B.R.1771(32)

C.R.E.T.E.

Handbook for
J.S. CAT. No. 6625 - 99 - 972 - 6157
CALIBRATOR, FREQUENCY, CT432

ANY SUGGESTIONS FOR AMENDMENTS OR ADDITIONS TO THIS BOOK SHOULD BE SUBMITTED TO THE CAPTAIN SUPERINTENDENT, ADMIRALTY SURFACE WEAPONS ESTABLISHMENT, THROUGH THE USUAL CHANNELS.

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WEAPONS DEPARTMENT ADMIRALTY
JUNE, 1960 (W.50322/60)

ADMIRALTY, S.W.1.
June, 1960.

W.50322/60

B.R.1771(32) C.R.E.T.E. "Handbook for J.S. Cat. No. 6625-99-972-6157 Calibrator, Frequency, CT432" having been approved by My Lords Commissioners of the Admiralty, is hereby promulgated.

By Command of Their Lordships

To:-

Flag Officers and
Commanding Officers
of H.M. Ships and
Vessels concerned.

CHANGES

When a change to this handbook is promulgated the brief details required below are to be filled in.

CHANGE No.	AUTHORITY (P Series A.F.O. No.)	DATE OF INSERTION	INITIALS
1	AFO-P-380/61	9-JUL-72	J & M
2	AFO-P-184/62	19-JUL-72	J & M
3	RNBAS-P-990/69	19-JUL-72	J & M

PART 1

CHAPTER 1

INTRODUCTION

Function of Instrument

1. The Calibrator, Frequency CT432 is designed to provide accurate spot frequencies at 100 kc/s, 1 Mc/s and 10 Mc/s and harmonics thereof up to approximately the 50th for the check calibration of signal generators, test oscillators, receivers and similar equipment. The necessary mixer and audio amplifier are provided for the aural detection of beat notes between crystals and an external signal source.

2. By suitable circuit switching any commonly available fundamental mode, parallel-resonant quartz oscillator crystal can be energised. The crystal is plugged into the appropriate holder on the front panel and selected by a switch. A signal source or a receiver can thus be tuned to any spot frequency provided the correct crystal is available, i.e. a crystal whose fundamental, sub-multiple or harmonic produces the desired frequency.

3. The Calibrator, Frequency CT432 is a small, portable instrument with a wide distribution, but it has a particular application for use with the CT381 Frequency Swept Oscillator (12 kc/s - 32 Mc/s) to provide the necessary crystal frequency accuracy required for the alignment of receiver intermediate-frequency amplifiers, filters etc.

Panel Controls, Switches etc.

4.(a) Mains Input plug (PLB)

Mains supply is applied to the instrument via this plug using the standard C.N.R.T.E. mains lead.

(b) MAINS switch (SC)

Mains on-off switch.

(c) Lamp (ILP1)

Indicates whether or not the mains supply is reaching the mains transformer.

(d) Mains Voltage Selector Panel

This panel is protected by a translucent removable cover. Two small plugs are inserted in the sockets appropriate to the voltage of the mains supply.

(e) FUSE (FS1)

Mains fuse, new type anti-surge fuse 0.5A, J.S. 5920-99-972-6964. This fuse enables the C-core transformer to be protected but withstands the initial switching surge.

