LAS-5500
AUDIO SYSTEM ANALYZER
SERVICE MANUAL

CONTENTS

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NOTE

These servicing instructions are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing other than that contained in the service manual unless you are qualified to do so.

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1. Test Equipment Required

The following test equipment is required for calibration and servicing of the Model LAS-5500. The suggested specifications are the minimum necessary for proper calibration of this instrument.

Test Equipment	Minimum Spec.
- Multimeter	Accuracy < ±1%
- Oscilloscope	1mV sensitivity 10MHz band width
- Frequency Counter	10Hz-1MHz 5 digit
- Distortion Meter	10Hz-500kHz 0.1%-1% full scale
- AC Millivoltmeter	0.3mV-10V full scale 10Hz-1MHz band width
- Wow & Flutter Calibrator	LEADER Model LFM-7000 or equivalent
- AC Voltmeter Calibrator	0.3mV-100V 400 or 1kHz
- Amplitude Calibrator	50mV-50Vp-p
- Sine wave Generator	10Hz-5MHz Flatness < ±0.5dB
- Square Wave Generator	Rise time 10nS
- Capacitance Meter	40pF

2. Calibration Procedure

* Calibration should be performed after a 30 minute warm-up period. It should also be confirmed that the unit is connected to the rated power line voltage.

* All adjustment should be completed in the given order, because some adjustments interact with others.

* During the adjustment procedure, remove the case only when necessary and replace immediately after making an adjustment. This will maintain all circuit at constant operating temperature.

1) Adjustment of Meter Mechanical Zero

a) Turn the instrument off and allow 30 second for all capacitors discharge.

b) Rotate zero adjustment screw clockwise or counterclockwise so that pointer indicates exactly zero.

c) After pointer is exactly at zero, rotate the screw slightly opposite direction to release tension of meter suspension.

2) Initial Control Settings

The initial control settings to be used for each check and adjustment are listed below. Any variations from these settings are stated in the applicable procedure.

- AUDIO GENERATOR

FREQ.	x1k
Freq. dial	1
OUTPUT LEVEL	Fully CW

- ATTENUATOR

ATT INPUT	FROM
ATTENUATION dB	0
600 ohm LOAD	OUT

- WOW FLUTTER METER

0 ADJ	Center
FUNCTION	CAL
INDICATION	JIS
WOW & FLUTTER	1%
METER MODE	W&F

- MILLIVOLTMETER

RANGE	100V
LEFT-RIGHT	LEFT

- OSCILLOSCOPE

SWEEP FREQ. Hz	100-1k
SWEEP FREQ. VARIABLE	Center
VERT INPUT	x1
VERT INPUT VARIABLE	Fully CW
V IN COUPLING	DC
INTENSITY	As desired
FOCUS	Best focused display
V-POSITION	Center
H-POSITION	Center

3) Audio Generator

a) Power Supply

- Connect the DC voltmeter to test point and ground line of PC board (T-1132).

- Adjust voltage according to Table 2-1.

Test point	Adj.	Voltage
Q201 emitter	VR201	+20V
Q202 collector	VR202	-20V

Table 2-1

b) Voltage Adjustment of CDS

- Set: FREQ. x1k
  Dial 1

- Connect the DC voltmeter to test point of CDS and ground line.

- Adjust VR104 for a reading of +7V within $\pm$0.1V.

- Connect the AC millivoltmeter to OSC OUTPUT connector.
  Output Level at maximum
- Adjust VR105 for a reading of 6.6Vrms into open circuit.

- Repeat above adjustment to obtain the accurate voltages.

c) Frequency Adjustment

- 1kHz, 10kHz (x1k)

  Set: FREQ. 1k
  Dial ≃1

· Connect the frequency counter to OSC OUTPUT connector.

· Adjust the dial for a reading of 1000Hz on the frequency counter.

· If the frequency error is ±2% (980Hz-1020Hz) or more, adjust frequency by following procedure:

  Set the dial for a reading of 1000Hz on the frequency counter.

  Make loose the screws on the flexible coupler of variable capacitor (VC1001).

  Position the "1" of the dial at the pointer. (Variable capacitor does not move.)

  Make tighten the coupler screws.

  Set "10" of the dial to pointer.

  Adjust {VC102 / VC105} for frequency reading of 10kHz.

CDSV	f	VC	↻
↑	↑	VC102	CW
↑	↓	VC105	CCW
↓	↑	VC105	CW
↓	↓	VC102	CCW

  Repeat above adjustment for best calibration accuracy.

- 1MHz (x100k)

· Set: FREQ ~~x10k~~ x100K
  Dial 10

CDSV	f	VC	↻
↑	↑	101	CW
↑	↓	107	CCW
↓	↑	107	CW

· Adjust VC101 and VC107 alternately for frequency reading of 1MHz, CDS voltage reading of approximately +7V.

- 100kHz (x10k)

· Set: FREQ. x10k
Dial 10

· Adjust VC102 and VC106 alternately for frequency reading of 00kHz, CDS voltage reading of approximately +7V.

- Other FREQ. ranges

· Adjust frequency of other ranges according to Table 2-2.

Frequency	FREQ.	Dial	Adj
10Hz	x10	1	VR101
100Hz		10	VC103
1kHz	x100	10	VC104

Table 2-2

d) Distortion Adjustment

- Set: FREQ. 1k
Dial 10

- Connect the distortionmeter to OSC OUTPUT connector.

- Adjust the controls of distortionmeter to obtain null point.

- Adjust VR102 for minimum distortion.
(Typically less than 0.045%)

- Set: FREQ. x100k
Dial 5

- Adjust the controls of distortionmeter to obtain null point.

- Adjust VR103 for a distortion of approximately 0.38% as shown in Figure 2-1.

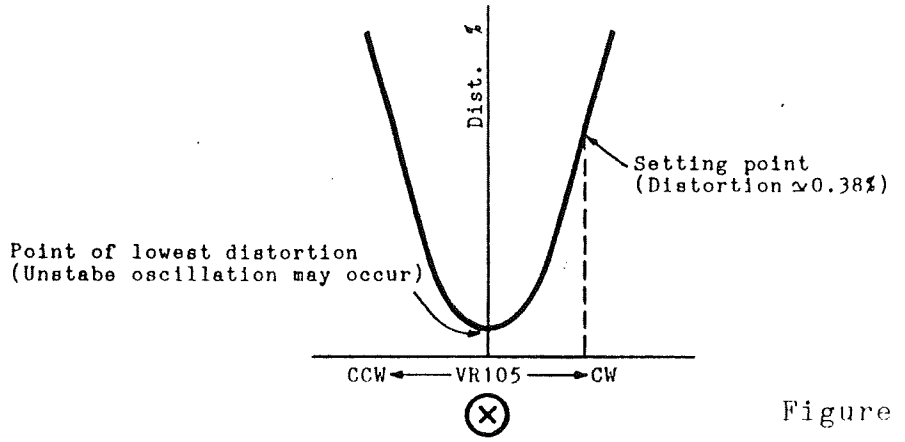


Figure 2-1

- Check the distortion according to Table 2-3.

Frequency	FREQ.	Distortion
10Hz	x10	1%
100Hz	x100	0.1%
1kHz	x1k	0.05%
10kHz	x10k	0.05%
100kHz	x100k	0.1%
500kHz		1%

Table 2-3

4) ATTENUATOR

a) Attenuation Check

- Set: FREQ. x1k
  Dial 1
  ATT INPUT FROM
  600 ohm LOAD IN
  ATTENUATION 0dB

- Connect the AC millivoltmeter to OUTPUT terminal and set the RANGE switch to 3V full scale.

- Adjust OUTPUT LEVEL control for reading of +10dB.

- Check the attenuator by rotating the 0.1dB step switch from 0dB to 1.0dB.

- Apply the same procedure for other attenuation ranges.

5) WOW FLUTTER METER

a) Power Supply

- Connect the DC voltmeter to test point and chassis.

- Adjust voltage accordiong to Table 2-4.

Test point	Adj	Voltage
Q1002 emitter	VR302	+15V
Q1001 collector	VR303	-15V

Table 2-4

b) 3kHz Oscillator Adjustment

- Turn POWER switch off.

- Remove PC board (T-1138) from connector and join with extension PC board, then insert to the same connector.

- Turn POWER switch on.

- Connect the AC millivoltmeter to 3kHz OUTPUT connector.

- Adjust 3kHz LEVEL adjustment (inside of the oscillator unit) for meter reading of approximately 300mVrms.

- Connect the frequency counter to 3kHz OUTPUT connector.

- The frequency reading should be 3000.0Hz within 2.5Hz (2997.5Hz to 3002.5Hz).

c) Input Sensitivity Adjustment

- Set: LAS-5500

0 ADJ	Center
FUNCTION	W&F
INDICATION	JIS
METER MODE	W&F

W&F Calibrator

STANDARD	JIS
FUNCTION	DRIFT 0%
OUTPUT LEVEL	13mV

- Adjust VR301 so that the INPUT MONITOR lamp just comes up.

d) Adjustment of DRIFT meter -1 (JIS, CCIR)

- Set: LAS-5500

  Same as c)

  W&F Calibrator

OUTPUT LEVEL	1V
Others	Same as c)

- Adjust VR401 for reading of 0%.

- Set the FUNCTION switch of W&F calibrator to DRIFT +5% or -5%.

- Adjust VR403 for reading of +5% or -5%.

- Repeat above adjustment to obtain the accurate DRIFT meter reading.

e) Adjustment of DRIFT meter -2 (DIN)

- Set: LAS-5500

INDICATION	DIN
Others	Same as c)

  W&F Calibrator

STANDARD	DIN
FUNCTION	DRIFT 0%

- Adjust VR402 for reading of 0%.

f) Adjustment of TO SCOPE output voltage

- Set: LAS-5500

FUNCTION	WTD
INDICATION	JIS
WOW & FLUTTER %	1%

  W&F Calibrator

FUNCTION	WOW
STANDARD	JIS
WAVEFORM	∿

FREQUENCY	10Hz
W&F %	1%
COUNTER FUNCTION	MOD

- Connect the W&F Calibrator to INPUT connector.

- Connect the AC millivoltmeter to TO SCOPE terminal on the rear panel.

- Adjust VR406 for reading of 1Vrms.

g) Adjustment of W&F meter -1 (JIS)

- WTD Full Scale Adjustment

· Set: LAS-5500
Same as f)

W&F Calibrator

FREQUENCY	4Hz
Others	Same as f)

· Adjust VR502 for reading of 1%.

- W&F Full Scale Adjustment

· Set the FUNCTION switch to W&F

· Adjust VR408 for reading of 1%.

- W&F Frequency Response Adjustment -1

· Set the FREQUENCY of W&F calibrator to 200Hz.

· Adjust VR405 for reading of 0.7%.

· Change the FREQUENCY to 0.5Hz.

· Adjust VR409 for maximum indication of 0.7%.

with VR409.

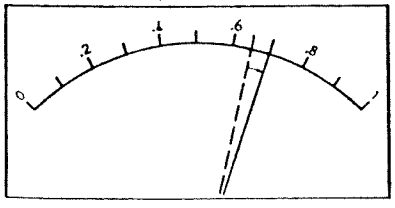


Figure 2-2

h) Adjustment of W&F meter -2 (CCIR)

- WTD Full Scale Adjustment

· Set: LAS-5500

FUNCTION	WTD
INDICATION	CCIR
WOW & FLUTTER %	1%

W&F Calibrator

STANDARD	CCIR
WAVEFORM	∿
FREQUENCY	4Hz
W&F %	1%

· Connect the oscilloscope to test point on the PC board (1139).

· Adjust VR501 for amplitude of 10Vp-p.

· Remove the oscilloscope from the test point.

· Adjust VR505 for reading of 1%.

- Meter Damping Adjustment

· Set WAVEFORM switch of the W&F calibrator to 100mS + PULSE.

· Adjust VR504 for minimum indication of between 0.37 and 0.45. (Maximum indication should be between 0.96 and 1.04.)

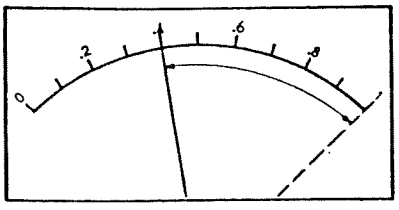


Figure 2-3

· Set the WAVEFORM switch to 10mS + PULSE.

· Adjust VR503 for maximum indication of 0.22%.

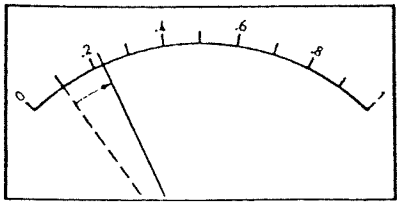


Figure 2-4

· Set the WAVEFORM switch to 100mS + PULSE.

· Adjust VR509 for maximum indication of 1.0.

· Repeat above adjustment (VR505 to 509) to obtain the best meter damping and accuracy according to Table 2-5.

