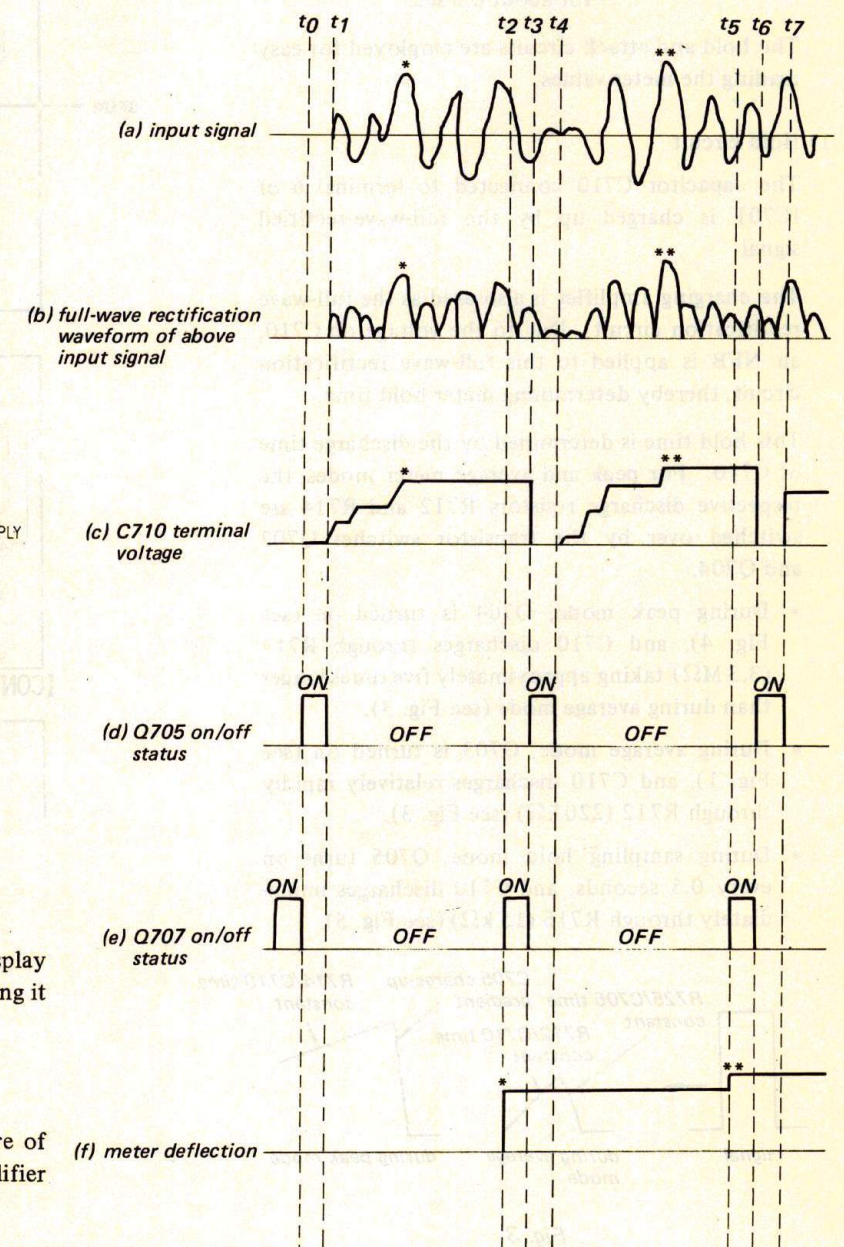
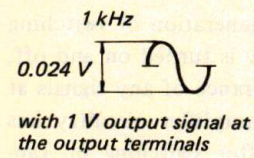


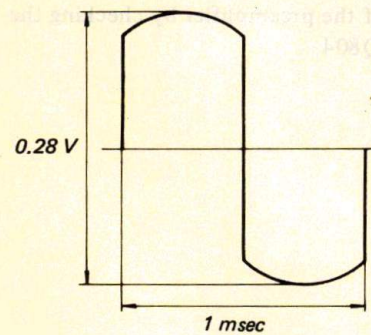
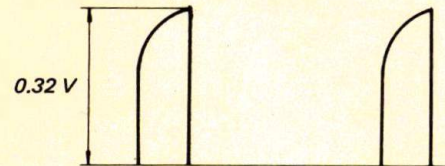
Fig. 6

Signal Waveforms at Important Points of the Circuit

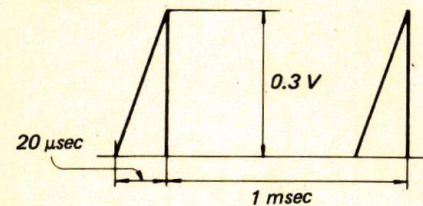
(A) waveform at input terminals



(B) waveform at pin 11 of IC701

(C) waveform at pin 5 of IC701
METER MODE switch set to AVERAGE

METER MODE switch set to PEAK



METER MODE switch set to SAMPLING HOLD

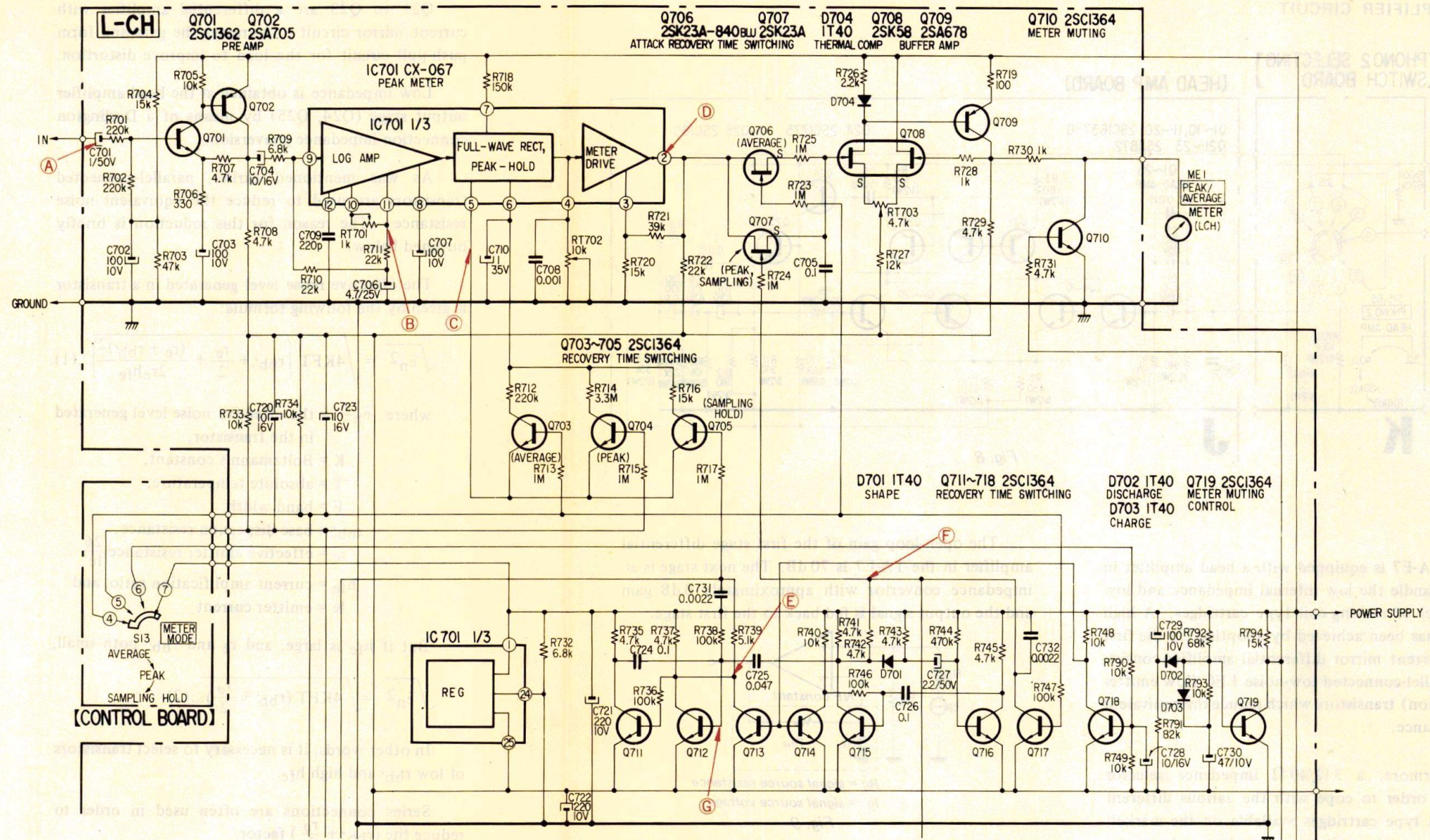
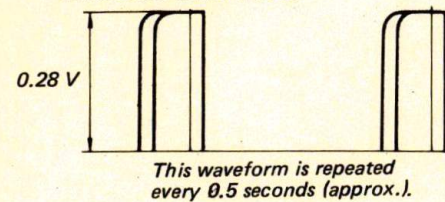
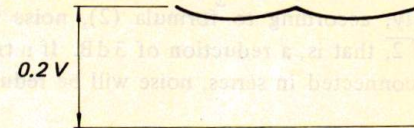


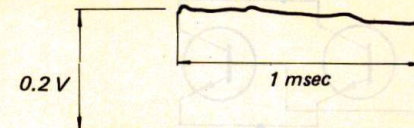
Fig. 7

(D) waveform at pin 2 of IC701

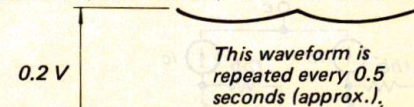
METER MODE switch set to AVERAGE



METER MODE switch set to PEAK

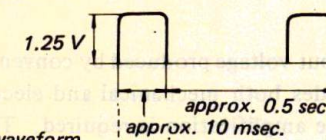


METER MODE switch set to SAMPLING HOLD

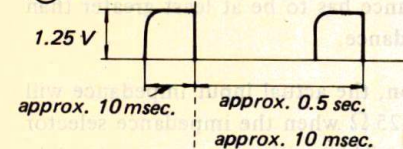


Waveforms for (E) and (F) refer to when the METER MODE switch is set to SAMPLING HOLD position.

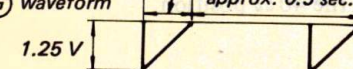
(E) waveform



(F) waveform



(G) waveform



HEAD AMPLIFIER CIRCUIT

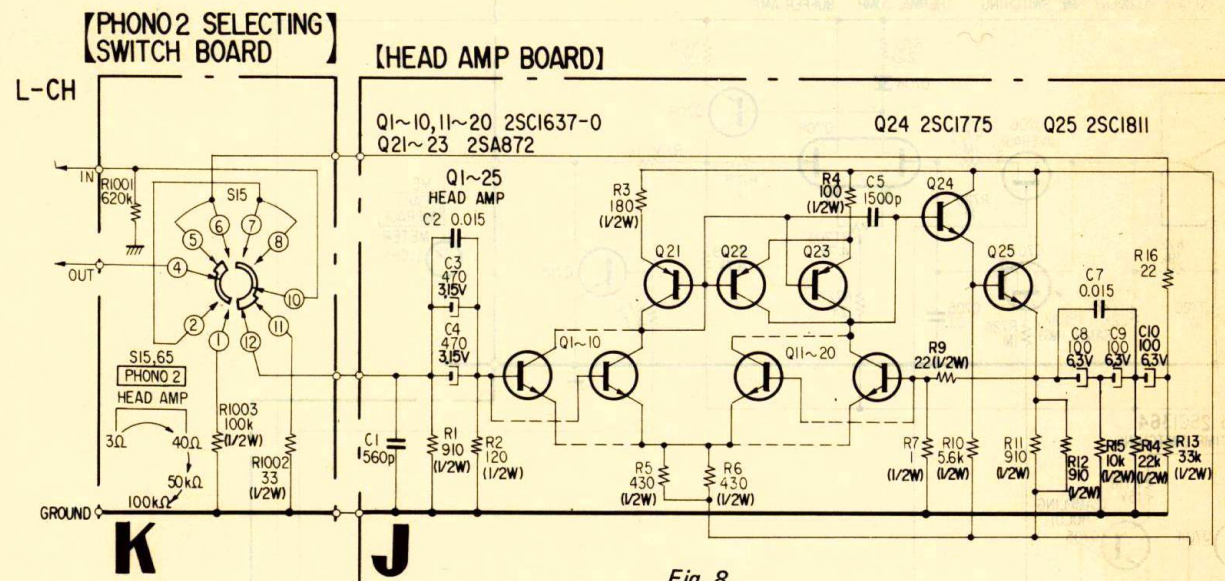


Fig. 8

The TA-E7 is equipped with a head amplifier in order to handle the low internal impedance and low output level of moving-coil type cartridges. A high S/N ratio has been achieved by adopting (in the first stage) a current mirror differential amplifier consisting of parallel-connected low-noise LEC (low emitter concentration) transistors which reduce the equivalent noise resistance.

Furthermore, a $3\Omega/40\Omega$ impedance selector is used in order to cope with the various different moving-coil type cartridges available on the market. High output moving-coil type cartridges and moving-magnet type cartridges can also be employed.

The left channel head amplifier circuit is shown in Fig. 8. The impedance selector switch is set to the value matching to the impedance of the cartridge being used. The input signal from the PHONO-2 terminals is applied to the parallel-connected differential amplifier formed by Q1 to Q10.

The head amplifier equivalent circuit is shown in Fig. 9. The input impedance is kept high by feedback circuit, and a choice of different values for terminating-resistance R_o is available. Another important factor in designing a head amplifier of low equivalent input noise is the reduction of the number of amplifier stages. If most of the gain is obtained in the first stage, noise level will be determined by the first stage.

The open-loop gain of the first stage differential amplifier in the TA-E7 is 70 dB. The next stage is an impedance converter with approximately 0 dB gain and the output signal is fed back to the first stage.

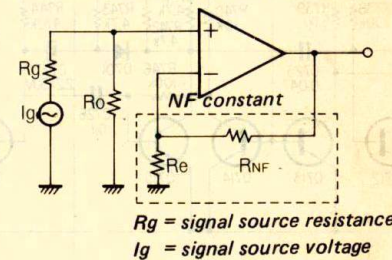


Fig. 9

The gain A of the actual amplifier shown in Fig. 9 is given as follows:

$$A \doteq \frac{R_{NF} + R_e}{R_e}$$

In the TA-E7, $A = \frac{R_9 + R_7}{R_7} = 23$, or approximately 27 dB.

Since the output voltage produced by conventional cartridges includes both mechanical and electrical resonances, voltage amplification is required. Therefore, input impedance has to be at least greater than the cartridge impedance.

For this reason, the actual input impedance will be approximately 25Ω when the impedance selector switch is set to the 3Ω position, and approximately 100Ω when set to the 40Ω position.

Q21 to Q23 are a differential amplifier with current mirror circuit to increase the gain and form push-pull circuit for the load to improve distortion.

