Ferrograph

AUXILIARY TEST UNIT

ATU 1

OPERATING INSTRUCTIONS

Serial No. 1350 onwards

AVM FERROGRAPH

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FERROGRAPH
AUXILIARY TEST UNIT

Contents

List of Illustrations

General Description

The Ferrograph Auxiliary Test Unit (ATU) is designed to complement the Ferrograph Recorder Test Set (RTS) and to extend its facilities even further so that together they comprise an extremely versatile measuring system. The ATU is styled to match the Recorder Test Set and is built into a case with the same overall dimensions. However, in the same way that the RTS can be used to test apparatus other than recorders, due to its sophisticated circuitry, the Auxiliary Test Unit can be used with virtually any other millivoltmeter and/or audio signal generator.

The Oscillator Amplifier section contains an amplifier coupled with an attenuator (600 Ω) to adjust the gain in pre-set steps between —20 dB and + 10 dB. Together with the RTS, the ATU gives an output signal continuously variable from —75 dBm to +20 dBm into 600 Ω.

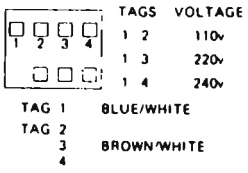
As supplied, the output of the ATU is accurately balanced and delivers a maximum of +20 dBm into a 600 Ω load. A special circuit can be included to limit the output to this figure to prevent an accidentally overload voltage being applied when the ATU is connected to land lines, etc., a small internal adjustment reduces the maximum output to +10 dBm.

The Meter section provides an input loading which may be either balanced or unbalanced, and in the balanced setting it is capable of handling signals of up to +20 dBm. Load impedances of 8 Ω, 600 Ω or 10k Ω can be push-button selected or the input can be left unloaded, when its impedance is either 50 k Ω ('bal') or 2M Ω + 150pF approx. ('unbal').

The actual meter readings are made using the Millivoltmeter section of the RTS (or a millivoltmeter connected to the 'TO EXTERNAL METER' socket), and as selected by the push-buttons these are either 'Wideband Response' (30 Hz - 20 kHz), 1 kHz (±100 Hz) band pass filter to reject hum and noise during the measurement of crosstalk, erasure, etc., or weighted response for the measurement of noise. The weighted response is to the DIN/CCIF characteristic as supplied, but replacement plug-in p.c. boards are available to other characteristics.

The ATU is 'self-powered' from an A.C. mains power supply and has a built-in audio amplifier and loudspeaker with volume control, for audible monitoring of any signal at the 'TO EXTERNAL METER' output. This facility is extremely useful for listening to announcements on frequency response tapes, etc.

Connections



POWER SUPPLY

The Auxiliary Test Unit can be operated from a power supply of 105-120 V or 200-250 V, 50-60 Hz. If not correctly set for the supply voltage, the voltage could be altered internally on the power supply transformer by re-soldering the Brown/White lead appropriately; tag 2-110V, tag 3-220V or tag 4-240 V; the Blue/White lead remains on tag 1. *The rear panel must be marked with the new voltage.* No adjustment is necessary for supply frequency in the range 50-60 Hz (approx.). The power supply lead should be plugged into the rear panel and connected through an appropriate plug to the power supply (A.C. only).

METER

The signal to be measured should be connected to the two 'meter' terminals at the lower left of the front panel — Red (signal) and Black (earth). This input is also duplicated on twin sockets on the panel above. These sockets are normally 3 contact, gauge B jack sockets (T-R-S) which will also accept 3 contact, gauge A jack plugs (T-R-S) without damage. The panel is removable so that alternative sockets or connectors can be fitted to suit the user's individual requirements, and 'blank' panels are available onto which these sockets/connectors can be mounted. The two sockets are controlled by a 2-position toggle switch above them, which selects either the left or right socket. This enables a stereo recorder, amplifier, etc., to be wired left channel to left socket, right channel to right socket, so that during the test procedure it is possible to compare the left and right channels without transferring the leads from track to track.

Oscillator Amplifier section

The Oscillator Amplifier section is connected between the equipment under test and the Recorder Test Set (Oscillator) or an external oscillator/audio signal generator. It is used to provide extra gain or attenuation and can also be used to load the oscillator output with a 600 Ω load.

OSCILLATOR AMPLIFIER LOADING

Where the equipment under test provides a load of 600 Ω at the 'oscillator' socket, the oscillator amplifier gain is accurately the nominal value of the push-button selected. If the equipment input impedance is high, the 'osc. loading 600 Ω' button should be pressed (push again to release), which connects a 600 Ω resistor across the 'oscillator' output to provide the correct loading for accuracy.

It is quite in order not to press the 'osc. loading 600 Ω' button, although the nominal figure of each button may then not be accurate, depending upon the impedance of the loading on the 'oscillator' output *viz.* the gain/attenuation may no longer be in exactly 10 dB steps. However, the actual output level can be measured using the RTS Meter or the external millivoltmeter (see METER section).

OSCILLATOR AMPLIFIER GAIN

The frequency and magnitude of the signal is still determined by the settings of the controls on the Recorder Test Set (or on the external oscillator). However, the 'OSCILLATOR GAIN' push buttons can be used in conjunction with the 'Oscillator Output — Coarse & Fine' controls to provide an output signal ranging from —75 dBm to +20 dBm into a 600 Ω load (the latter can be limited to +10 dBm as described in 'Special Features — Output Modification').

The ATU provides extra gain or attenuation on pressing one of the four push-buttons, —20 dB, —10 dB, 0 dB or + 10 dB, when the three other buttons are automatically released. The first two buttons provide attenuation, the last additional gain, and the other gives the same output signal level as that fed in. The nominal gain is accurate for a load of 600 Ω but is not accurate for load impedances which differ from this *viz.* the gain/attenuation may no longer be in exactly 10 dB steps.