Pulse width	Max. indication
100mS	0.96-1.04
60mS	0.84-0.96
30mS	0.56-0.68
10mS	0.18-0.24

Table 2-5

- W&F Frequency Response Adjustment

· Set: LAS-5500

FUNCTION	W&F

W&F Calibrator

WAVEFORM	∿
FREQUENCY	0.3Hz

· Adjust VR407 for maximum indication of 0.7%.

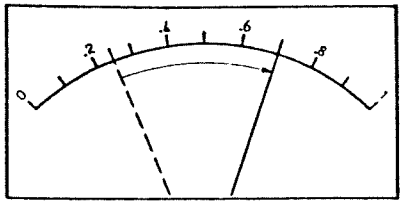


Figure 2-5

i) Adjustment of W&F meter -3 (DIN)

- W&F Full Scale Adjustment

· Set: LAS-5500

FUNCTION	W&F
INDICATION	DIN
WOW & FLUTTER %	1%

W&F Calibrator

STANDARD	DIN
WAVEFORM	∿
FREQUENCY	4Hz
W&F %	1%

· Adjust VR506 for reading of 1%.

- W&F Frequency Response Adjustment

· Set the FREQUENCY to 300Hz.

· Adjust VR404 for reading of 0.7%.

6) AC Millivoltmeter

a) Power Supply

- Connect the DC voltmeter to Q616 emitter and chassis.

- Adjust VR604 for voltage reading of +18V.

b) Full Scale Adjustment -1

- Set: RANGE 10mV
  FILTER IN

- Connect the AC voltmeter calibrator to LEFT INPUT connector and set the output voltage to 10mV.

- Adjust VR602 for reading of 10mV.

c) Full Scale Adjustment -2

- Set the FILTER switch to OUT.

- Adjust VR701 for reading of 10mV.

d) Full Scale Adjustment -3

- Set: RANGE ~~10V~~ ~~10V~~ 1V
  FILTER OUT

- Connect the AC voltmeter calibrator to LEFT INPUT connector and set the output voltage to ~~10V.~~ ~~10V~~ 1V

- Adjust VR601 for reading of ~~10V~~. 1V

e) Frequency Response Adjustment

- Set the RANGE switch to 1V.

- Connect the sine wave generator to LEFT INPUT connector and set the frequency to 400Hz, output voltage for 1V indication.

- Change the frequency to 50kHz.

- Adjust VC601 for reading of 1V.

- Repeat d) and e) if necessary.

f) Output Voltage Adjustment

-Set:

FREQ.	x1k
Dial	1
RANGE	100mV
V IN COUPLING	FROM VM
VERT INPUT	x10
V-VARIABLE	Fully CW

- Adjust ATTENUATOR and OUTPUT LEVEL control for full scale indication.

- Adjust VR603 to obtain 8 divisions vertical display on the oscilloscope. (The oscilloscope should be calibrated.)

7) Oscilloscope

a) Power Supply

- Connect the DC voltmeter to test point and chassis.

- Check the voltage according to Table 2-6.

Test point	Voltage
TP904	+8V
TP902	-15V
TP903	+200V
P906 pin1	-1200V

Table 2-6

b) Vertical Amplifier

- Sensitivity Check

  • Set: VERT INPUT x1
  V-VARIABLE Fully CW
  V-IN COUPLING DC

  • Connect the amplitude calibrator to V IN connector and set the output level to 50mV.

  • The amplitude should be 5 divisions or more.

- DC Balance Adjustment

  • Set: VERT INPUT GND
  V-VARIABLE Fully CCW

  • Position the trace to center horizontal graticule line using the V-POSITION control.

  • Turn the V-VARIABLE control to fully CW.

  • Position the trace to the center horizontal graticule line by adjusting VR801.

  • Repeat above procedure for minimum trace shift when rotating the V-VARIABLE control between fully CW and fully CCW.

- Attenuator Phase Compensation

  • Set the VERT INPUT switch to x10.

  • Connect the square wave generator to V IN connector and set the frequency to 1kHz, output level for 5 divisions display.

  • Adjust VC801 for a best flat-top square wave.

  • Adjust all VERT INPUT ranges according to Table 2-7.

VERT INPUT	PHASE COMP.
x1	-
x10	VC801
x100	VC803
x1000	VC805

Table 2-7

- Input Capacitance Adjustment

· Set the VERT INPUT switch to x1.

· Connect the capacitance meter to V IN connector.

· The input capacitance should be approximately 40pF.

--- Note the meter reading ---

· Set the VERT INPUT switch to x10.

· Adjust VC802 for same reading as x1 range.

· Adjust all VERT INPUT ranges according to Table 2-8.

VERT INPUT	INPUT CAP.
x1	-
x10	VC802
x100	VC803
x1000	VC804

Table 2-8

- Band Width Check

· Connect the sine wave generator to LEFT INPUT connector and set the frequency to 1kHz, output level for 8 divisions display.

· Change the frequency to 5MHz.

· Display amplitude should be 5.6 divisions or more.

c) Sweep Generator/Horizontal Amplifier

- Sweep Length Adjustment

Connect the square wave generator to V IN connector and set the frequency to 1kHz.

· Set the SWEEP FREQ. Hz switch to 10-100 range and adjust SWEEP VARIABLE control to obtain the display as shown in Figure 2-6.

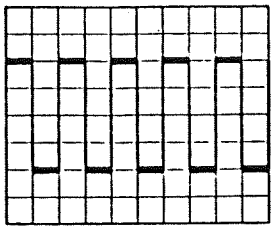


Figure 2-6

· Adjust VR804 to obtain the 6 cycle square wave as shown in Figure 2-7.

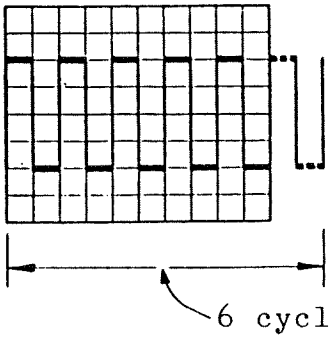


Figure 2-7

d) Trigger

- Trigger Level Adjustment

· Connect the square wave generator to V IN connector and set the frequency to 1kHz, output level for 0.5 division display.

· Adjust VR802 as shown in Figure 2-8.

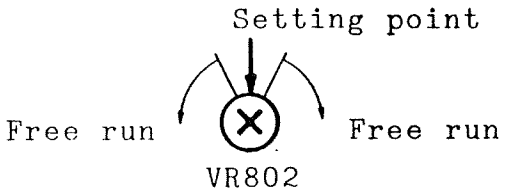


Figure 2-8

- Stability Adjustment

· Connect the sine wave generator to V IN connector and set the Frequency to 50Hz, output level for 4 divisions display.

· Adjust VR803 as shown in Figure 2-9

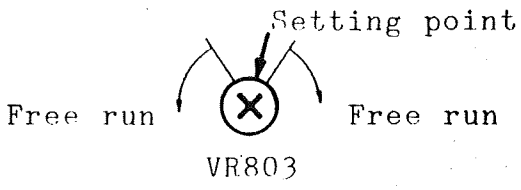


Figure 2-9

3. Trouble shooting Procedure

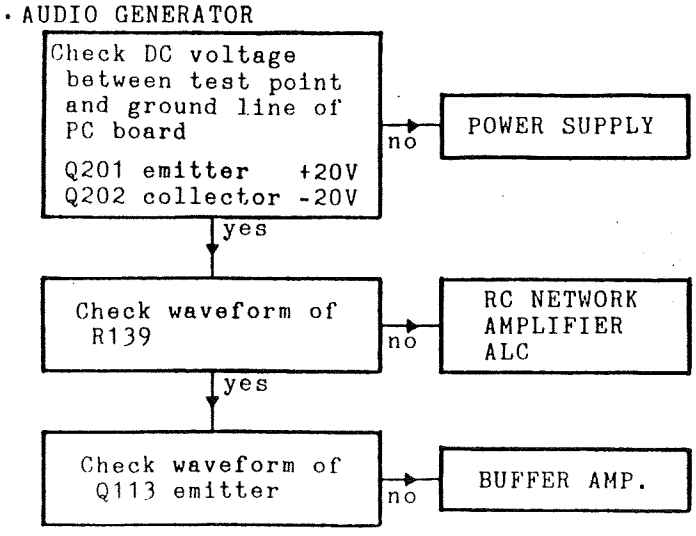
1) Check all control settings, because an incorrect setting can make a good unit appear defective.

2) Some trouble can be solved with proper adjustment.

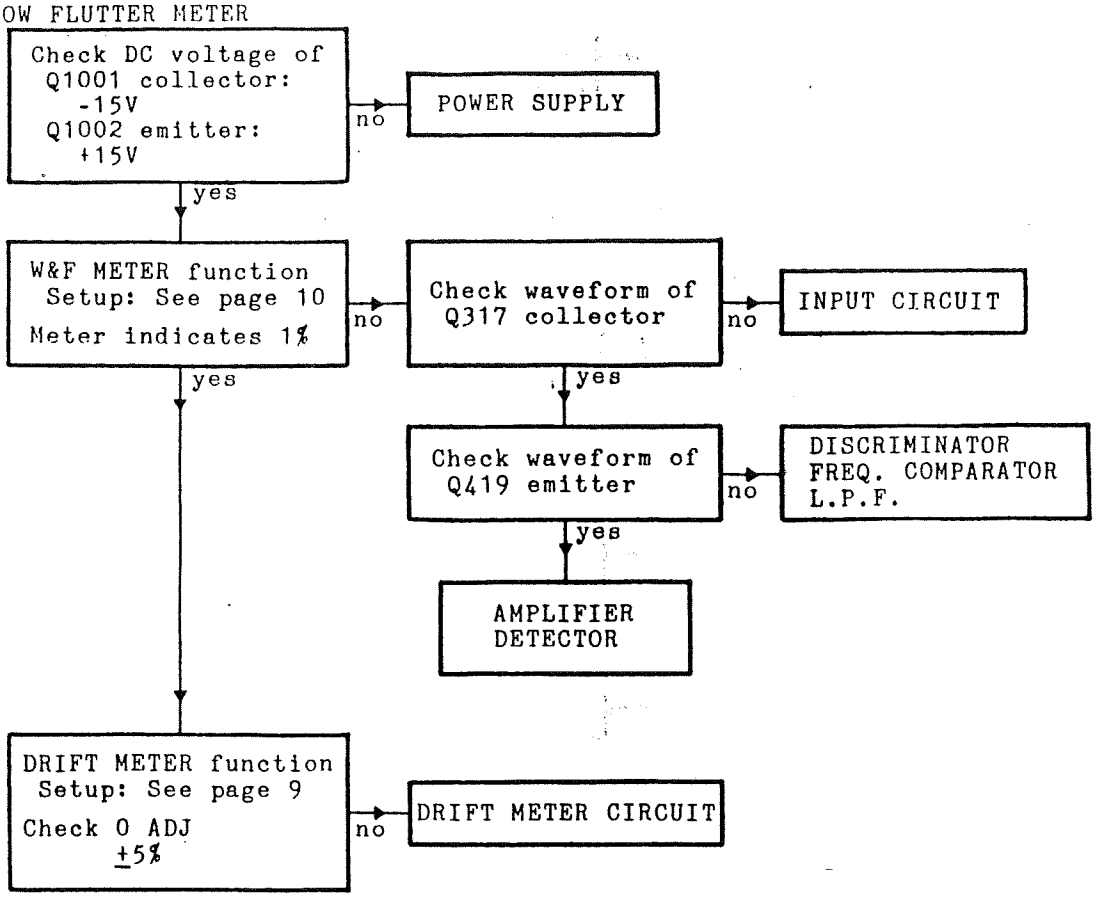
3) Check the DC voltage as shown on the schematic diagram to locate the defective circuit. Start with the power supply.

4) Check all circuit for visual defects such as broken components, loose connections and poor soldering which could be a cause of trouble.