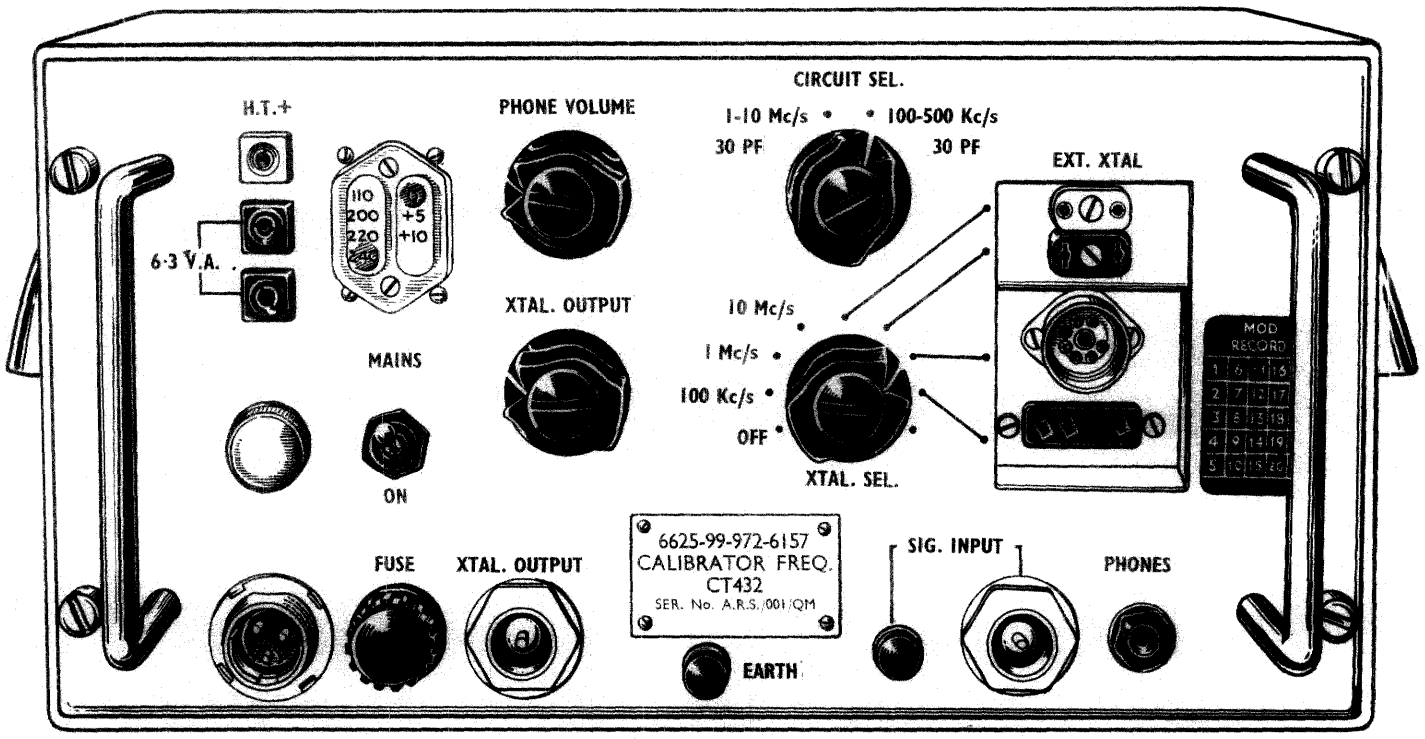

FIG. 1.1.1. VIEW OF FRONT PANEL

This sheet issued with A.L. No. 1, September, 1960.

PART 1

TECHNICAL DESCRIPTION

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PHYSICAL DATA

Height	Width	Depth	Weight
$6\frac{5}{8}$ in.	14 in.	$10\frac{3}{4}$ in.	12 lb (including mains lead)

POWER REQUIREMENTS AND CONSUMPTION

110, 115, 120, 200, 210, 220, 230, 240, 250 volts 50 to 60 c/s with front panel tap selection, 25 watts.

In addition there is available on front panel sockets the h.t. voltage approximately 225V d.c. (partially smoothed) approximately 20 mA and 6.3V a.c. 1.5A (balanced).

ACCESSORIES

J.S. Cat. No. 5995-99-940-0491 (formerly A.P.67384) Connector, Mains.

OTHER SERVICE OR COMMERCIAL DESIGNATIONS

Aeronautical Radio Services - Calibrator, Frequency AR58.

HANDBOOK B.R.1771(32)

ESTABLISHMENT LIST E1115

PRODUCTION SPECIFICATION A.S.W.E. 19869

CALIBRATOR, FREQUENCY, CT432

(Joint-Service Cat. No. 6625-99-972-6157)

