175

DOSSIER TECHNIQUE

FERISOL

HF-VHF-UHF MILLIVOLMETER

TYPE AB 301 N°

U325 Ø2

APPAREILS DE MESURE

ÉLECTRONIQUES

FERISOL

DOSSIER TECHNIQUE

HF-VHF-UHF MILLIVOLMETER

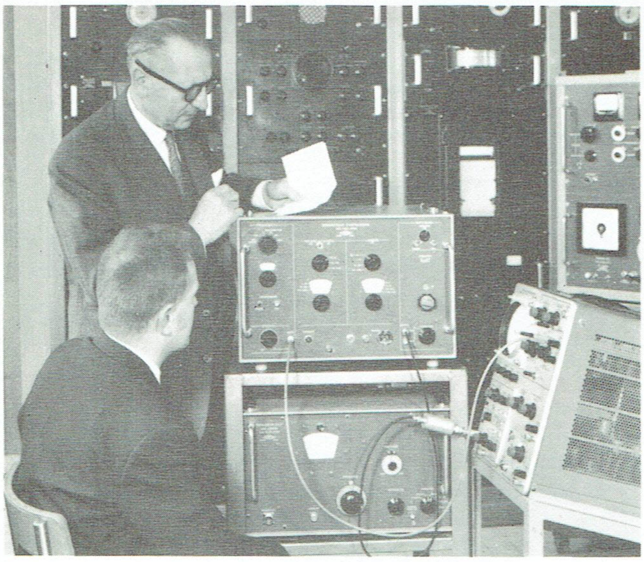
TYPE AB 301 N°

18, Avenue P.-Vaillant-Couturier
TRAPPES (S.-&-O.) France
Adresse Télégraphique : FERI-TRAPPES
Téléph. : 923-08-00 (5 lignes groupées sous ce n°)

FERISOL

ELECTRONIC MEASURING INSTRUMENTS

" FERISOL SERVICE "



The term « FERISOL SERVICE » covers a combination of facilities designed to assure our customers maximum profits from their relations with our various departments.

« FERISOL SERVICE » means that each FERISOL product benefits from the experience of our different technical services, first in our laboratories and, after delivery, throughout its normal service life.

INSPECTORATE LABORATORY

The « Inspectorate Laboratory » is responsible for the performance of all acceptance test, prior to delivery to the customer.
The laboratory is equipped with all measuring instruments and standards, as required for the performance, under the highest conditions of accuracy, of all voltage, current, frequency, capacitance, power, distortion, etc... measurements at low, high and very high frequency.

TECHNICAL RECORDS

Each instrument is supplied with its individual technical file. This shows, at a glance, all the specifications and performance capabilities of the instrument. The technical file also includes operating and maintenance instructions, a circuit diagram and, if required, a set of curves used for the purpose of calibration, and a copy of acceptance report of the model, as issued by the Govermental departments.

ACCEPTANCE REPORT

This essential item of the technical file is in the form of tables listing all acceptance test data. All test data are set out against standard values.
A FERISOL engineer is assigned the task of verifying the results of the tests, in the presence of the customer who is given every opportunity to observe the instrument under actual operating conditions, and to carry out any test as he deems necessary.
The test report, drafted in duplicate, bears the date of acceptance and is signed by the two parties to the acceptance procedure.

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PURCHASE ORDERS

Orders placed with us are always acknowledged by written confirmation specifying the terms of sales : date of delivery, method of shipment, terms of payment, etc...

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FERISOL instruments are warranted, for a period of one year, against defective materials and workmanship. The warrantee covers any repair that would prove necessary during that period, except such repair as would result from maloperation, shock, overloading and, generally, misuse of the instrument. The warrantee applicable to electron tubes is that extended by the tube manufacturers.

OVERHAUL AND SERVICING

In respect of each instrument returned to us for overhauling, outside the period of warrantee, a specialized department prepares an estimate which is mailed to the customer within the ten days following receipt of the instrument. Overhaul work begins immediately on receipt of the customer's acceptation of the estimate, and is normally completed in about two or three weeks.