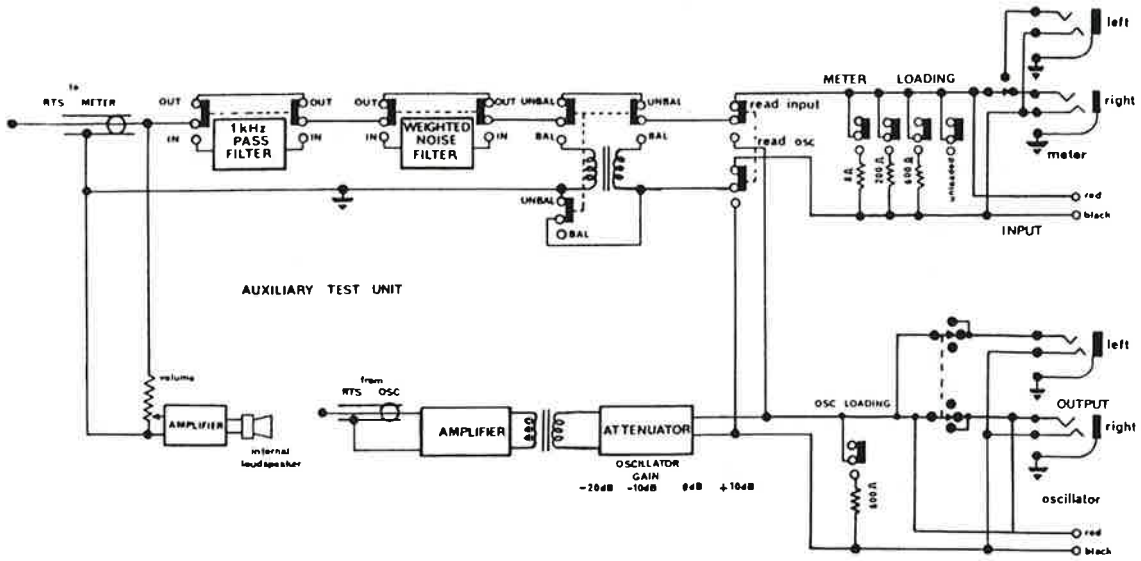


FIG. 2. BLOCK DIAGRAM

Meter section

The Meter section is connected between the equipment under test and the Recorder Test Set (or external millivoltmeter). It provides a range of load impedances and a selection of filters to widen the scope of the Millivoltmeter Section of the Recorder Test Set. It is also connected to the internal audio amplifier and built-in loudspeaker so that by turning up the 'volume' control whatever is being fed out of the 'TO EXTERNAL METER' socket can be monitored aurally.

Note: When the ATU is used with the RTS, the 'read input' button on the RTS must always be pressed; the function of the RTS 'read osc.' button is replaced by the ATU 'read osc.' button as explained below.

METER LOADING

The output of the equipment under test is loaded by 8 Ω, 600 Ω, 10 k Ω or left unloaded by pressing the appropriate push-button at the lower left of the front panel — when one is pressed the others are automatically released. When the 'unloaded' button is pressed, the load impedance is either 50 k Ω with the 'bal' button in or 2M Ω +150 pF approx. with the 'bal' button out ('unbal').

If any other impedance loading is required, this can be obtained by connecting a suitable resistor across the 'meter' input terminals.

The loading can be made balanced by pressing the 'bal' button, or it can be unbalanced by leaving the 'bal' button unpressed (or by pressing it again to release it). In the 'unbal' condition (button out) the Black terminal is earthed.

MILLIVOLTMETER

The function of the Meter section is controlled by the five push-buttons on the front panel, titled 'MILLIVOLTMETER'.

Normally the input signal at the 'meter' socket is fed via the 'MILLIVOLTMETER' controls to the 'TO EXTERNAL METER' output socket, but it is possible to change the input signal to that at the 'oscillator' output socket by pressing the 'read osc.' button (press again to release). Use of this button thus gives instantaneous 'A-B' comparison of the input and output signals of the equipment under test, *e.g.* record and replay signals of a tape recorder, and also enables the output signal to be measured accurately.

As explained in 'Meter Loading', the loading on the 'meter' input can be either balanced or with one side earthed (Black terminal). This is determined by the setting of the left hand button; in — 'bal', out — 'unbal' respectively.

The remaining three 'millivoltmeter' buttons are interconnected such that pressing one automatically releases the other two.

On pressing the 'Wideband response' button, the signal is unmodified by the filters and is fed straight through to the output socket. The response of the amplifier is flat over the range 30 Hz - 20 kHz.

On pressing the '1 kHz filter' button, the band pass filter of 1 kHz $\pm$100 Hz is connected in circuit so that only those signals within this narrow band pass through to the output socket. This is very useful for eliminating unwanted signals and noise (hum, hiss, etc.) when measuring erasure, interchannel breakthrough, etc., where the signal being measured is at low level.

On pressing the 'weighted noise' button, the response of the amplifier is modified to a chosen frequency response, permitting noise measurements to the required characteristic. As supplied from the Factory, the response is CCIR/ARM/2 k characteristic but other characteristics are available as replacement p.c. boards (see 'SPECIAL FEATURES — Filter characteristics').

The overall gain from the 'meter' input to the 'TO EXTERNAL METER' output is unity at 1 kHz for all combinations of the 'MILLIVOLTMETER' push-buttons.

LOUDSPEAKER VOLUME

The signal at the 'TO EXTERNAL METER' output socket is also connected via the 'volume' control to an audio amplifier and internal loudspeaker. This facility is extremely useful for listening to test tape announcements, frequency response tones, etc.

Measurements

The Oscillator Amplifier Section should be used in conjunction with the controls on the Recorder Test Set to set the signal level at that appropriate for the measurement being carried out. When the Millivoltmeter Section is being used, the 'read input' button must always be pressed on the RTS.

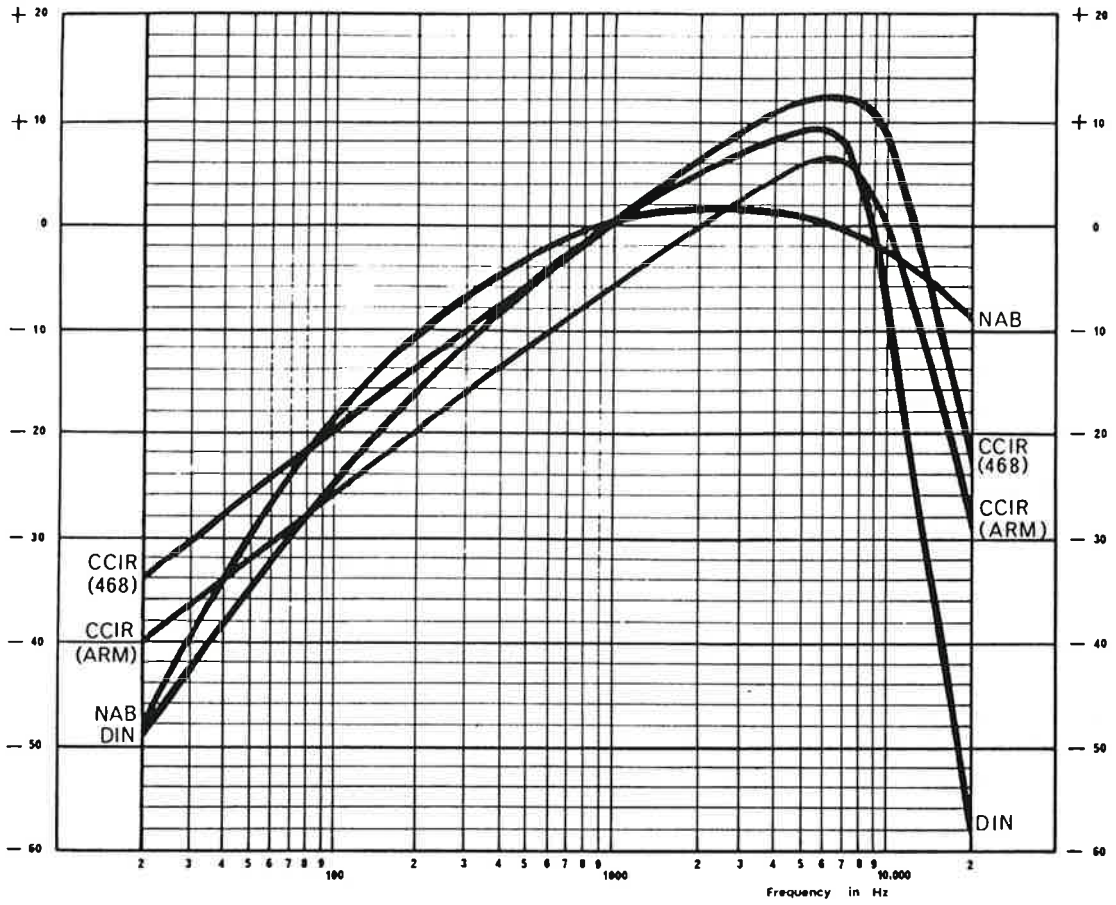


FIG. 3. WEIGHTED NOISE FILTER CHARACTERISTIC

On the Meter section the correct loading should be arranged by pressing the appropriate push-buttons of the 'METER LOADING' controls. For general measurements, such as Frequency Response, Drift, Wow & Flutter, Distortion, etc., the 'Wideband response' button should be pressed, thus releasing the 'weighted noise' and '1 kHz filter' buttons. This means that the signal is fed straight through to the Millivoltmeter and is unmodified by any filters.