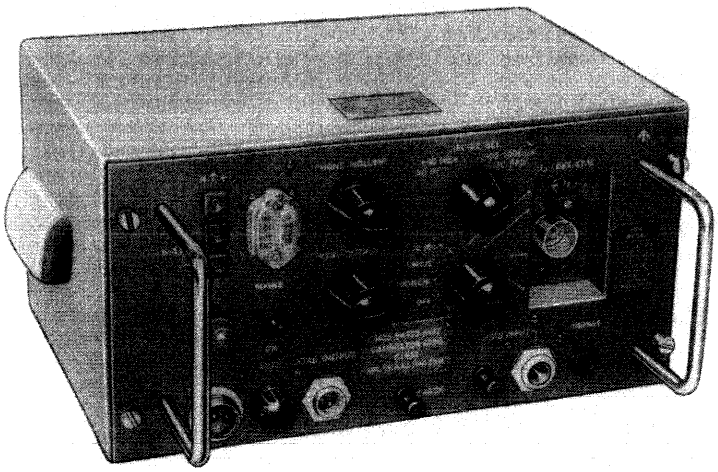
SUMMARY OF DATA

PURPOSE

To provide spot frequencies to calibrate receivers, signal generators, test oscillators and similar equipment between 10 kc/s and 500 Mc/s using fundamental frequency crystals in the ranges 100–500 kc/s and 1–10 Mc/s.

DESCRIPTION

It is a portable instrument consisting of a crystal oscillator system with a cathode follower variable output; in addition a mixer-audio amplifier system is provided for the aural detection (headphones) of beat notes between crystal frequency or harmonics and an external signal source. Three crystals 100 kc/s, 1 Mc/s and 10 Mc/s are provided internally and, in addition, four crystal holders accessible on the front panel to accommodate crystals to D.E.F. Specification 5271 styles A, B, C, D, E and F, fundamental mode between 100–500 kc/s and 1–10 Mc/s operating in the parallel resonant condition with an oscillator capacitance of 30 pF. Crystal positions are selected by a switch such that all unused crystals and holders are earthed, and to maintain accuracy and ease of oscillation over the frequency range a two position band switch (100–500 kc/s and 1–10 Mc/s) is provided.



CALIBRATOR, FREQUENCY, CT432

PERFORMANCE AND ACCURACY

Frequency Coverage: 100–500 kc/s and 1–10 Mc/s–Fundamental
10 kc/s – 500 Mc/s–Harmonic Mixing.

Accuracy

Internal crystals:

Type ZFC	100 kc/s	± 0.01%	± 0.0025%	$-20^{o}+70^{o}$C
Type ZEC	1 Mc/s	± 0.01%	± 0.0013%	$-20^{o}+70^{o}$C
Type ZEC	10 Mc/s	± 0.01%	± 0.0025%	$-20^{o}+70^{o}$C

External crystals:

Tolerance of crystal plus a maximum of ± 0.005% (depending on crystal cut) to allow for the instrument capacitance tolerance of ± 2 pF on the nominal 30 pF.

Output: Continuously variable cathode follower output, maximum available greater than 0.25 volts across a 75 ohm external load. The output impedance is high and several volts of signal are available across a high impedance load.

Harmonic Content: The crystal oscillator is designed to have a high harmonic content in the output.

Internal Mixing System: Input impedance 15k on parallel terminal and coaxial plug. The a.f. output is fed from a jack to headphones of any impedance between 600 ohms and 4000 ohms. Lower impedances may be used with a slight loss of sensitivity. Audio gain control is provided but the level in the headphones is limited such that the user is not caused discomfort.

Sensitivity: Calibration of a signal source with a 50 mV e.m.f. output is possible up to approximately 50th harmonic for 100 kc/s and 1 Mc/s crystals, falling to 25th harmonic for a 10 Mc/s crystal, but with signal levels of 100 mV adequate sensitivity is available up to 500 Mc/s using a 10 Mc/s crystal.

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HANDBOOK FOR

J.S. CAT. NO. 6625-99-972-6157

CALIBRATOR, FREQUENCY, CT432

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DETAILED TECHNICAL DESCRIPTION

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PART 1

CHAPTER 2

DETAILED TECHNICAL DESCRIPTION

The Crystal Oscillator

1. Appendix A discusses quartz crystals and the factors controlling the design and accuracy of the oscillator used in this instrument.

2. A pentode valve V1 (CV4014) is used in a Colpitts circuit with grid to ground crystal connections.

3. A crystal selector switch (SA) has nine available positions which enable the selection of internal 100 kc/s (XL1), 1 Mc/s (XL2), 10 Mc/s (XL3) crystals and four types of base on the front panel for external crystals; in addition two off positions are provided, one at each end of travel of the switch. The arrangement of the switch is such that all unused positions are earthed; however the switch should not be left selecting an empty base or spurious oscillations may occur.

4. A circuit selector switch (SB) selects the feedback components to V1 necessary for stable operation over a frequency range 100-500 kc/s or 1-10 Mc/s. It selects the necessary value of capacitance ratio C4 to C3 or C2 to C1, the correct grid leak and cathode load resistor and also alters the screen voltage of V1 by shorting R8 as necessary.

