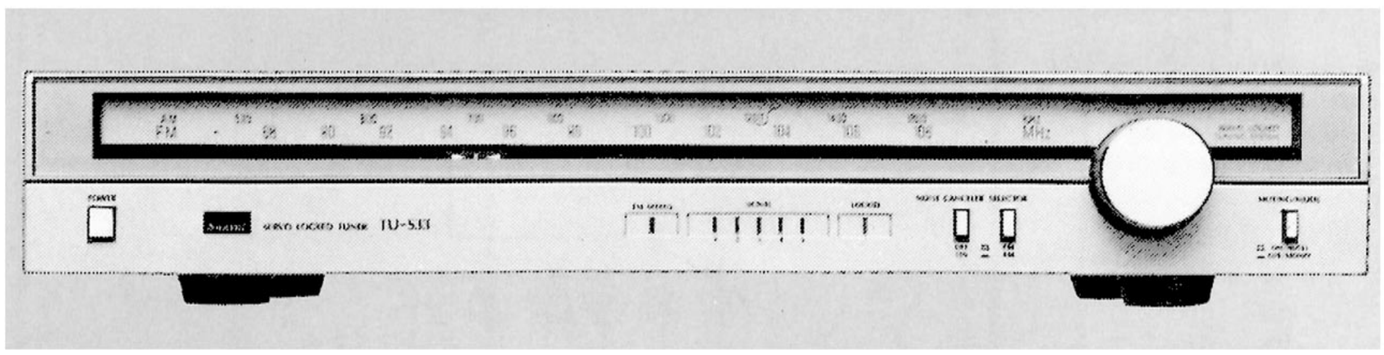
SERVICE MANUAL

SERVO LOCKED TUNER

SANSUI TU-S33/S33L



SANSUI ELECTRIC CO., LTD.

• SPECIFICATIONS

FM Section

Tuning range . . . . . 88 to 108 MHz

Usable sensitivity

Mono IHF . . . . . 10.6 dBf (1.85 μV: T100)

DIN . . . . . 0.9 μV

50 dB quieting sensitivity

Mono . . . . . .16.5 dBf

Stereo . . . . . 36.5 dBf

Signal to noise ratio at 65 dBf

Mono . . . . . 81 dB

Stereo . . . . . 76 dB

Distortion at 65 dBf

Mono . . . . . less than 0.08 % at 100 Hz
less than 0.08 % at 1,000 Hz
less than 0.08 % at 6,000 Hz

Stereo . . . . . less than 0.09 % at 100 Hz
less than 0.09 % at 1,000 Hz
less than 0.09 % at 6,000 Hz

Alternate channel selectivity (at 400 kHz)

. . . . . 60 dB

Capture ratio . . . . . 1.0 dB

Image response ratio . . 50 dB (at 98 MHz)

Spurious response ratio 75 dB (at 98 MHz)

Stereo separation . . . . 40 dB at 100 Hz
50 dB at 1,000 Hz
35 dB at 10,000 Hz

Frequency response

Stereo . . . . . 30 to 15,000 Hz
+0.3 dB, −1.0 dB

Antenna input impedance

. . . . . 300 ohms balanced
75 ohms unbalanced

AM (MW, LW) Section

Tuning range . . . . . MW: 530 to 1,600 kHz
LW: 150 to 350 kHz
<TU-S33L Only>

Usable sensitivity . . . . MW: 56 dB/m (630 μV/m)
LW: 58 dB/m (794 μV/m)
<TU-S33L Only>

Selectivity (±9 kHz) . . 30 dB

Signal to noise ratio . . 45 dB

Distortion (at 30 % Modulation, 80 dB/m)

. . . . . less than 0.5 %

Image response ratio (MW)

. . . . . 45 dB at 1,000 kHz

IF response ratio (MW)

. . . . . 35 dB at 1,000 kHz

Others

Output voltage and impedance

OUTPUT . . . . . 0.5 V/2.2 kilohms

Power requirements . . 220/240 V (50/60 Hz)

For U.S.A. and Canada

. . . . . 120 V (60 Hz)

Power consumption . . 14 W

Dimensions . . . . . 430 mm (16-15/16") W
76 mm (3") H
272 mm (10-3/4") D

Weight . . . . . 3.5 kg (7.7 lbs.) net
4.5 kg (9.9 lbs.) packed

* **Design and specifications subject to changes without notice for improvements.**

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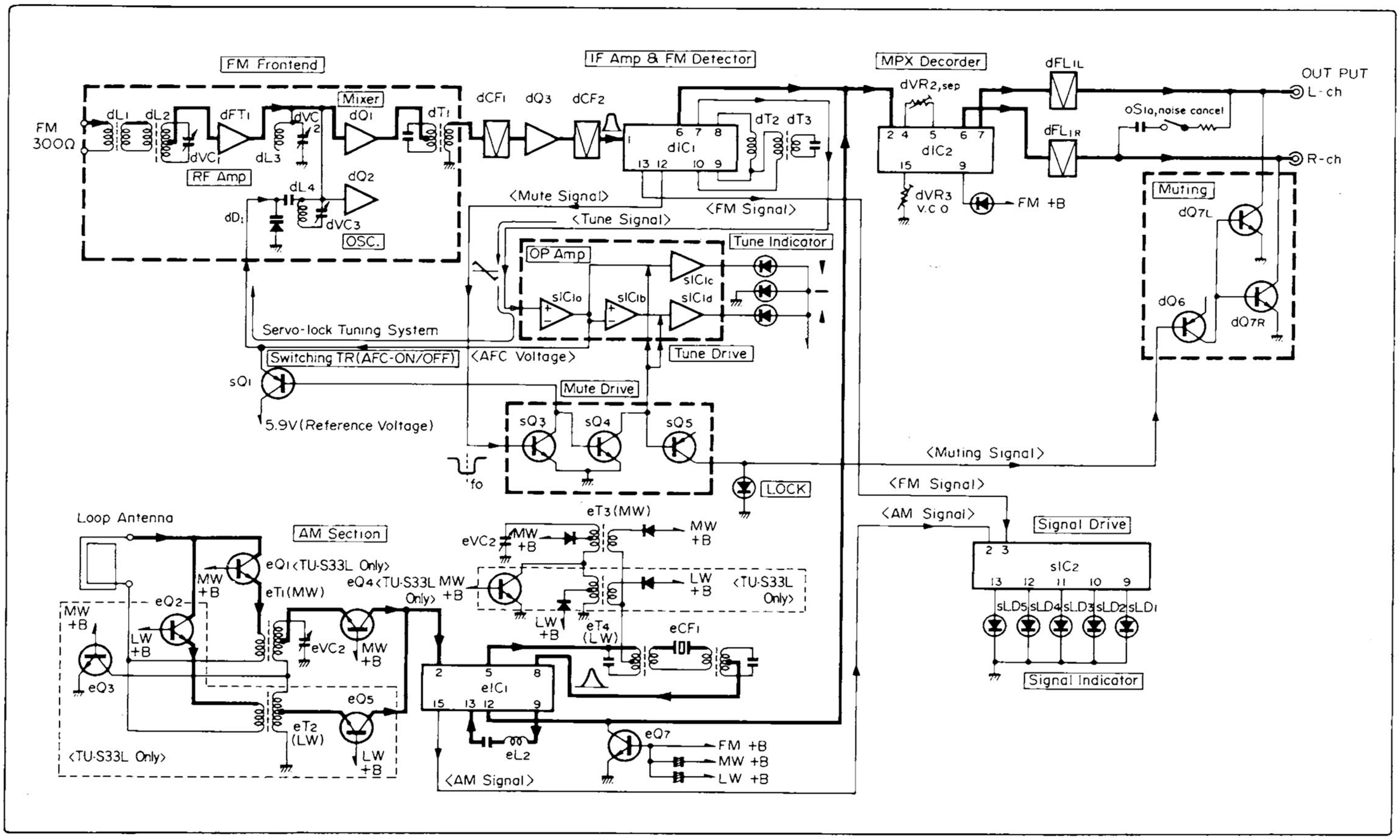
1. BLOCK DIAGRAM