SIGNAL-TO-NOISE RATIO

The standard procedure for measuring the Signal-to-Noise should be followed as usual; for the Recorder Test Set this is described in Section 3.6, page 10 of the 'Operating Instructions'.

With the 'Wideband response' button pressed, the normal Signal-to-Noise Ratio is obtained, but with the 'weighted noise' button pressed, the Signal-to-Noise Ratio is measured according to the DIN/CCIF characteristic or to other characteristics as described in 'SPECIAL FEATURES — Filter characteristics'.

ERASURE

(a) Make a peak level recording of a 1 kHz signal as described for 'Signal-to-Noise Ratio' above *viz.* at 2% (or 3%) T.H.D. or with reference to a specified tape flux level.

(b) Wind back to approximately the half way point of this recording and erase the latter part of the recording.

(c) Wind back to the start of the recording.

(d) Press the '1 kHz filter' button and replay the recording.

(e) On the Recorder Test Set press the 'MILLIVOLTMETER input' button and adjust the 'MILLIVOLTMETER' switch to give a convenient reading on the meter.

(f) When the 'erased' section of the recording is reached, re-adjust the 'MILLIVOLTMETER' switch to give a convenient reading on the meter.

(g) The difference in the two readings can be read directly from the R.T.S. meter dB scale plus the difference in the two 'MILLIVOLTMETER' switch settings.

(h) On stereo recorders, this procedure should be repeated for the other track.

Note 1. The 1 kHz filter is necessary to eliminate hum, noise, etc., when measuring the erased signal, which at —60 dB to —70 dB would otherwise be masked by the background noise at about —50 dB to —60 dB depending upon the type of tape recorder.

Note 2. A completely clean (or unused) part of the tape must be used for each repeat measurement.

CROSSTALK

There are two basic types of crosstalk which can occur on tape recorders; inter-channel breakthrough between upper and lower channels on stereo recorders only, and inter-track crosstalk between adjacent tape tracks which can occur on both mono and stereo recorders.

½ Track Mono

(a) Connect the tape recorder to the Left (upper) sockets as in 'CONNECTIONS'.

(b) Using bulk erased or virgin tape, make a peak level recording of a 1 kHz signal.

(c) Set the ATU meter switch to the left, press the '1 kHz filter' button and replay the recording.

(d) On the RTS, adjust the 'MILLIVOLTMETER' switch to give a convenient reading on the meter.

(e) Wind on the tape to the end of the recording, reverse the tape reels and replay the tape.

(f) With the ATU 'meter' switch still to the left, note the difference between this reading and the original 'peak level' reading (intertrack crosstalk).

½ Track Stereo

(a) Connect the tape recorder to the Left (upper) and Right (lower) sockets as in 'CONNECTIONS'.

(b) Set the 'oscillator' switch to the centre position, the recorder Record Mode selector to 'stereo' and make a peak level recording of a 1 kHz signal on both tracks simultaneously.

(c) Replay the recording and set the tape recorder replay controls to give equal readings on the Millivoltmeter when the ATU 'meter' switch is moved from left to right.

(d) Using bulk erased or virgin tape, make a peak level recording of a 1 kHz signal on the Upper Track only (Record Mode switch at 'upper').

(e) Set the ATU meter switch to the left, press the '1 kHz filter' button and replay the recording.

(f) On the RTS, adjust the 'MILLIVOLTMETER' switch to give a convenient reading on the meter.

(g) While still playing the recording, set the ATU 'meter' switch to the right and re-adjust the RTS 'MILLIVOLTMETER' switch to give a convenient reading on the meter.

(h) The difference in the two readings can be observed directly from the RTS meter dB scale plus the difference in the two 'MILLIVOLTMETER' switch settings (interchannel crosstalk, upper to lower).

(i) Wind on the tape to the end of the recording, reverse the tape reels and replay the tape.

(j) With the ATU 'meter' switch to the right, note the difference between this reading and the original 'peak level' reading (intertrack crosstalk, lower to upper).

(k) Wind the tape to a completely unused part of the tape (or bulk erase all previous recordings) and make a peak level recording of a 1 kHz signal on the Lower Track only (Record Mode switch at 'lower').

(l) Replay the tape and set the RTS 'MILLIVOLTMETER' Switch to give a convenient reading on the meter.

(m) Set the ATU 'meter' switch to the left and re-adjust the RTS 'MILLIVOLTMETER' switch to give a convenient reading on the meter.

(n) The difference in the two readings can be read from the meter dB scale (interchannel crosstalk, lower to upper).

(o) Wind on the tape to the end of the recording, reverse the tape reels and replay the tape.

(p) Set the ATU 'meter' switch to the left, comparing the reading with that of the peak level recording (l) (intertrack crosstalk, upper to lower).