5. The nominal 30 pF circuit capacitance presented to the crystal is preset during calibration independently for each range. These coaxial air spaced trimmers C1 and C3 must not be altered unless crystal test sets and standard frequency measuring equipment are available.

6. The oscillator triode i.e. grid, cathode and screen of V1 is electron coupled to V2.

The Cathode Follower Output

7. V2 (CV4031) is a double triode strapped as a cathode follower with an a.c. coupled potentiometer, the crystal output control (RV1), which feeds direct to the crystal output plug (PLC) and also to the mixer valve V3. The output impedance varies with the setting of RV1 but for any crystal frequency at least 0.25 volts is available across an external 75 ohm load.

The Mixer

8. The mixer valve V3 (CV4011) is a high slope, suppressor pentode. The output from the cathode follower, which has an amplitude of several volts when PLC is unloaded, is fed to the control grid of V3. The external signal source is fed into either the signal input coaxial plug (PLA) or red terminal (TP2), which are paralleled within the instrument, through a d.c. isolating capacitor C13 to the suppressor grid of V3 and mixing takes place within the electron stream. Adjustment of RV1 may be necessary to obtain an optimum level for efficient mixing.

9. High-frequency signals are by-passed to earth by C14 and R21 and the audio-beat signals appear across RV2, the phone volume control.

The Audio Amplifier

10. The two stage audio amplifier consists of a double triode valve V4 (CV4004). Audio signals from the mixer are amplified by V4A and then by V4B; the resultant a.f. output is fed to a telephone jack (JKA).

11. The anode load R29 of V4B is high compared with any likely headphone impedance and hence the output acts as a constant current feed to the headphones. If a strong beat note is tuned in with the phone volume control (RV2) turned fully clockwise (i.e. maximum gain) the resultant signal output is a square wave; thus, due to this limiting action, the loudness at the headphones is limited to a level lower than that likely to cause discomfort. This factor will readily be appreciated by anyone who has had headphones suddenly connected to an unlimited signal source.

The Power Supply

12. A tapped primary transformer feeds a simple, full wave rectifier system with capacitance input and resistance smoothing.

13. The input capacitor C21 is a 4 μF paper capacitor, but additional smoothing is obtained by the use of a 32 + 32 μF electrolytic capacitor (C20). Electrolytic capacitors deteriorate in store and when used after a period of six months or more may pass a relatively large reforming current. R22 is a wire wound high wattage component which can carry this large current without overloading for the reforming period. Thus, when a new or unused instrument is first switched on the sensitivity may be low due to a reduced h.t. voltage.

14. The heater line is centre tapped to earth using two 47 ohm resistors (R34 and R35) to reduce hum levels.

15. In a further effort to reduce hum levels the chassis is not used as an earth return for any audio or power supply frequencies. Instead, a thick copper wire runs around the chassis, on insulated pillars where necessary, and all important earth returns are connected to this wire which is earthed to the chassis at one point only.

16. The power supply is restricted to 50-60 c/s only since hum from 400-500 c/s supplied would render the instrument unusable.

17. The mains transformer is capable of supplying more power than is required for the CT432. Sockets are provided on the front panel and about 1.5A at 6.3V a.c., balanced to centre tapped earth by R34 and R35, and up to 20 mA at 220-250 volts loaded (h.t.+) are available for external use. When used externally the h.t. should be further smoothed by the addition of at least a 16 μF electrolytic capacitor (450V d.c. working) across the supply (SKTA +ve to TP1 -ve). The heater is balanced but no damage will result if either one of the heater sockets is earthed, but the hum level in the headphones may be increased.

PART 2

OPERATION AND MAINTENANCE DIRECTIONS

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PART 2

CHAPTER 1

OPERATING INSTRUCTIONS

Preparation for use

1.(1) Check that MAINS switch is off.

(2) Check that Mains Voltage Selector Panel is set to the voltage of the available mains supply. If not, remove the translucent cover, and adjust the two small plugs ensuring that both are inserted in the sockets such that the sum of the engravings on the cover indicate the supply voltage. Replace the cover plate after adjustment.

(3) Connect to the mains supply using standard mains lead 5995-99-940-0491.