The facilities of our Inspectorate Laboratory are available to customers who wish to have the overhauled instruments verified in their presence. A " partial " acceptance report is established, wherein the items reported by the customer receive special consideration. Incidentally, we urge customers to send, with the instrument returned for overhaul, a briefing note describing the nature of the fault, as intermittent faults may well escape during the repair work.

Overhauls are warranted for a period of six months, subject to the provisions of the preceding paragraph.

PACKING AND CRATING

In the case of crated instruments, we place inside the crating a questionnaire form for filling by the consigner in the case of abnormal occurences during transportation (delays, breakage, customs, difficulties, etc...). On receipt of this questionnaire, we are informed of the conditions of the shipment and we are accordingly in a position to take any action deemed necessary. Our types of crating, for home and exports shipments, are designed for the different means of transport and are fully weatherproof.

HOW TO USE THIS CATALOGUE

MAIN SECTIONS

The different types of FERISOL instruments are classified into 6 main sections : HF, VHF, UHF and SHF Generators - Frequency measurements - Impedance measurements - Voltage measurements - LF and DC measurements - Miscellaneous measurements - Components.

These sections are identified by means of clipped inserts. A nomenclature of the instruments described in the different sections is given in our General List of Products.

NOTE - We reserve the right to cease, without prior notice, the manufacture of any one instrument, or to modify its specifications without incurring the liability of carrying-out such modifications on instruments purchased previously.

1 000 October 1964

Printed in France
by FERISOL

FERISOL

HF, VHF, UHF MILLIVOLTMETER
Type AB 301

10 mV to 3 V (f.s.d.) – 100 kc/s to 1 Gc/s

Direct reading – High input impedance

(Provisional Technical Data)

GENERAL

The new AB 301 Millivoltmeter is a high-sensitivity direct-reading instrument designed for the measurement of AC voltages in the range 100 kc/s to 1 Gc/s. Relative measurements are still obtainable beyond that range.

The dial of the instrument is calibrated directly in RF-voltage values and the reading scale is practically linear. Another advantage, which further enhances conveniency of operation, is that no correction curves are needed. Also, a decibel scale enables relative measurements with respect to 0 dB level, corresponding to 1 mW across an impedance of 50 ohms (0.223 volt).

Zero stability is such that, on the highest sensitivity scale, there is practically no drift, even after a few hours of operation.

OPERATING FEATURES

The optimum range of operation of the instrument covers the HF, VHF and UHF frequencies, i.e. the range of frequencies where means for measuring low voltages across relatively high impedances, are practically not available.

Coaxial terminations of the « N » or « plug-in » types can also be utilized with the probe supplied with the instrument, in order to facilitate manipulation. In addition, a measuring « T » (Type ABT 100) has been especially designed to enable measurements on coaxial lines.

DESCRIPTION

The Millivoltmeter type AB 301 operates on the following principle :

The voltage to be measured is compared to a reference voltage the level of which is adjusted automatically by means of feedback loop. Use of especially designed circuits provides a reference level whose amplitude, measured by conventional method, is exactly proportional to the amplitude of the unknown signal. In addition, special built-in design features ensure practically perfect zero stability even on the lowest sensitivity range.

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SPECIFICATIONS

Reading scales : Two voltage scales graduated from 0 to 1 and from 0 to 3.
One dB scale graduated from − 12 dB to + 3 dB.

Voltage measurement range : 0 to 3 volts in 6 settings.

Distribution of voltage ranges : 0 to 10 mV, 0 to 30 mV, 0 to 100 mV, 0 to 300 mV, 0 to 1 V, 0 to 3 V.

Decibel readings : − 42 dB to + 23 dB - 0 dB reference = 1 mW across 50 Ω (i.e. 0.223 V).
Each voltage range corresponds to a 10 dB step.

Calibration : the instrument is calibrated in sinewave r.m.s. values.

Calibration accuracy : ± 3 % f.s.d. at 10 Mc/s, for a sinewave.

Frequency response

FREQUENCY	Operating temperature range	
	+ 10° to 40° C	0° to + 10° C and 40° to 50° C
0.1 Mc/s to 50 Mc/s	± 2 %	± 5 %
50 Mc/s to 400 Mc/s	± 4 %	± 7 %
400 Mc/s to 600 Mc/s	± 0.7 dB	± 1 dB
600 Mc/s to 1 000 Mc/s	± 1.2 dB	± 1.5 dB

Input impedance at 1 Mc/s : equivalent to a resistance ⩾ 200 kΩ in parallel across 1.6 pF (mean value) capacitance.