2. OPERATIONS (See Block Diagram)

2-1. Features of servo-lock tuning system

The use of servo-lock tuning system makes it possible to eliminate tuning error in FM section, maintain a stable receiving, and accurately select an optimum tuning point at which the distortion is minimum and the separation is best.

2-2. Operations of servo-lock tuning system

The servo-lock tuning system comprises a local oscillator section including a variable capacitance diode (dD1), a servo circuit including an operational amplifier (sIC1a and sIC1b) to amplify an AFC voltage applied from an FM detector IC, and a switching circuit (sQ1) to switch AFC operations.
The tuning error can be eliminated by applying a servo voltage to the variable capacitance diode provided in a tuning circuit of the FM front-end local oscillator section.

A. Operation of servo-lock tuning system in detuning

A signal applied to the variable capacitance diode is switched from the reference signal to the servo signal by a muting signal generated from the terminal No. 12 of the FM detector IC (dIC1).
In detuning, since the muting signal becomes a H-voltage level, sQ3 is on and sQ1 is also on; accordingly, the servo signal is not applied to the variable capacitance diode dD1, but the reference voltage signal from the terminal No. 10 of dIC1 is applied to dD1.

B. Operation of servo-lock tuning system in receiving

In receiving FM broadcasting, since the muting signal from the terminal No. 12 of the FM detector IC (dIC1) becomes a L-voltage level, sQ3 is off and sQ1 is also off; accordingly, the AFC signal from the terminal No. 7 of dIC1 is amplified through the operational amplifier sIC1a and sIC1b and then applied to the variable capacitance diode dD1.
Therefore, in case some tuning error occurs due to, for instance, temperature drift, the operational amplifier detects a difference in voltage level between AFC voltage signal and reference voltage signal. This servo signal outputted from the operational amplifier controls the oscillation frequency of the local oscillator section so as to eliminate the tuning error, thereby an optimum tuning point being obtainable at all times.

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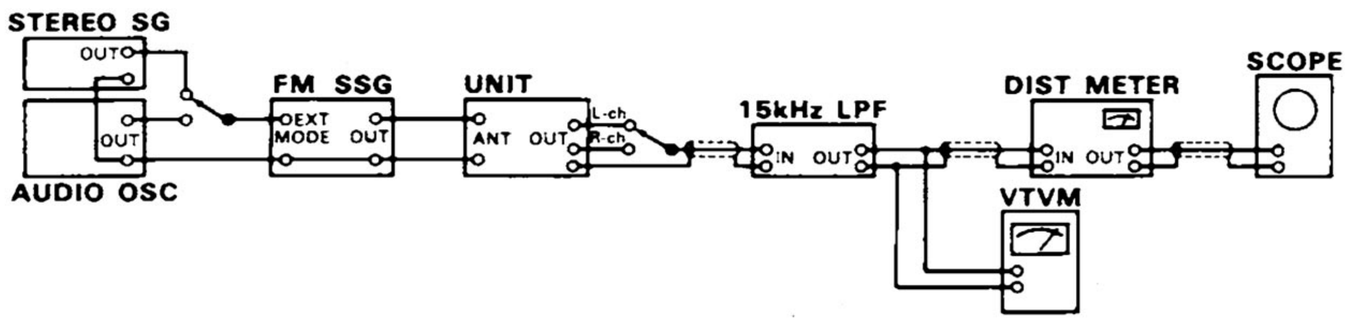
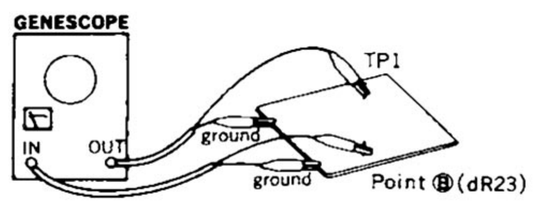
3. ADJUSTMENTS

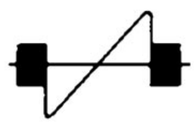
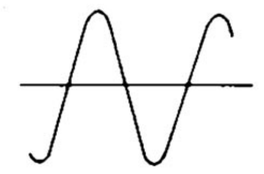
3-1. FM Adjustment (See Top View on Page 5)





(1) FM IF, RF Adjustment and Dial Calibration

Note: 1. Selector . . . . . FM
2. Mode/Muting . . . . . MONO/OFF
3. Short between the TP5 (F-3659) and the ground.