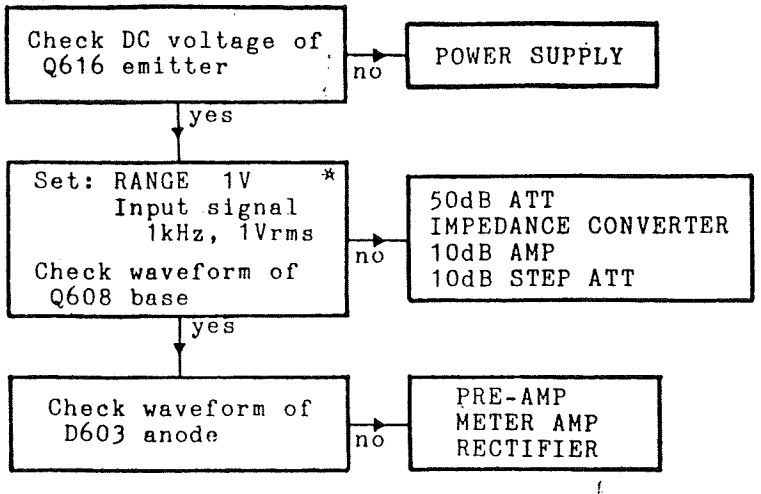
5) Troubleshooting Chart



• WOW FLUTTER METER

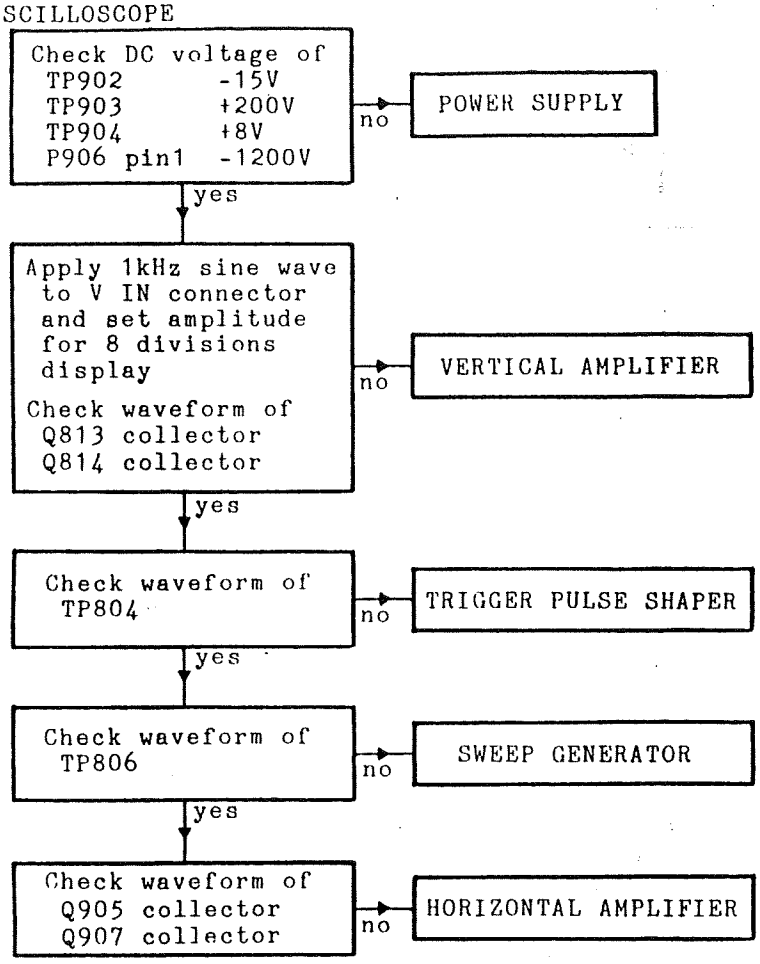


• AC MILLIVOLT METER

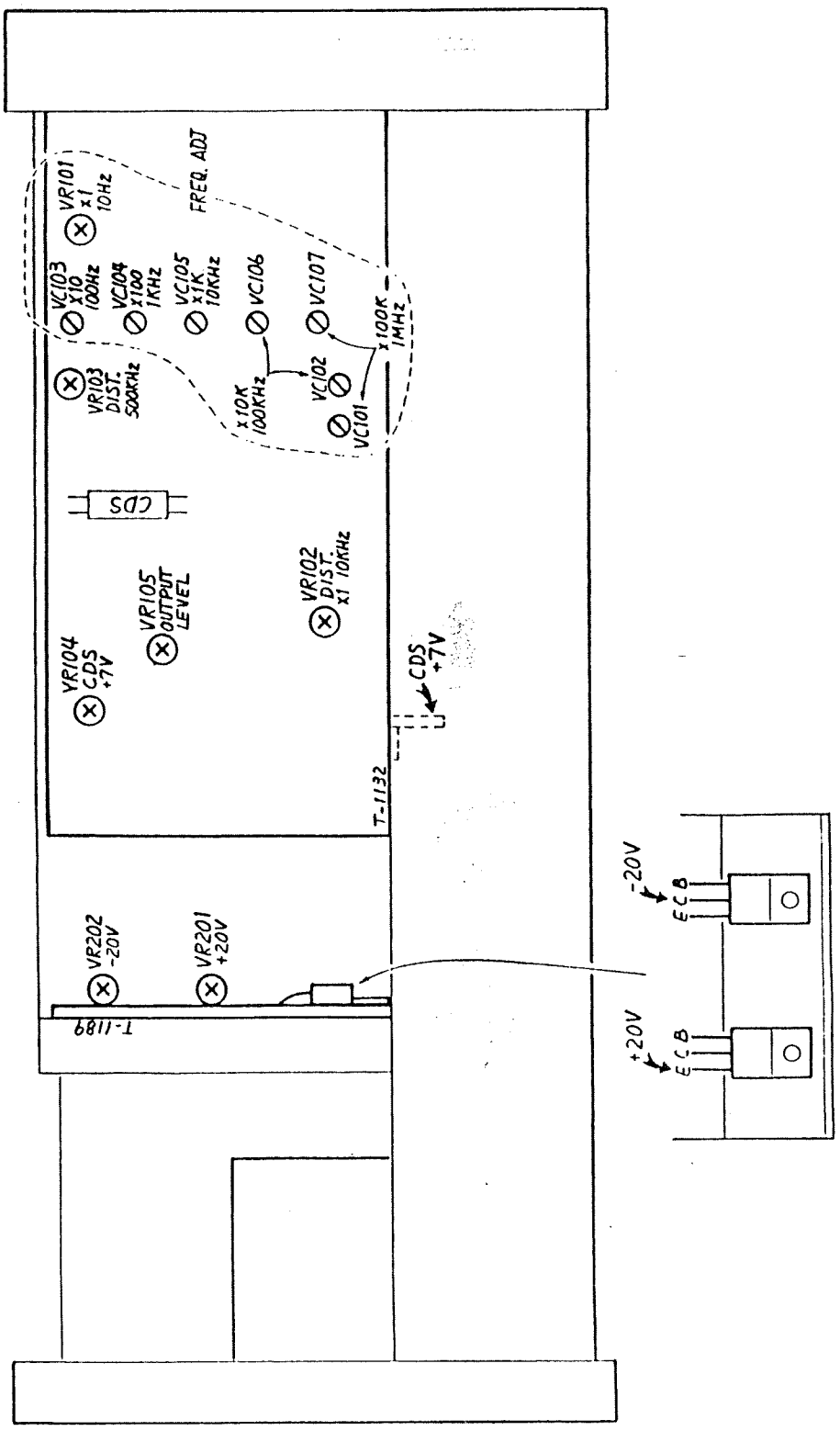


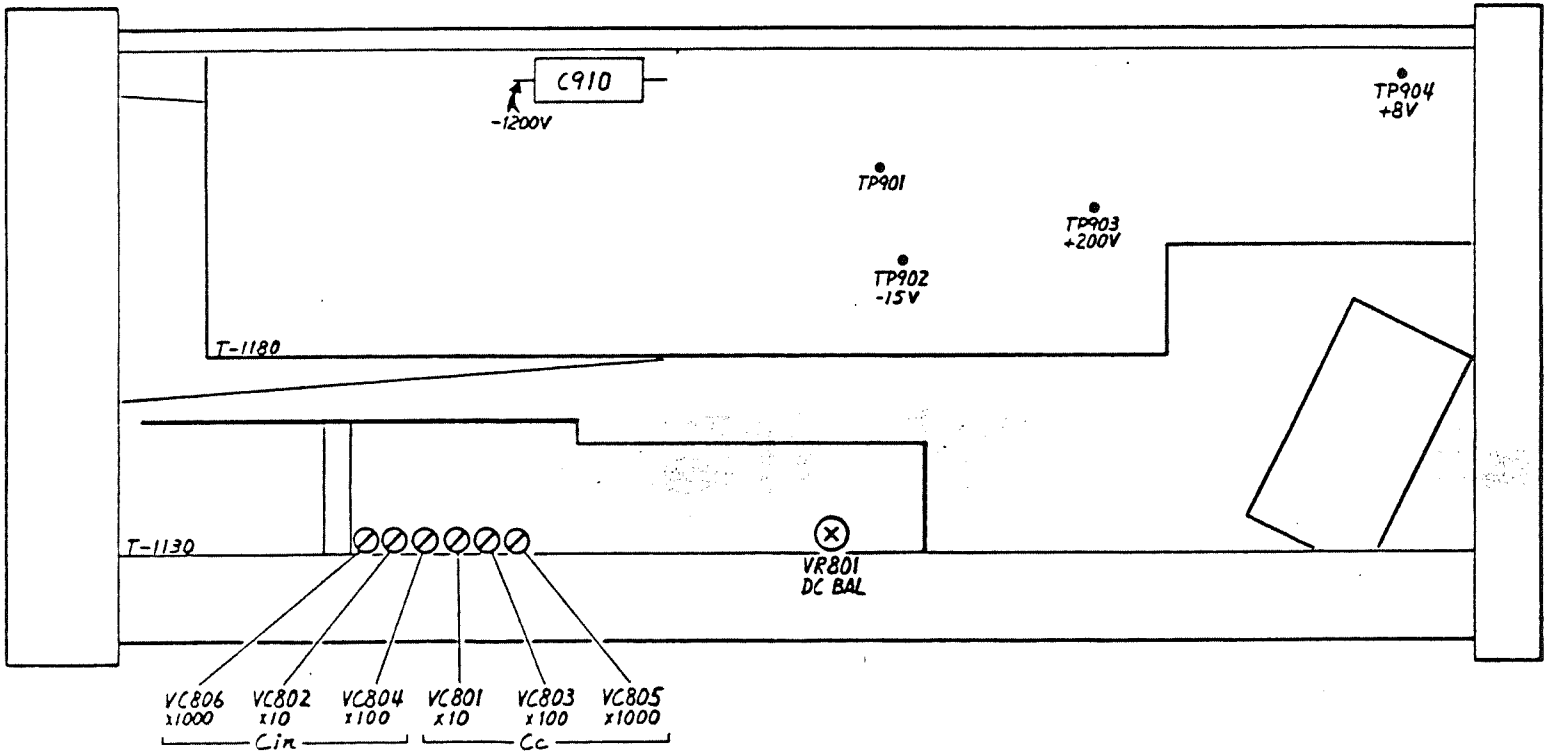
* Input voltage of METER PRE-AMPLIFIER (Q608 base) is approximately 9mVp-p at full scale indication regardless of RANGE switch setting.