Power supply : 50 c/s AC line.
110, 120, 127, 220, 240 volts (± 10 %).
Power consumption : 35 VA approximately.

Overall dimensions : 210 × 220 × 305 mm.

Weight : 7 kg approximately.

Included in supply : 1 power cord - 1 type « N » termination - 1 side ground-terminal - a technical manual.

ACCESSOIRIE AVAILABLE AT EXTRA COST

ABT 100 measuring « T » : 50 Ω nominal impedance
VSWR introduced by ABT 100/AB 301 probe combination :
⩽ 1.1 for F ⩽ 400 Mc/s
⩽ 1.2 for F ⩽ 1000 Mc/s

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TECHNICAL MANUAL

OPERATION and MAINTENANCE

for

ELECTRONIC VOLTMETER

TYPE AB 301

OCTOBER 1964

T A B L E   O F   C O N T E N T S

CHAPTER I

INTRODUCTION

I.1 - GENERAL DESCRIPTION -

The millivoltmeter type AB 301 performs the direct measurement of AC voltages from 1 mV to 3 volts, in the frequency range 100 kc/s to 1,000 Mc/s. The instrument also enables relative measurements from 10 kc/s up to approximately 1500 Mc/s.

The key feature of the millivoltmeter AB 301 is that readout is performed on linear scales, with overlapping in 10 dB steps, even that the lowest voltage levels. Readout conveniency is further enhanced by the provision of a large size galvanometer.

Another advantage is the ruggedness of the crystal mount used in the probe and designed to withstand up to 10 volts. The mount is readily interchangeable.

Finally, an overall negative feedback loop ensures exceptional readout stability, even on the highest sensitivity settings.

I.2 - SPEFICICATIONS -

Reading scales	: two voltage scales graduated from 0 to 1 : and from 0 to 3. : One dB scale graduated from - 12 dB to : + 3dB.
Voltage measurement range	: 0 to 3 volts in 6 settings.
Distribution of voltage ranges	: 0 to 10 mV, 0 to 30 mV, 0 to 100 mV : 0 to 300 mV, 0 to 1 V, 0 to 3 V.
Decibel readings	: - 42 dB to + 23 dB. 0 dB reference = 1 mW : across 50 Ω (i.e. 223 mV). : Each voltage range corresponds to a 10 dB : step.
Calibration	: the instrument is calibrated in sinewave : r.m.s. values.
Calibration accuracy	: ± 3 % f.s.d. at 10 Mc/s for a sinewave.

Frequency response :

FREQUENCY	Operating temperature range: + 10° to 40°C	Operating temperature range: 0° to +10°C and 40° to 50°
0,1 Mc/s to 50 Mc/s	± 2 %	± 5 %
50 Mc/s to 400 Mc/s	± 4 %	± 7 %
400 Mc/s to 600 Mc/s	± 0,7 dB	± 1 dB
600 Mc/s to 1,000 Mc/s	± 1,2 dB	± 1,5 dB

Input impedance at 1 Mc/s : equivalent to a resistance ⩾ 200 kΩ in parallel across 1,6 pF (mean value) capacitance.

Protection against accidental overloads : a built in protection device against accidental overloads. Permissible maximum voltage to probe input : 10 V.

Power supply : 50 c/s A C line.
110, 120, 127, 220 or 240 volts (± 10 %)
Power consumption : 35 VA approx.

Overall dimensions : 210 x 220 x 305 mm.

Weight : 7 kgs approximately.

Accessoires furnished : 1 type " N " terminal - 1 side ground terminal a technical manual.