Low impedance is obtained at the head amplifier output stage (Q24, Q25) by means of a Darlington connection impedance conversion.

As was mentioned earlier, parallel-connected transistors are used to reduce the equivalent noise resistance. The reason for this reduction is briefly outlined below.

The effective noise level generated in a transistor is given by the following formula:

$$\sqrt{\bar{e}_n^2} = \sqrt{4KFT \left[r_{bb'} + \frac{r_e}{2} + \frac{(r_e + r_{bb'})^2}{2r_e h_{fe}} \right]} \dots (1)$$

where $\bar{e}_n^2$ = the effective noise level generated in the transistor,

K = Boltzmann's constant,

T = absolute temperature,

F = band width,

$r_{bb'}$ = base dispersion resistance,

r_e = effective emitter resistance $\frac{26}{I_e}$

h_{fe} = current amplification ratio, and

I_e = emitter current

But if h_{fe} is large, and r_e and $r_{bb'}$ both small,

$$\sqrt{\bar{e}_n^2} = \sqrt{4KFT (r_{bb'} + \frac{r_e}{2})} \dots (2)$$

In other words, it is necessary to select transistors of low $r_{bb'}$ and high h_{fe} .

Series connections are often used in order to reduce the $(r_{bb'} + \frac{r_e}{2})$ factor.

In Fig. 10, two transistors are shown as connected in series. The $r_{bb'} + r_e$ factor in the equivalent circuit will become $1/2$, so $(r_{bb'} + \frac{r_e}{2})$ will also become $1/2$. Consequently, according to formula (2), noise will become $1/\sqrt{2}$, that is, a reduction of 3 dB. If n transistors are connected in series, noise will be reduced by $1/\sqrt{n}$.

Series Connection

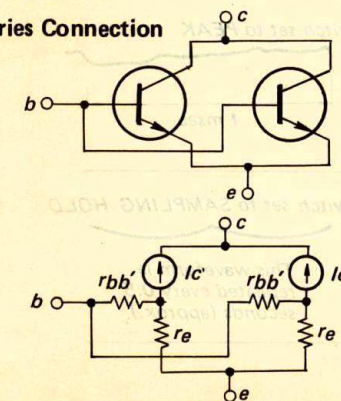


Fig. 10

Muting Circuit

In order to prevent the generation of switching noises when the power supply is turned on and off, and also to prevent the appearance of any signals at the output until the whole amplifier circuitry has been completely stabilized after switching on (approximately 3 seconds), the TA-E7 uses a muting circuit. This circuit mutes the input of the flat amplifier and output of the preamplifier by checking the surge of current at Q804.

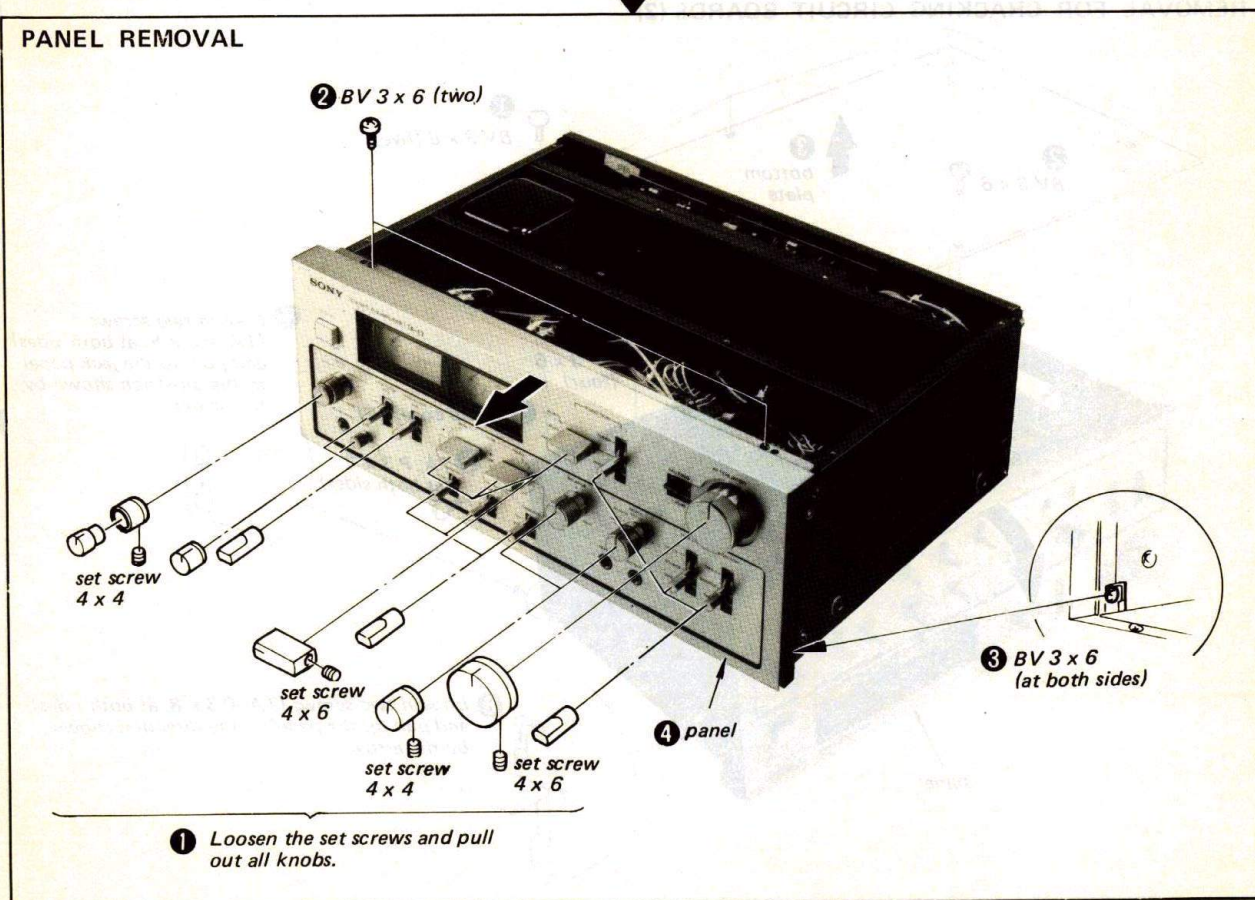
SECTION 2 DISASSEMBLY

Remove the parts in the numerical order.

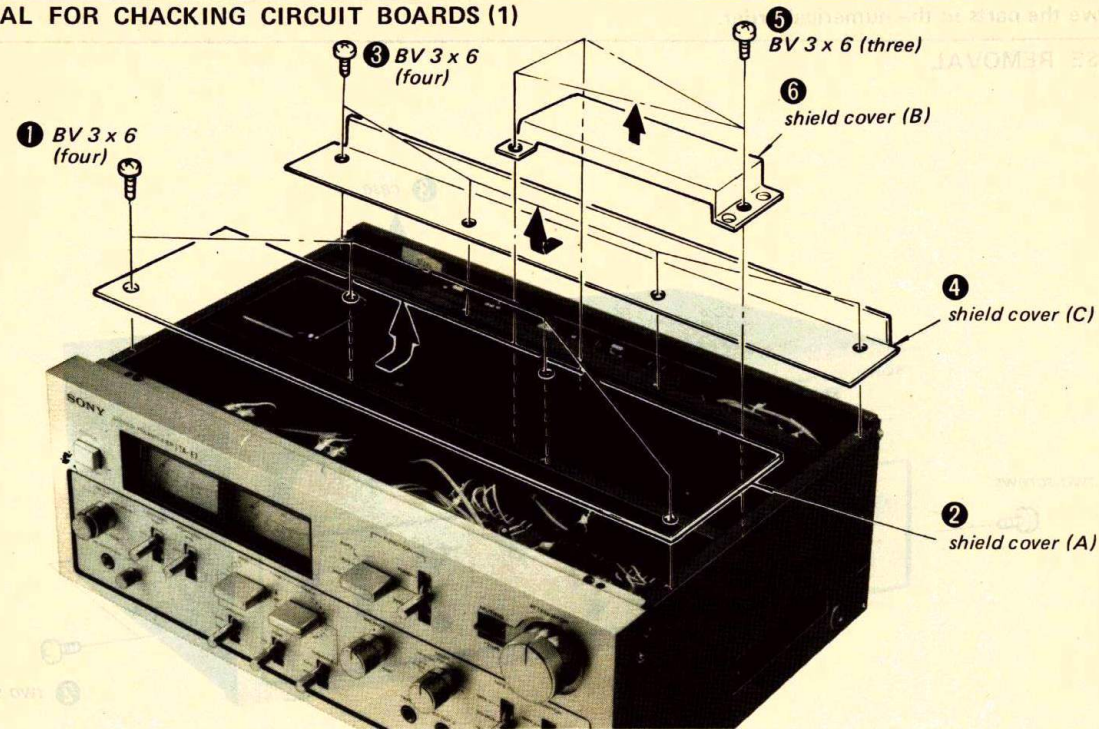
CASE REMOVAL



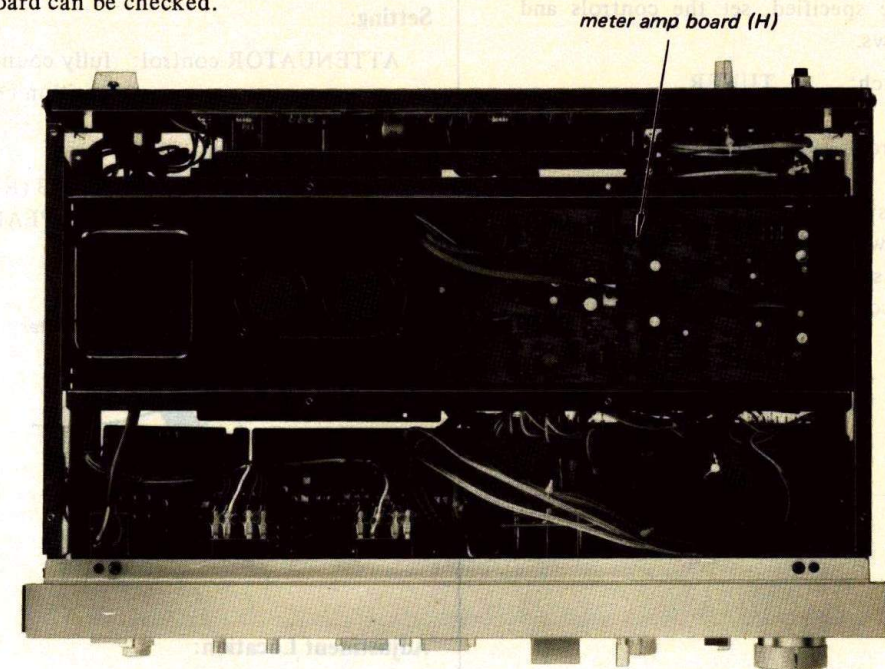
PANEL REMOVAL



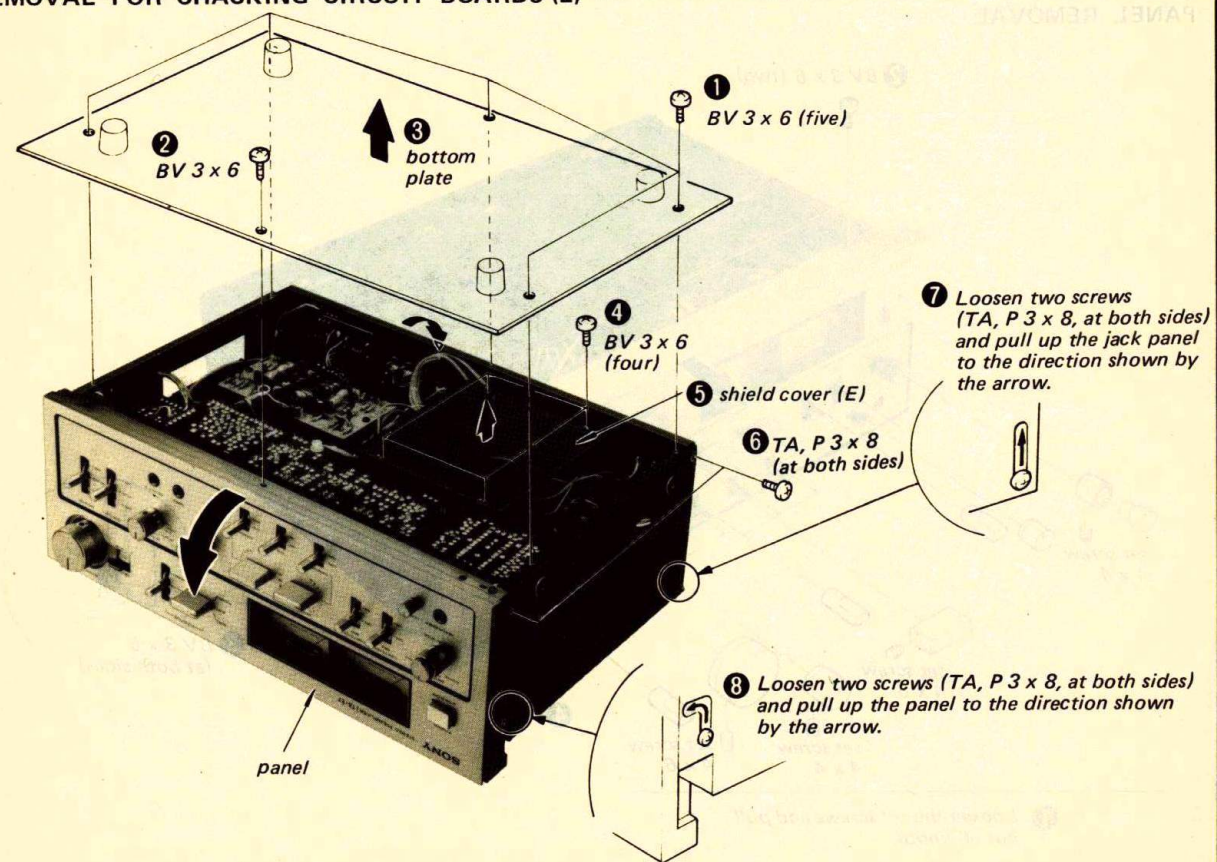
REMOVAL FOR CHACKING CIRCUIT BOARDS (1)



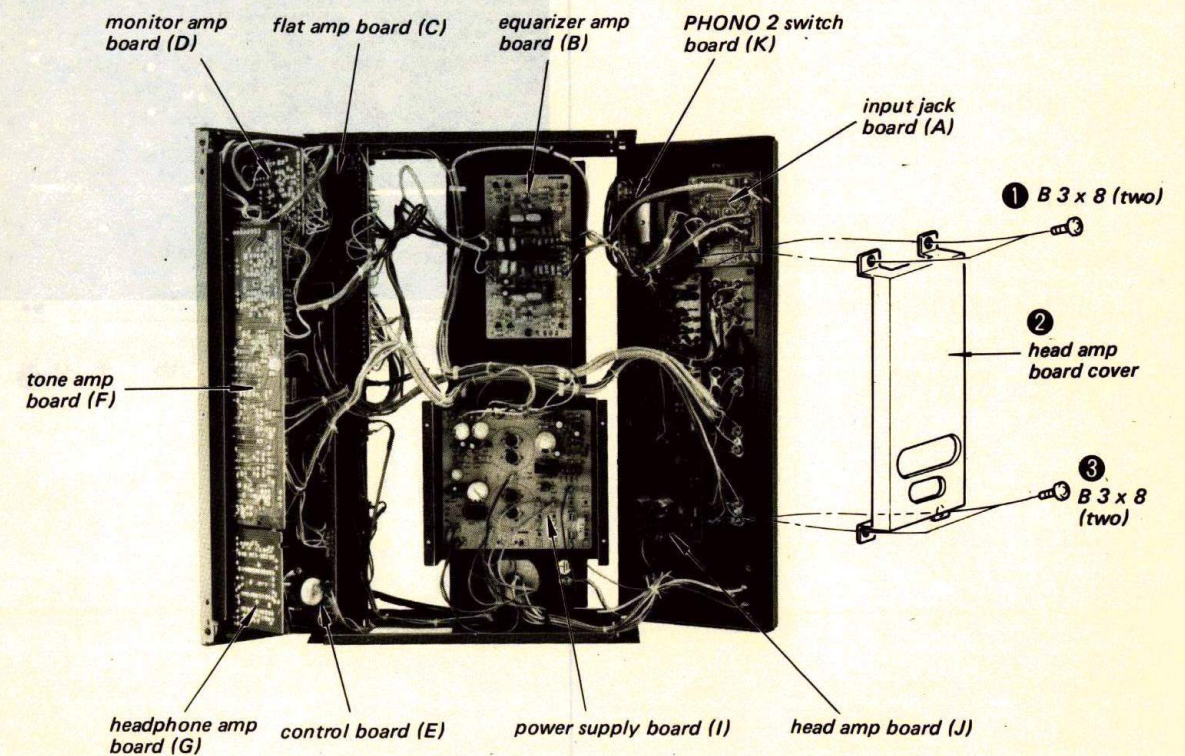
Meter amp board can be checked.