STEP	SUBJECT		FEED SIGNAL FROM	FEED SIGNAL TO	MEASURE OUTPUT	ADJUST	ADJUST FOR	REMARKS
1.	IF Coil Adj.		98MHz ANT Input 20dBf (14.8dB), 1kHz (100% MOD.), FM SSG	ANT terminal 300Ω	Between Point Ⓐ (eR30) & Earth DC Volt Meter	dT1 (F-3659)	Max. DC Volt (about DC 0.7V)	
2.	Discriminator Coil Adj. In case of using Genescope	1	No Input	—	Between dTP2 & dTP3 DC Volt Meter	dT2 (F-3659)	DC 0V ±0.1V	
		2	Output 80dB, Genescope	TP1 (F-3659)	Between Point Ⓑ (dR23) & Earth	dT3, dT2 (F-3659)	Steep linearity of S curve. Make symmetrical S curve.	
	Discriminator Coil Adj. In case of using Dist meter	1	No Input		Between dTP2 & dTP3 DC Volt Meter	dT2 (F-3659)	DC 0V ±0.1V	• Repeat procedures as stated in 1 and 2. • Since the dT1 has already adjusted, perform only a fine adjustment in this procedure.
		2	98MHz ANT Input 65dBf (59.8dB), 1kHz (100% MOD.), FM SSG	ANT terminal 300Ω	OUTPUT L-CH or R-CH, Dist Meter	dT3, dT2 dT1 (F-3659)	Min. THD	
3.	88MHz Dial Calibration		88MHz ANT Input 65dBf (59.8dB), 1kHz (100% MOD.), FM SSG	Same as above	OUTPUT L-CH or R-CH, VTVM & SCOPE	dL4 (F-3659)	Max. Output	• Repeat procedures as stated in 3 and 4.
4.	108MHz Dial Calibration		108MHz ANT Input 65dBf (59.8dB), 1kHz (100% MOD.), FM SSG	Same as above	Same as above	dTC3 (F-3659)	Same as above	
5.	88MHz RF Adj.		88MHz ANT Input Minimum value with since wave 1000Hz (100% MOD.), FM SSG	Same as above	Same as above	dL2, dL3 (F-3659)	Same as above	
6.	108MHz RF Adj.		108MHz ANT Input Minimum value with sine wave, 1000Hz (100% MOD.), FM SSG	Same as above	Same as above	dTC1, dTC2 (F-3659)	Same as above	

(2) FM STEREO Adjustment

1. FM/AM muting switch . . . . . ON
2. Mode/Muting . . . . . AUTO/ON
3. Noise canceler . . . . . OFF

STEP	SUBJECT	FEED SIGNAL FROM	FEED SIGNAL TO	MEASURE OUTPUT	ADJUST	ADJUST FOR	REMARKS
1.	PLL VCO Adj.	98MHz ANT Input 65dBf (59.8dB), FM SSG, Pilot 19kHz 9% MOD.), R or L MODE 1kHz + Pilot (100% MOD.), STEREO SG	ANT terminal 300Ω	Stereo indicator	dVR3 (F-3659)	Light indicator	Adjust the dVR3 within center of lighting level
	PLL VCO Adj. In case of using Freq.	98MHz ANT Input 65dBf (59.8dB), FM SSG, No MOD.	Same as above	Between dTP4 & Earth Freq. counter	dVR3 (F-3659)	19kHz ±50Hz	

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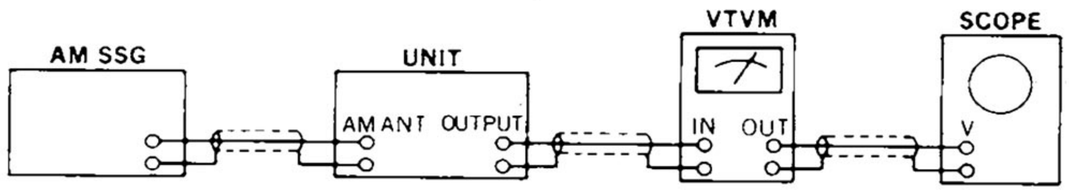
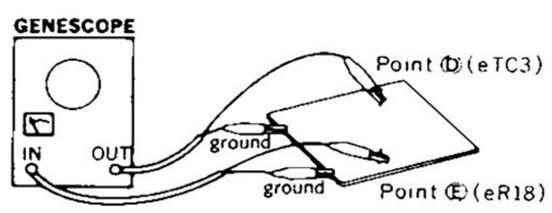
STEP	SUBJECT	FEED SIGNAL		MEASURE OUTPUT	ADJUST	ADJUST FOR	REMARKS
		FROM	TO				
2.	Separation Adj.	98MHz ANT Input 65dBf (59.8dB), FM SSG, Pilot 19kHz (9% MOD.), L MODE 1kHz + Pilot (100% MOD.), STEREO SG.	Same as above	OUTPUT L-CH VTVM & SCOPE	—	Read this indication on VTVM	Confirm R → L-CH
				OUTPUT R-CH VTVM & SCOPE	dVR2 (F-3659)	−35dB from the indication above.	
3.	Muting level Adj.	98MHz ANT Input 23dBf (17.8dB), FM SSG, Pilot 19kHz (9% MOD.), L or R MODE 1kHz + Pilot (100% MOD.), STEREO SG.	Same as above	Stereo indicator or OUTPUT L-CH or R-CH VTVM & SCOPE	dVR1 (F-3659)	Stereo indicator turns ON or Output Signal comes out	

3-2. AM Adjustment (See Top View on Page 5)

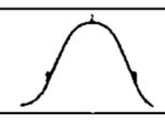
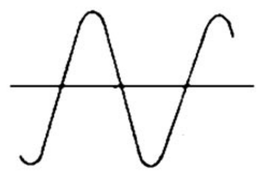
Note: 1. Selector . . . . . AM
2. Mode/Muting . . . . . OFF
3. Connect the AM loop antenna to the AM antenna terminal and GND terminal.





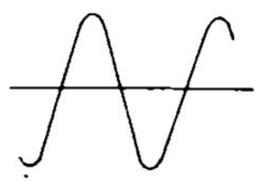
(1) AM IF, RF Adjustment and MW AM Dial Calibration

Note: Band Selector . . . . . MW

STEP	SUBJECT	FEED SIGNAL		MEASURE OUTPUT	ADJUST	ADJUST FOR	REMARKS
		FROM	TO				
1.	IF Coil Adj.	Output 60dB, Genescope	Point Ⓓ (eTC3)	Between Point Ⓔ (eR18) & Earth	eCF1, eT2 (F-3659)	Max. Waveform	
2.	600kHz Dial Calibration	600kHz ANT Input 60dB, 400Hz (30% MOD.), AM SSG	ANT terminal	OUTPUT L-CH or R-CH VTVM & SCOPE	eT3 (F-3659)	Max. Output	• Repeat procedures as stated in 2 and 3.
3.	1400kHz Dial Calibration	1400kHz ANT Input 60dB, 400Hz (30% MOD.), AM SSG	Same as above	Same as above	eTC3 (F-3659)	Same as above	
4.	600kHz RF Adj.	600kHz ANT Input 40dB, 400Hz (30% MOD.), AM SSG	Same as above	Same as above	eT1 (F-3659)	Same as above	
5.	1400kHz RF Adj.	1400kHz ANT Input 40dB, 400Hz (30% MOD.), AM SSG	Same as above	Same as above	eTC1 (F-3659)	Same as above	

(2) LW AM Dial Calibration (TU-S33L Only)