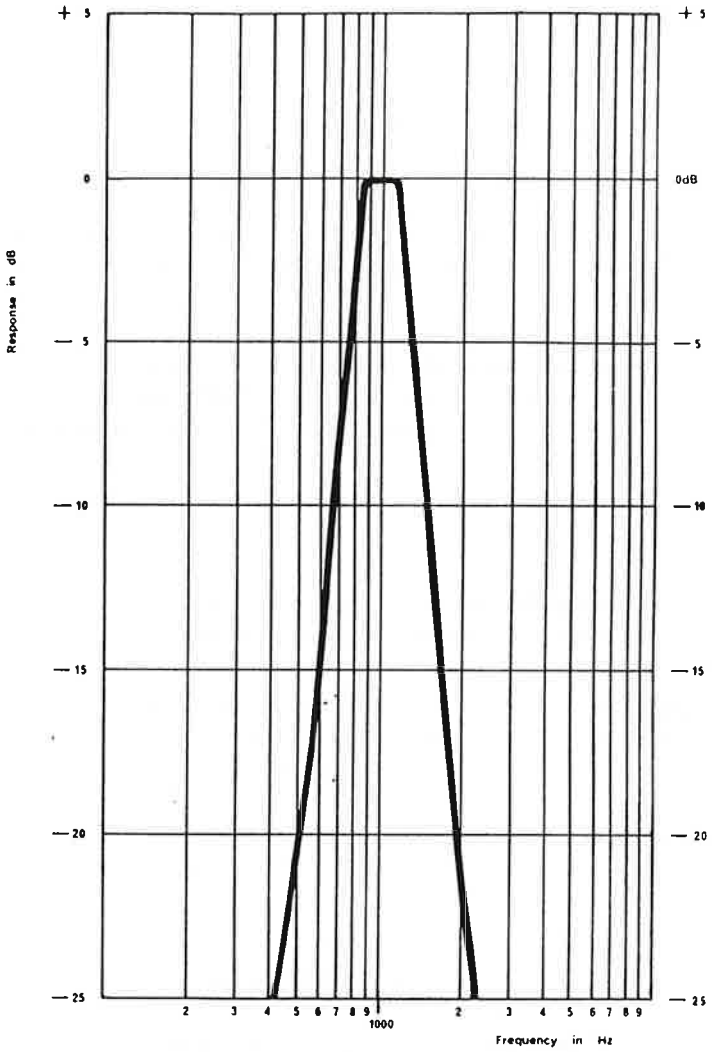


FIG. 4. 1 kHz BAND PASS FILTER
— TYPICAL RESPONSE CURVE

¼ Track Stereo

(a) Connect the tape recorder to the Left (upper) and Right (lower) sockets as in 'CONNECTIONS'.

(b) Set the 'oscillator' switch to the centre position, the recorder Record Mode selector to 'stereo' and make a peak level recording of a 1 kHz signal on both tracks simultaneously.

(c) Replay the recording and set the tape recorder replay controls to give equal readings on the Millivoltmeter when the ATU 'meter' switch is moved from left to right.

(d) Using bulk erased or virgin tape, make a peak level recording of a 1 kHz signal on the Upper Track only (Record Mode switch at 'Upper').

(e) Set the ATU 'meter' switch to the left, press the '1 kHz filter' button and replay the recording.

(f) On the RTS, adjust the 'MILLIVOLTMETER' switch to give a convenient reading on the meter.

(g) While still playing the recording, set the ATU 'meter' switch to the right and re-adjust the RTS 'MILLIVOLTMETER' switch to give a convenient reading on the meter.

(h) The difference in the two readings can be observed directly from the RTS meter dB scale plus the difference in the two 'MILLIVOLTMETER' switch settings (interchannel crosstalk, upper to lower).

(i) Wind on the tape to the end of the recording, reverse the tape reels and replay the tape.

(j) With the ATU 'meter' switch to the right, note the difference between this reading and the original 'peak level' reading (inter-track crosstalk, 4-3).

(k) Wind the tape to a completely unused part of the tape (or bulk erase all previous recordings) and make a peak level recording of a 1 kHz signal on the Lower Track only (Record Mode switch at 'lower').

(l) Replay the tape and set the RTS 'MILLIVOLTMETER' switch to give a convenient reading on the meter.

(m) Set the ATU 'meter' switch to the left and re-adjust the RTS 'MILLIVOLTMETER' switch to give a convenient reading on the meter.

(n) The difference in the two readings can be read from the meter dB scale (interchannel crosstalk, lower to upper).

(o) Wind on the tape to the end of the recording, reverse the tape reels and replay the tape.

(p) Set the ATU 'meter' switch to the right, then to the left, comparing each of these readings with the peak level recording (l) (inter-track crosstalk, 2-3 and 2-1 respectively).

Note 1. A completely clean (or unused) part of the tape *must* be used for each repeat measurement.

Note 2. With stereo or two channel recorders, different crosstalk readings are obtained depending upon the setting of the Record Mode selector. As described above, on 'upper' or 'lower', the crosstalk figures for Series 7 Ferrograph recorders is usually better than —65 dB at 1 kHz. If the readings are repeated with the Record Mode selector at 'stereo', the crosstalk figures are typically —45 to —50 dB.

Special Features

FILTER CHARACTERISTIC

As normally supplied, the response of the 'weighted noise' filter is to the CCIR/ARM/2 k Ref. characteristic. Other characteristics can be provided by replacing the Weighted Noise Filter P.C. Board as described.

(a) Remove the top panel of the ATU by undoing the two screws on the underside of its rear fold.

(b) Remove the P.C. Board Fixing Strap by undoing the screw at each end and lifting clear.

(c) Remove the rear left-hand P.C. Board and plug in the replacement Filter Board which is wired to the required characteristic.

(d) Ensure that all p.c. boards are positioned correctly, then refit the Fixing Strap and tighten the two fixing screws.

(e) Replace the top panel and tighten the fixing screws.

Filter Boards available:—	DIN (45405)/CCIF	025-365
	CCIR (Recom. 468)	025-413
	NAB	025-414
	CCIR/ARM/2 k Ref.	025-706

OUTPUT MODIFICATION

As normally supplied, the maximum signal available from the RTS2/ATU is +20 dBm. However, the signal obtainable from the 'oscillator' output is limited by the internal circuitry to +10 dBm by the following procedure.

(a) Remove the top panel of the ATU by undoing the two screws on the underside of its rear fold.

(b) Remove the P.C. Board Fixing Strap by undoing the screw at each end and lifting clear.

(c) Remove the right-hand P.C. Board.

(d) Remove or cut the wire link between the two pins at the top of the board (adjacent to the potentiometer).

(e) Replace the P.C. Board.

(f) Ensure that all p.c. boards are positioned correctly, then refit the Fixing Strap and tighten the two fixing screws.

(g) Replace the top panel and tighten the fixing screws.

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Specification

METER SECTION

Wideband Response

Maximum Input — Balanced: · 10 dBm 30 Hz - 20 kHz
· 20 dBm 60 Hz - 20 kHz
Unbalanced: 100 V (direct connection between input and output)

Weighted Noise Filter

Response to DIN (45-405)/CCIF characteristic (see page 11)

Maximum input level at 1 kHz · 20 dBm

1 kHz Band Pass Filter

Response: level at 900 - 1,100 Hz
—20 dB at 500 Hz & 2 kHz
—65 dB at 100 Hz & 10 kHz

Maximum input level at 1 kHz + 20 dBm

Input/Output Gain

Unity at 1 kHz for all control settings.