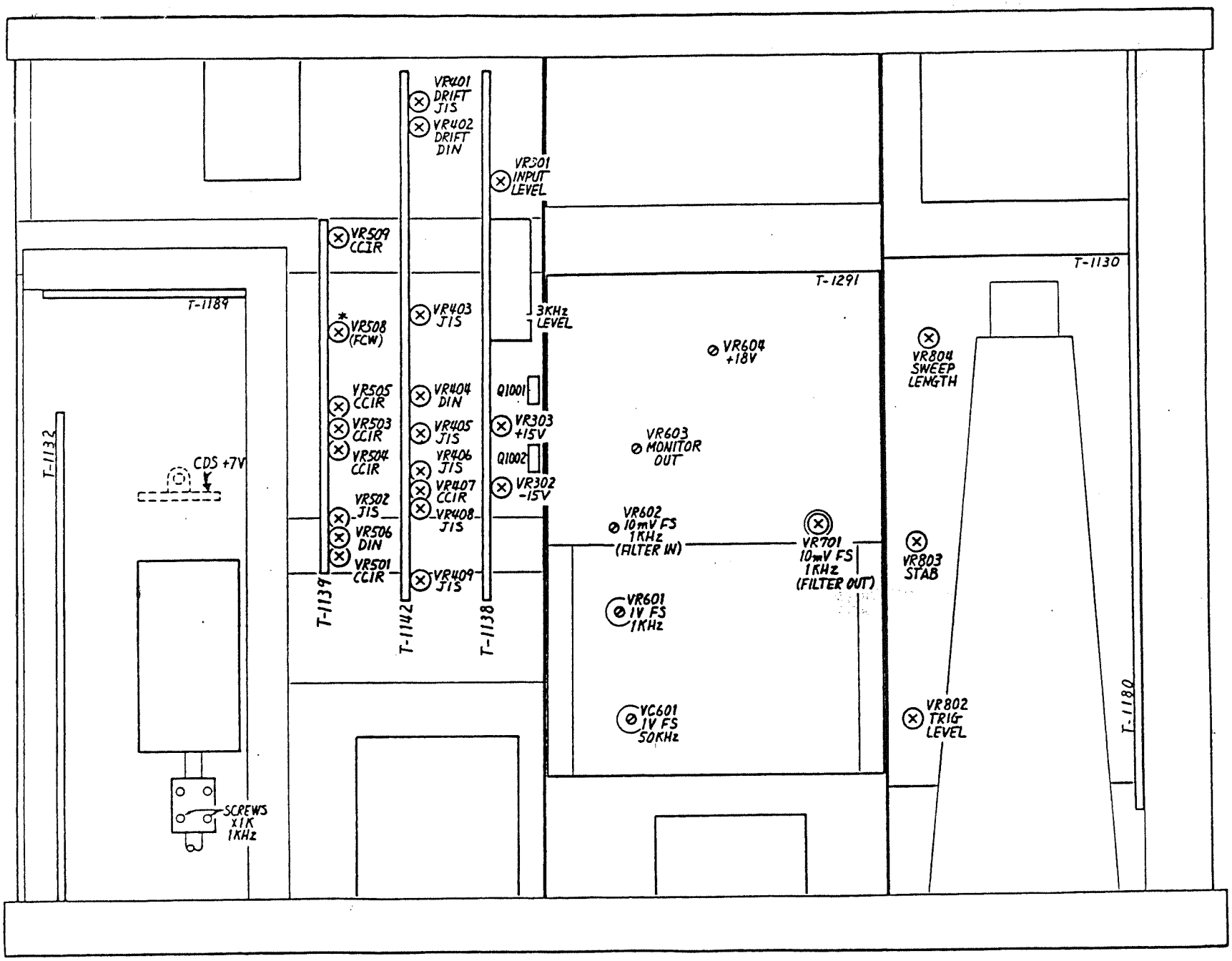
· OSCILLOSCOPE



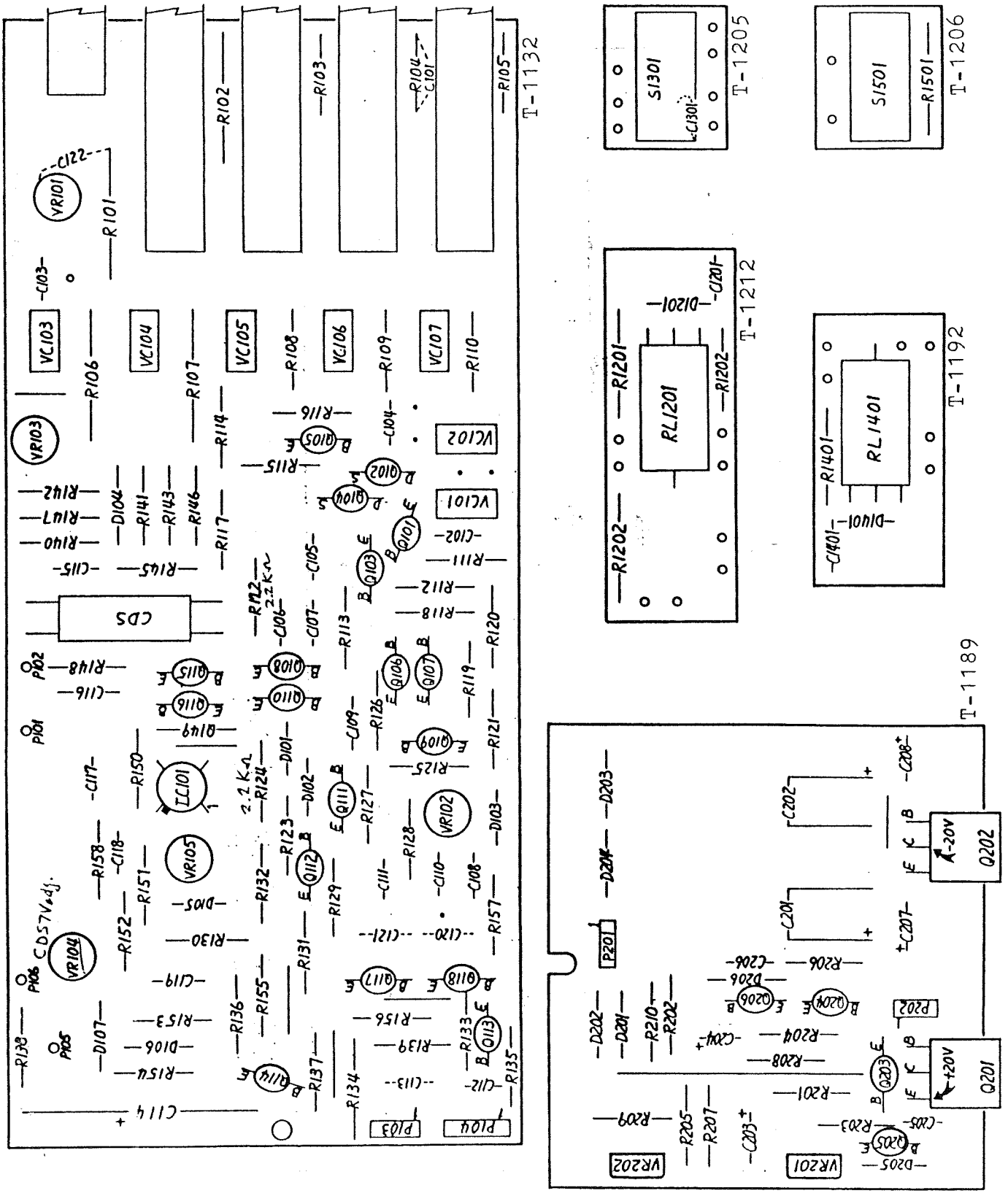
4. Location of Adjustment



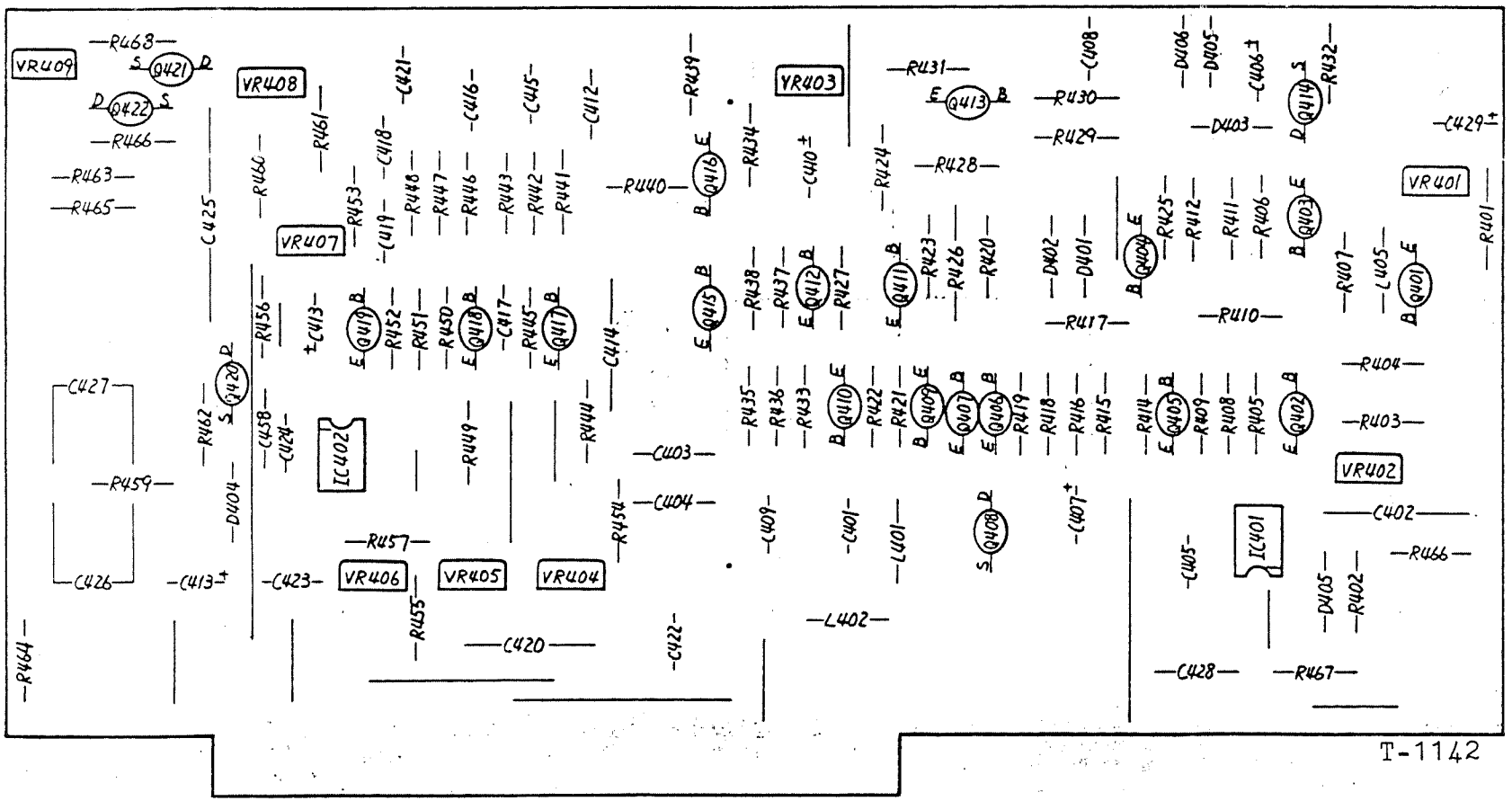

C910
-1200V
TP904
+8V
TP901
TP903
+200V
TP902
-15V
T-1180
T-1130
VR801
DC BAL
VC806
x1000
VC802
x10
VC804
x100
VC801
x10
VC803
x100
VC805
x1000
Cin
Cc


VR401 DRIFT J1S
VR402 DRIFT DIN
VR301 INPUT LEVEL
VR509 CCIR
T-1189
T-1291
T-1130
* VR508 (FCW)
VR403 J1S
3KHz LEVEL
VR604 +18V
VR804 SWEEP LENGTH
VR505 CCIR
VR404 DIN
Q1001
VR503 CCIR
VR405 J1S
VR303 +15V
VR603 MONITOR OUT
VR504 CCIR
VR406 J1S
Q1002
VR407 CCIR
VR302 -15V
T-1132
CDS +7V
VR502 J1S
VR602 10mV FS 1KHz (FILTER IN)
VR701 10mV FS 1KHz (FILTER OUT)
VR803 STAB
VR506 DIN
VR408 J1S
VR501 CCIR
VR409 J1S
T-1139
T-1142
T-1138
VR601 1V FS 1KHz
VC601 1V FS 50KHz
VR802 TRIG LEVEL
T-1180
SCREWS X1K 1KHz