Note: Band Selector . . . . . LW

STEP	SUBJECT	FEED SIGNAL		MEASURE OUTPUT	ADJUST	ADJUST FOR	REMARKS
		FROM	TO				
1.	170kHz Dial Calibration	170kHz ANT Input 60dB, 400Hz (30% MOD.), AM SSG	ANT terminal	OUTPUT L-CH or R-CH VTVM & SCOPE	eT4 (F-3659)	Max. Output	
2.	300kHz Dial Calibration	300kHz ANT Input 60dB, 400Hz (30% MOD.), AM SSG	Same as above	Same as above	eTC4 (F-3659)	Same as above	
3.	170kHz RF Adj.	170kHz ANT Input 40dB, 400Hz (30% MOD.), AM SSG	Same as above	Same as above	eT2 (F-3659)	Same as above	
4.	300kHz RF Adj.	300kHz ANT Input 40dB, 400Hz (30% MOD.), AM SSG	Same as above	Same as above	eTC2 (F-3659)	Same as above	

•Abbreviations

Equipment		Others	
AM FM Generator Oscilloscope	Genescope	Antenna	ANT.
AM Standard Signal Generator	AM SSG	Modulation	MOD.
FM Standard Signal Generator	FM SSG	Total Harmonic Distortion	T.H.D.
FM Stereo Generator	Stereo SG		
Oscilloscope	Scope		
Audio Oscillator	Audio Osc.		
Distortion Meter	Dist. Meter		

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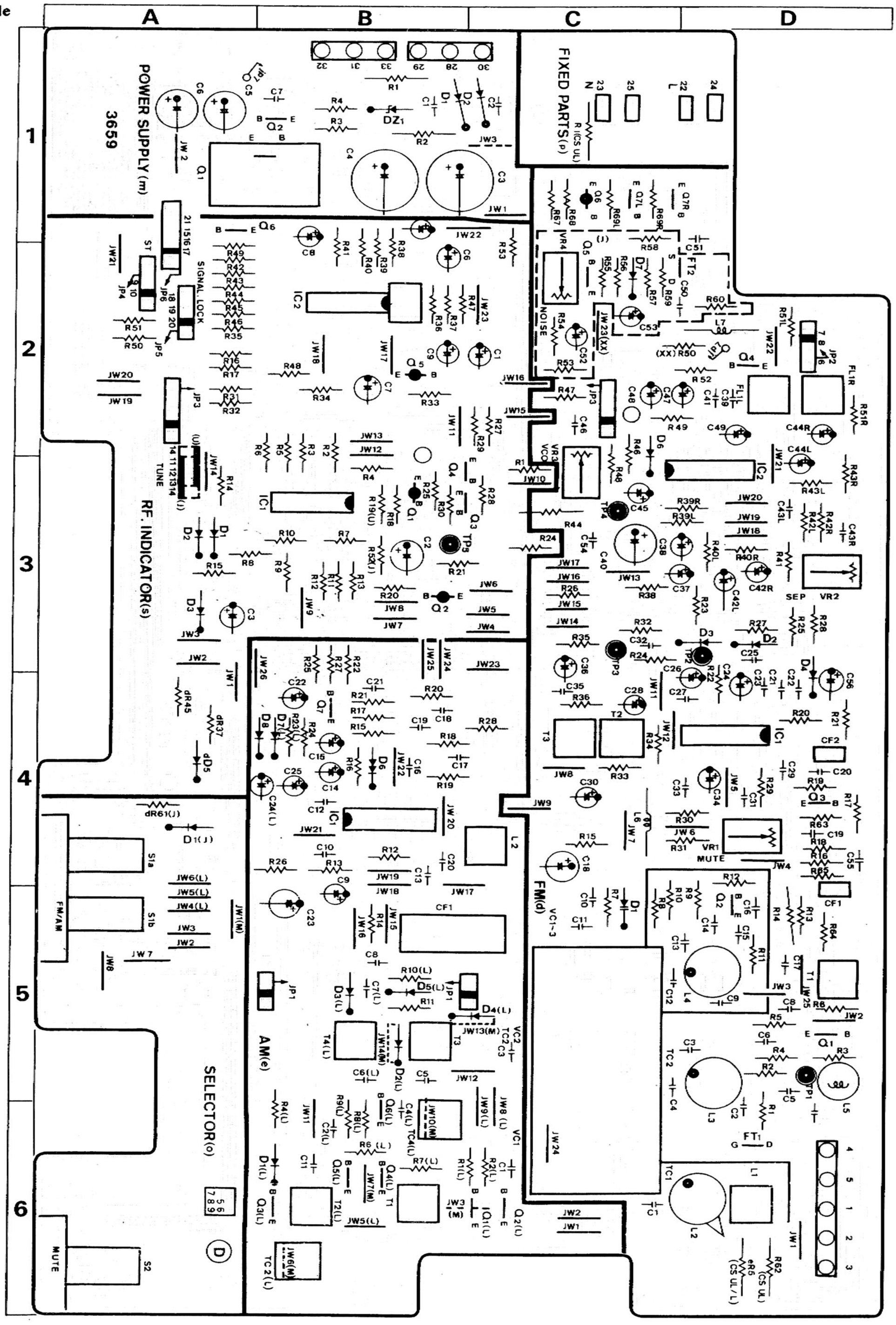
4. PARTS LOCATION & PARTS LIST

●Since some of capacitors and resistors are omitted from parts lists in this Service Manual, refer to the Common Parts List for capacitors & resistors, which was appended previously to Sansui Manual.

4-1. F-3659 AM/FM RF, IF Circuit Board (Stock No. 00660301 = TU-S33/00660805 = TU-S33L)

Component Side



Parts List

Parts No.	Stock No.	Description
●Transistor		
dQ1	03063401	2SC1674
	or 07273601	2SC1923
dQ2	03069501	2SC668
dQ3	03069501	2SC668
dQ4	03059501	2SC945
	or 07194801	2SC1815
	or 03068301	2SC2320
dQ6	07197001	2SA733A
	or 07194701	2SA1015
dQ7	03059501	2SC945
	or 07194801	2SC1815
●FET		
dFT1	03703701	2SK120
●IC		
dIC1	46052600	μPC1208
dIC2	46153600	μPC1235C
●Diode		
dD1	07299300	1S2236
dD2 ~ 6	03117600	1S2473
	or 46086000	1S1588
dVC1	46144100	Variable Capacitor
dCF1	07102210	Ceramic Filter
dCF2	07102210	Ceramic Filter
dLF1	07196400	Low Pass Filter
dL2	42007200	FM RF Coil
dL3	42103400	FM RF Coil
dL4	42204000	FM RF Coil
dL5	49002800	Inductor 1.0μH
dL6	42904600	Peaking Coil
dL7	42904600	Peaking Coil
dT1	42359300	FM IF Coil
dT2	46077600	FM IF Coil
dT3	46086900	FM IF Coil
dVR1	07241500	Semi Variable Resistor 50kΩ (B), mute
dVR2	07241700	Semi Variable Resistor 200kΩ (B), sep.
dVR3	07218000	Semi Variable Resistor 6.8kΩ (B), V.C.O.
dL1	46163700	Balun
●Transistor		
eQ7	03059501	2SC945
	or 07194801	2SC1815
	or 03068301	2SC2320
●IC		
eIC1	03603900	HA1197
	or 03608000	LA1240
●Varistor		
eD6	03401500	MV-12
●Diode		
eD8	03117600	1S2473
	or 46086000	1S1588
eT1	46085900	AM RF Coil
eT3	46079000	AM OSC Coil