REMOVAL FOR CHACKING CIRCUIT BOARDS (2)



Circuit boards can be checked.



SECTION 3 ADJUSTMENTS

Control and Switch Setting:

Unless otherwise specified, set the controls and switches as follows.

FUNCTION switch:	TUNER
MODE switch:	STEREO
BALANCE control:	mechanical mid
TONE switch:	OFF
HIGH FILTER switch:	OFF
LOW FILTER switch:	OFF
METER MODE switch:	PEAK
METER SENS control:	MIN

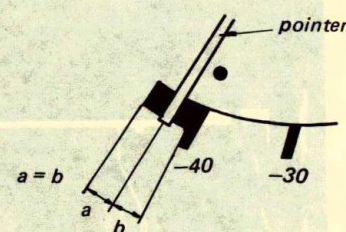
METER ZERO LEVEL ADJUSTMENT

Setting:

ATTENUATOR control: fully counterclockwise position (∞)

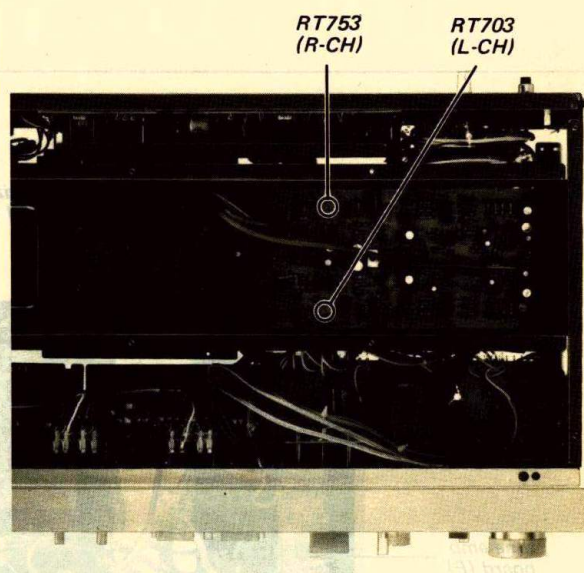
Procedure:

Adjust RT703 (L-CH) and RT753 (R-CH) for specified pointer position on the PEAK/AVERAGE meter as shown below.



Adjustment Location:

— Meter Amp Board —

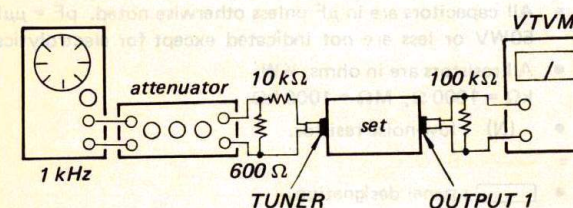


METER 0dB, -10dB ADJUSTMENT

Setting:

ATTENUATOR control: fully clockwise position (0)

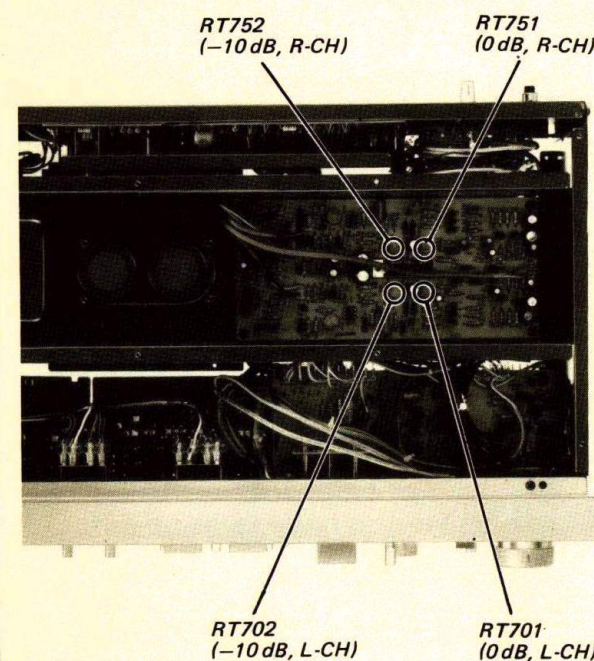
Procedure:



1. Adjust the attenuator for 1 V reading on VTVM.
2. Adjust RT701 (L-CH) and RT751 (R-CH) for 0 dB reading on the PEAK/AVERAGE meter.
3. Set the attenuator to 10 dB lowered position from the position obtained in step 1 above.
4. Adjust RT702 (L-CH) and RT752 (R-CH) for -10 dB reading on the PEAK/AVERAGE meter.
5. Repeat above steps several times.

Adjustment Location:

— Meter Amp Board —



SECTION 4 DIAGRAMS

CIRCUIT BOARDS

A: INPUT JACK BOARD
 B: EQUALIZER AMP BOARD
 C: FLAT AMP BOARD
 D: MONITOR AMP BOARD
 E: CONTROL BOARD
 F: TONE AMP BOARD
 G: HEADPHONE AMP BOARD
 H: METER AMP BOARD
 I: POWER SUPPLY BOARD
 J: HEAD AMP BOARD
 K: PHONO 2 SWITCH BOARD
 MUTING SWITCH BOARD

4-1. SCHEMATIC DIAGRAM

J: HEAD AMP BOARD
 K: PHONO 2 SWITCH BOARD

Note:

- Components for right channel have same values as for left channel.
- All capacitors are in μF unless otherwise noted. $\text{pF} = \mu\mu\text{F}$. 50WV or less are not indicated except for electrolytics.
- All resistors are in ohms, $\frac{1}{2}\text{W}$.
 $\text{k}\Omega = 1000\Omega$, $\text{M}\Omega = 1000\text{k}\Omega$
- (N) : low-noise resistor.
- — : B+ bus.
- : panel designation.
- --- : B- bus.
- Voltages are dc with respect to ground unless otherwise noted.
- Readings are taken under no signal conditions with a VOM (20 $\text{k}\Omega/\text{V}$).
- Switch

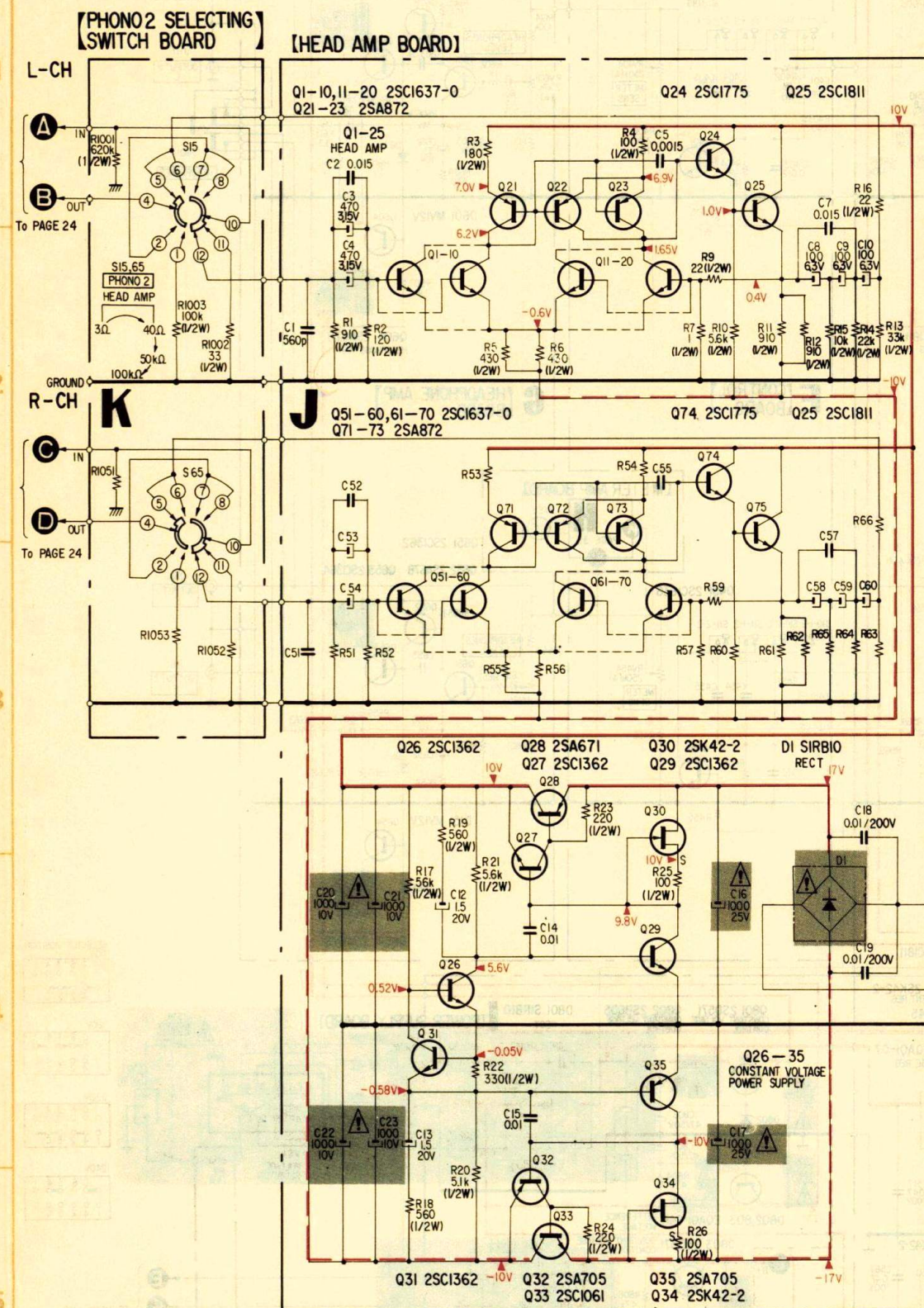
Ref. No.	Switch	Position
S15	PHONO 2	HEAD AMP
S16		3 Ω

Note: The components identified by shading and $\triangle$ mark are critical for safety. Replace only with part number specified.