5. Printed Circuit Board



T-1138
SL-01
IC301
VR301
VR302
VR303


VR409
VR408
VR407
VR406
VR405
VR404
VR403
VR402
VR401
IC402
IC401
Q421
Q422
Q420
Q419
Q418
Q417
Q416
Q415
Q414
Q413
Q412
Q411
Q410
Q409
Q408
Q407
Q406
Q405
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Q403
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Q401
R468
R466
R463
R465
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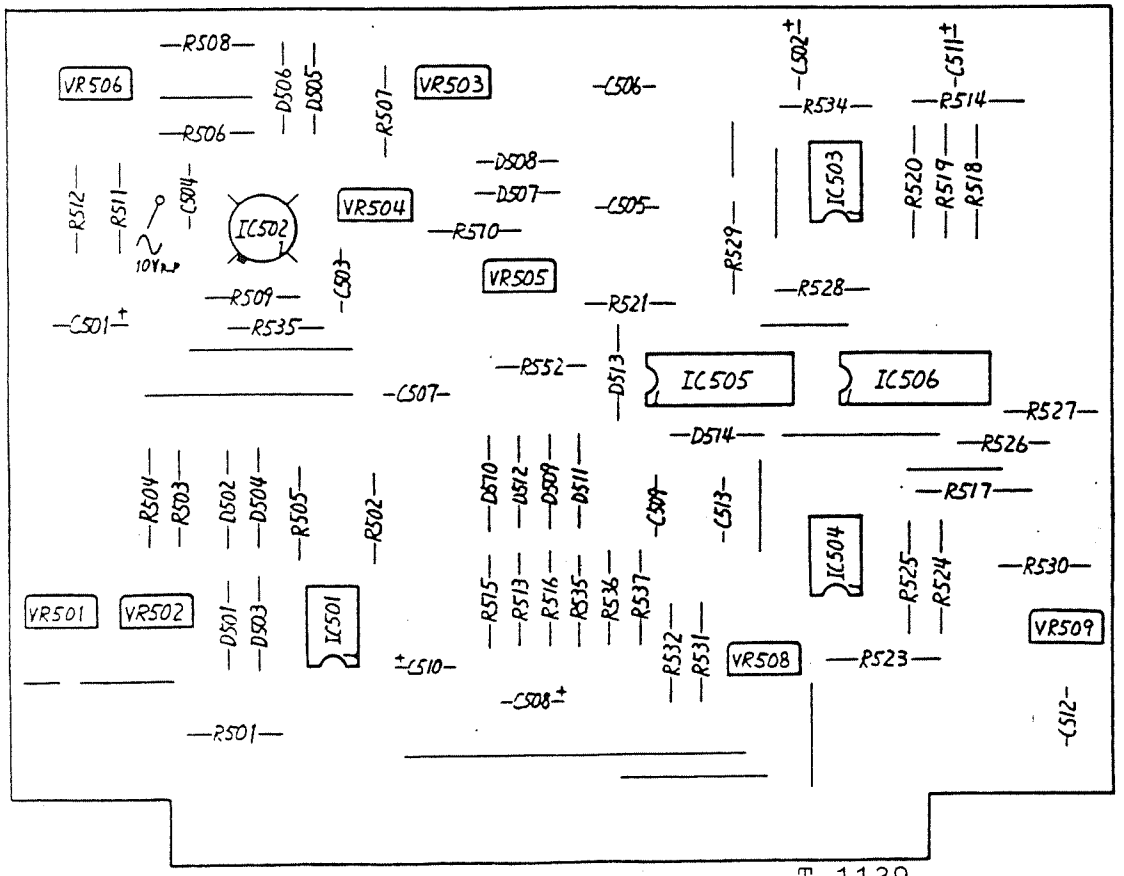
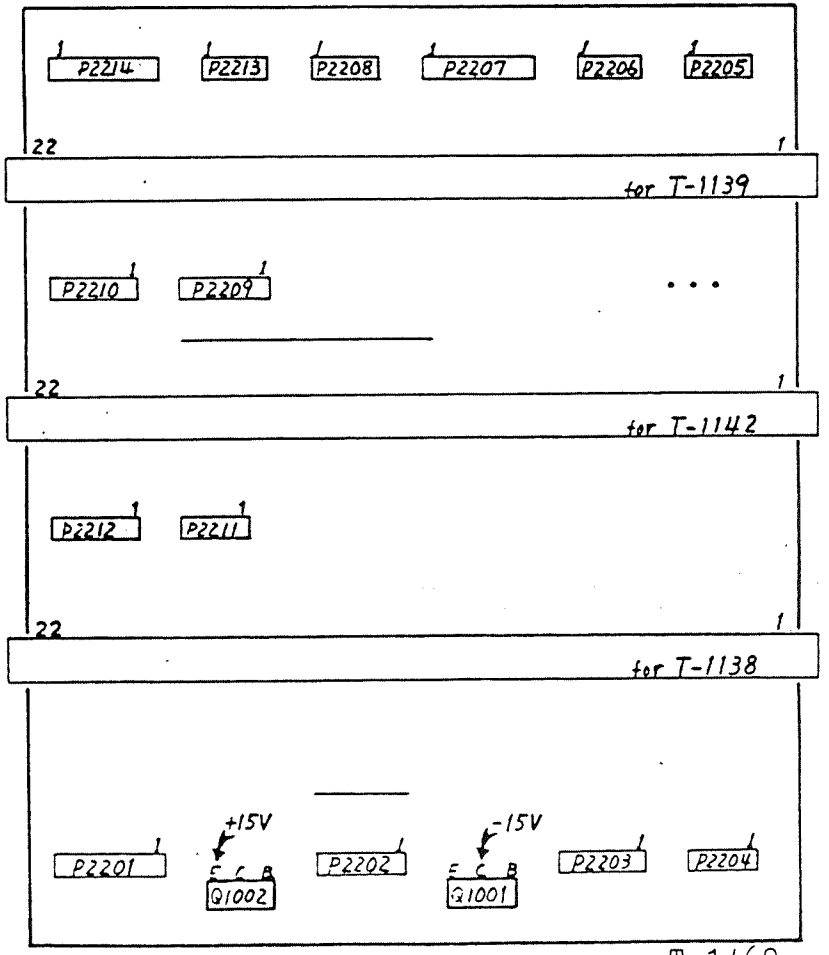
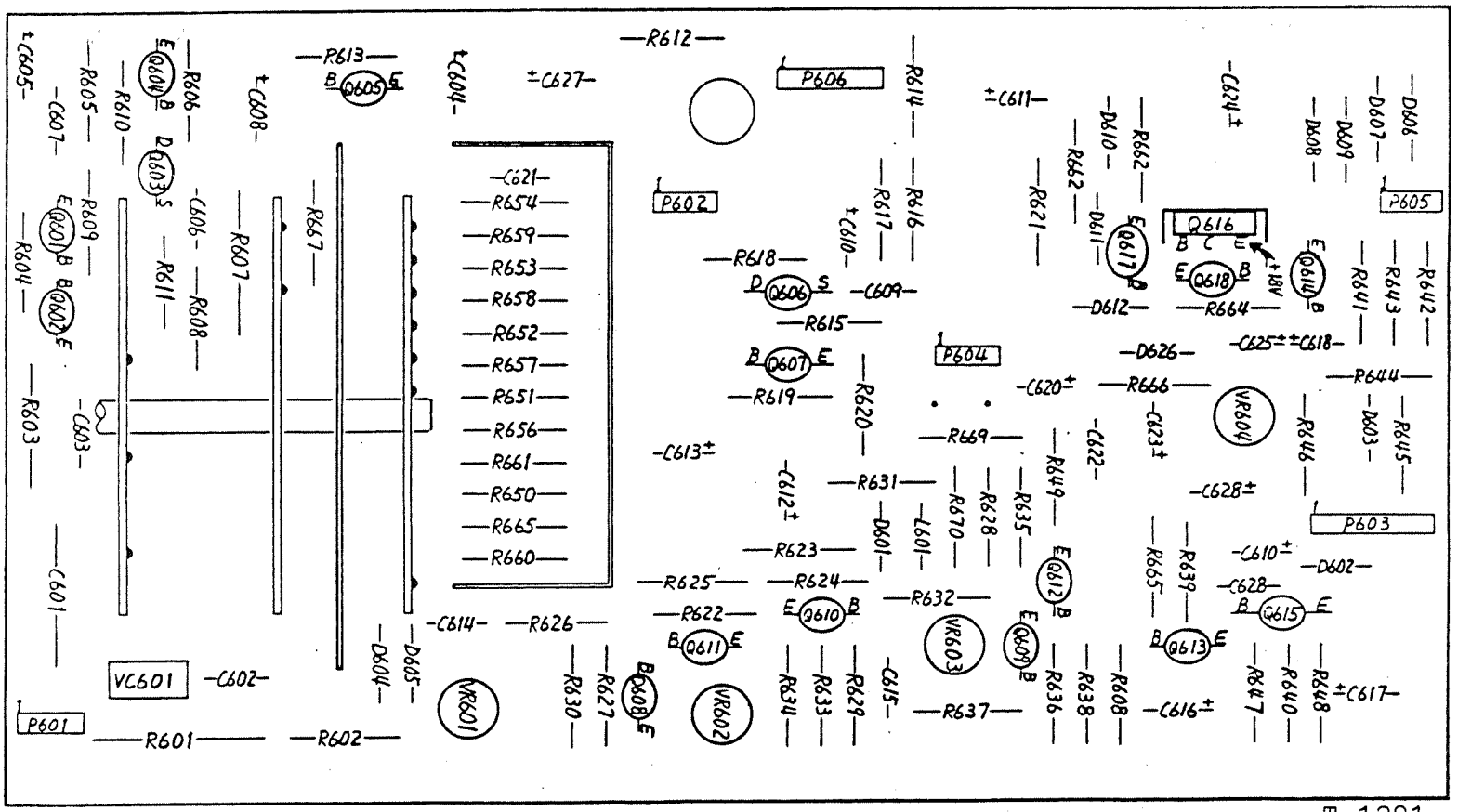
R408
R407
R406
R405
R404
R403
R402
R401
C425
C427
C426
C458
C424
C423
C422
C421
C420
C419
C418
C417
C416
C415
C414
C413
C412
C411
C410
C409
C408
C407
C406
C405
C404
C403
C402
C401
C428
D404
D403
D402
D401
D406
D405
L402
L401
L405
S1601
S1602
R1601
T-1190
R1704
R1708
R1703
R1707
R1702
R1706
R1701
R1705
S1701
T-1135
T-1142


R508
VR506
D506
D505
R507
VR503
C506
C502
R534
R514
C511
R506
IC503
R520
R519
R518
D508
D507
C504
R512
R511
IC502
VR504
C505
R570
R529
10V
C503
VR505
R509
R528
R521
C501
R535
R552
D513
IC505
IC506
C507
R527
D514
R526
R504
R503
D502
D504
R505
R502
D510
D512
D509
D511
C509
C513
R517
IC504
R525
R524
R530
VR501
VR502
D501
D503
IC501
R515
R513
R516
R535
R536
R537
VR509
C510
R532
R531
VR508
R523
C508
C512
R501

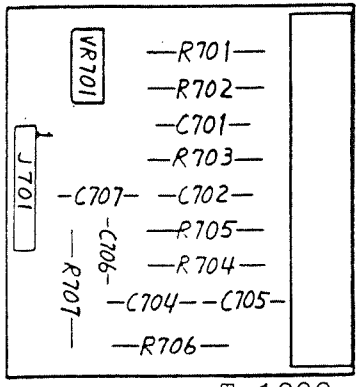
T-1139


P2214
P2213
P2208
P2207
P2206
P2205
22
1
for T-1139
P2210
P2209
P2212
P2211
for T-1142
for T-1138
P2201
+15V
Q1002
P2202
-15V
Q1001
P2203
P2204