Parts No.	Stock No.	Description
eCF1	09103700	Ceramic Filter
eL2	42306200	AM IF Coil
●Transistor		
mQ1	03083902	2SD313
mQ2	03059501	2SC945
	or 07194801	2SC1815
	or 03068301	2SC2320
●Diode		
mD1	03117700	10E-2
mD2	03117700	10E-2
●Zener Diode		
mDZ1	03159800	EQA01-14R
mR1	00179700	120Ω 1W N.I.R.
mR2	00183600	4.7Ω 1W N.I.R.
oS1	46164000	Push Switch, selector
oS3	46163900	Push Switch, mode/muting
●Transistor		
sQ1	07197001	2SA733A
	or 03012701	2SA999
sQ2	07197001	2SA733A
	or 03012701	2SA999
sQ3	03059501	2SC945
	or 07194801	2SC1815
	or 03068301	2SC2320
sQ4	03059501	2SC945
	or 07194801	2SC1815
	or 03068301	2SC2320
sQ5	07197001	2SA733A
	or 07194701	2SA1015
	or 03012701	2SA999
sQ6	03059501	2SC945
	or 07194801	2SC1815
	or 03068301	2SC2320
●IC		
sIC1	07205200	NJM2902N
	or 07258300	MB3614M
sIC2	03611600	LB1416
●Diode		
sD1	03117600	1S2473
	or 46086000	1S1588
sD2	03117600	1S2473
	or 46086000	1S1588
sD3	03117600	1S2473
	or 46086000	1S1588
<TU-S33L Only>		
●Transistor		
eQ1 ~ 4	46118801	2SC2878
●Diode		
eD1 ~ 5	03117600	1S2473
	or 46086000	1S1588
eD7	03117600	1S2473
	or 46086000	1S1588
eTC2	12301000	Trimmer Capacitor
eTC4	12301000	Trimmer Capacitor
eT2	46163600	LW RF Coil
eT4	07258200	LW OSC Coil

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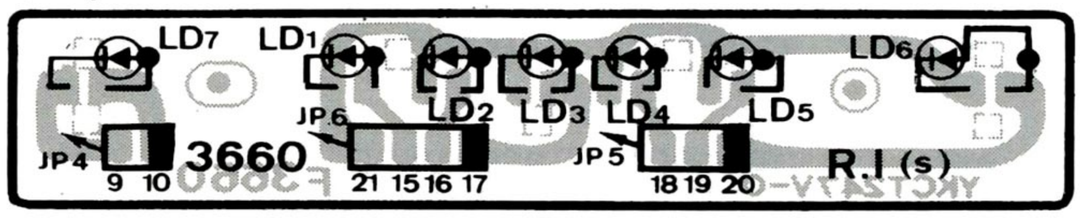
- The circuit boards, F-3660, F-3661 & F-3662 are not supplied as the assembled, the individual parts on the circuit boards, however are provided for orders.

4-2. F-3660 Indicator Circuit Board

Component Side



Parts List

Parts No.	Stock No.	Description
●Light Emitting Diode		
sLD1	46173900	SLP-270C, signal
sLD2	46173900	SLP-270C, signal
sLD3	46173900	SLP-270C, signal
sLD4	46173900	SLP-270C, signal
sLD5	46173900	SLP-270C, signal
sLD6	46174000	SLP-470C, lock
sLD7	46169300	SEL-1210S, stereo

4-3. F-3661 Output Terminal Circuit Board

Parts List

Parts No.	Stock No.	Description
	07249000	2P Output Terminal

4-4. F-3662 Power Switch Circuit Board

Parts List

Parts No.	Stock No.	Description
pC1	00386100	0.0047μF 150V C.C.
pS1	46087300	Push Switch, power

● **Abbreviations**

C.R.	Carbon Resistor	E.L.	Low Leak Electrolytic Capacitor
S.R.	Solid Resistor	E.B.	Bi-Polar Electrolytic Capacitor
Ce.R.	Cement Resistor	E.BL.	Low Leak Bi-Polar Electrolytic Capacitor
M.R.	Metal Film Resistor		
F.R.	Fusing Resistor	Ta.C.	Tantalum Capacitor
N.I.R.	Non-Inflammable Resistor	F.C.	Film Capacitor
C.C.	Ceramic Capacitor	M.P.	Metalized Paper Capacitor
C.T.	Ceramic Capacitor, Temperature Compensation	P.C.	Polystyrene Capacitor
		G.C.	Gimmic Capacitor
E.C.	Electrolytic Capacitor		