Accessory available at extra cost :

ABT 100 measuring " T" : 50 Ω nominal impedance.
V.S.W.R. introduced by ABT 100/AB 301 probe combination
⩽ 1,1 for F ⩽ 400 Mc/s
⩽ 1,2 for F ⩽ 1,000 Mc/s

I.3 - NOTE FOR MEASURING LOW VOLTAGES -

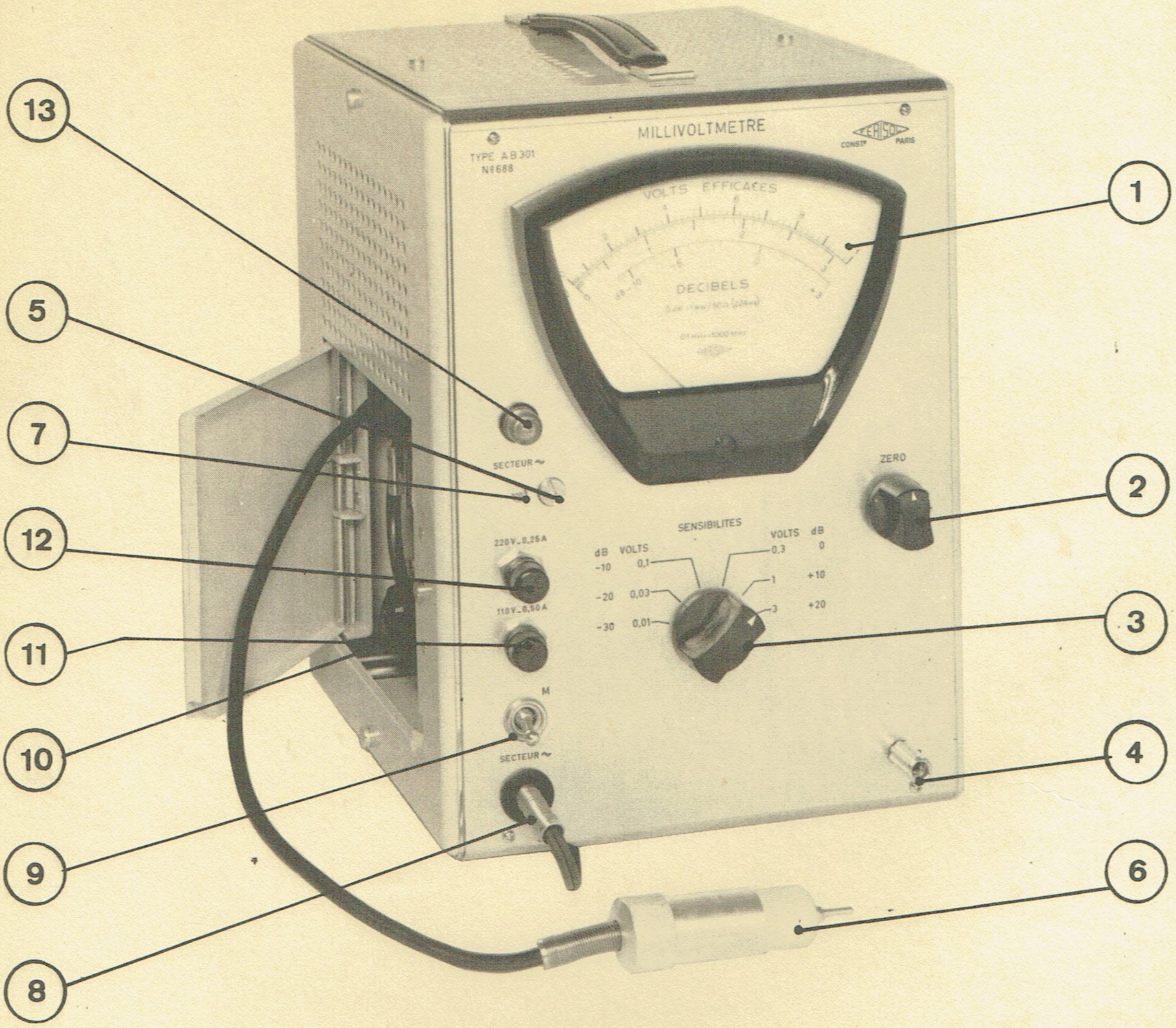
For measurements in UHF range the wavemeter type NA 101 C with thermistor mount type S 402 compensated in temperature, can be used (10 Mc/s to 10,000 Mc/s)

For measurements in LF range and up to 2 Mc/s, the sensitive V.T.V.M. type A 403 A can be used.