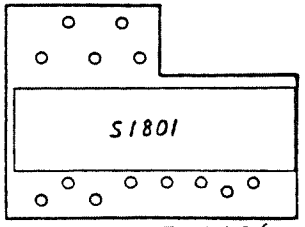
T-1469



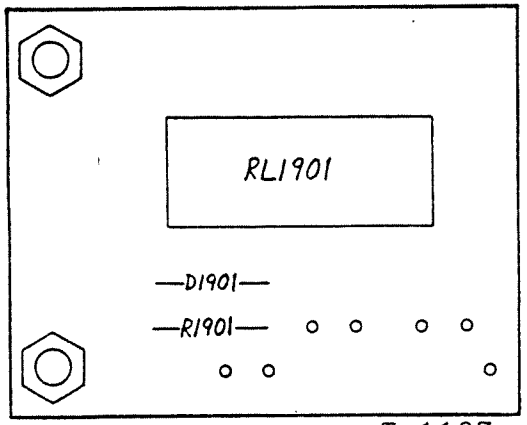
T-1291



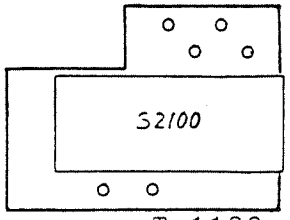
T-1292



T-1136

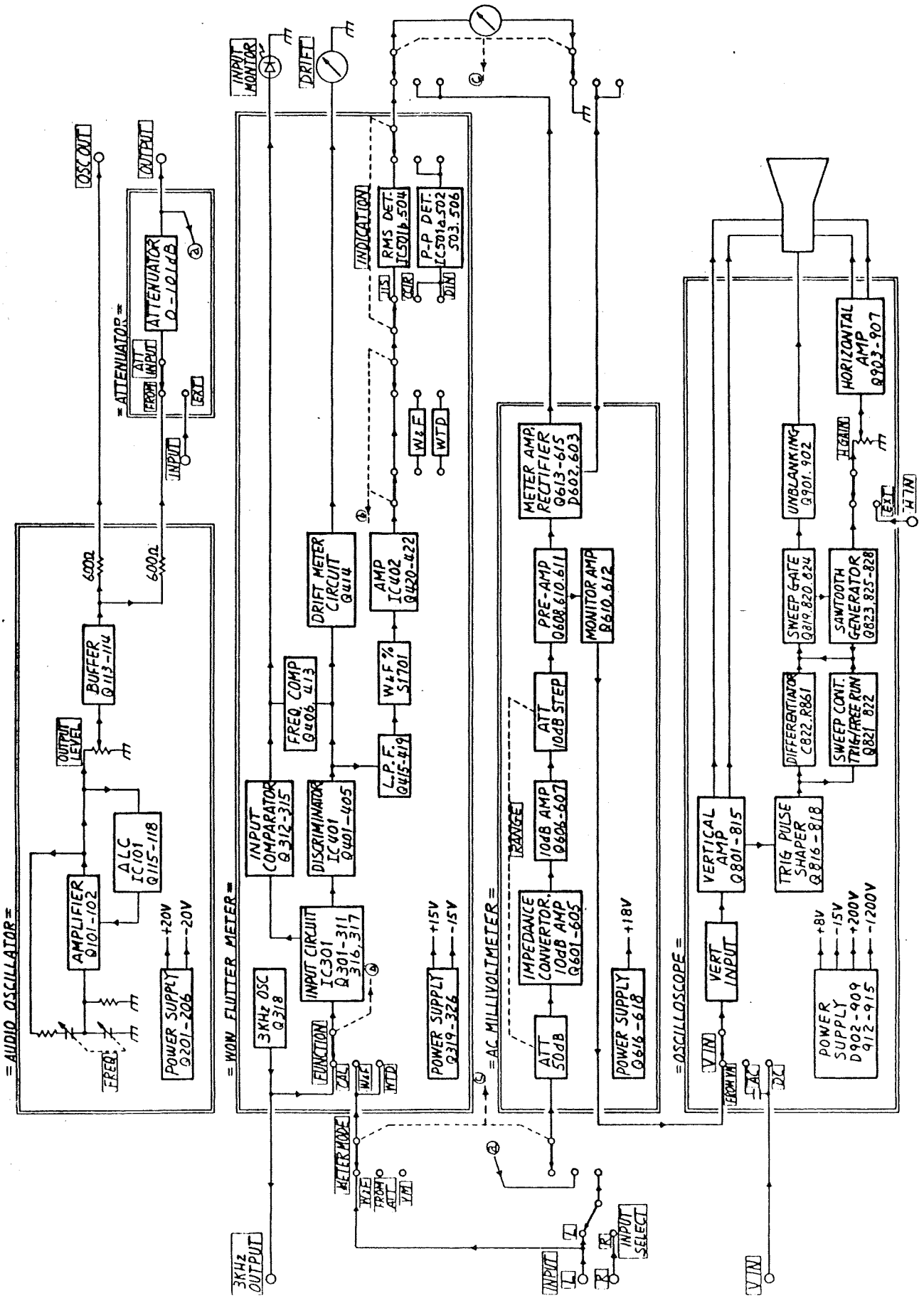


T-1137



T-1193

6. Block Diagram



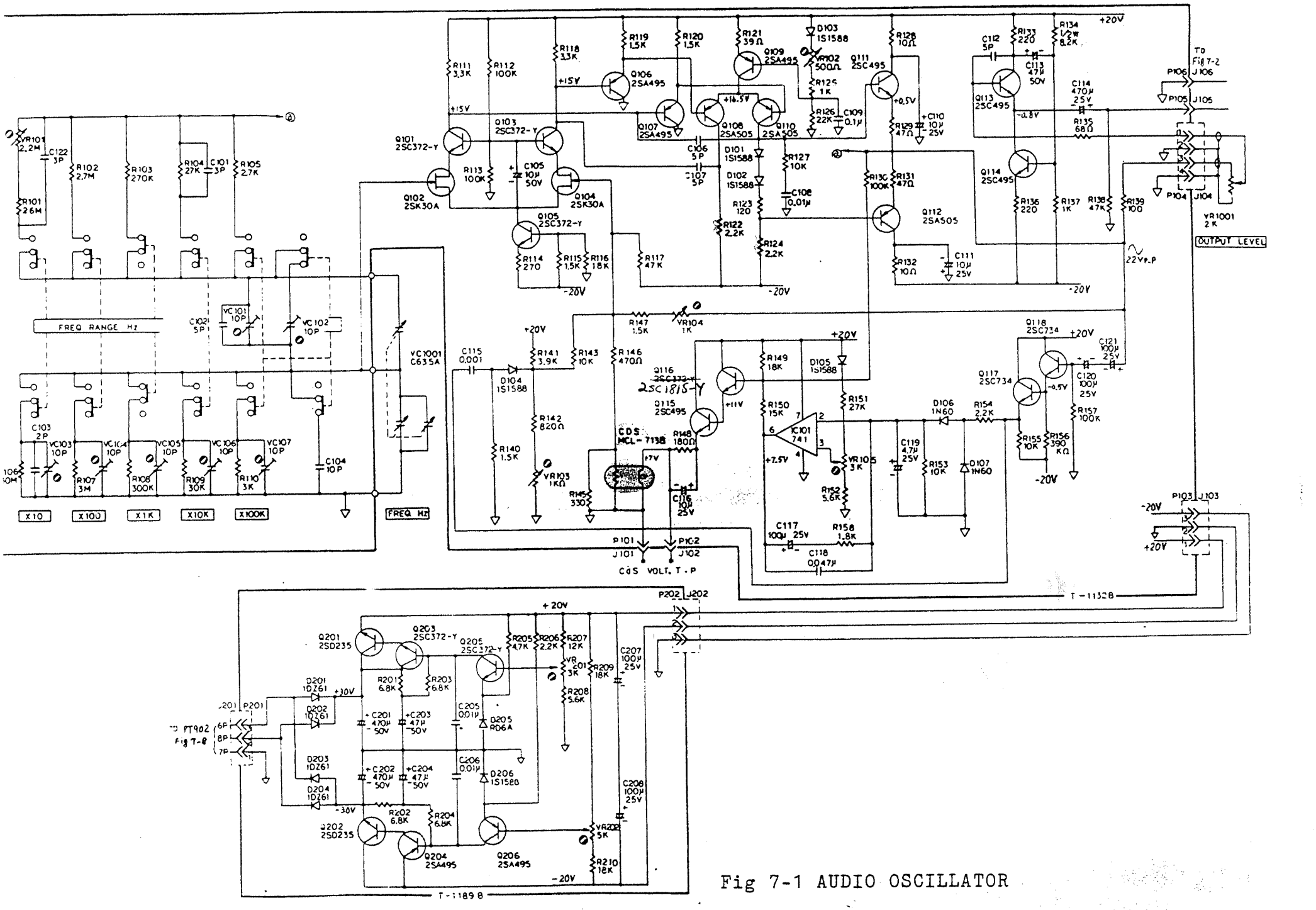
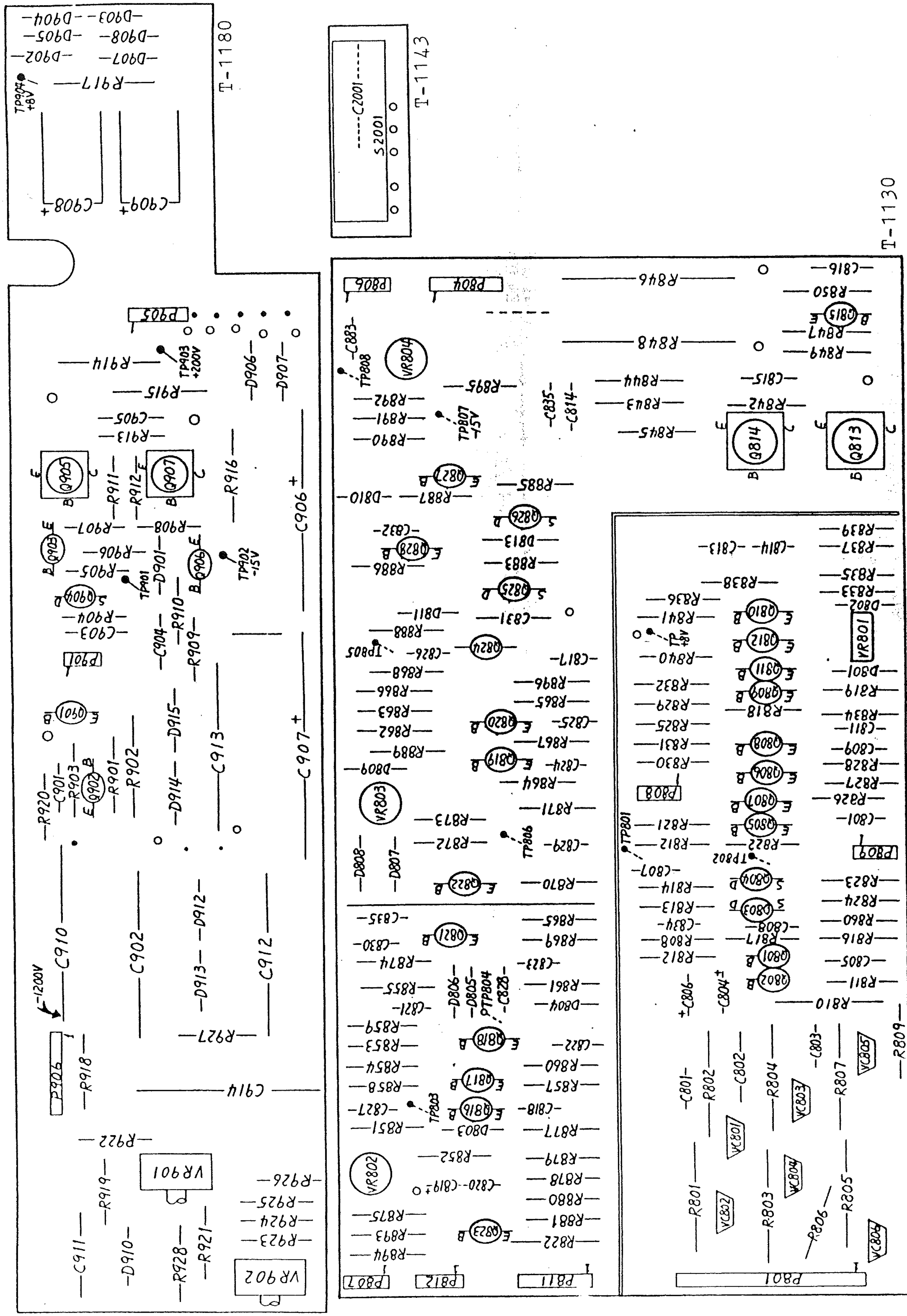