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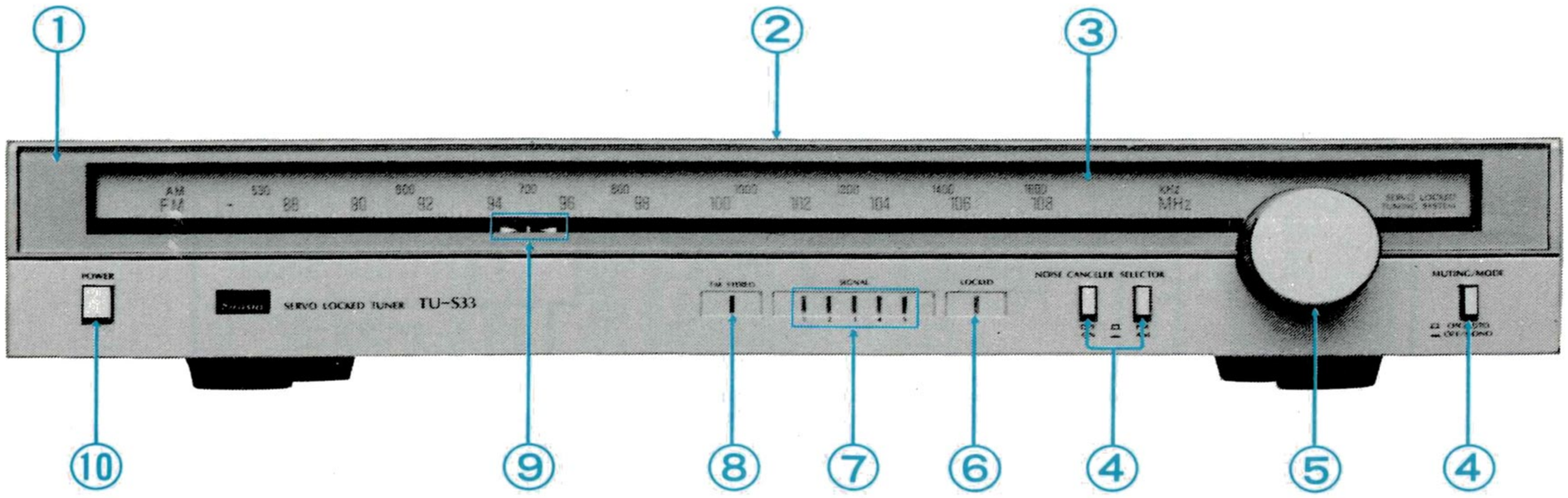
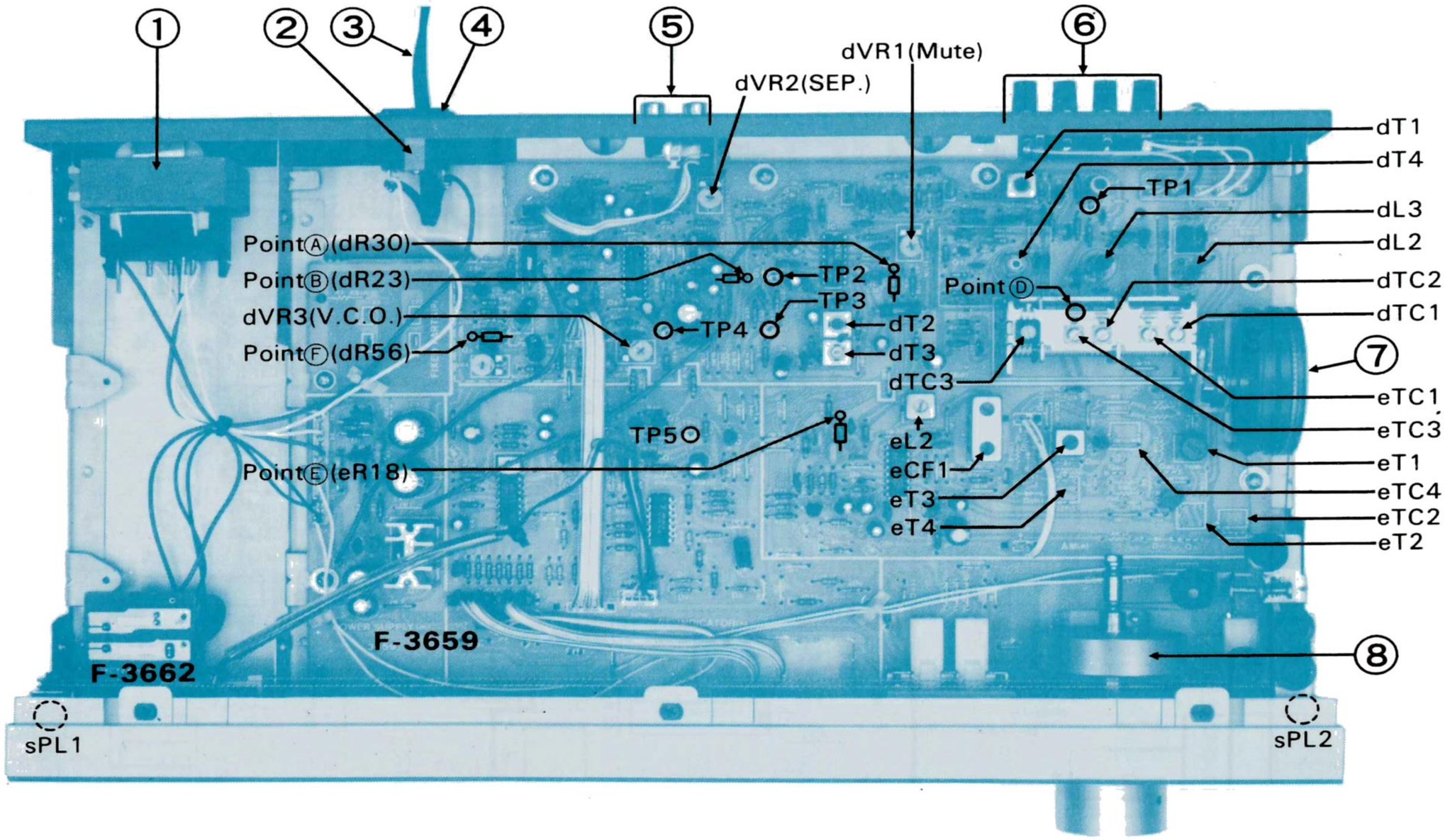
5. OTHER PARTS

5-1. Front View



5-2. Top View



Parts List <Front View>

Parts No.	Stock No.	Description
1	07824500	Front Panel Ass'y <TU-S33·Silver>
	07824600	Front Panel Ass'y <TU-S33·Black>
	07824700	Front Panel Ass'y <TU-S33L·Black>
2	07823210	Bonnet <Silver·TU-S33 Only>
	07823310	Bonnet <Black>
3	07825800	Dial Scale <TU-S33>
	07826000	Dial Scale <TU-S33L>
4	07809500	Push Knob <Silver·TU-S33 Only>
	07809600	Push Knob <Black>
5	07824000	Knob <Silver·TU-S33 Only>
	07824100	Knob <Black>
6	46174000	SLP-470C LED, lock
7	46173900	SLP-270C LED, signal
8	46169300	SEL-1210S LED, stereo
9	07264700	LED Ass'y
10	07809700	Push Knob <Silver·TU-S33 Only>
	07809800	Push Knob <Black>

Parts List <Top View>

Parts No.	Stock No.	Description
1	15005601	Power Transformer <TU-S33>
	15005605	Power Transformer <TU-S33L>
2	07189600	AC Outlet
3	38004700	AC Cord
4	39106000	Strain Relief
5	07249000	2P Output Terminal Board
6	22104000	Antenna Terminal Board
7	61467220	Pulley
8	07823100	Tuning Unit
sPL1	46168400	Pilot Lamp, 14V 85mA
sPL2	46168300	Pilot Lamp, 14V 85mA