MILLIVOLTMETER

MILLIVOLTMETRE

TYPE AB301



VUE GENERALE

GENERAL VIEW

CHAPTER II

SETTING UP and OPERATING PROCEDURE

II.1 - LOCATION OF FRONT PANEL CONTROLS -

The instrument is illustrated on the added photo. Circled numerals reper to the following components :

1) - Reading meter
2) - Zero control
3) - Sensitivity switch
4) - Ground terminal
5) - AC line selector control
6) - Test probe
7) - AC line selector : read-out of supply voltage
8) - Power cord
9) - Power switch - ON.OFF
10) - Trap for housing of test probe and its accessoiries
11) - Fuse - 110 V
12) - Fuse - 220 V
13) - Power indicator lamp

II.2 - FUNCTION AND OPERATION OF FRONT PANEL CONTROLS -

a) - Sensitivity switch (3)

This six position selector switch provides for the selection of instrument sensitivity in relation to the voltage or level (dB scale) to be measured. Range overlap is in 10 dB steps.

b) - Zero (2)

The zero control is used solely on the 10 mV range in order to bring the pointer of the meter within the red sector at the outset of the scale. Zero resetting is not required on the other ranges, and the pointer should normally rest near the zero mark. However, if the preheating period is too short or in the case of wide variation of the ambient temperature, the instrument may register a spurious deflection of up to 10 to 15 % f.s.d. This zero variation does not affect measurement accuracy as long as such measurements are not performed within the lower third of the scales. There is, nevertheless, one important provision which is to ensure correct zero setting on the 10 mV range. Failure to observe this may lead to reading errors. The zero is correct when the pointer registers minimum deflection and settles within the red sector of the scales.

c)- Indicator meter

The indicator is a galvanometer of rugged design (160 µA - 1400 Ω) with three reading scales :

2 volt scales 0 to 1 and 0 to 3 V
1 dB scale from -12 to + 3 dB (0 dB ref = 1 mW/50 Ω)

II.3 - OPERATING PROCEDURE -

II.3.1 - Switching on -

- Switch control (5) of the AC line input selector to nominal line voltage. The voltage is indicated in the readout window (7)
- Plug the power cable (8) into the AC line outlet and set AC line switch (9) to ON.

II.3.2 - Zero setting and pre-heating period -

After a pause of several minutes, switch the instrument to the 10 mV range and perform the zero set adjustment by means of the front panel control (2). For this adjustment, the probe must be equipped with the N type shield termination or, else, be short-circuited.

Note 1 - The response of the control is non-symmetrical. Rotate the knob fully clockwise. The pointer should deflect to mid scale. Next, turn gradually counter clockwise in order to bring the pointer to within the red sector of the scale. When this condition obtains, spurious deflection will be minimum. Continuation of the counter clockwise movement will again deflect the pointer to the right but to a maximum of 15 to 20 % f.s.d.

Note 2 - Duration of pre-heating period will be 15 minutes at a maximum. However, for maximum zero stability on the 10 mV range, pre-heating duration should be from 30 minutes to 60 minutes.

Note 3 - For normal operation, it is assumed that the mechanical zero of the indicator meter has been checked before switching on.

II.3.3. - AC voltage measurements -

The Millivoltmeter AB 301 is an instrument of high sensitivity particularly as regards the 10 and 30 mV ranges. The mere contact of the finger on the tip of the probe will cause sharp meter deflection, through without risk of damage to the meter or to the instrument because built-in protective devices limit the voltage and current to safe levels.

Caution : The only limit value to be observed is the maximum voltage to be applied to the instrument probe - i.e. 10 V. Higher values may cause damage to the crystal mount, due to excessive reverse voltage.

II.3.3.1. Operating procedure

The AC voltages to be measured are applied to the probe. In the case of measurements performed at frequencies below 50 Mc/s, it will be found more convenient to use the probe tip with flexible lead (side earthing terminal) and crocodile clip connected to the earth of the source to be measured (or to the low-potential point).

Above 50 Mc/s, measurements may be biased by the length of the interconnections. However, use of a very short earthing connection will permit measurement, if necessary up to 100 to 200 Mc/s.