(4) Set the XTAL SEL. Switch to the fully counter-clockwise OFF position.

(5) Set the PHONE VOLUME control fully counter-clockwise.

(6) Switch MAINS switch ON and allow instrument to warm up (2 minutes is adequate), and then proceed to the relevant paragraph.

To Set-up a Given Frequency using an Internal Crystal

2.(1) If 100 kc/s, 1 Mc/s or 10 Mc/s is required set the XTAL SEL. switch to the required frequency.

(2) Set CIRCUIT SEL. switch either to 1-10 Mc/s, for 1 or 10 Mc/s crystal, or 100-500 kc/s, for the 100 kc/s crystal.

(3) The output signal is obtained via XTAL OUTPUT plug and may be adjusted by XTAL OUTPUT control.

To set-up a Given Frequency using an External Crystal

3.(1) If an external crystal is to be used plug it into the appropriate base on the EXT. XTAL panel.

(2) Set the XTAL SEL. switch to select that base.

(3) Set CIRCUIT SEL. switch to the range appropriate to the crystal being used.

(4) The output signal is obtained via XTAL OUTPUT plug and may be adjusted by XTAL OUTPUT control.

NOTE:- The use of crystals outside the limits of 1-10 Mc/s and 100-500 kc/s

Any fundamental crystal as low as 75 kc/s and as high as 20 Mc/s can be used but the accuracy is undefined outside the limits of 1-10 Mc/s and 100-500 kc/s. For crystals below 100 kc/s set CIRCUIT SEL. switch to 100-500 kc/s position; for

crystals above 10 Mc/s set CIRCUIT SEL. switch to 1-10 Mc/s position; for crystals between 500 kc/s - 1 Mc/s try both positions and check that headphone signal is NOT extremely noisy as noise here usually indicates poor oscillation or parasitic squegging of the crystal system.

For use as a source of r.f. Energy for Receiver Calibration

4. (1) Set XTAL SEL. switch to the internal or external crystal, the fundamental or harmonic of which will give the desired frequency or range of frequencies.

(2) Set CIRCUIT SEL. switch to the frequency range appropriate to the crystal used.

(3) Set XTAL OUTPUT control to approximately mid-travel.

(4) Couple to the receiver under test via the XTAL OUTPUT plug; the degree of coupling will depend upon the sensitivity of the receiver and the order of the crystal harmonic being used. Loose inductive coupling is usually adequate and should always be tried before using direct coupling.

(5) Tune the receiver, with the b.f.o. operative, for zero beat at the receiver output for each desired frequency. The accuracy of measurement will depend on the accuracy of setting and type of b.f.o. and also the frequency of measurement. The lower the frequency of measurement the greater effect of any maladjustment of b.f.o.; above 1 Mc/s the error is negligible. For frequencies below 1 Mc/s, or for receivers without a b.f.o., couple a signal generator tuned to the required frequency to the receiver and again obtain zero beat.

NOTE:- Care must be taken to ensure that the correct beat is obtained. Always use the lowest order of harmonic possible, i.e. for a frequency of 20 Mc/s use 2nd harmonic of internal 10 Mc/s crystal rather than 20th harmonic of 1 Mc/s internal crystal.

For the Calibration of Signal Generators

5. (1) Ensure that the XTAL OUTPUT plug is not connected to an external load.

(2) Set XTAL OUTPUT control to approximately mid-travel.

(3) Set XTAL SEL. switch to the internal or external crystal, the fundamental or harmonic of which will give the desired frequency or range of frequencies.

(4) Set CIRCUIT SEL. switch to the frequency range appropriate to the crystal being used.

(5) Plug headphones of any impedance into the PHONES jack.

(6) Connect the signal generator output either to the SIG. INPUT plug or terminal.

(7) Adjust signal generator output level to approximately 20 mV and set to the required frequency. Search for beat note and adjust signal generator output and PHONE VOLUME control for convenient phone level, the zero beat indicating the correct signal generator frequency adjustment. A 20 mV input is adequate, with the PHONE VOLUME control set to approximately mid-travel, for fundamental or low order harmonics. If high order harmonics have to be used turn the PHONE VOLUME control fully clockwise and, listening to a beat, adjust the

CRYSTAL OUTPUT control for the most efficient mixing, i.e. to give the loudest audio signal possible. An increase of signal generator level up to 100 mV or more will also give louder beats.