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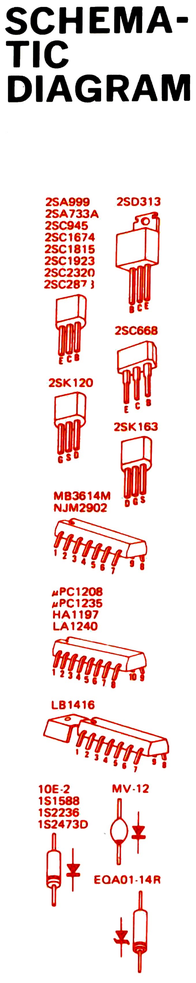
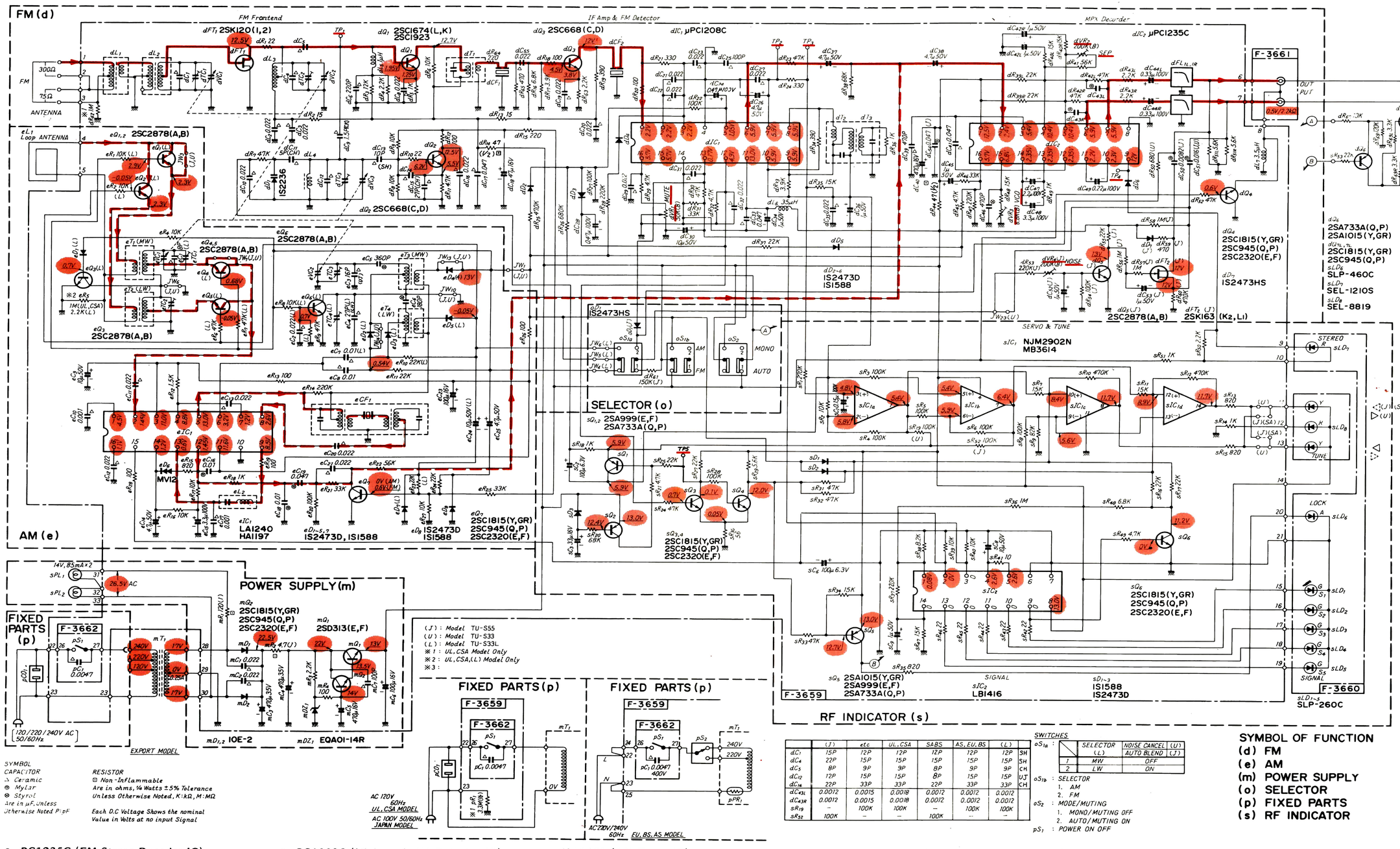
6. SCHEMATIC DIAGRAM





SYMBOL
CAPACITOR
Δ Ceramic
Ⓜ Mylar
Ⓢ Styrol
Are in μF, Unless Otherwise Noted P:pF

RESISTOR
⊡ Non-Inflammable
Are in ohms, ¼ Watts ±5% Tolerance
Unless Otherwise Noted, K:kΩ, M:MΩ

Each D.C Voltage Shows the nominal Value in Volts at no input Signal

	(J)	etc	UL,CSA	SABS	AS,EU,BS	(L)	
dC1	15P	12P	12P	12P	12P	12P	SH
dC4	22P	15P	15P	15P	15P	15P	SH
dC3	8P	9P	9P	8P	9P	9P	CH
dC12	12P	15P	15P	8P	15P	15P	UJ
dC14	22P	33P	33P	22P	33P	33P	CH
dC43L	0.0012	0.0015	0.0018	0.0012	0.0012	0.0012	
dC43R	0.0012	0.0015	0.0018	0.0012	0.0012	0.0012	
sR19	–	100K	100K	–	100K	100K	
sR52	100K	–	–	100K	–	–	

SWITCHES

oS1a :

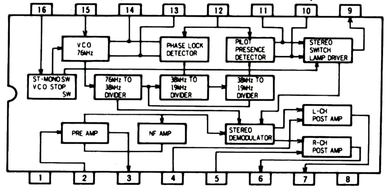
	SELECTOR	NOISE CANCEL (U)
	(L)	AUTO BLEND (J)
1	MW	OFF
2	LW	ON

oS1b : SELECTOR 1. AM 2. FM

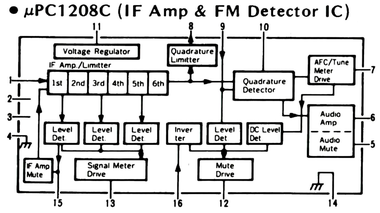
oS2 : MODE/MUTING 1. MONO/MUTING OFF 2. AUTO/MUTING ON

pS1 : POWER ON OFF

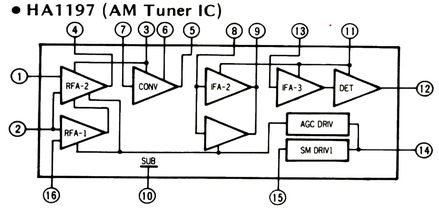
● μPC1235C (FM Stereo Decoder IC)



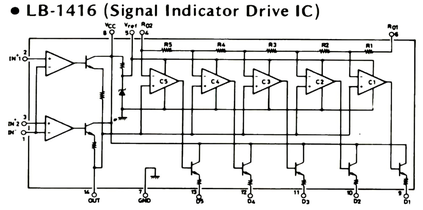
● μPC1208C (IF Amp & FM Detector IC)



● HA1197 (AM Tuner IC)



● LB-1416 (Signal Indicator Drive IC)



7. THREADING OF DIAL CORD

7-1. Replacement of Dial Cord

Thread the dial cord in numerical order from ① to ⑭ as Fig. 7-1.
Close the variable capacitor completely.