Practically, at frequencies above 50 Mc/s, use will be made of the type N coaxial cable supplied with the instrument, for the purpose of measuring voltages at cable terminations.

Caution : Above 500 Mc/s, maximum accuracy will be secured only if use is made of the coaxial Tee inserted into a 50 Ω line. This will keep the overall VSWR to a low level.

II.3.3.2. DC voltage superimposed over AC voltages

The maximum DC voltage applicable to the input of the probe is 500 V. However, it is advisable not to exceed 300 V.

II.3.3.3. Error due to form factor

The instrument functions as a peak voltmeter throughout the measured voltage range. Calibration is always r.m.s. values in relation to a drive voltage of strictly sine shape. Consequently, in the case of signals with amplitude or harmonic distortions, the difference between "read" and "real" value may be considerable.

C H A P T E R III

DESCRIPTION OF THE INSTRUMENT

The Millivoltmeter AB 301 consists primarily of a crystal probe which converts the measured RF voltage into DC voltage. The probe is followed by an AC amplifier which amplifies the DC signal chopped by a "chopper" circuit. A special design feature enables locking to the resultant low frequency AC signal, a high frequency signal used as a negative feedback signal.

This negative feedback signal is detected by a second crystal also located in the probe and is substracted from the DC signal detected from the measured external signal. This arrangement ensures excellent temperature compensation and also, as a result of heavy negative feedback, excellent stability of readout. The system provides linear meter response in spite of the use of crystals as detector elements.

III.1 - PRINCIPLE OF OPERATION (see block diagram) -

The RF signal to be measured is applied to a crystal which delivers a very low DC voltage at the low level ranges (square-law portion of crystal response curve). This was, until now, an obstacle to the construction of instruments combining both sensitivity and stability. Use was successively made of diodes followed by a DC amplifier, and next of grid-detection systems wherein the detector element was located in a bridge in order to improve stability. Finally, the best results were achieved with circuits wherein the detector element is followed by a mechanical chopper, with AC amplification at low frequency of the chopped DC signal and ultimately, synchronous rectification.

This principle forms the bases of the design of the Type AB 301 with this difference that the FERISOL design incorporates one main advance, inasmuch as chopping is performed by a circuit which is 100 % electronic. In addition, the circuit is fully balanced, with application of negative feedback, in order to obtain very good stability.

III.2 - SIGNAL CHOPPING AND AMPLIFICATION -

The DC signal detected through a crystal located in the probe, is chopped by a bridge circuit consisting of two photo-resistive cells alternately subjected to light. The cells behave as resistances which are alternately of very low or very high value, thereby exciting or shorting the DC signal. This provides, easily and simply, an AC voltage of practically square shape. The two photo-resistive cells are excited by two light beams "chopped" by a toothed disc driven by a small synchronous motor powered by 50 c/s line voltage. The arrangement ensures chopping frequency of good stability.

The resultant AC signal is easily amplified through a three-stage RC amplifier providing high overall gain. Next, the signal is rectified synchronously with respect to chopping frequency, by means of a circuit incorporating two other photo-resistive cells operating in the same manner as the first two cells. This arrangement eliminates the risk of instability and background noise normally associated to the low frequency amplifier.

The system provides a DC voltage of adequate magnitude, proportional to the high frequency signal measured by the instrument.

III.3- NEGATIVE FEEDBACK LOOP AND MEASUREMENT READOUT -

A difficult problem was how to secure a negative feedback signal capable of keeping control over instrument stability.

This was achieved by placing in the probe a second crystal, identical to the first crystal (so that the effect of the temperature will be the same in both crystals) such a crystal being used to rectify an RF signal delivered by the negative feedback network. This makes it possible to apply to the input chopper a DC signal which is substracted from the signal rectified through the first crystal. Ultimately, the effect is that of a negative feedback system, as provided by the symmetry of the photo-resistive chopper located at the input of the low frequency AC amplifier. In addition to negligible drift versus temperature, the system enables linear readout of the measured signal.

The negative feedback RF signal applied to the second crystal is derived from a fixed-frequency (approximately 100 kc/s) oscillator.

A special design feature permits locking of the signal level to the DC voltage obtained after synchronous rectification.