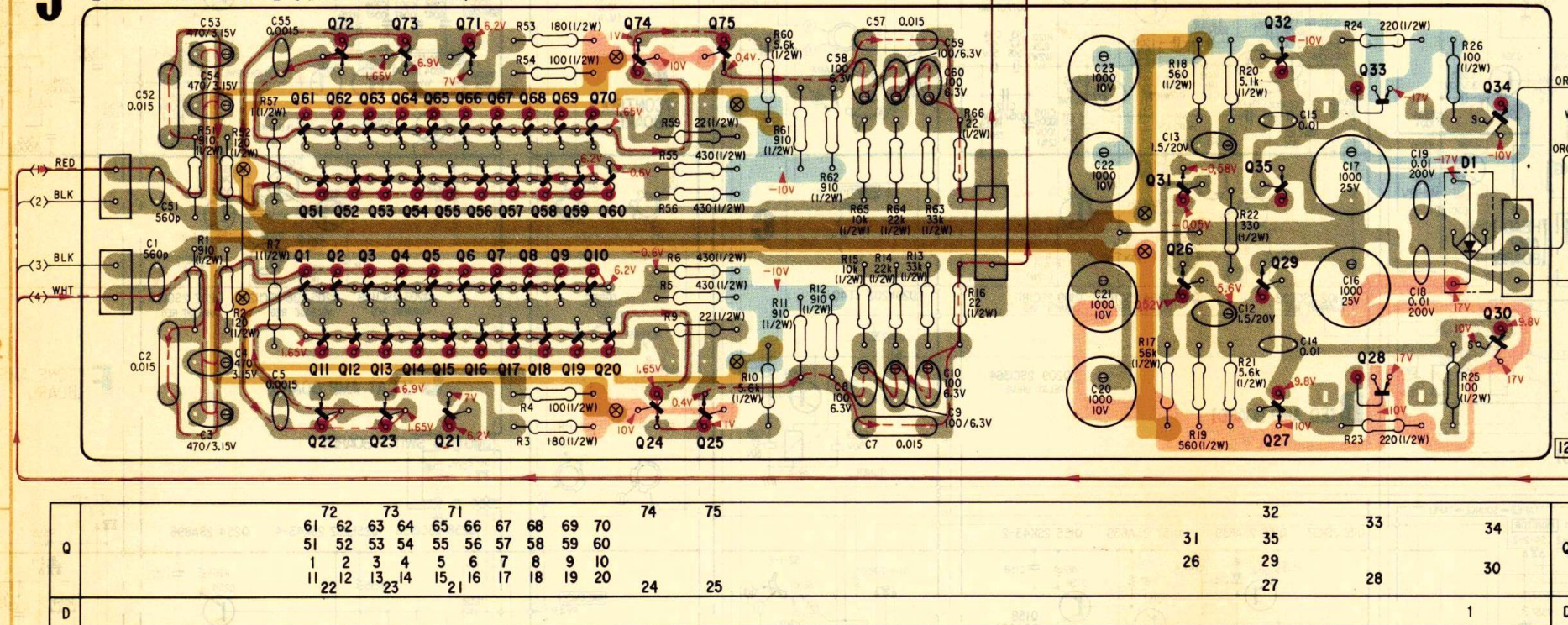


4-2. MOUNTING DIAGRAM

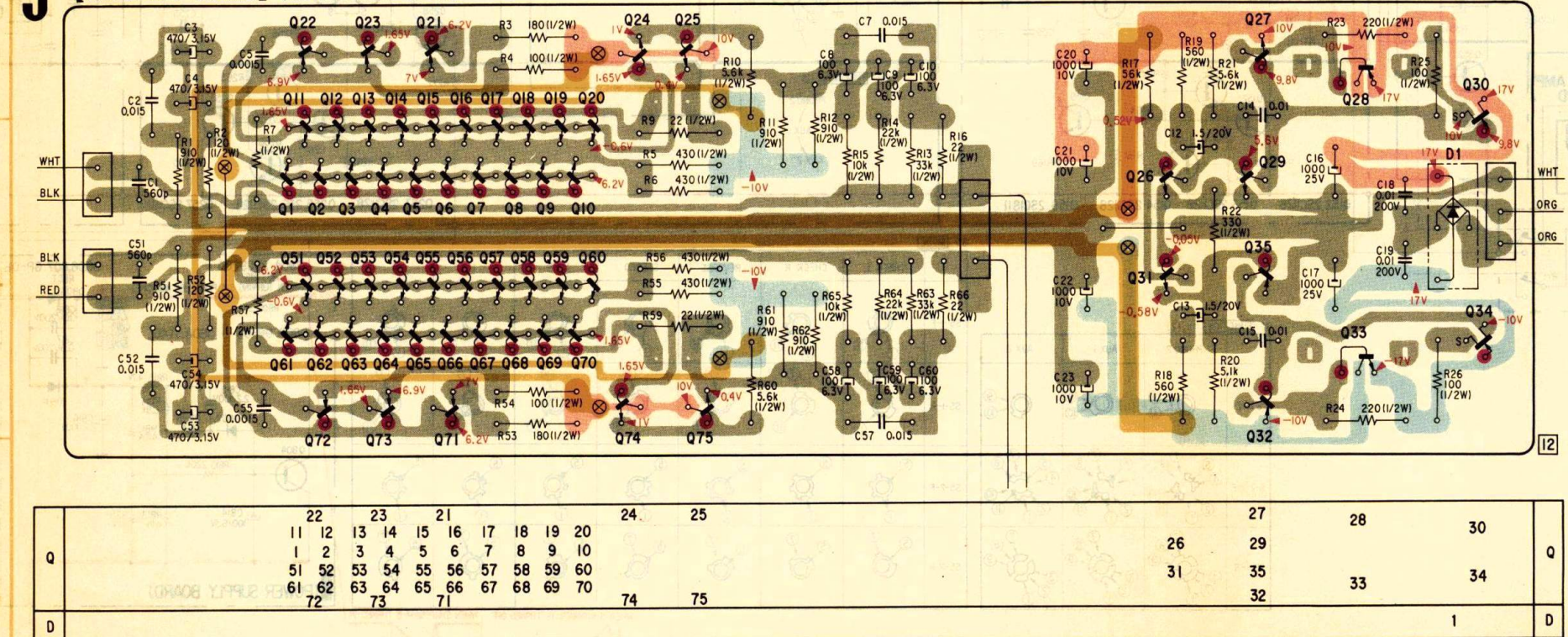
J: HEAD AMP BOARD
K: PHONO 2 SWITCH BOARD



J [HEAD AMP BOARD] (COMPONENT SIDE)



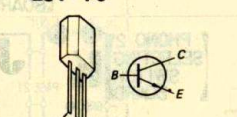
J [HEAD AMP BOARD] (CONDUCTOR SIDE)



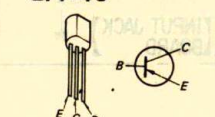
Replacement Semiconductors

For replacement, use semiconductors except in ().

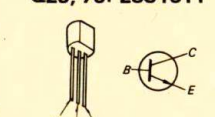
Q1-20, Q51-70: 2SC1637-0



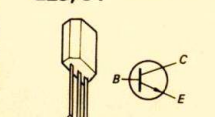
Q21-23, Q71-73: 2SA872



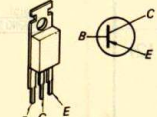
Q24, 74: 2SC1775
Q25, 75: 2SC1811



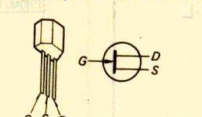
Q26, 27: 2SC632A (2SC1362)



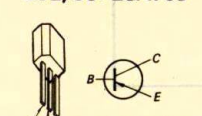
Q28: 2SA671



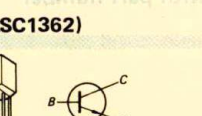
Q30, 34: 2SK42-2



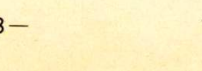
Q32, 35: 2SA705



Q33: 2SC1061

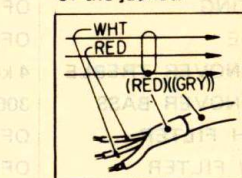


D1: SIRBIO



Note:

- Color code of sleeving over the end of the jacket.



⊗ : Through hole.

• : B+ pattern

• : B- pattern

• : component-side pattern

• Signal Path

• L-CH

• R-CH

• Voltages are dc with respect to ground unless otherwise noted.

• Readings are taken under no signal conditions with a VOM (20 kΩ/V).

4-3. SCHEMATIC DIAGRAM

- A: INPUT JACK BOARD
B: EQUALIZER AMP BOARD
C: FLAT AMP BOARD
D: MONITOR AMP BOARD
E: CONTROL BOARD
F: TONE AMP BOARD
G: HEADPHONE AMP BOARD
I: POWER SUPPLY BOARD
MUTING SWITCH BOARD

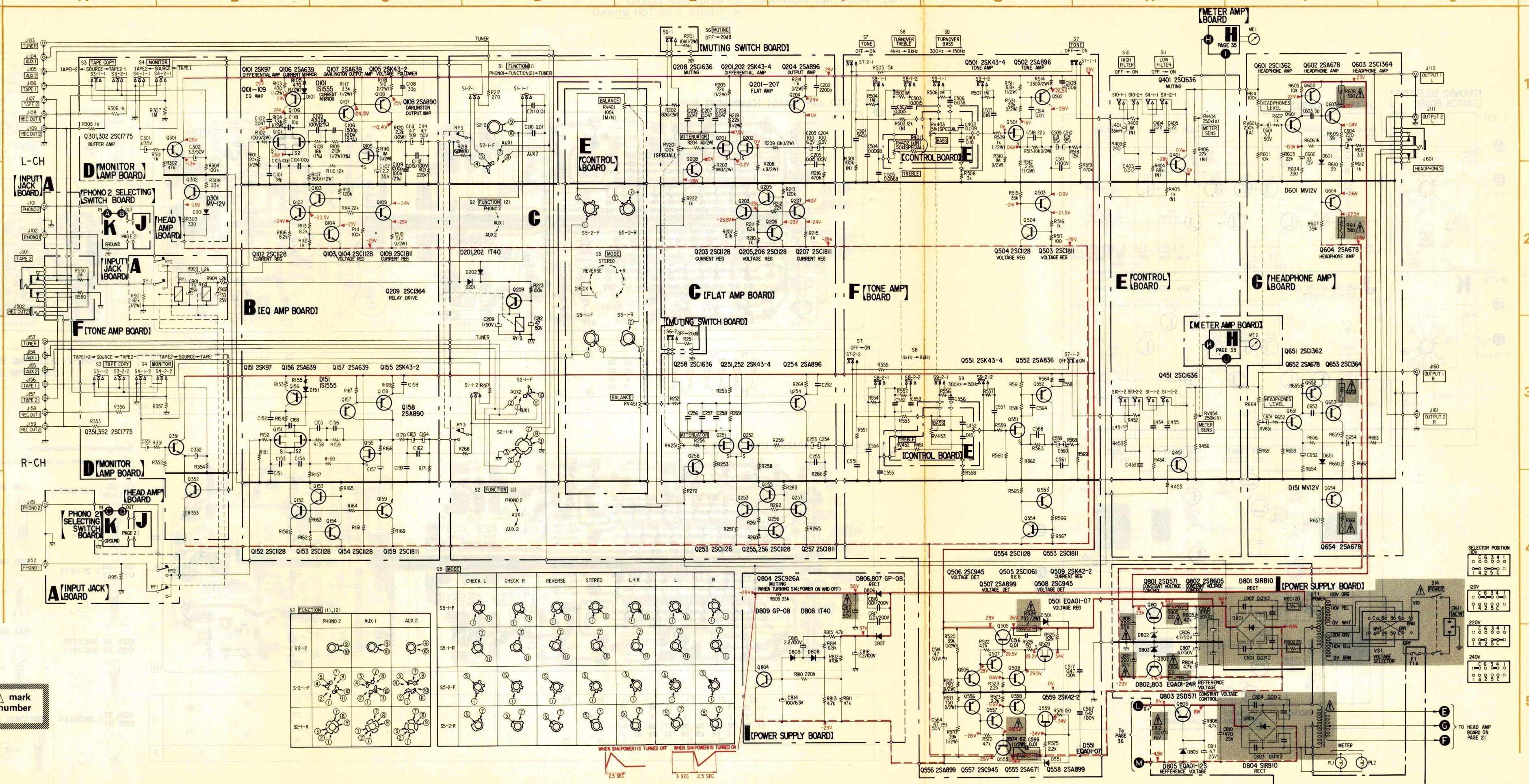
Note:

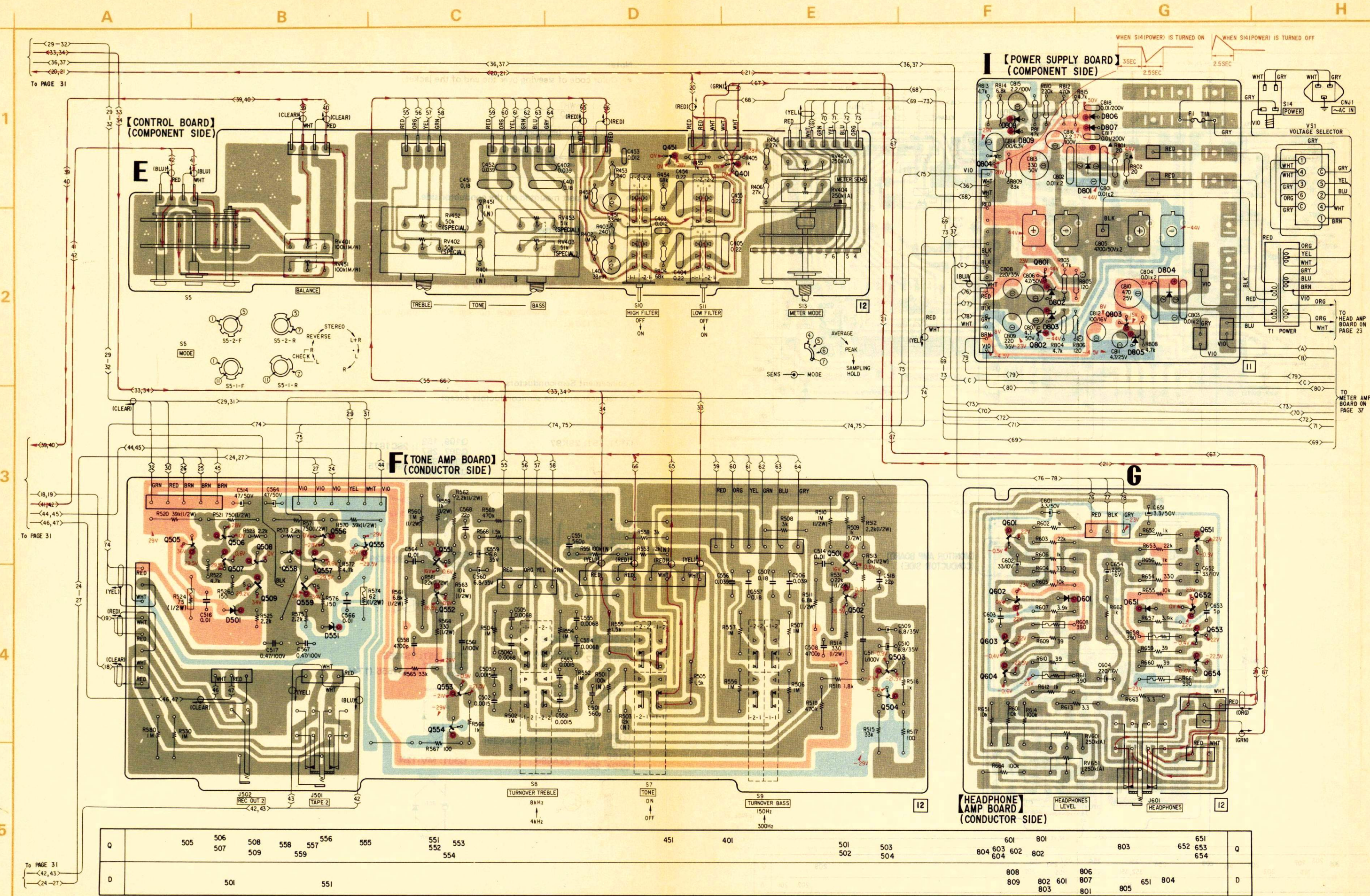
- Components for right channel have same values as for left channel.
- All capacitors are in μF unless otherwise noted. $\text{pF} = \mu\text{F} \times 10^{-6}$, 50WV or less are not indicated except for electrolytics.
- All resistors are in ohms, $\frac{1}{4}\text{W}$ unless otherwise noted. $\text{k}\Omega = 1000\Omega$, $\text{M}\Omega = 1000\text{k}\Omega$.
- : nonflammable resistor.
- : fusible resistor.
- (N) : low-noise resistor.
- : B+ bus.
- : B- bus.
- Voltages are dc with respect to ground unless otherwise noted.
- Readings are taken under no signal conditions with a VOM (20 $\text{k}\Omega/\text{V}$).

Switch

Ref. No.	Switch	Position
S1	FUNCTION (1)	FUNCTION (2)
S2	FUNCTION (2)	PHONO 2
S3	TAPE COPY	SOURCE
S4	MONITOR	SOURCE
S5	MODE	CHECK-L
S6	MUTING	OFF
S7	TOPE	OFF
S8	TURN OVER TREBLE	4 kHz
S9	TURN OVER BASS	300 kHz
S10	HIGH FILTER	OFF
S11	LOW FILTER	OFF
S14	POWER	OFF

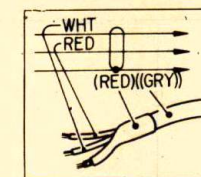
Note: The components identified by shading and mark are critical for safety. Replace only with part number specified.