Input Termination (push button selected)

Unbalanced: 8 Ω, 600 Ω, 10 k Ω or 'unloaded' (RTS input impedance)

Balanced: 8 Ω, 600 Ω, 10 k Ω or 'unloaded' (50 k Ω)

Hum & Noise (600 Ω source)

Less than —85 dBm

Common Mode Rejection

> 70 dB at 50 Hz

OSCILLATOR AMPLIFIER SECTION

Maximum Output level (internal limiter)

+20 dBm into 600 Ω load (+10 dBm with internal adjustment)

Frequency Response (into 600 Ω load)

30 Hz - 20 kHz + 0, —0·5 dB

Output Impedance

600 Ω balanced (< 100 Ω on · 10 dB gain settings)

Hum & Noise (600 Ω load)

> 85 dB below signal

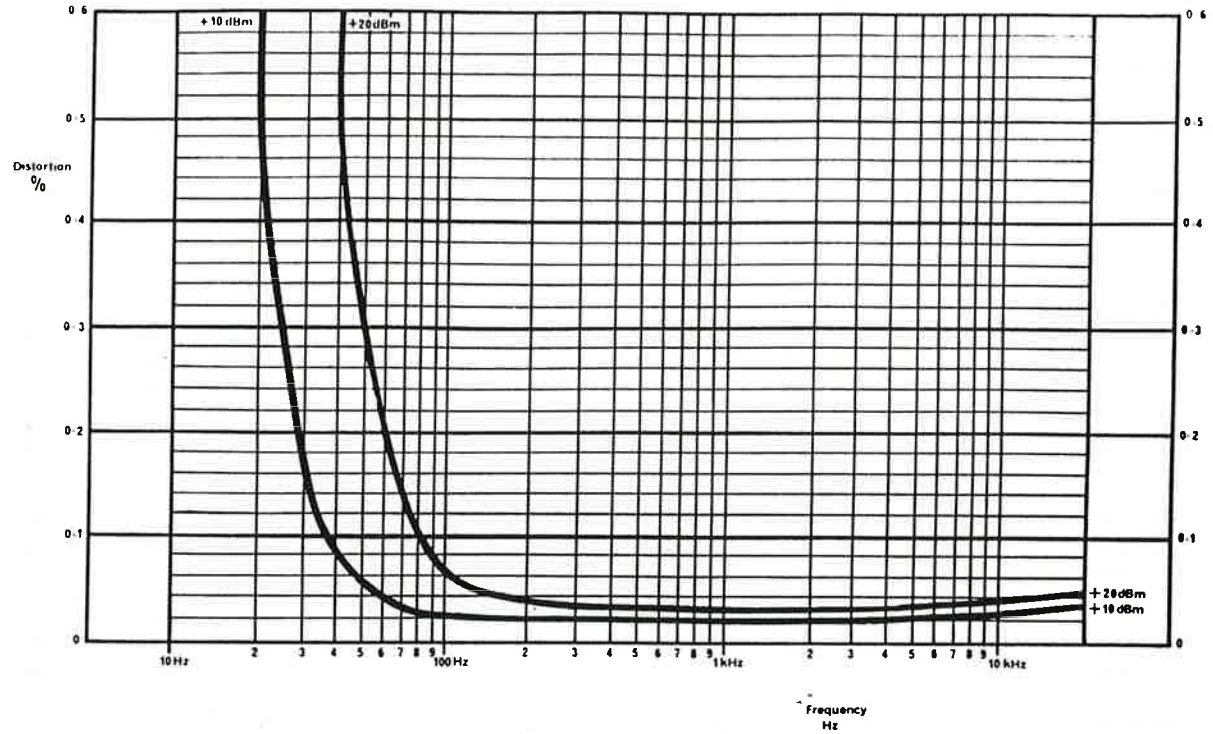

FIG. 5. DISTORTION — METER SECTION (Balanced Condition)

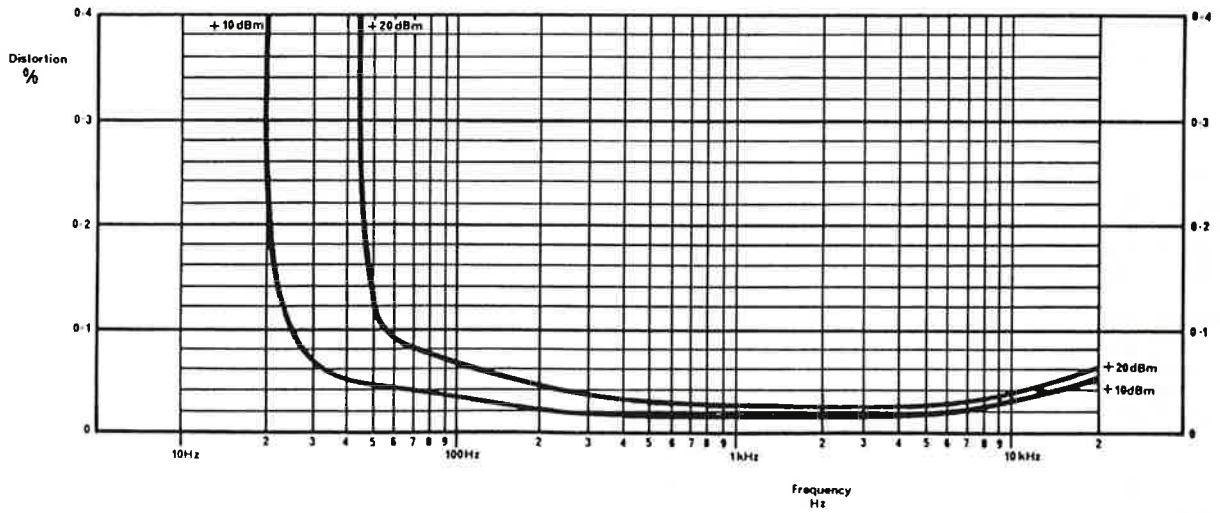

FIG. 6. DISTORTION — OSCILLATOR AMPLIFIER SECTION (600 Ω load)

GENERAL

Power Supply

105-120 V, 200-230 V, or 230-260 V, 50-60 Hz

Weight

12 lbs (5·5 kgs)

Dimensions

17⅜ in wide x 10 in deep over handles x 5⅝ in high
(440 mm x 254 mm x 143 mm)

FERROGRAPH
AUXILIARY TEST UNIT

List of Components

Unless stated otherwise in the lists, all resistors are ±5% tolerance and rated at ¼W. The number quoted in the last column is the Ferrograph part number.

Circuit Reference	GENERAL	*Part Number*
RV1	2·2M Ω Logarithmic	582-079
VT1	Transistor 40312	825-002
SW1	Supply Switch 'On'	750-004
SW2	Meter Switch	747-002
SW3	Oscillator Switch	747-001
SKT1	Socket 'meter'—left	692-023
SKT2	Socket 'meter'—right	692-023
SKT3	Socket 'To Ext. Meter'	692-030
SKT4	Socket 'From Ext. Osc.'	692-030
SKT5	Socket 'oscillator'—left	692-023
SKT6	Socket 'oscillator'—right	692-023
X1	Terminal 'meter'—black	790-008
X2	Terminal 'meter'—red	790-007
X3	Terminal 'oscillator'—red	790-007
X4	Terminal 'oscillator'—black	790-008
T1	Transformer, mains supply	MC/T1721
N1	Neon Indicator Lamp	455-011
FS1	Fuse 0·75A (20 x 5 mm dia)	380-008
	Fuse Holder (20 x 5 mm dia)	380-005
LS1	Loudspeaker (30 Ω)	700-000

Circuit Reference	POWER SUPPLY BOARD			*Part Number*
	Resistors (R) & Potentiometers (RV)			
R200	40k Ω	1%		625-24-40K
RV201	1k Ω	Linear		582-032
R202	4·3k Ω	1%		625-24-4K3
R203	3·9k Ω			625-28-3K9
R204	100k Ω			625-28-100k
R205	10k Ω			625-26-10K
	Capacitors			
C200	100μF	40V	Electrolytic	130-001
C201	0·01μF	100V	10%	131-500
C202	250μF	64V	Electrolytic	130-010
	Miscellaneous			
VT200	Transistor BC183LB			825-015
VT201	Transistor BC461			825-032
MR200	Bridge Rectifier WO2 (or WO4)			600-002
MR201	Zener Diode BZY88 C5V6			290-013