Finally, the indicator meter is driven by means of a portion of the negative feedback signal which is exactly proportional to the measured signal, due to the heavy negative feedback applied to the system.

III.4- POWER SUPPLIES -

In order to retain the excellent natural stability of the instruments, use is made of two power supplies - HT and LT - both electronically regulated (+ 170 V and - 7.3 V).

The two power supplies are fully transistorized so that overall power dissipation is minimized. The reference voltages are supplied by high stability Zener diodes.

Another notable feature is the stabilized DC supply of the filament of V 1 (input tube of the high gain low frequency amplifier).

CHAPTER IV

MAINTENANCE

IV.1 - GENERAL -

In the case of faulty operation, it is good practice to begin with a rapid overall check of component conditions (burnt out resistors, loose parts, etc ..), before proceeding with detailed fault tracing.

Check also that all tube filaments light up, and more specially the 6.5 V - 0.1 A bulbs which operate the photo-resistive chopper circuit. See that the synchronous motor runs normally.

The circuit diagram appended to these instructions indicates the ratings of the various components and the voltage values obtaining at significant points of the circuit for normal operation (instrument operated at nominal line supply voltage).

These readings should be checked with an electronic voltmeter (type A 205 or A 206) having a DC input resistance of 100 M Ω.

A substantial difference between the rated values and the meter readings is symptomatic of abnormal operation.

Note 1 - In order to open the instrument, simply unscrew the two nickel plated screws securing each side panel, or the four screws securing the cover (2 screws at the rear and 2 screws at the top).

Note 2 - Main operating components - tubes, semi conductors, controls and printed-circuit elements - are clearly identified on the instrument and on the figures appended to these instructions.

IV.2 - POWER SUPPLY -

IV.2.1. - Instrument fails to switch on (tubes do not light up)

- Check fuses and power cable for continuity,
- Check operation of AC line switch and of neon indicator lamp (DS1),
- Check continuity of transformer input circuit (primary) and of AC line voltage selector.

Note that the AC line selector switch positions fuse F 1 on 220 and 240 V.

IV.2.2. - No general LT supply (-7.3 V)

- Check diode CR 13 (OAZ 205),

- Check transistor Q 7 (ASZ 15),
- Check condition of capacitors C 35 and C 36,
- Check CR 11 and CR 12 (10J2).

Note : Replacement of any one of the above components necessitates the checking and, possibly, the re-setting to -6.3 V of the filament voltage of tube V1, by means of resistor R 75.

IV.2.3. - No general HT supply (+ 170 V)

In the absence of + 170 V supply, or if the metered value differs excessively from that value (< + 160 V) or (> + 175 V), check the following points :

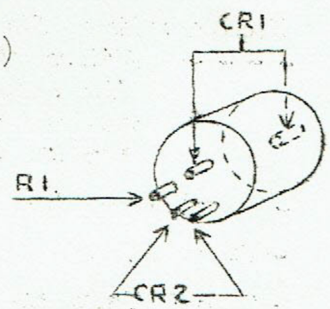
- absence of short-circuit, or excessive current consumption in the circuit supplied with the + 175 V. A rapid check of the DC voltages indicated on the circuit diagram, or insertion of a milliammeter in the place of the HT fuse will indicate the current consumption - which should normally be approximately 45 mA.
- DC voltage on the collector of Q4 - approximately -30 V,
- Check the characteristics of Q4, Q5 and Q6,
- Check diodes CR10 (DZ 15A) and CR 14 (DZ 10B),
- Check rectifier crystals CR8 and CR9 (OA 211),
- Check capacitors C34, C37 and C39.

IV.3 - PROBE + CHOPPER AND AC AMPLIFIER CIRCUIT -

IV.3.1. - Meter fails to deflect

- Perform checks described in para IV.2,
- Check operation of light chopper :

  correct lighting of tubes V 9 to V 12 (inclusive) and correct operation of motor B1.
- Check conditions of probe crystals (CR1 and CR2)



The figure on the left shows the arrangement of the crystal mount terminals.