Note:

- Color code of sleeving over the end of the jacket.



- B+ pattern
- B- pattern

- Signal Path
- L-CH
- R-CH

- nonflammable resistor.
- fusible resistor.

- Voltages are dc with respect to ground unless otherwise noted.
- Readings are taken under no signal conditions with a VOM (20 k Ω /V).

Replacement Semiconductors

For replacement, use semiconductors except in ().

Q401, 451: 2SC1636
Q804: 2SC926A



Q507, 556, 558: 2SA899



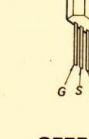
D501, 551: EQB01-07
D802, 803: EQB01-24
D805: EQB01-12Z (EQA01-12S)



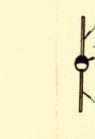
Q501, 551: 2SK43-4



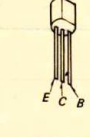
Q509, 559: 2SK42-2



D601, 651: MV-12N



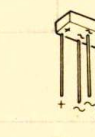
Q502, 552: 2SA896



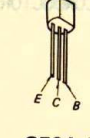
Q555: 2SA671



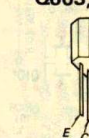
D801, 804: SIRB10



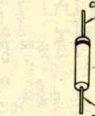
Q503, 553: 2SC1811



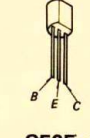
Q601, 651: 2SC632A (2SC1362)
Q603, 653: 2SC634A (2SC1364)



D806, 807: 10E2 (GP-08)
D809



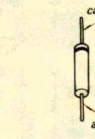
Q504, 554: 2SC1128



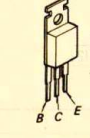
Q602, 604, Q652, 654: 2SA678



D808: 1S1555



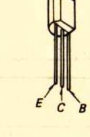
Q505: 2SC1061



Q801, 803: 2SC1475 (2SD571)



Q506, 508, Q557: 2SC945



Q802: 2SA835 (2SB605)



4-5. MOUNTING DIAGRAM

A: INPUT JACK BOARD

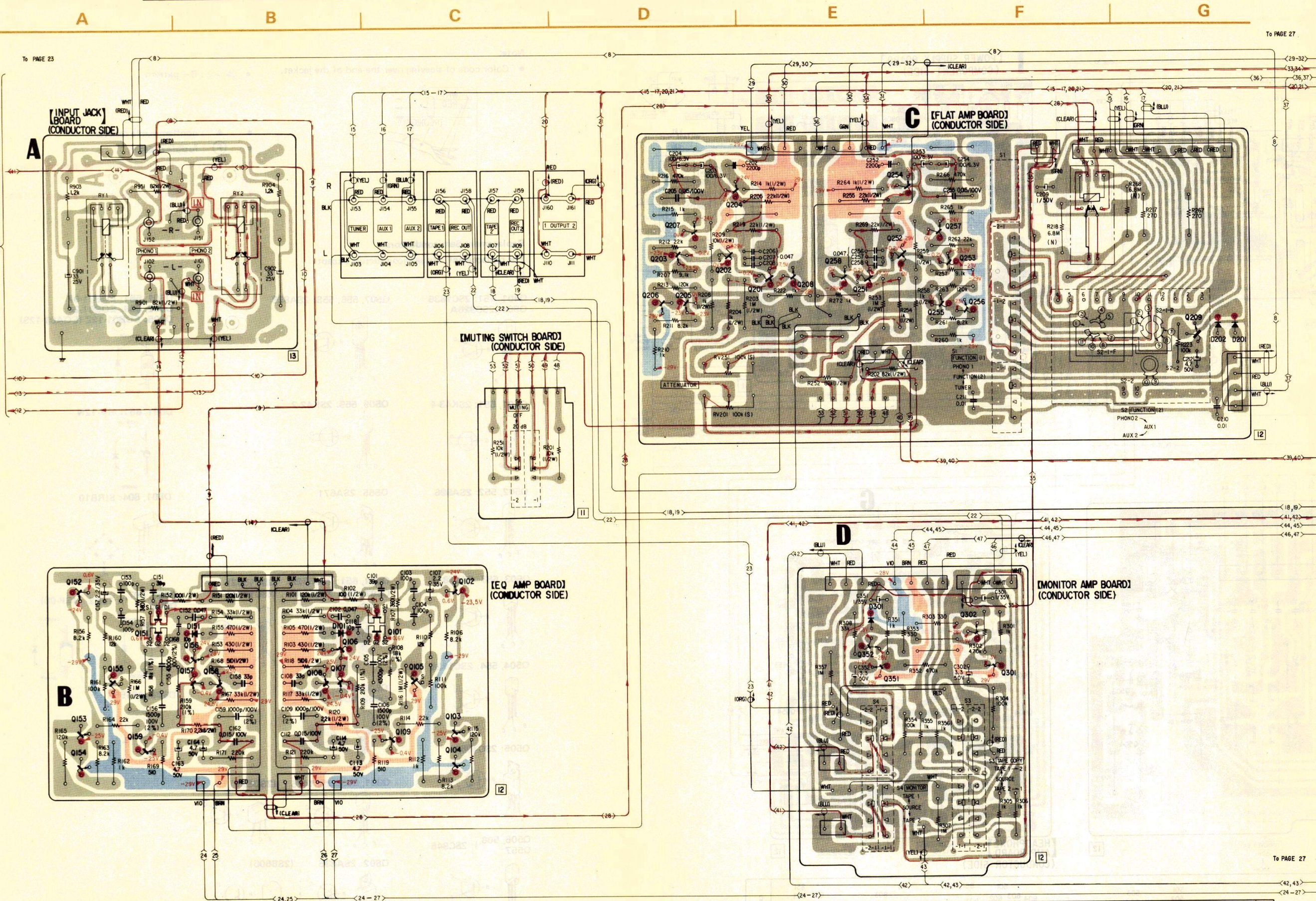
B: EQUALIZER AMP BOARD

C: FLAT AMP BOARD

D: MONITOR AMP BOARD

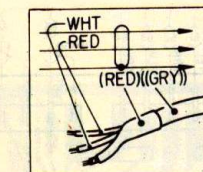
MUTING SWITCH BOARD

F: TONE AMP BOARD



Note:

- Color code of sleeving over the end of the jacket.

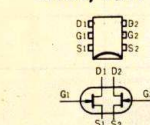


- part mounted on the conductor side.
- B+ pattern
- B- pattern
- Signal Path
- L-CH
- R-CH
- Voltagess are dc with respect to ground unless otherwise noted.
- Readings are taken under no signal conditions with a VOM (20 kΩ/V).

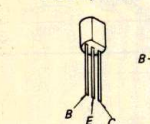
Replacement Semiconductors

For replacement, use semiconductors except in ().

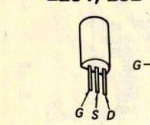
Q101, 151: 2SK97



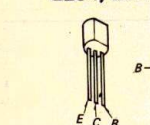
Q102-104,
Q152-154
Q203, 205, 206
Q253, 255, 256



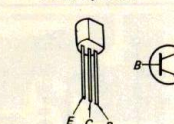
Q105, 155: 2SK43-2
Q201, 202:
Q251, 252



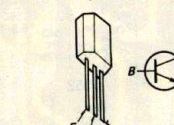
Q106, 107:
Q156, 157
Q108, 158:
Q204, 254



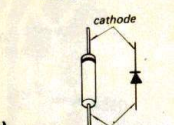
Q109, 159:
Q207, 257
Q301, 302:
Q351, 352



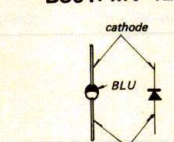
Q208, 258:
Q401, 451



D101, 151: 1S1555
D201, 202:
D808

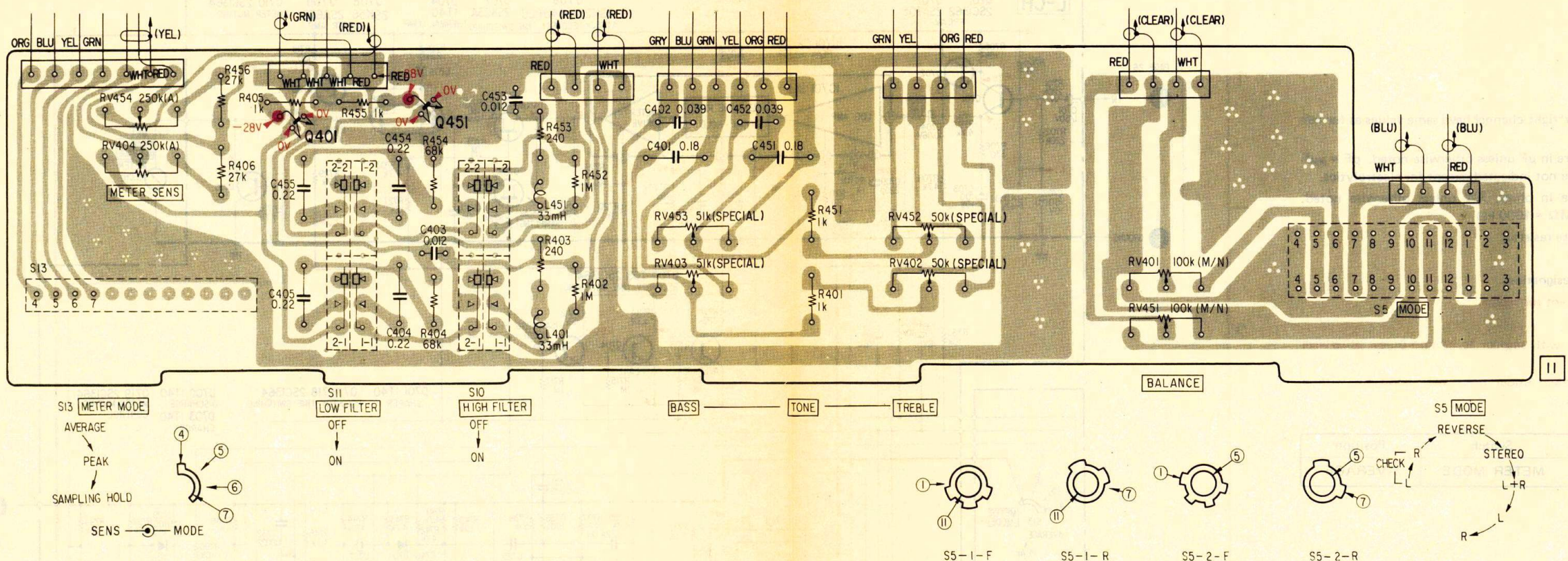


D301: MV-12N



Q	152	155	151	156	158	106	101	105	102	203	207	204	201	208	258	251	254	257	253	256	209	Q
D	153	154	159	157	158	108	107	109	103	206	205	202	200	208	258	251	254	257	253	256	202	D

[CONTROL BOARD] (CONDUCTOR SIDE)



4-6. SHCEMATIC DIAGRAM

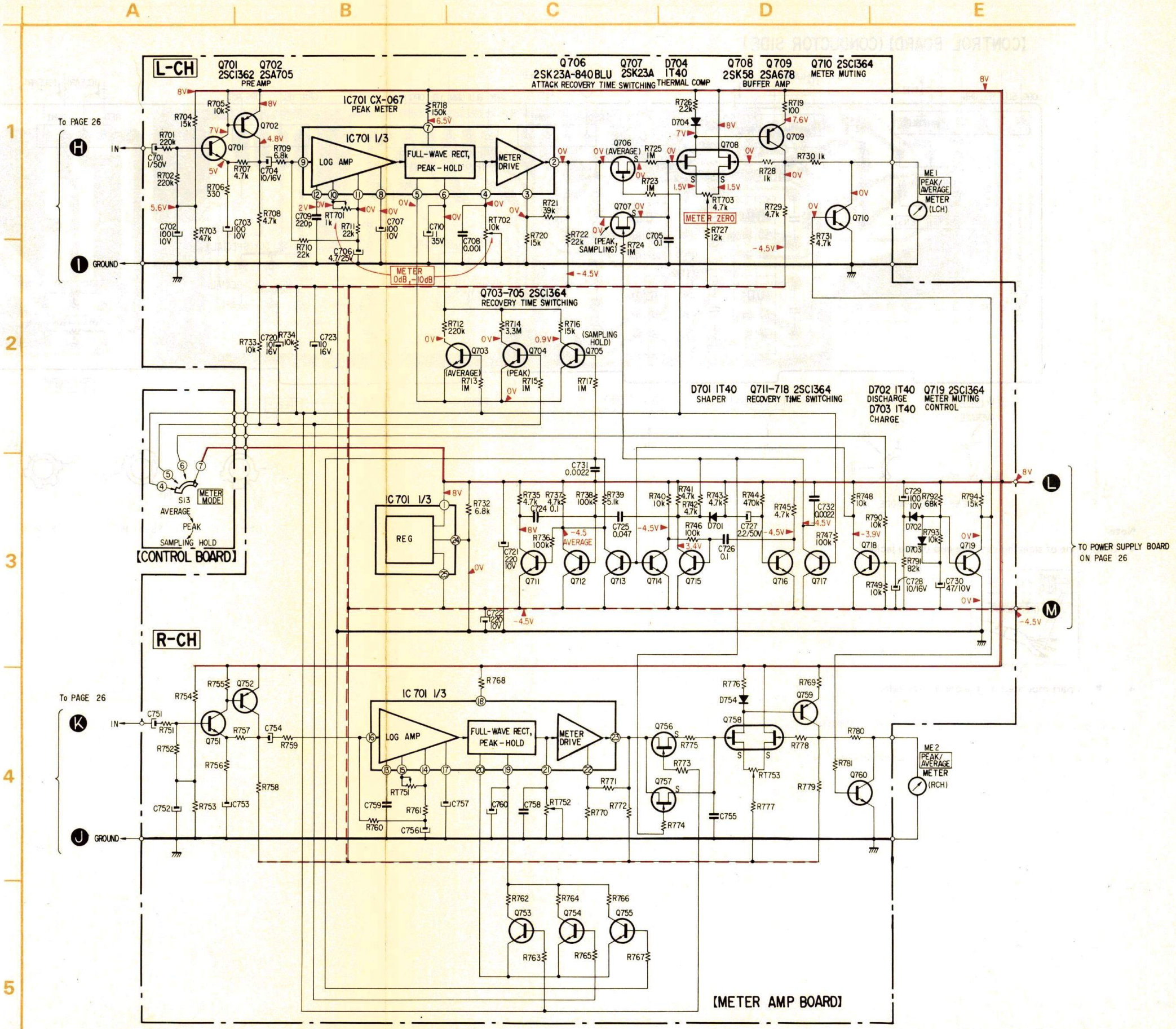
H: METER AMP BOARD

Note:

- Components for right channel have same values as for left channel.
- All capacitors are in μF unless otherwise noted. $\text{pF} = \mu\mu\text{F}$ 50WV or less are not indicated except for electrolytics.
- All resistors are in ohms, $\frac{1}{4}\text{W}$ unless otherwise noted. $\text{k}\Omega = 1000\Omega$, $\text{M}\Omega = 1000\text{k}\Omega$
- (N) : low-noise resistor.
- — : B+ bus.
- : panel designation.
- : adjustment for repair.
- - - - : B- bus.
- Voltages are dc with respect to ground unless otherwise noted.
- Readings are taken under no signal conditions with a VOM (20 $\text{k}\Omega/\text{V}$).