NOTE:- Do not work with a higher level of r.f. signal than necessary since odd subsidiary beats, e.g. 3 : 2, 5 : 7 etc. will appear and may readily lead to confusion. Always use the lowest order of harmonic possible. If the scale of the signal source is of questionable accuracy the following method may be used, i.e. if the desired frequency is 3.2 Mc/s locate 3 Mc/s and 4 Mc/s points against 1 Mc/s crystal, also 3.33 Mc/s (3rd harmonic signal) against the 10 Mc/s crystal and having ascertained the approximate setting of 3.2 Mc/s pick-up the 32nd harmonic of the 100 kc/s crystal and tune for zero beat.

For the Calibration of Radio Transmitters and Power Oscillators

6.(1) Proceed as in Paragraph 5(1) to (5) inclusive.

(2) CAUTION

Special attention must be paid to the manner of coupling. A transmitter would require NO coupling whatsoever, but would rely on radiation pick-up, ANY FORM OF DIRECT COUPLING WOULD RESULT IN SEVERE DAMAGE TO THE INSTRUMENT. Smaller sources of r.f. power will require increasing amounts of coupling for convenient headphone levels. It is always sound policy first to try indirect coupling and increase to direct coupling if conditions warrant it.

(3) Difficulty will be experienced in determining the correct beat unless the frequency of transmitter is approximately known. If not, a simple absorption wavemeter should be used in conjunction with the instrument; the wavemeter to indicate order of frequency and the instrument to provide the accuracy.

To compare two External Frequencies

7.(1) Set the XTAL SEL. switch to an OFF position.

(2) Set the XTAL OUTPUT control to approximately mid-travel.

(3) One of the signals to be compared should be fed into either the SIG. INPUT plug or terminal and the second signal should be fed into the XTAL OUTPUT plug. The input impedance is of the order of 500 ohms with the XTAL OUTPUT control at mid-travel but with this limitation two r.f. signals can be made to beat satisfactorily.

PART 2

OPERATION AND MAINTENANCE DIRECTIONS

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CHAPTER 2

MAINTENANCE

NOTE:- Component Layouts Figs. 2.2.1 are provided to facilitate the identification of components. Fig. 1.1.1 (Part 1 Chapter 1) shows the front panel controls.

General

1. The instrument does not require any routine adjustment and the instrument should not be removed from its case until the need to do so has been clearly established.

2. Attention is drawn to Part 2 Chapter 3 **"SOME IMPORTANT NOTES ON COMPONENTS AND THEIR EFFECT ON THE CALIBRATION OF THIS INSTRUMENT".** The coaxial air spaced trimmers C1 and C3 must not be altered by ship's staffs; they are preset during calibration using crystal test sets and standard frequency measuring equipment.

3. Wiring layout is also important and the system adopted must be adhered to, especially the earth returns. On models with Serial Nos. 029 onwards, the lead to the SIG INPUT plug is screened. Earlier models should not be modified by ship's staff.

Rapid Performance - Checks

4. The following paragraphs 5-10 provide a quick method of determining if the instrument is working normally, although it will not check crystal frequency accuracy. These tests can be performed without removing the instrument from its case.

Apparatus Required

5.(a) A.P.71115 Signal Generator CT378 (any signal generator can be used provided it covers the frequency range 4-11 Mc/s).

(b) 6625-99-943-1523 Avometer Model 7X.

(c) 6625-99-943-2418 Voltmeter Electronic CT54.

Preparation for Test

6.(1) Set the **MAINS** switch and **XTAL SEL.** switch to **OFF.**

(2) Connect the **MAINS** lead (5995-99-940-0491) to the **MAINS** plug of the instrument.

(3) Test the continuity of the earth lead of the instrument, using Model 7X Avometer on 10 000 ohm range. This should be done by connecting one lead of the Avometer to the **EARTH** terminal of the instrument, and the other lead of Avometer to the earth-pin of the 3-pin plug of mains lead. This continuity resistance should be less than 0.5 ohms. If the continuity resistance exceeds 0.5 ohms, the defective earth lead must be repaired before proceeding further with the Rapid Performance Checks.

(4) Measure the voltage of the a.c. mains supply. Set the Mains Voltage Selector panel to suit the voltage of the mains as detailed in the Operating Instructions.

(5) Connect mains lead to the supply socket.

(6) Set the mains switch to ON.