Circuit Reference	OSCILLATOR AMPLIFIER BOARD	*Part Number*
	Resistors (R) & Potentiometers (RV)	
R300	68k Ω	625-26-68K
R301	10k Ω	625-26-10K
R302	22M Ω	625-08-22M
R303	1k Ω	625-26-1K
R304	4·7k Ω	625-26-4K7
R305	47k Ω	625-28-47K
RV306	22k Ω Linear	582-012
R307	4·7k Ω	625-26-4K7
R308	1M Ω	625-26-1M
R309	22k Ω	625-26-22K
R310	22k Ω	625-26-22K
R311	4·7k Ω	625-26-4K7
R312	68k Ω	625-28-68K
R313	39 Ω	625-26-39
R314	2·2k Ω	625-26-2K2
R315	560 Ω	625-26-560
R316	4·7k Ω	625-26-4K7
R317	1k Ω	625-26-1K
R318	100k Ω	625-28-100K
RV319	1k Ω Linear	582-047
R320	1·2k Ω	625-26-1K2
R321	6·8k Ω	625-28-6K8
R322	2·2k Ω	625-28-2K2
R323	10 Ω	625-26-10
R324	10 Ω	625-26-10

List of Components

Circuit Reference				Part Number
R325	390 Ω			625-26-390
R326	82k Ω			625-26-82K
R327	680k Ω			625-26-680K
	Capacitors			
C300	0·47μF	100V	10%	131-265
C301	0·47μF	100V	10%	131-265
C302	0·1μF	100V	10%	131-250
C303	250μF	64V	Electrolytic	130-010
C304	1μF	100V	10%	131-521
C305	250pF	350V	10%	131-758
C306	1μF	100V	10%	131-521
C307	100μF	40V	Electrolytic	130-001
C308	640μF	25V	Electrolytic	130-004
C309	0·01μF	250V	10%	131-263
C310	32μF	40V	Electrolytic	130-013
C311	640μF	25V	Electrolytic	130-004
C312	0·015μF	250V	10%	131-267
	Miscellaneous			
VT300	Transistor BC214LB			825-016
VT301	FE Transistor 2SK30GR			825-006
VT302	Transistor BC214LB			825-016
VT303	Transistor BC183LB			825-015
VT304	Transistor BC183LB			825-015
VT305	Transistor BC461			825-032
VT306	Transistor BC300			825-033
MR300	Diode BAX16			290-001
MR301	Zener Diode BZY88 C5V6			290-013
MR302	Diode BAX16			290-001
MR303	Diode BAX16			290-001
MR304	Diode BAX16			290-001
MR305	Diode BAX16			290-001

Circuit Reference	**1 kHz FILTER BOARD**			Part Number
	Resistors (R) & Potentiometers (RV)			
RV400	220kΩ Linear			582-084
R401	100k Ω			625-26-100K
R402	100k Ω			625-26-100K
R403	22k Ω			625-26-22K
R404	22k Ω	1%		625-24-22K
R405	22k Ω	1%		625-24-22K
R406	22k Ω			625-26-22K
R407	100 Ω			625-26-100
R408	100 Ω			625-26-100
R409	5·6k Ω			625-26-5K6
R410	100k Ω			625-26-100K
R411	56k Ω			625-26-56K
R412	680k Ω			625-26-680K
R413	10k Ω			625-26-10K
R414	10k Ω			625-26-10K
R415	33k Ω			625-26-33K
R416	47 Ω			625-26-47
	Capacitors			
C400	4700pF	30V	2½%	131-778
C401	0.047μF	100V	2½%	131-264
C402	820pF	30V	2½%	131-773
C403	3000pF	63V	2½%	131-788
C404	3900pF	63V	2½%	131-787
C405	0.01μF	250V	10%	131-263
C406	0.047μF	100V	10%	131-256
C407	250μF	64V	Electrolytic	130-010
	Miscellaneous			
VT400	Transistor 2SC1000			825-035
VT401	Transistor 2SC1000			825-035
VT402	Transistor 2SC1000			825-035

Circuit Reference	**MOTHER BOARD**			Part Number
	Resistors			
R500	8 Ω	5%	17W	626-034
R501	600 Ω	1%	¼W	624-023
R502	10k Ω	1%	¼W	625-28-10K
R503	330k Ω			625-28-330K
R504	10k Ω			625-28-10K
R505	155 Ω	¼%		624-024
R506	155 Ω	¼%		624-024
R507	421·6 Ω	¼%		624-025
R508	155 Ω	¼%		624-024
R509	155 Ω	¼%		624-024
R510	155 Ω	¼%		624-024
R511	155 Ω	¼%		624-024
R512	421·6 Ω	¼%		624-025
R513	155 Ω	¼%		624-024
R514	155 Ω	¼%		624-024
R515	199·8 Ω	¼%		624-028
R516	199·8 Ω	¼%		624-028
R517	462·2 Ω	¼%		624-027
R518	142 Ω	¼%		624-026
R519	142 Ω	¼%		624-026
R520	600 Ω	1%	¼W	624-023

FERROGRAPH
AUXILIARY TEST UNIT

List of Components

Circuit Reference		*Part Number*
	Capacitor	
C500	100pF 160V 2½%	131-799
	Miscellaneous	
SW500	P.B. Switch (4 pole) 'Meter Loading'	749-015
SW501	P.B. Switch (10 pole) 'Millivoltmeter-Oscillator Gain'	749-014
SKT500	Socket, P.C. Board	692-051
SKT501	Socket, P.C. Board	692-051
SKT502	Socket, P.C. Board	692-051
SKT503	Socket, P.C. Board	692-051
T500	Transformer (Balance)	200-037
T501	Transformer (Osc. Amp. Output)	200-038

Circuit Reference	**CCIR WEIGHTED NOISE BOARD**	*Part Number*
	Resistors	
R600	1M Ω	625-26-1M
R601	560k Ω	625-26-560K
R602	330k Ω	625-26-330K
R603	1k Ω	625-26-1K
R604	10k Ω	625-26-10K
R605	4·7k Ω 1%	625-24-4K7
R606	18k Ω 1%	625-24-18K
R607	18k Ω 1%	625-24-18K
R608	1k Ω	625-26-1K
R609	10k Ω	625-26-10K
R610	4·7k Ω 1%	625-24-4K7
R611	18k Ω 1%	625-24-18K
R612	18k Ω 1%	625-24-18k
R613	1k Ω	625-26-1K
R614	10k Ω	625-26-10K
R615	6·8k Ω 1%	625-24-6K8
R616	56k Ω 1%	625-24-56K
R617	2·2M Ω	625-26-2M2
R618	560 Ω	625-26-560
R619	10k Ω	625-26-10K
R620	1M Ω	625-26-1M
R621	47 Ω	625-26-47
	Capacitors	
C600	250µF 64V Electrolytic	130-010
C601	0·22µF 100V 10%	131-253
C602	3300pF 30V 2½%	131-770
C603	2200pF 160V 2½%	131-801
C604	270pF 30V 2½%	131-804
C605	3300pF 30V 2½%	131-770
C606	270pF 30V 2½%	131-804
C607	2200pF 160V 2½%	131-801
C608	3300pF 30V 2½%	131-770
C609	1µF 63V Electrolytic	130-015
C610	390pF 30V 2½%	131-805
C611	0·22µF 100V 10%	131-253
	Miscellaneous	
VT600	Transistor 2SC1000	825-035
VT601	Transistor 2SC1000	825-035
VT602	Transistor 2SC1000	825-035
VT603	Transistor S2C1000	825-035