Switch

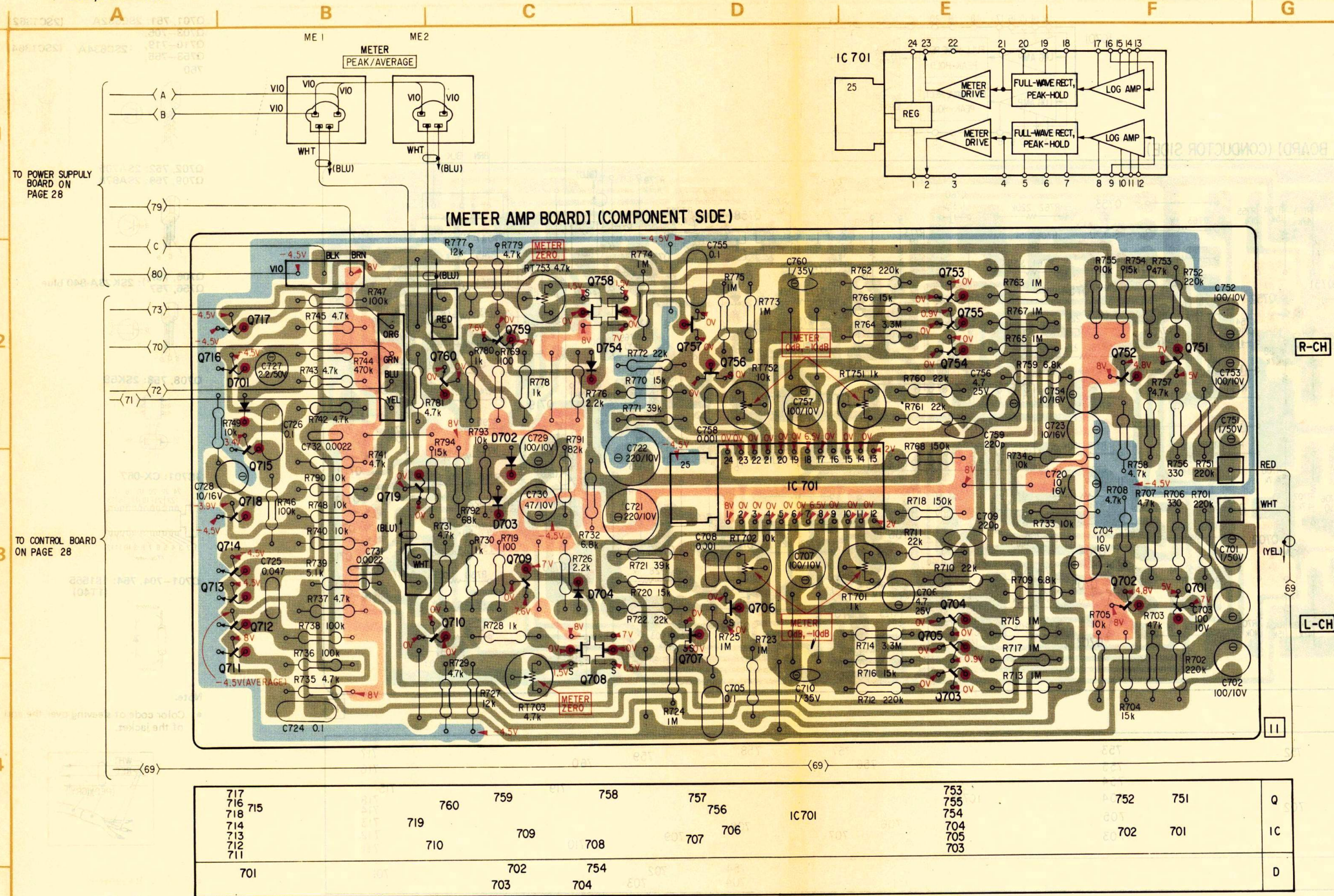
Ref. No.	Switch	Position
S13	METER MODE	AVERAGE



4-7. MOUNTING DIAGRAM

H: METER AMP BOARD

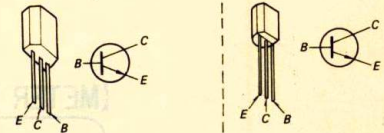
— Component Side —



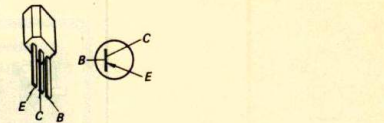
Replacement Semiconductor

For replacement, use semiconductors except in ().

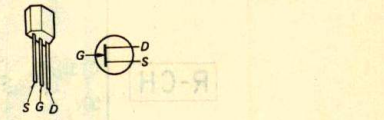
Q701, 751: 2SC632A (2SC1362)
Q703-705, Q710-719, Q753-755, 760: 2SC634A (2SC1364)



Q702, 752: 2SA705
Q709, 759: 2SA678



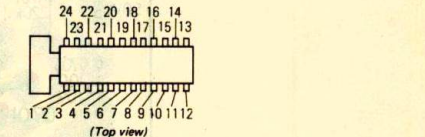
Q706, 707, 756, 757: 2SK23A-840 blue



Q708, 758: 2SK58



IC701: CX-067

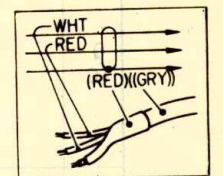


D701-704, 754: 1S1555 (1T40)



Note:

- Color code of sleeving over the end of the jacket.

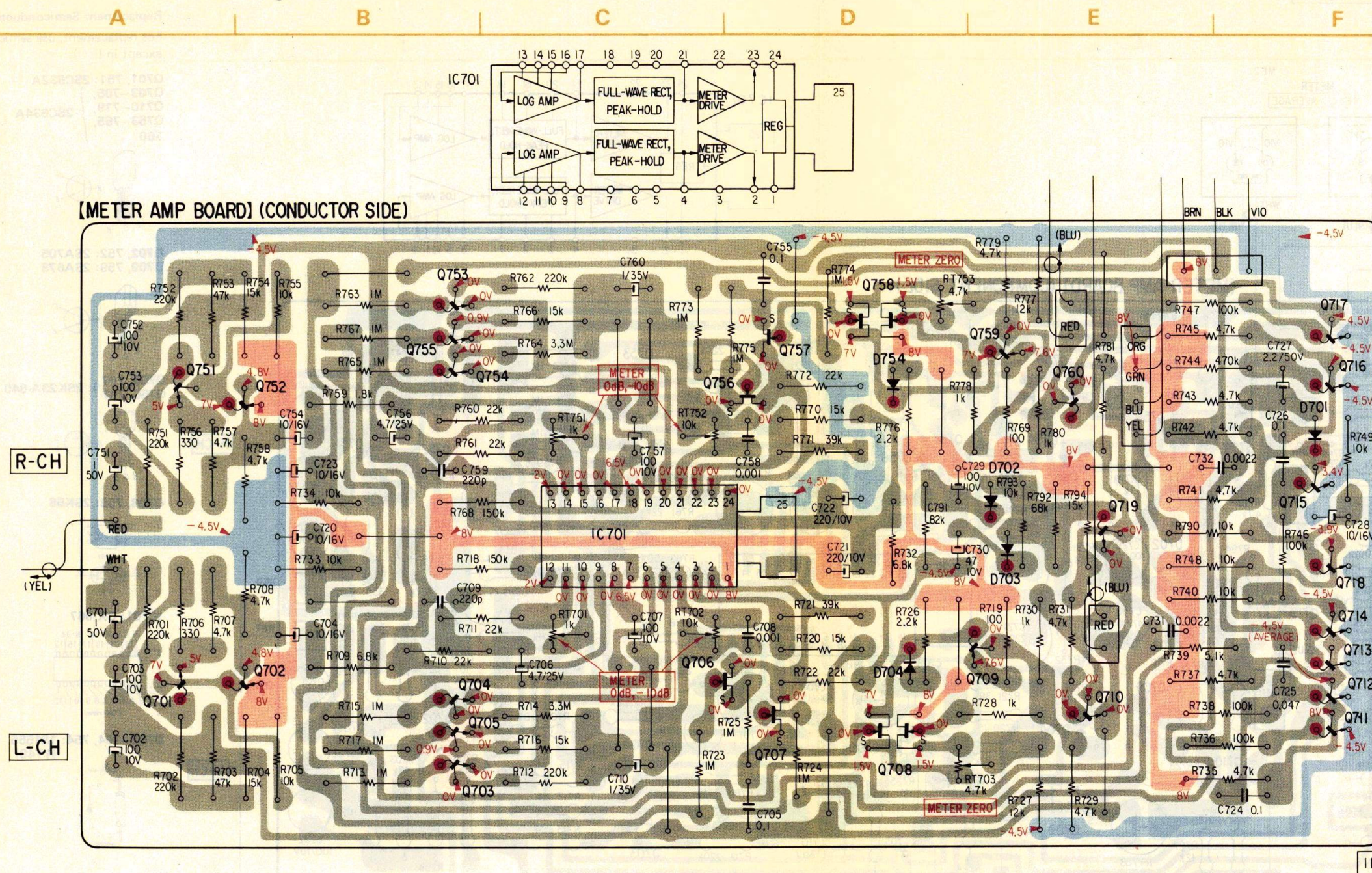


- B+ pattern
- B- pattern
- Voltages are dc with respect to ground unless otherwise noted.
- Readings are taken under no signal conditions with a VOM (20 kΩ/V).

4-8. MOUNTING DIAGRAM

H: METER AMP BOARD

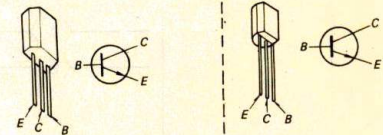
- Conductor Side -



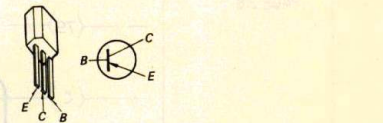
Replacement Semiconductor

For replacement, use semiconductors except in ().

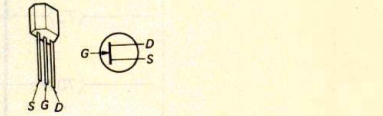
Q701, 751: 2SC632A (2SC1362)
 Q703-705, 710-719, 753-755, 760: 2SC634A (2SC1364)



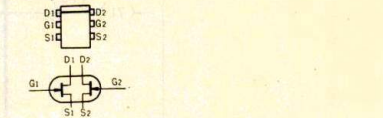
Q702, 752: 2SA705
 Q709, 759: 2SA678



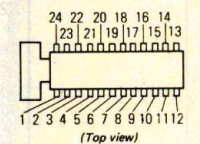
Q706, 707, 756, 757: 2SK23A-840 blue



Q708, 758: 2SK58



IC701: CX-067

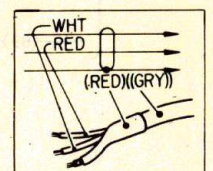


D701-704, 754: 1S1555 (1T40)



Note:

- Color code of sleeving over the end of the jacket.



- B+ pattern
- B- pattern
- Voltages are dc with respect to ground unless otherwise noted.
- Readings are taken under no signal conditions with a VOM (20 kΩ/V).

Q	751		752		753		754		755		756		757		758		759		760		717	
	701		702		704		705		706		707		708		709		710		711		712	
	713		714		715		716		717		718		719		720		721		722		723	
	724		725		726		727		728		729		730		731		732		733		734	

3

5-1.

D

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B

A

Note:

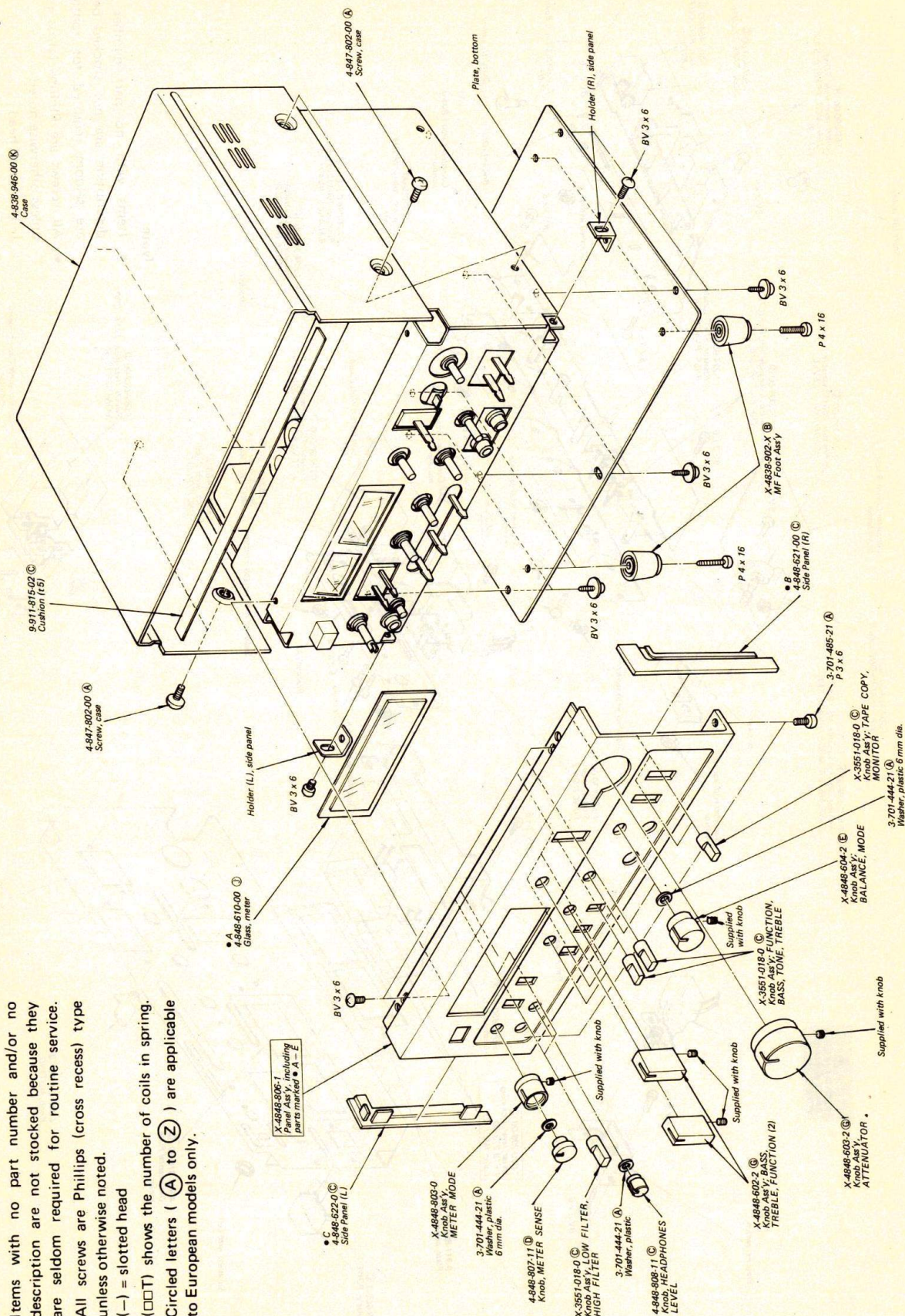
- Items with no part number and/or no description are not stocked because they are seldom required for routine service.
- All screws are Phillips (cross recess) type unless otherwise noted.
(-) = slotted head
- (□□T) shows the number of coils in spring.
- Circled letters (**A** to **Z**) are applicable to European models only.