Fig 7-1 AUDIO OSCILLATOR


T-1180
T-1143
T-1130
TP904 +8V
TP903 +200V
TP902 -15V
TP807 -15V
-1200V

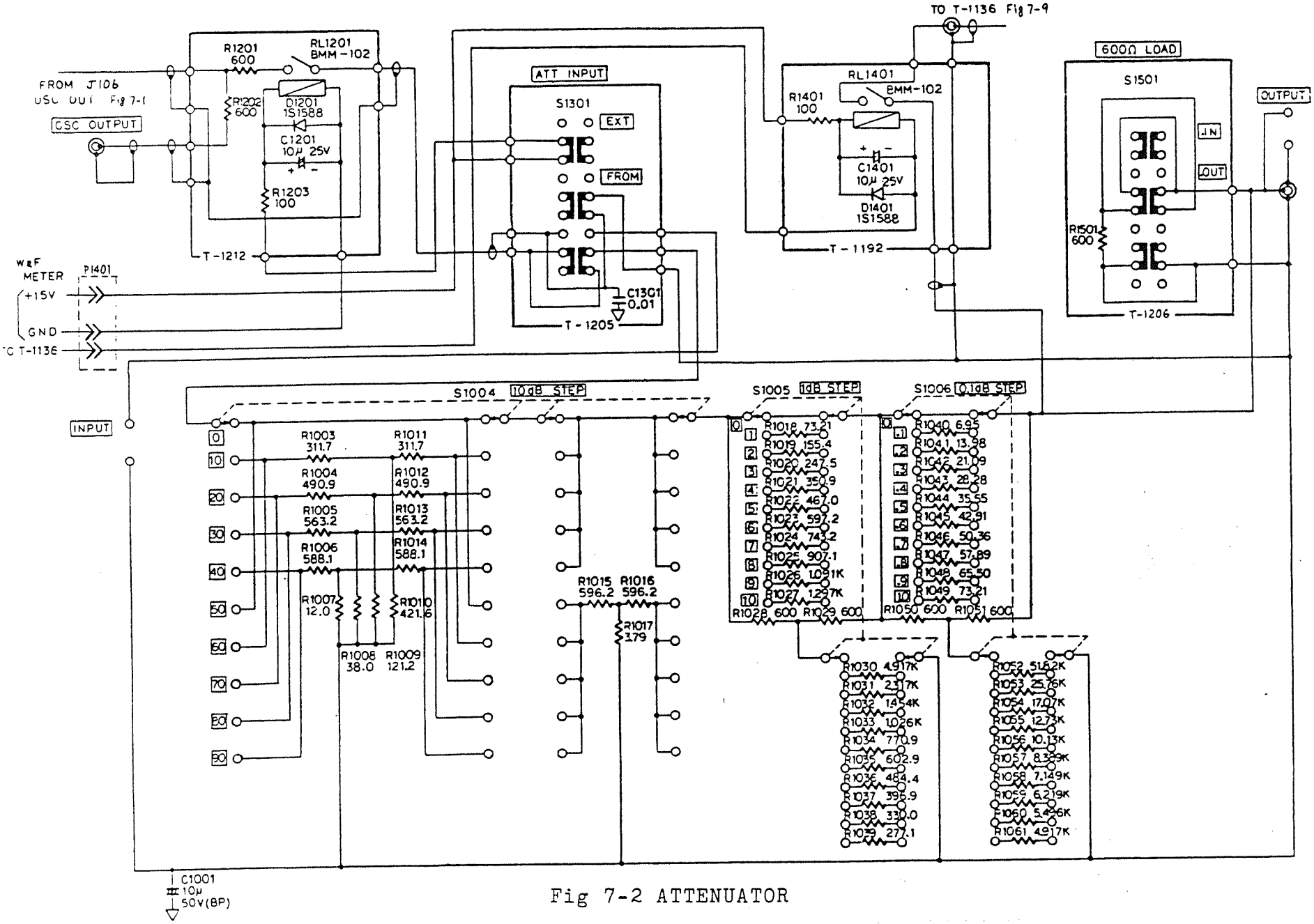


Fig 7-2 ATTENUATOR

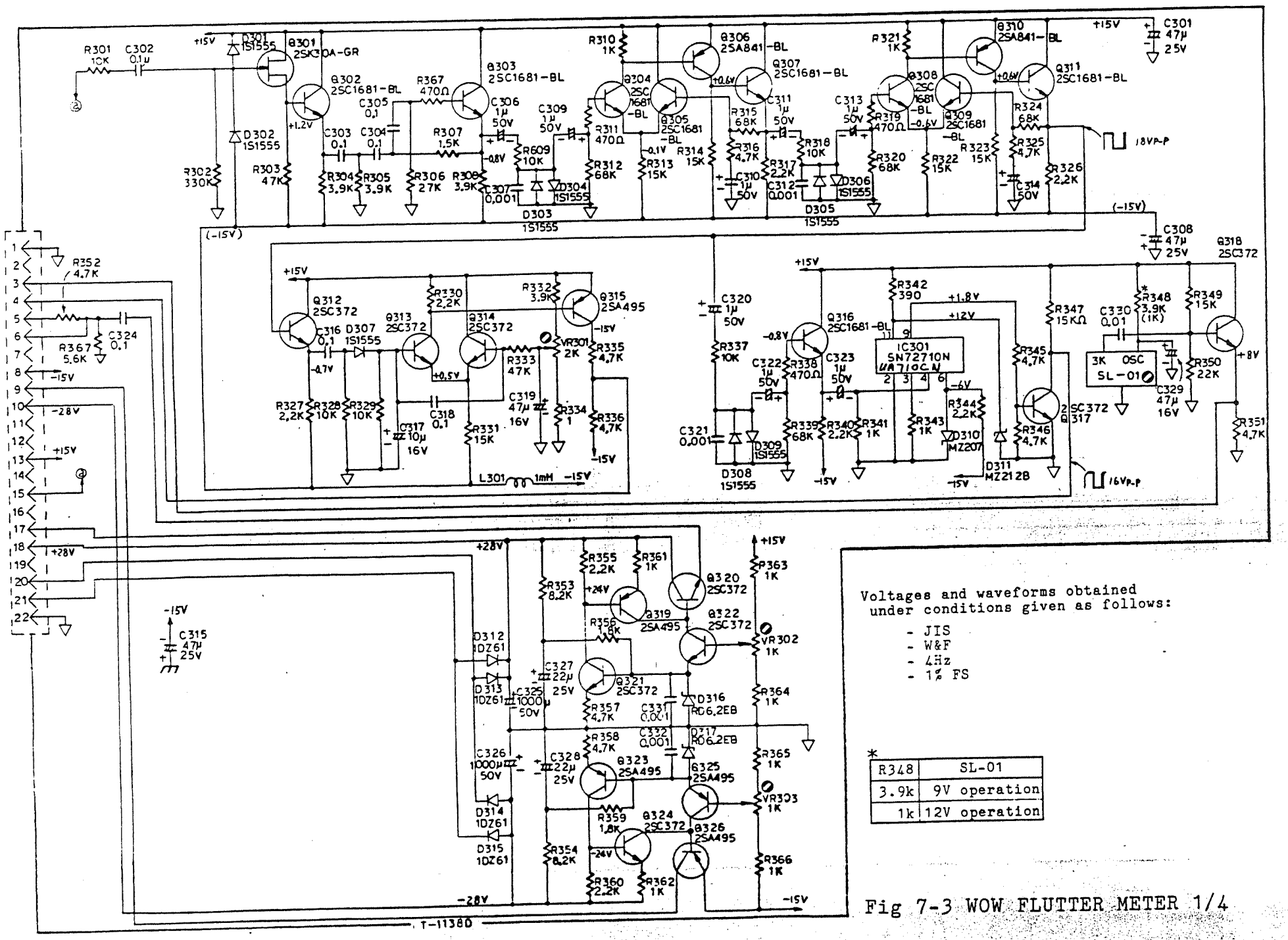


Fig 7-3 WOW FLUTTER METER 1/4

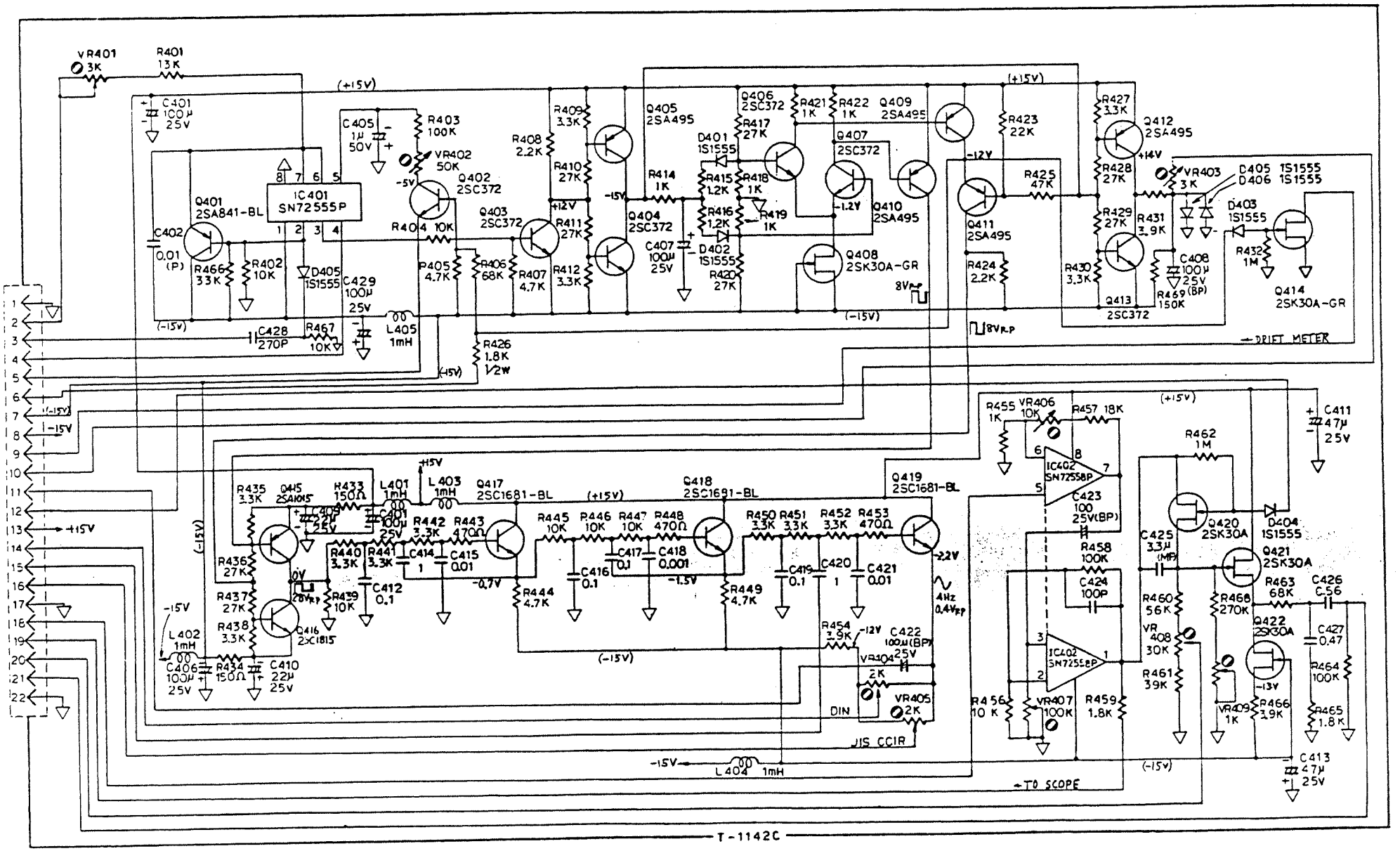


Fig 7-4 WOW FLUTTER METER 2/4

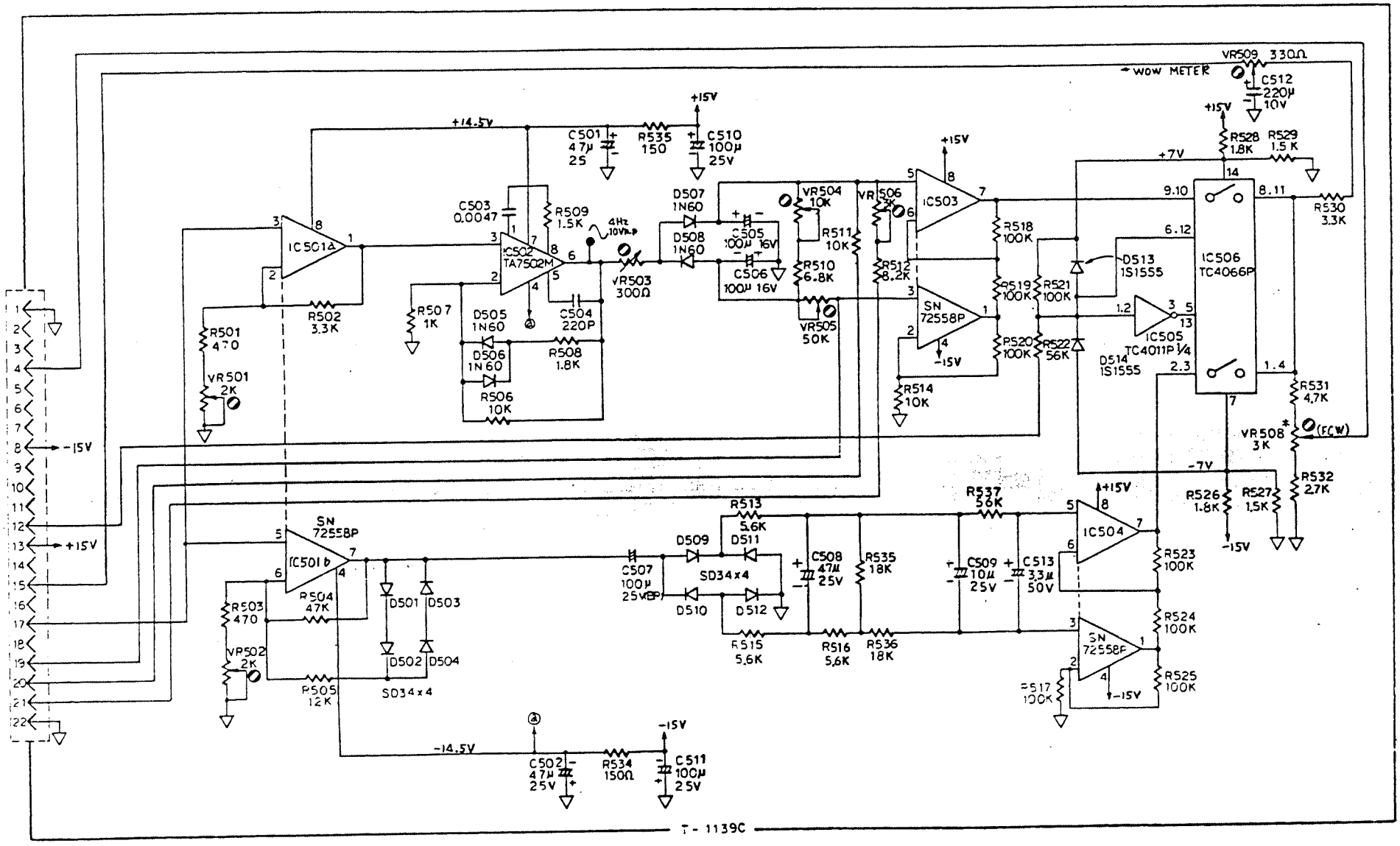


Fig 7-5 WOW FLUTTER METER 3/4

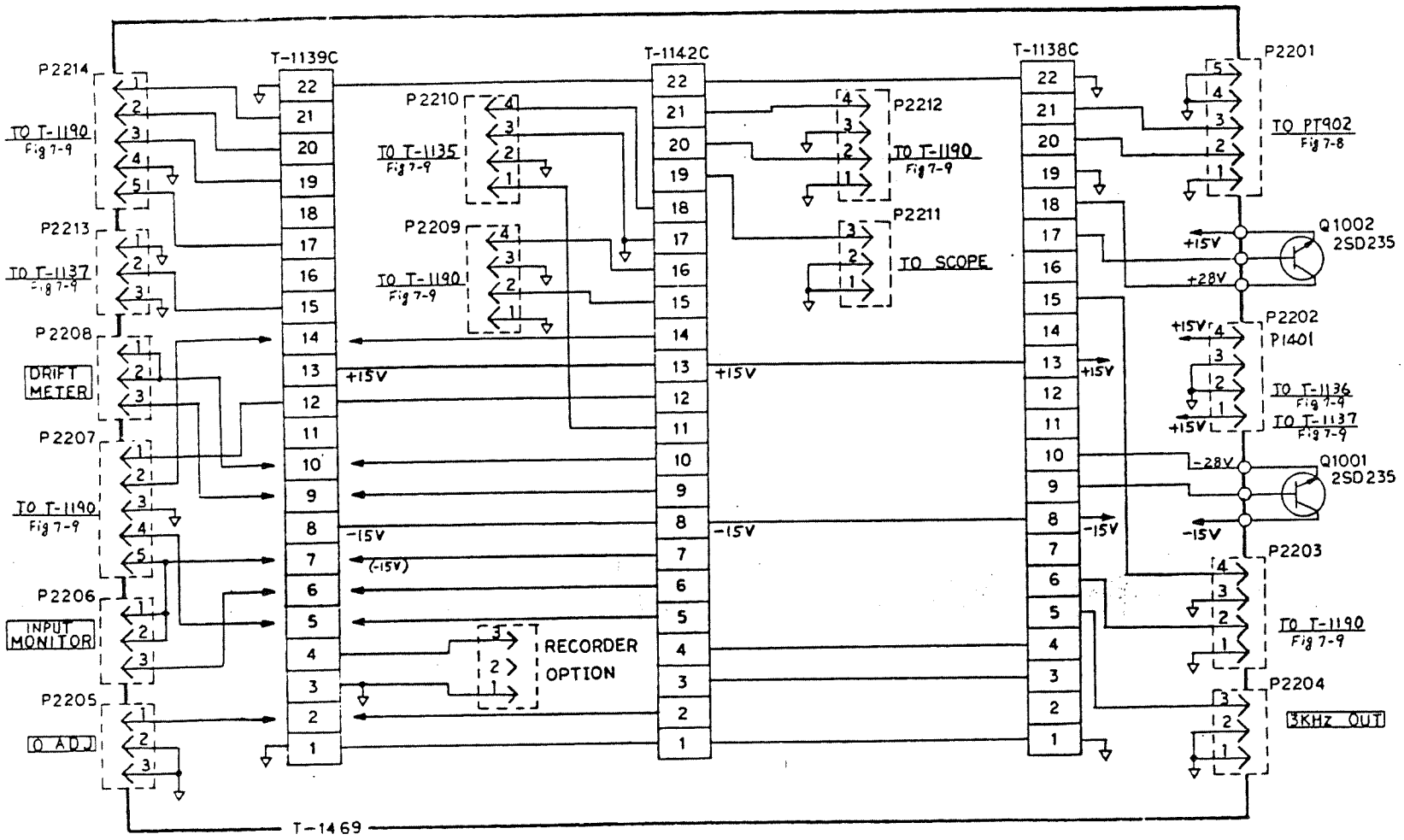
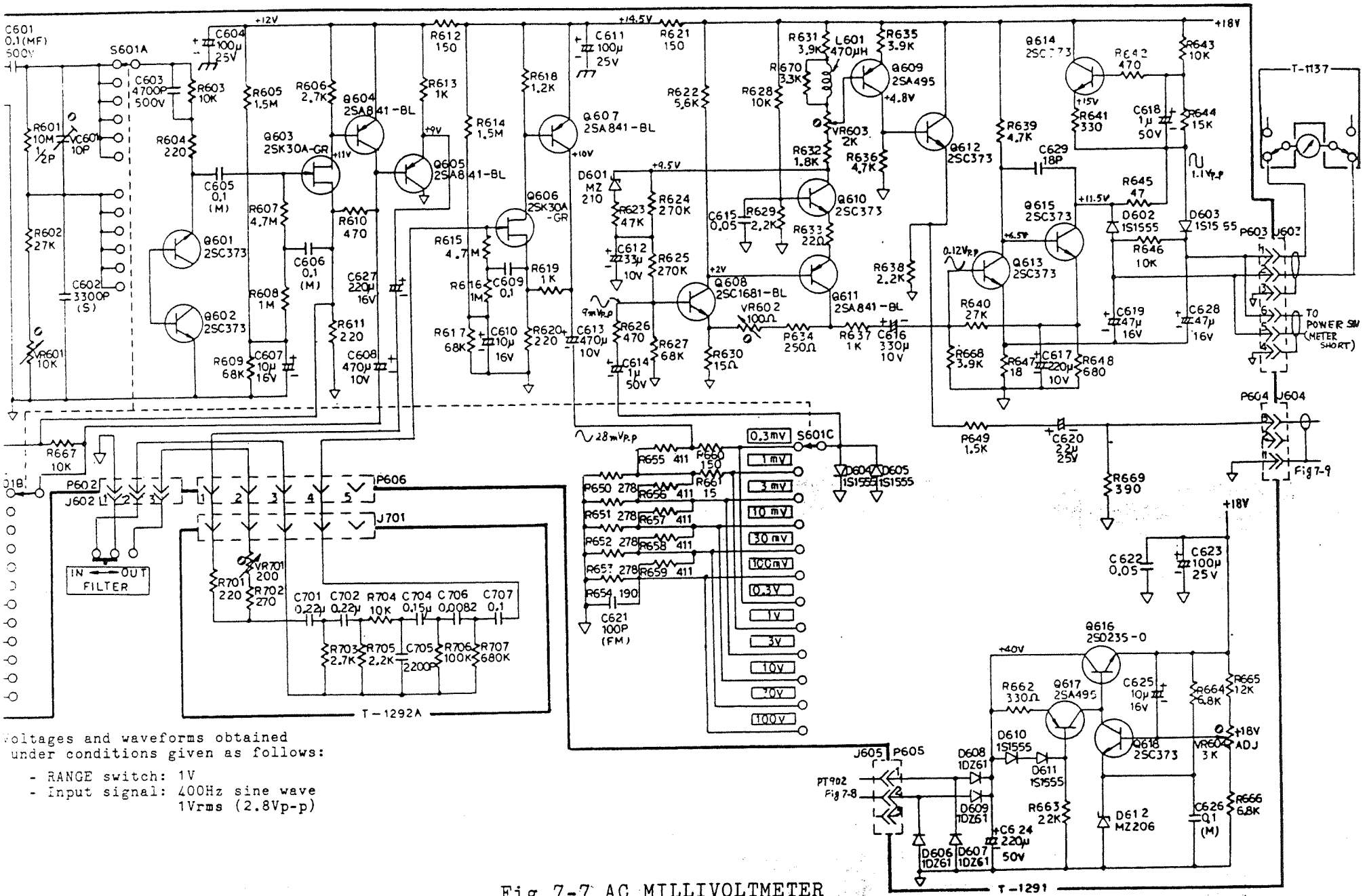