To Check Power Supply

7.(1) Check that the indicator lamp is alight.

(2) Check that h.t. + voltage between red socket and earth terminal using Model 7X Avometer set to 400V d.c. range is of the order of 300V.

(3) Check that a.c. voltage across blue sockets using Model 7X Avometer set to 10V a.c. range is of the order of 6.3V.

(4) If the checks are satisfactory proceed with checks on crystal oscillator (Paragraph 9). If the checks are not satisfactory there may be a major defect, but before removing instrument from case proceed with Paragraph 8.

FAULT SYMPTOMS ON POWER SUPPLY WHICH MAY BE REMEDIED WITHOUT REMOVING INSTRUMENT FROM CASE

8.

	FAULT SYMPTOM	POSSIBLE CAUSE AND REMEDY
(1)	In Paragraph 7 if the indicator lamp does not light and voltages are not present at sockets.	Mains Fuse. Set the mains switch to OFF. Check the Fuse for continuity using Avometer Model 7X. If the fuse is sound, then there is a major defect, so proceed with removing instrument from case. If the fuse is defective, this can be due to age or overload. Insert a new Fuse and attempt Para. 7 again. NOTE:- The fuse used is an 0.5 amp anti-surge fuse (5920-99-972-6964). If the fuse is not obtainable an H.R.C. 1.6 amp fuse (5920-99-059-0110) may be fitted as an emergency measure. If the fault persists it is due to an overload, which is a major defect, so proceed with removing instrument from case. If now checks detailed in Paragraph 7 are satisfactory, proceed with checks on crystal oscillator. (Paragraph 9.)
(2)	In Paragraph 7 if the indicator lamp does not light and 6.3V a.c. approx. is present across blue sockets.	Indicator lamp. Set the mains switch to OFF. Check the lamp for continuity using Model 7X Avometer. If faulty insert a new lamp 12V (6420-99-995-9120) and if lamp now glows and voltages as stated in Paragraph 7 are present at sockets proceed with checks on Crystal Oscillator, Paragraph 9. If lamp is not faulty, or on replacement still does not glow, then there is a wiring fault to holder so proceed with removing instrument from case.