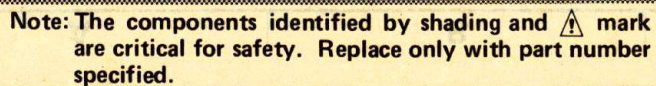
5

2

3

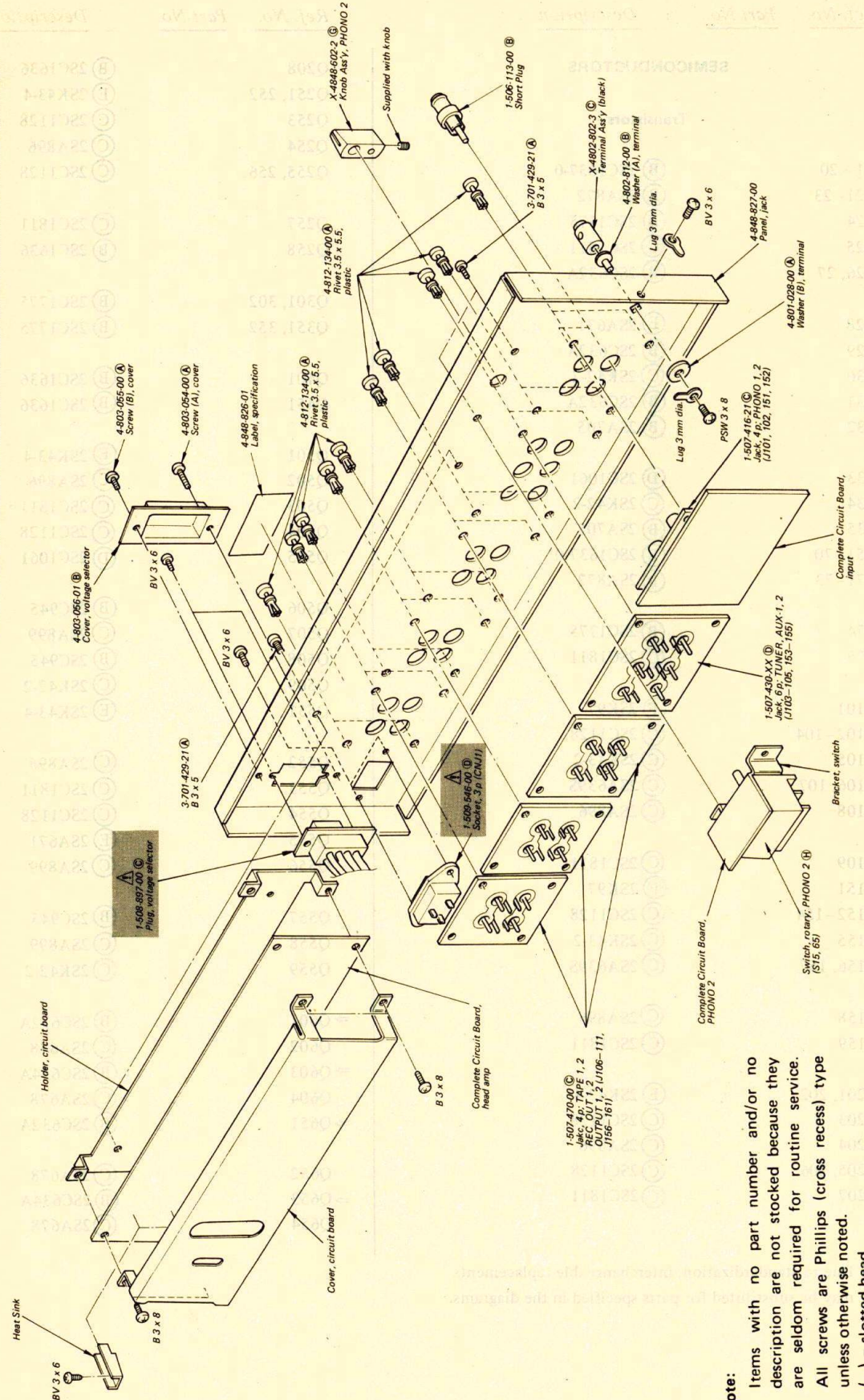
4





- Items with no part number and/or no description are not stocked because they are seldom required for routine service.
- All screws are Phillips (cross recess) type unless otherwise noted.
(—) = slotted head
- (□□T) shows the number of coils in spring.
- Circled letters (Ⓐ to Ⓩ) are applicable to European models only.

5-4.



Note: The components identified by shading and mark are critical for safety. Replace only with part number specified.

Note:

- Items described are
- All un-
- (—)
- (000)
- Circ-
- to

SECTION 7

ELECTRICAL PARTS LIST

• Circled letters (A to Z) are applicable to European models only.

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
SEMICONDUCTORS					
Transistors					
Q1-20	(B) 2SC1637-0		Q208	(B) 2SC1636	
Q21-23	(B) 2SA872		Q251, 252	(E) 2SK43-4	
Q24	(B) 2SC1775		Q253	(C) 2SC1128	
Q25	(C) 2SC1811		Q254	(C) 2SA896	
⇒ Q26, 27	(B) 2SC632A		Q255, 256	(C) 2SC1128	
Q28	(E) 2SA671		Q257	(C) 2SC1811	
⇒ Q29	(B) 2SC632A		Q258	(B) 2SC1636	
Q30	(C) 2SK42-2		Q301, 302	(B) 2SC1775	
⇒ Q31	(B) 2SC632A		Q351, 352	(B) 2SC1775	
Q32	(B) 2SA705		Q401	(B) 2SC1636	
Q33	(D) 2SC1061		Q451	(B) 2SC1636	
Q34	(C) 2SK42-2		Q501	(E) 2SK43-4	
Q35	(B) 2SA705		Q502	(C) 2SA896	
Q51-70	(B) 2SC1637-0		Q503	(C) 2SC1811	
Q71-73	(B) 2SA872		Q504	(C) 2SC1128	
Q74	(B) 2SC1775		Q505	(D) 2SC1061	
Q75	(C) 2SC1811		Q506	(B) 2SC945	
Q101	(F) 2SK97		Q507	(C) 2SA899	
Q102-104	(C) 2SC1128		Q508	(B) 2SC945	
Q105	(C) 2SK43-2		Q509	(C) 2SK42-2	
⇒ Q106, 107	(C) 2SA639S		Q551	(E) 2SK43-4	
Q108	(C) 2SA896		Q552	(C) 2SA896	
Q109	(C) 2SC1811		Q553	(C) 2SC1811	
Q151	(F) 2SK97		Q554	(C) 2SC1128	
Q152-154	(C) 2SC1128		Q555	(E) 2SA671	
Q155	(C) 2SK43-2		Q556	(C) 2SA899	
⇒ Q156, 157	(C) 2SA639S		Q557	(B) 2SC945	
Q158	(C) 2SA896		Q558	(C) 2SA899	
Q159	(C) 2SC1811		Q559	(C) 2SK42-2	
Q201, 202	(E) 2SK43-4		⇒ Q601	(B) 2SC632A	
Q203	(C) 2SC1128		Q602	(C) 2SA678	
Q204	(C) 2SA896		⇒ Q603	(B) 2SC634A	
Q205, 206	(C) 2SC1128		Q604	(C) 2SA678	
Q207	(C) 2SC1811		⇒ Q651	(B) 2SC632A	
			Q652	(C) 2SA678	
			⇒ Q653	(B) 2SC634A	
			Q654	(C) 2SA678	

⇒: Due to standardization, interchangeable replacements may be substituted for parts specified in the diagrams.

Ref. No.	Part No.	Description
⇒ Q701	(B) 2SC632A	
Q702	(B) 2SA705	
⇒ Q703-705	(B) 2SC634A	
Q706, 707	(C) 2SK23A-840 blue	
Q708	(F) 2SK58	
Q709	(C) 2SA678	
⇒ Q710-719	(B) 2SC634A	
⇒ Q751	(B) 2SC632A	
Q752	(B) 2SA705	
⇒ Q753-755	(B) 2SC634A	
Q756, 757	(C) 2SK23A-840 blue	
Q758	(F) 2SK58	
Q759	(C) 2SA678	
⇒ Q760	(B) 2SC634A	
⇒ Q801	(C) 2SC1475	
⇒ Q802	(E) 2SA835	
⇒ Q803	(C) 2SC1475	
Q804	(D) 2SC926A	
IC		
IC701	(K) CX-067	
Diodes		
D1	(A) (C) SIRB10	
D101	(B) 1S1555	
D151	(B) 1S1555	
⇒ D201, 202	(B) 1S1555	
D301	(B) MV-12N	
D501	(B) EQB01-07	
D551	(B) EQB01-07	
D601	(B) MV-12N	
D651	(B) MV-12N	
⇒ D701-704	(B) 1S1555	
⇒ D754	(B) 1S1555	

⇒: Due to standardization, interchangeable replacements may be substituted for parts specified in the diagrams.

• Circled letters (A to Z) are applicable to European models only.

Ref. No.	Part No.	Description
D801	(A) (C) SIRB10	
D802, 803	(B) EQB01-24	
D804	(A) (C) SIRB10	
⇒ D805	(B) EQB01-12Z	
⇒ D806, 807	(B) 10E2	
⇒ D808	(B) 1S1555	
⇒ D809	(B) 10E2	
CAPACITORS		
All capacitors are in μ F and ceramic unless otherwise noted. 50WV or less are not indicated except for electrolytics. μ F = μ F, elect = electrolytic		
C1, 51	1-102-115-11 (A) 560p	
C2, 52	1-130-127-11 (B) 0.015 100 V polyethylene	
C3, 53	1-131-429-11 (G) 470 3.15 V tantalum	
C4, 54		
C5, 55	1-102-119-11 (A) 0.0015	
C7, 57	1-130-127-11 (B) 0.015 100 V polyethylene	
C8-10	1-131-295-11 (C) 100 6.3 V tantalum	
C58-60		
C12, 13	1-131-202-11 (B) 1.5 20 V tantalum	
C14, 15	1-108-239-12 (A) 0.01 mylar	
C16, 17	(A) 1-123-066-11 (B) 1000 25 V elect	
C18, 19	1-108-421-12 (B) 0.01 200 V mylar	
C20-23	(A) 1-121-943-11 (B) 1000 10 V elect	
C101, 151	1-102-965-11 (A) 39p	
C102, 152	1-101-006-11 (A) 0.047	
C103, 153	1-102-973-11 (A) 100p	
C104, 154		
C105, 155	1-130-123-11 (B) 0.0043 100 V polyethylene	
C106, 156	1-130-124-11 (B) 0.015 100 V polyethylene	
C107, 157	1-131-217-11 (B) 2.2 35 V tantalum	
C108, 158	1-102-963-11 (A) 33p	
C109, 159	1-130-122-11 (B) 0.001 100 V polyethylene	
C112, 162	1-130-127-11 (B) 0.015 100 V polyethylene	
C113, 163	1-121-396-11 (A) 4.7 50 V elect	
C114, 164		
C118, 168	1-102-947-11 (A) 10p	

Note: The components identified by shading and A mark are critical for safety. Replace only with part number specified.

• Circled letters (A to Z) are applicable to European models only.

Ref. No.	Part No.	Description
C202, 252	1-102-121-11 (A) 0.0022	
C203, 253	1-131-295-11 (C) 100	6.3 V tantalum
C204, 254	1-130-127-11 (B) 0.015	100 V polyethylene
C205, 255	1-101-006-11 (A) 0.047	
C206-208		
C256-258		
C209	1-121-391-11 (A) 1	50 V elect
C210, 211	1-108-239-12 (A) 0.01	mylar
C212	1-121-396-11 (A) 4.7	50 elect
C301, 351	1-131-215-11 (B) 1	35 V tantalum
C302, 352	1-121-393-11 (A) 3.3	50 V elect
C401, 451	1-108-364-12 (B) 0.18	mylar
C402, 452	1-108-360-12 (A) 0.039	mylar
C403, 453	1-108-581-12 (B) 0.012	mylar
C404, 454	1-108-611-12 (B) 0.22	mylar
C405, 455		
C501, 551	1-102-115-11 (A) 560	
C502, 552	1-108-228-12 (A) 0.0015	mylar
C503, 553		
C504, 554	1-108-237-12 (A) 0.0068	mylar
C505, 555		
C506, 556	1-108-360-12 (A) 0.039	mylar
C507, 557	1-108-364-12 (B) 0.18	mylar
C508, 558	1-102-125-11 (A) 0.0047	
C509, 559	1-131-239-11 (B) 6.8	35 V tantalum
C510, 560		
C511, 561	1-130-083-11 (C) 1	100 V polyethylene
C514, 564	1-121-411-11 (B) 47	50 V elect
C514, 564	1-108-239-12 (A) 0.01	mylar
C516, 566	1-108-239-12 (A) 0.01	mylar
C517, 567	1-130-086-11 (B) 0.47	100 V polyethylene
C518, 568	1-102-514-11 (A) 22 p	
C601, 651	1-121-393-11 (A) 3.3	50 V elect
C602, 652	1-121-402-11 (A) 33	10 V elect
C603, 653	1-102-864-11 (A) 5 p	
C604, 654	1-121-421-11 (B) 220	16 V elect
C701, 751	1-121-391-11 (A) 1	50 V elect
C702, 752	1-121-414-11 (A) 100	10 V elect
C703, 753		

Ref. No.	Part No.	Description
C704, 754	1-121-651-11 (A) 10	16 V elect
C705, 755	1-108-849-11 (B) 0.1	mylar
C706, 756	1-121-395-11 (A) 4.7	25 V elect
C707, 757	1-121-414-11 (A) 100	10 V elect
C708, 758	1-108-825-12 (A) 0.001	mylar
C709, 759	1-102-978-11 (A) 220 p	
C710, 760	1-131-448-11 (B) 1	35 V tantalum
C720	1-121-651-11 (A) 10	16 V elect
C721, 722	1-121-420-11 (B) 220	10 V elect
C723	1-121-651-11 (A) 10	16 V elect
C724	1-108-849-12 (B) 0.1	mylar
C725	1-108-845-12 (A) 0.47	mylar
C726	1-108-849-12 (B) 0.1	mylar
C727	1-121-450-11 (A) 2.2	50 V elect
C728	1-121-651-11 (A) 10	16 V elect
C729	1-121-414-11 (A) 100	10 V elect
C730	1-121-975-11 (A) 47	10 V elect
C731, 732	1-108-829-12 (A) 0.0022	mylar
C801-804	1-102-355-11 (B) 0.01	500 V
C805	1-125-093-11 (J) 4700	50 V elect
C806, 807	1-121-396-11 (A) 4.7	50 V
C808, 809	1-123-063-11 (B) 220	35 V elect
C810	1-121-940-11 (B) 470	25 V elect
C811	1-121-395-11 (A) 4.7	25 V elect
C812	1-123-193-11 (B) 100	16 V elect
C813	1-123-060-11 (B) 330	50 V elect
C814	1-121-413-11 (A) 100	6.3 V elect
C815, 816	1-123-250-11 (B) 2.2	100 V elect
C817, 818	1-108-421-12 (B) 0.01	mylar
C901, 902	1-119-216-11 (B) 33	25 V elect

RESISTORS

All resistors are in ohms and of 1/2 W carbon unless otherwise noted. Common 1/2 W carbon resistors are omitted. Refer to the list on the last page for their part numbers.