Circuit Reference	**NAB WEIGHTED NOISE BOARD**	*Part Number*
	Resistors	
R700	1MΩ	625-26-1M
R701	1.5MΩ	625-26-1M5
R702	1kΩ	625-26-1K
R703	680kΩ	625-26-680K
R704	4.7kΩ	625-26-4K7
R705	15k Ω 1%	625-24-15K
R706	39k Ω 1%	625-24-39K
R707	100 Ω	625-26-100
R708	100 Ω	625-26-100
R709	4·7k Ω	625-26-4K7
R710	56kΩ 1%	625-24-56K
R711	3.3kΩ 1%	625-24-3K3
R712	100kΩ	625-24-100K
R713	82kΩ 1%	625-24-82K
R714	1KΩ	625-26-1K
R715	10k Ω	625-26-10K
R716	1M Ω	625-26-1M
R717	1·2M Ω	625-26-1M2
	Capacitors	
C700	250µF 64V Electrolytic	130-010
C701	0·22µF 100V 10%	131-253
C702	0·33µF 30V 2½%	131-270
C703	5600pF 30V 2½%	131-789
C704	1µF 40V Electrolytic	130-015
C705	300pF 30V 2½%	131-792
C706	3300pF 30V 2½%	131-770
C707	0·033µF 30V 1%	131-262
C708	0·22µF 100V 10%	131-253
C709	250µF 64V Electrolytic	130-010
	Miscellaneous	
VT700	Transistor 2SC1000	825-035
VT701	Transistor 2SC1000	825-035
VT702	Transistor 2SC1000	825-035

FERROGRAPH
AUXILIARY TEST UNIT

List of Components

Circuit Reference	DIN/CCIF WEIGHTED NOISE BOARD		*Part Number*
	Resistors		
R800	1M Ω		625-26-1M
R801	560k Ω		625-26-560K
R802	560k Ω		625-26-560K
R803	47 Ω		625-26-47
R804	100 Ω		625-26-100
R805	22k Ω		625-26-22k
R806	560 Ω		625-26-560
R807	22k Ω	1%	625-24-22K
R808	22k Ω	1%	625-24-22K
R809	4·7k Ω		625-26-4K7
R810	2·7k Ω	1%	625-24-2K7
R811	12k Ω	1%	625-24-12K
R812	12k Ω	1%	625-24-12K
R813	100 Ω		625-26-100
R814	4·7k Ω		625-26-4K7
R815	2·7k Ω	1%	625-24-2K7
R816	12k Ω	1%	625-24-12K
R817	12k Ω	1%	625-24-12K
R818	100 Ω		625-26-100
R819	4·7k Ω		625-26-4K7
R820	2·7k Ω	1%	625-24-2K7
R821	10k Ω	1%	625-24-10K
R822	120k Ω		625-26-120K
R823	2·2k Ω	1%	625-24-2K2
R824	18k Ω	1%	625-24-18K

Circuit Reference				*Part Number*
R825	33k Ω	1%		625-24-33K
R826	18k Ω	1%		625-24-18K
R827	100 Ω			625-26-100
R828	10k Ω			625-26-10K
R829	1M Ω			625-26-1M
	Capacitors			
C800	0·22μF	100V	10%	131-253
C801	5600pF	30V	2½%	131-789
C802	6800pF	30V	2½%	131-790
C803	8200pF	30V	2½%	131-791
C804	300pF	30V	2½%	131-792
C805	6800pF	30V	2½%	131-790
C806	300pF	30V	2½%	131-792
C807	8200pF	30V	2½%	131-791
C808	12000pF	30V	2½%	131-793
C809	0·047μF	30V	2½%	131-264
C810	0·068μF	30V	2½%	131-269
C811	500pF	30V	2½%	131-794
C812	250μF	64V	Electrolytic	130-010
C813	0·22μF	100V	10%	131-253
	Miscellaneous			
VT800	Transistor 2SC1000			825-035
VT801	Transistor 2SC1000			825-035
VT802	Transistor 2SC1000			825-035
VT803	Transistor 2SC1000			825-035
VT804	Transistor 2SC1000			825-035
VT805	Transistor 2SC1000			825-035

Circuit Reference	LOUDSPEAKER AMPLIFIER BOARD		*Part Number*
	Resistors		
R150	2.2kΩ		625-28-2k2
R151	68kΩ		625-28-68k
R152	39kΩ		625-28-39k
R153	68kΩ		625-28-68k
R154	2.2kΩ		625-28-2k2
R155	270Ω		625-28-270
R156	39Ω		625-28-39
R157	2.2kΩ		625-28-2k2
R158	39Ω		625-28-39
R159	270Ω		625-28-270
R160	2.2kΩ		625-28-2k2
R161	2.2kΩ		625-28-2k2
R162	10Ω		625-28-10
R163	10Ω		625-28-10
R164	270Ω		625-28-270
R165	100Ω		626-024
	Capacitors		
C150	0.47μF	100V	131-265

Circuit Reference				*Part Number*
C151	33μF	40V	Electrolytic	130-048
C152	220μF	63V	Electrolytic	130-010
C153	4700pF	30V	2½%	131-778
C154	220μF	63V	Electrolytic	130-010
C155	4700pF	30V	2½%	131-778
C156	33μF	40V	Electrolytic	130-048
C157	220μF	63V	Electrolytic	130-010
	Miscellaneous			
VT150	Transistor		BC214	825-016
VT151	Transistor		BC182	825-012
VT152	Transistor		BC461	825-032
VT153	Transistor		BC300	825-033
D150	Diode	BAX16		290-001
D151	Diode	BAX16		290-001
P150	Connector	Molex 4 way		577-072
P151	Connector	Molex 2 way		577-071
SKT150	Connector	Molex 4 way		692-090
SKT151	Connector	Molex 2 way		692-089