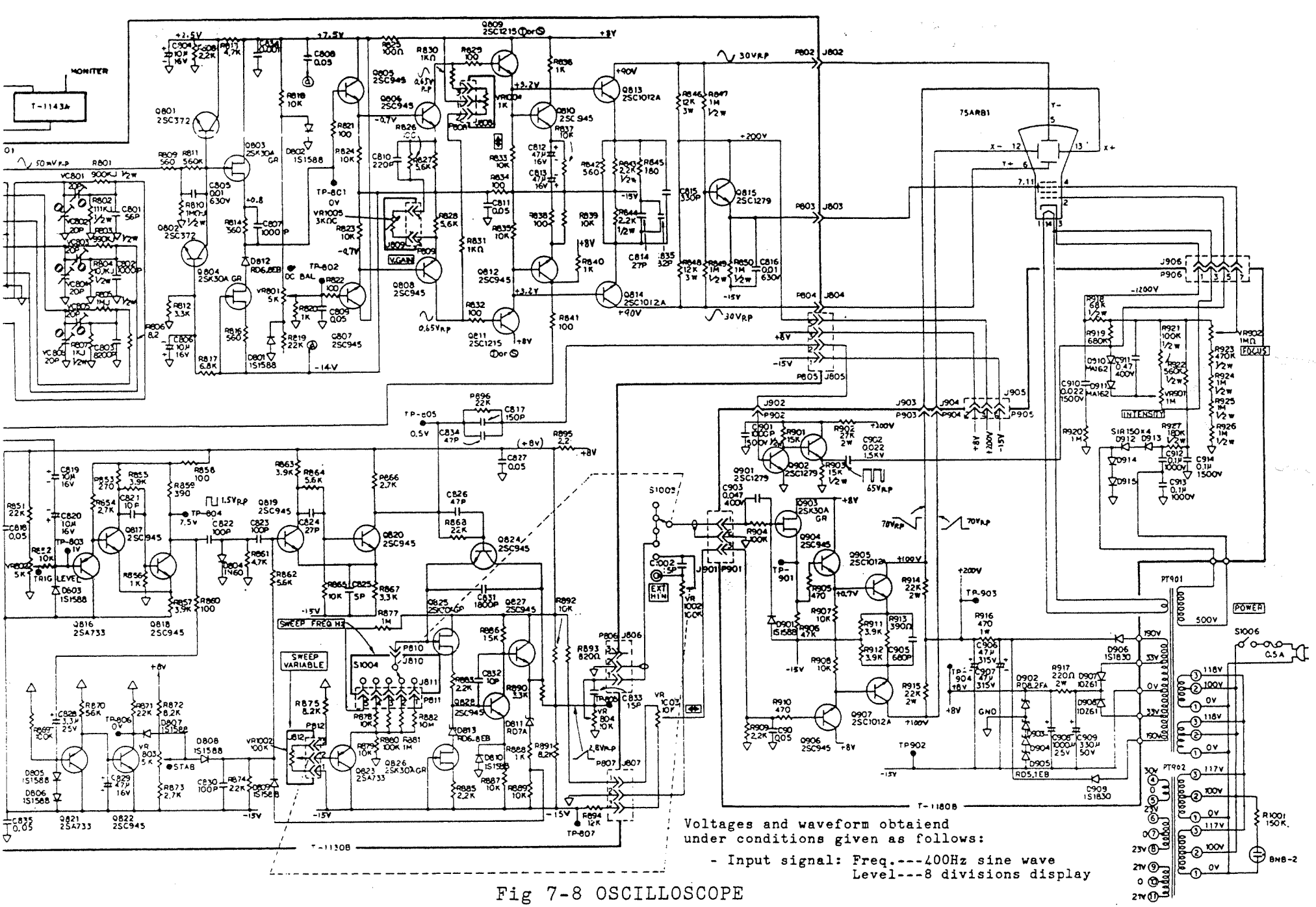
Fig 7-6 WOW FLUTTER METER 4/4



Voltages and waveforms obtained under conditions given as follows:

- RANGE switch: 1V
- Input signal: 400Hz sine wave 1Vrms (2.8Vp-p)

Fig 7-7 AC MILLIVOLTMETER



Voltages and waveform obtaiend
under conditions given as follows:

- Input signal: Freq.---400Hz sine wave
  Level---8 divisions display

Fig 7-8 OSCILLOSCOPE

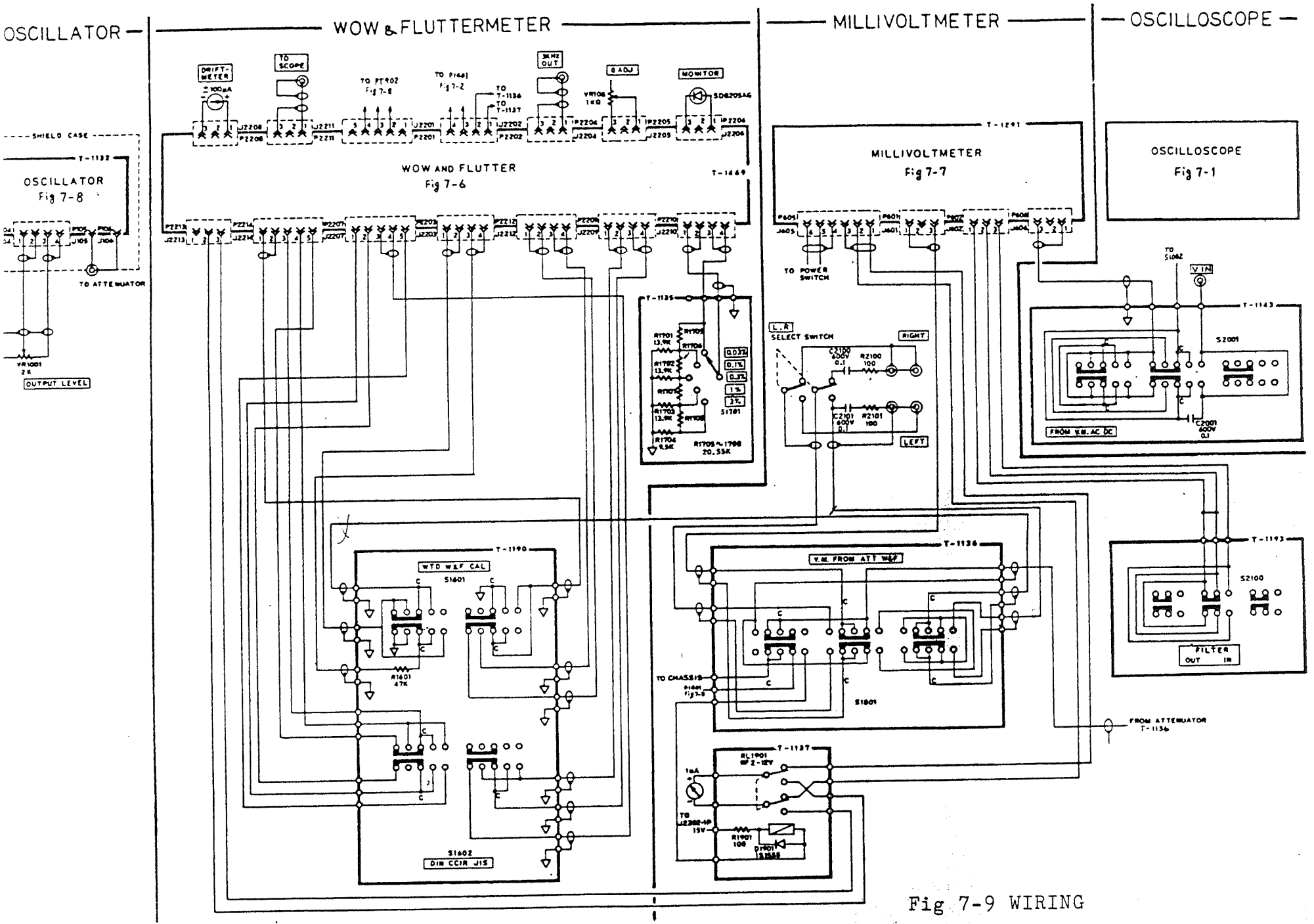


Fig 7-9 WIRING