R1, 51	1-244-872-11 (A) 910
R2, 52	1-244-851-11 (A) 120
R3, 53	1-244-855-11 (A) 180
R4, 54	1-244-849-11 (A) 100

Ref. No.	Part No.	Description
R5, 55	1-244-864-11 (A) 430	
R6, 56		
R7, 57	1-244-801-11 (A) 1	
R9, 59	1-244-833-11 (A) 22	
R10, 60	1-244-891-11 (A) 5.6 k	
R11, 61	1-244-872-11 (A) 910	
R12, 62		
R13, 63	1-244-909-11 (A) 33 k	
R14, 64	1-244-905-11 (A) 22 k	
R15, 65	1-244-897-11 (A) 10 k	
R16, 66	1-244-833-11 (A) 22	
R17	1-244-915-11 (A) 56 k	
R18, 19	1-244-867-11 (A) 560	
R20	1-244-890-11 (A) 5.1 k	
R21	1-244-891-11 (A) 5.6 k	
R22	1-244-861-11 (A) 330	
R23, 24	1-244-857-11 (A) 220	
R25, 26	1-244-849-11 (A) 100	
R101, 151	1-244-923-11 (A) 120 k	
R102, 152	1-244-849-11 (A) 100	
R103, 153	1-244-864-11 (A) 430	
R104, 154	1-244-909-11 (A) 33 k	
R105, 155	1-244-865-11 (A) 470	
R107, 157	1-244-862-11 (A) 360	
R108, 158	1-214-162-11 (B) 18 k	1/2 W metal oxide
R109, 159	1-214-472-11 (B) 210 k	1/2 W metal oxide
R116, 166	1-244-945-11 (A) 1	
R117, 167	1-244-909-11 (A) 33 k	
R118, 168	1-244-866-11 (A) 510	
R120, 170	1-244-881-11 (A) 2.2 k	
R201, 251	1-244-897-11 (A) 10 k	
R202, 252	1-244-919-11 (A) 82 k	
R203, 253	1-244-945-11 (A) 1	
R204, 254	1-244-873-11 (A) 1 k	
R205, 255	1-244-905-11 (A) 22 k	
R208, 258	1-244-873-11 (A) 1 k	
R209, 259	1-244-897-11 (A) 10 k	
R214, 264	1-244-873-11 (A) 1 k	

Ref. No.	Part No.	Description
R219, 269	1-244-105-11 (A) 22	
R509, 559	1-244-873-11 (A) 1 k	
R510, 560	1-244-945-11 (A) 1	
R511, 561	1-244-893-11 (A) 6.8 k	
R512, 562	1-244-881-11 (A) 2.2 k	
R513, 563	1-244-897-11 (A) 10 k	
R514, 564	1-244-861-11 (A) 330	
R520, 570	1-244-911-11 (A) 39 k	
R521, 571	1-244-870-11 (A) 750	
R524	1-212-979-11 (A) 75	1/2 W fusible
R531, 581	1-244-905-11 (A) 22 k	
R574	1-212-977-11 (A) 62	1/2 W fusible
R608, 658	1-212-895-11 (A) 390	1/2 W fusible
R611, 661		
R801, 802	1-211-505-11 (A) 20	1/4 W nonflammable
R805, 806	1-212-883-11 (A) 120	1/4 W fusible
R901, 951	1-244-919-11 (A) 82 k	
R1001, 1051	1-244-940-11 (A) 620 k	
R1002, 1052	1-244-837-11 (A) 33	
R1003, 1053	1-244-921-11 (A) 100 k	
RT701, 751	1-222-804-00 (B) 1 k, adjustable	
RT702, 752	1-222-701-00 (B) 10 k, adjustable	
RT703	1-222-978-00 (B) 4.7 k, adjustable	
RV201, 251	1-224-987-00 (H) 100 k, variable; ATTENUATOR	
RV401, 451	1-224-986-00 (E) 100 k, variable; BALANCE	
RV402, 452	1-224-988-00 (H) 50 k, variable; TREBLE	
RV403, 453	1-224-989-00 (H) 51 k, variable; BASS	
RV404	1-552-119-00 (K) 250 k, variable; METER SENS/ MODE including S13	
RV601, 651	1-224-723-00 (C) 250 k, variable; HEADPHONES LEVEL	
RV701, 751	1-222-804-00 (B) 1 k, adjustable	
RV702, 752	1-222-701-00 (B) 10 k, adjustable	
RV703, 753	1-221-978-00 (B) 4.7 k, adjustable	

Note: The components identified by shading and A mark are critical for safety. Replace only with part number specified.

Note: The components identified by shading and A mark are critical for safety. Replace only with part number specified.

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Ref. No. Part No. Description

SWITCHES

S1	1-552-089-00	(E) Lever Slide, FUNCTION (1)
S2	1-552-120-00	(H) Rotary, FUNCTION (2)
S3, 4	1-552-032-00	(D) Lever Slide, TAPE COPY, MONITOR
S5	1-552-118-00	(H) Rotary, MODE
S6	1-552-031-00	(C) Lever Slide, MUTING
S7-9	1-552-090-00	(H) Lever Slide, TONE TURNOVER TREBLE, BASS
S10, 11	1-552-085-00	(D) Lever Slide, HIGH FILTER, LOW FILTER
S13	1-552-119-00	(K) Rotary, METER SENS/MODE; including in RV404
S14	1-552-141-12	(E) Pushbutton, POWER
S15, 65	1-552-165-00	(H) Rotary, PHONO 2

JACKS

J101, 151	1-507-416-XX	(C) 4 p, PHONO 1, 2
J102, 152	1-507-430-XX	(D) 6 p, TUNER, AUX-1, 2
J103-105	1-507-470-00	(C) 4 p, TAPE-1, 2, REC OUT-1, 2, OUTPUT-1, 2
J153-155		
J106-111		
J156-161		
J501	1-507-453-00	(C) TAPE 2
J502	1-507-454-00	(C) REC OUT 2
J601	1-507-453-00	(C) HEADPHONE
CNJ1	1-509-546-00	(D) Socket, 3 p

MISCELLANEOUS

F1	1-532-078-00	(B) Fuse, 1 A
L401, 451	1-407-879-00	(B) Microinductor, 33 mH
ME1, 2	1-520-298-00	(L) Meter, level; including 1-518-273-00 Lamp
RY1, 2	1-515-277-00	(F) Relay
RY3	1-515-267-00	(F) Reed Relay
T1	1-442-975-00	(S) Transformer, power
	1-508-897-00	(C) Plug, voltage selector

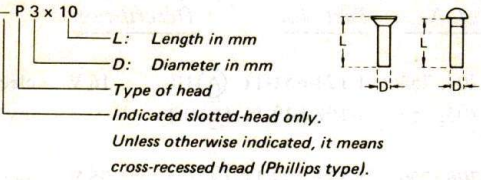
ACCESSORIES & PACKING MATERIALS

Part No.	Description
1-506-113-00	(B) Short Plug
1-551-085-00	(F) Phono Cord
3-701-630-00	(A) Bag, plastic; printed matters
4-837-003-00	(C) Bag, protection
4-838-952-00	(C) Cushion
4-848-830-01	(H) Carton

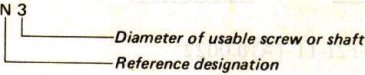
Note: The components identified by shading and A mark are critical for safety. Replace only with part number specified.

HARDWARE NOMENCLATURE

Screw:



Nut, Washer, Retaining ring:



Reference Designation	Shape	Description	Remarks
SCREWS			
P		pan-head screw	binding-head (B) screw for replacement
PWH		pan-head screw with washer face	binding-head (B) screw and flat washer for replacement
PS PSP		pan-head screw with spring washer	binding-head (B) screw and spring washer for replacement
PSW PSPW		pan-head screw with spring and flat washers	binding-head (B) screw and spring and flat washers for replacement
R		round-head screw	binding-head (B) screw for replacement
K		flat-countersunk-head screw	
RK		oval-countersunk-head screw	
B		binding-head screw	
T		truss-head screw	binding-head (B) screw for replacement
F		flat-fillister-head screw	
RF		fillister-head screw	
BV		braizer-head screw	

Reference Designation	Shape	Description	Remarks
SELF-TAPPING SCREWS			
TA		self-tapping screw	ex: TA, P 3 x 10
PTP		pan-head self-tapping screw	binding-head self-tapping (TA, B) screw for replacement
PTPWH		pan-head self-tapping screw with washer face	binding-head self-tapping (TA, B) screw and flat washer for replacement
PTTWH		pan-head thread-rolling screw with washer face	binding-head (B) screw and flat washer for replacement
SET SCREWS			
SC		set screw	
SC		hexagon-socket set screw	ex: SC 2.6 x 4, hexagon socket
NUT			
N		nut	
WASHERS			
W		flat washer	
SW		spring washer	
LW		internal-tooth lock washer	ex: LW3, internal
LW		external-tooth lock washer	ex: LW3, external
RETAINING RINGS			
E		retaining ring	
G		grip-type retaining ring	

1/4 WATT CARBON RESISTORS

Ω	Part No.	Ω	Part No.	Ω	Part No.	Ω	Part No.	Ω	Part No.	Ω	Part No.	Ω	Part No.
1.0	1-244-601-11	10	1-244-625-11	100	1-244-649-11	1.0k	1-244-673-11	10k	1-244-697-11	100k	1-244-721-11	1.0M	1-244-745-11
1.1	1-244-602-11	11	1-244-626-11	110	1-244-650-11	1.1k	1-244-674-11	11k	1-244-698-11	110k	1-244-722-11	1.1M	1-244-746-11
1.2	1-244-603-11	12	1-244-627-11	120	1-244-651-11	1.2k	1-244-675-11	12k	1-244-699-11	120k	1-244-723-11	1.2M	1-244-747-11
1.3	1-244-604-11	13	1-244-628-11	130	1-244-652-11	1.3k	1-244-676-11	13k	1-244-700-11	130k	1-244-724-11	1.3M	1-244-748-11
1.5	1-244-605-11	15	1-244-629-11	150	1-244-653-11	1.5k	1-244-677-11	15k	1-244-701-11	150k	1-244-725-11	1.5M	1-244-749-11
1.6	1-244-606-11	16	1-244-630-11	160	1-244-654-11	1.6k	1-244-678-11	16k	1-244-702-11	160k	1-244-726-11	1.6M	1-244-750-11
1.8	1-244-607-11	18	1-244-631-11	180	1-244-655-11	1.8k	1-244-679-11	18k	1-244-703-11	180k	1-244-727-11	1.8M	1-244-751-11
2.0	1-244-608-11	20	1-244-632-11	200	1-244-656-11	2.0k	1-244-680-11	20k	1-244-704-11	200k	1-244-728-11	2.0M	1-244-752-11
2.2	1-244-609-11	22	1-244-633-11	220	1-244-657-11	2.2k	1-244-681-11	22k	1-244-705-11	220k	1-244-729-11	2.2M	1-244-753-11
2.4	1-244-610-11	24	1-244-634-11	240	1-244-658-11	2.4k	1-244-682-11	24k	1-244-706-11	240k	1-244-730-11	2.4M	1-244-754-11
2.7	1-244-611-11	27	1-244-635-11	270	1-244-659-11	2.7k	1-244-683-11	27k	1-244-707-11	270k	1-244-731-11	2.7M	1-244-755-11
3.0	1-244-612-11	30	1-244-636-11	300	1-244-660-11	3.0k	1-244-684-11	30k	1-244-708-11	300k	1-244-732-11	3.0M	1-244-756-11
3.3	1-244-613-11	33	1-244-637-11	330	1-244-661-11	3.3k	1-244-685-11	33k	1-244-709-11	330k	1-244-733-11	3.3M	1-244-757-11
3.6	1-244-614-11	36	1-244-638-11	360	1-244-662-11	3.6k	1-244-686-11	36k	1-244-710-11	360k	1-244-734-11	3.6M	1-244-758-11
3.9	1-244-615-11	39	1-244-639-11	390	1-244-663-11	3.9k	1-244-687-11	39k	1-244-711-11	390k	1-244-735-11	3.9M	1-244-759-11
4.3	1-244-616-11	43	1-244-640-11	430	1-244-664-11	4.3k	1-244-688-11	43k	1-244-712-11	430k	1-244-736-11	4.3M	1-244-760-11
4.7	1-244-617-11	47	1-244-641-11	470	1-244-665-11	4.7k	1-244-689-11	47k	1-244-713-11	470k	1-244-737-11	4.7M	1-244-761-11
5.1	1-244-618-11	51	1-244-642-11	510	1-244-666-11	5.1k	1-244-690-11	51k	1-244-714-11	510k	1-244-738-11	5.1M	1-244-762-11
5.6	1-244-619-11	56	1-244-643-11	560	1-244-667-11	5.6k	1-244-691-11	56k	1-244-715-11	560k	1-244-739-11		
6.2	1-244-620-11	62	1-244-644-11	620	1-244-668-11	6.2k	1-244-692-11	62k	1-244-716-11	620k	1-244-740-11		
6.8	1-244-621-11	68	1-244-645-11	680	1-244-669-11	6.8k	1-244-693-11	68k	1-244-717-11	680k	1-244-741-11		
7.5	1-244-622-11	75	1-244-646-11	750	1-244-670-11	7.5k	1-244-694-11	75k	1-244-718-11	750k	1-244-742-11		
8.2	1-244-623-11	82	1-244-647-11	820	1-244-671-11	8.2k	1-244-695-11	82k	1-244-719-11	820k	1-244-743-11		
9.1	1-244-624-11	91	1-244-648-11	910	1-244-672-11	9.1k	1-244-696-11	91k	1-244-720-11	910k	1-244-744-11		

Sony Corporation

9-958-390-11

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77K0567-1
Printed in Japan