FERROGRAPH

AUXILIARY TEST UNIT

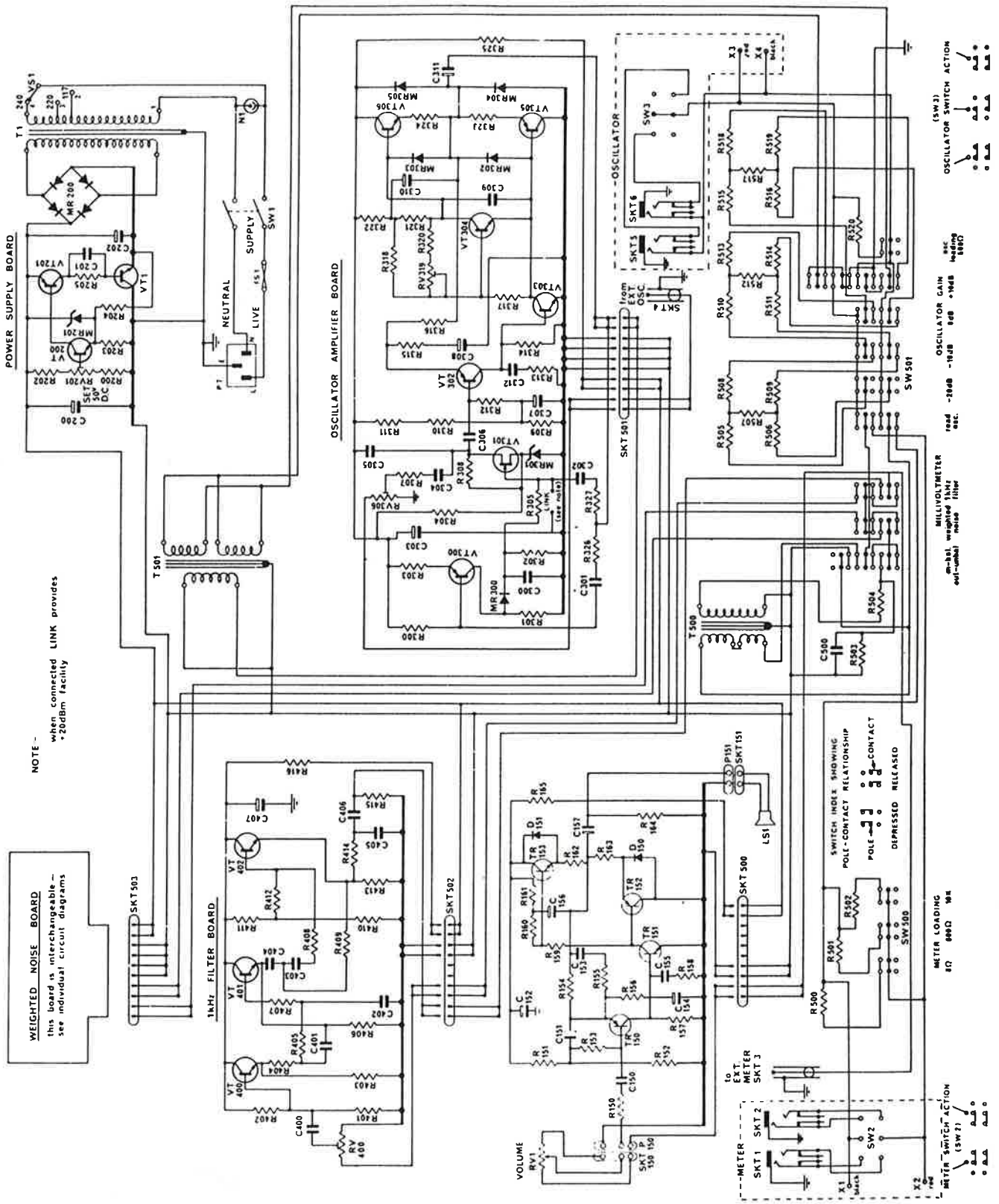

FIG. 7. CIRCUIT DIAGRAM — AUXILIARY TEST UNIT

250-052

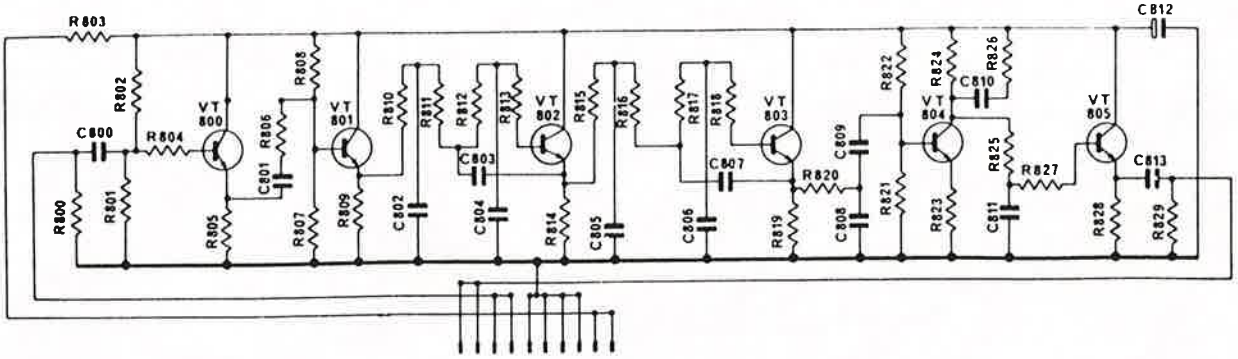

FIG. 8a. DIN/CCIF WEIGHTED NOISE BOARD

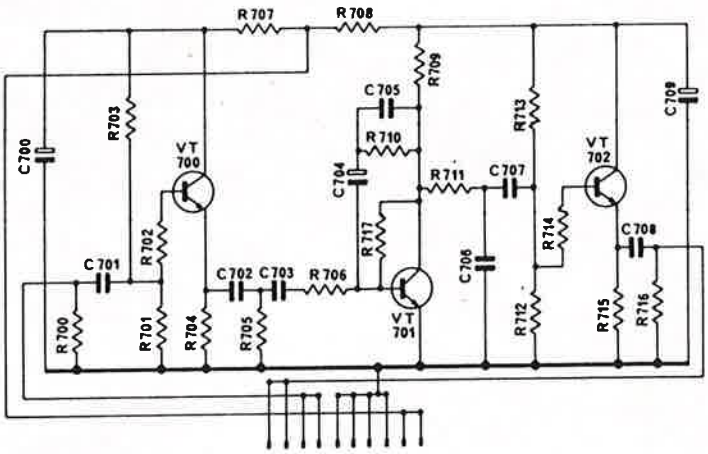

FIG. 8b. NAB WEIGHTED NOISE BOARD

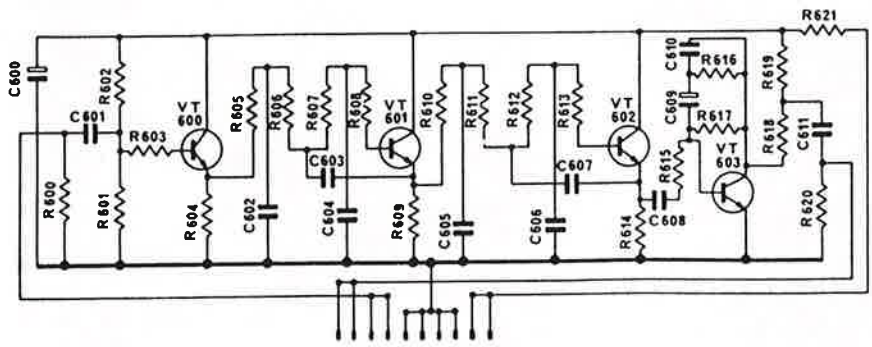

FIG. 8c. CCIR WEIGHTED NOISE BOARD

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