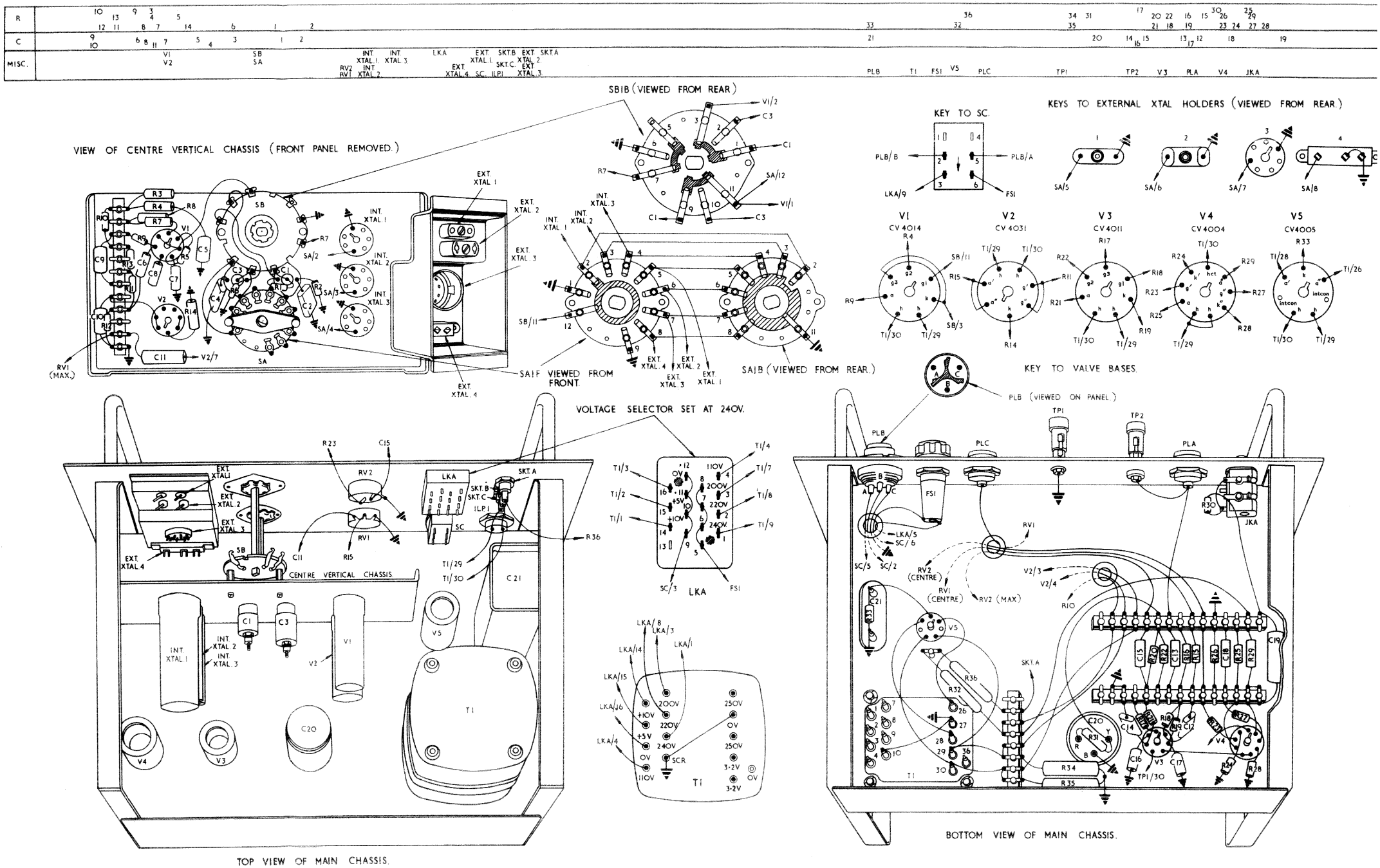

FIG. 2.2.1

CALIBRATOR FREQUENCY CT 432

LAYOUT

6625-99-972-6157

R	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 31 32 33 34 35 36 22 23 24 25 26 27 28 29 30	R
C	1 2 4 3 6 5 7 8 9 10 11 12 13 14 15 20 16 17 21 18 19	C
MISC	XL1 XL2 XL3 SAIB SAIF SBc SBa SBb V1 V2 RV1 V3 ILP1 RV2 V4A V5 V4B T1 LKA LKB FS1 SC JKA	MISC

SA
CRYSTAL SELECTOR

IF

IB

SB
CIRCUIT SELECTOR

POSN.	TERM.
1 – 10 Mc/s	1, 5 & 9
100 – 500 kc/s	2, 6 & 10

V1 V2 V3 V4 V5

h (tap)

SA CRYSTAL SELECTOR

SAIB SAIF SB CIRCUIT SELECTOR SBc SBa SBb

XL1 100 kc/s XL2 1Mc/s XL3 10Mc/s EXT. XTAL

R1 100K C1 3-30p C3 4-60p R2 3·3K C2 68p C4 220p R6 5·6K R7 10K R8 68K C5 ·01 R5 1·5M

R3 100K R4 100K R9 68K C9 ·01 R13 4·7K C10 ·01 C6 ·004 C8 ·004 C7 ·004 R10 560 R11 10M

V1 CV4014 V2 CV4031

C11 ·05 RV1 2·5K XTAL OUTPUT R14 4·7K R12 3·3M R15 47 C12 470p

V3 CV4011

R20 2·2M R22 150K C15 ·01 R21 22K C14 330p C13 ·004 R17 15K R18 100K R16 2·2M C16 ·01 C17 ·01 R19 1·2K

RV2 2·5M PHONE VOLUME

V4A CV4004 R23 220K V4B CV4004 R27 150K

R25 270K C18 ·01 R29 100K C19 0·1 R24 220 R26 3·3M R28 220 R30 2·2M

PHONE JKA

R36 2·4K SKTA (RED) H.T.+

R32 2·4K R31 47K C21 4 C20 32+32 V5 CV4005 R33 1M T1

240V 220V 200V 110V 0V +5V +10V LKA LKB FS1 0·5A PLB SC MAINS

R34 47 R35 47 ILP1 6·3V SKTB (BLUE) SKTC (BLUE) 6·3V A.C.

TP1 (BLACK)

TP2 (RED)

PLA SIGNAL INPUT

PLC XTAL OUTPUT

CALIBRATOR FREQUENCY, CT 432 Fig. 2.2.2

6625-99-972-6157 CIRCUIT DIAGRAM