* Dial Cord (0.5 mmϕ) <Stock No. 60360520>

7-2. Attachment of Dial Pointer

1. Close the variable capacitor completely.
2. Set the dial pointer to the start-point as Figs. 7-1, 7-2.

- Confirm that the dial pointer runs smoothly on the dial scale by turning the tuning shaft.
- Move the position A of the clip pushing the dial thread in the arrow direction and then pull it upward to remove the clip.

* Clip (Dial Pointer) <Stock No. 07654600>

Fig. 7-1

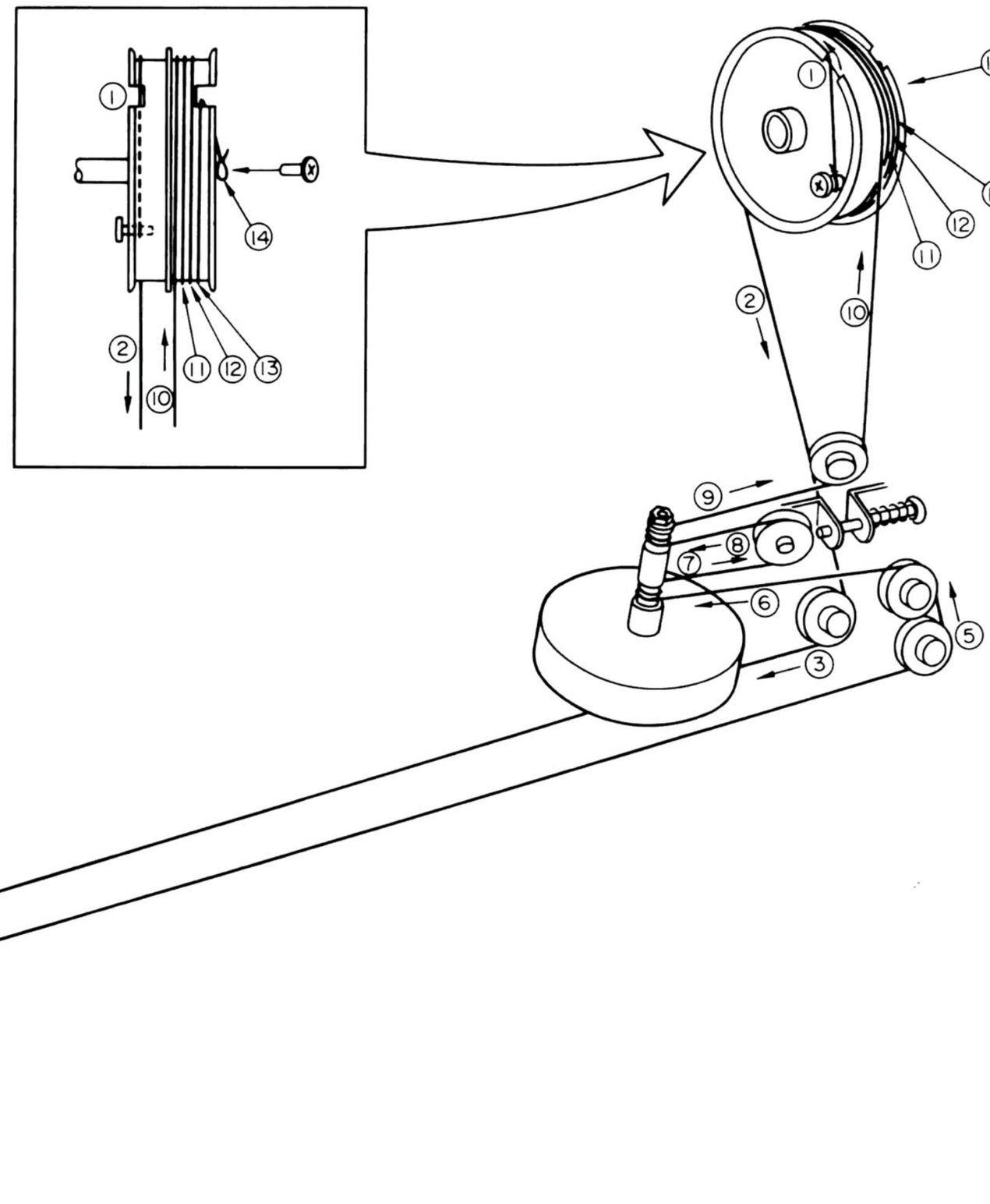


Fig. 7-2

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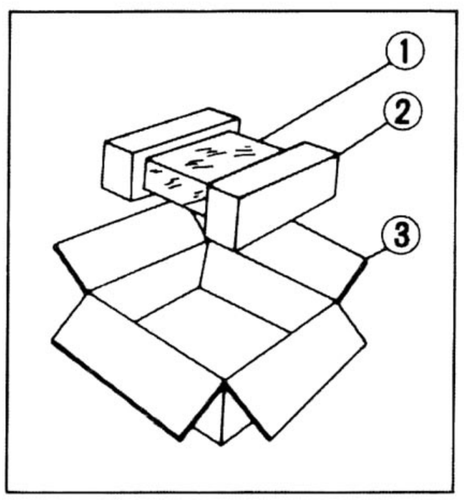
8. PACKING LIST

Parts No.	Stock No.	Description
1	07599500	Vinyl Cover
2	07827200	Styrofoam Packing
3	07827110	Carton Case <TU-S33, Silver>
	07827010	Carton Case <TU-S33, Black>
	07826810	Carton Case <TU-S33L, Black>



9. ACCESSORY LIST

Stock No.	Description
46141900	Operating Instruction <TU-S33>
46142000	Operating Instruction <TU-S33L>
38103300	PJP Cord
46051700	FM Antenna
07198900	AM Loop Antenna
07563000	Loop Antenna Holder

Sansui

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