For a test voltage of 1 V : the following resistance values should obtain (both crystals) :

R. forward = approx. 20 Ω

R. reverse > 1 MΩ

- Check tubes V 1 and V 2 and the DC voltages indicated on the circuits diagram,
- the gain of the various stages of the low frequency AC amplifier is approximately :

  55 for V1 A)
  60 for V1 B) at 10 c/s
  100 for V2)

- Check operation of switches S1A and S1B,
- Check operation of tube V3 A (DC cathode follower) and condition of galvanometer M1 and of crystal CR7 (OA73).

IV.3.2. - <u>Meter deflects - but deflection is erratic</u>

- Check operation of light chopper,
- Check continuity of zero-control circuit (R2, R3 and R4),
- Check tube V3A and its bias control (R28 - R29).

IV.4 - NEGATIVE FEEDBACK SYSTEM -

IV.4.1. - <u>Meter does not register any deflection</u>

- Check operation of 100 kc/s oscillator (Q2) ; AC voltage on collector : 9 V peak to peak and 2 x 2 V peak to peak on outputs of secondary,
- Check diode CR4 (OA5) for possible short circuit,
- Check tubes V3B and V4, and DC voltages of associated circuits,
- Check diode OA 73, which, with a test voltage of 1 V should show :

  R forward $< 200\ \Omega$
  R reverse $> 200\ k\Omega$.

IV.4.2. - <u>Meter registers full scale deflection continuously</u>

- Check bias voltages on diode CR 5 (BA 102).

<u>Caution</u> : diode CR5 is a varicapt type which demands reverse biasing. Failure to observe this will cause permanent damage to the diode. The function of CR3 (OAZ 206) is to limit the control voltage of CR5 in the positive direction in order to prevent forward biasing.

- Check Zener diode CR6 (OAZ200) controlling Q3,
- Check Q3,
- Check adjustment of R 28 and of C 25.

<u>Procedure</u> :

Switch the instrument to the 300 mV sensitivity range.

Do not immediately apply a signal to the probe - the cathode voltage of V3A must be equal to zero ($\pm$ 0.01 V). If this condition does not obtain, disconnect one terminal of C5 and retrim the adjustment of R28 to re-set the cathode voltage of V3A to zero. Finally, retrim adjustment of C25 so as to bring the 100 kc signal to a minimum on the cathode of V3B (minimum < 0.1 V r.m.s.). Then, re-connect C5.

IV.4.3. - Instrument operation is unstable

- during voltage measurement : check power supplies and more especially the + 170 V supply (Vc of Q4 > -5V for -10% AC line voltage variation),
- In the absence of voltage on the probe :
  the pointer of the meter is well away from the zero mark - by 20 to 30 % f.s.d. This obtains on all ranges.
- Check condition of Q1 (OC 77). Ve of Q1 should be 0 for Vk of V3A positive, and Ve = Vk of V3A when negative,
- Check adjustment of R 28 and of C 25, as described in para IV.4.2,
- Check crystal CR2 (see para IV.3.1.).

IV.4.4. - Meter pointer fails to return to zero after overloading

The meter does not return to zero after overloading, or takes a very long time to return to zero, or requires switching off and on to return to zero. Check :

- condition of CR3 (OAZ 206),
- - 6.3 V stabilized supply (voltage adjustable by means of R75),
- check diode CR5 (BA 102) and proceed with adjustment of R 28 - C 25 as indicated in para. IV.4.2.

IV.5 - INSTRUMENT OPERATES BUT READINGS ARE INCORRECT -

The instrument should be checked, preferably with an incident RF signal of medium frequency (e.g. 10 Mc/s).

IV.5.1. - Readings are "lagging" - particularly on the 10 and 30 mV ranges

- Check probe crystals (see para. IV.3.1),
- Check gain of stages of the LF AC amplifier (see para. IV.3.1.),
- Carry out all checks as prescribed in para. IV.4.

IV.5.2. - Readings "lagging" on all sensitivity settings

In order to identify this fault, use must be made of a signal generator capable of an output of up to 3 V into 50 Ω. Use a type LA 201 attenuator variable in 10 dB steps (matched to 50 Ω), in order to check the overlap of the successive sensitivities.

The test will be performed at a frequency of 10 Mc/s.

If the operation of the millivoltmeter AB 301 appears to be normal, simply readjust R 63 in order to reset the deflection of the indicator meter to correct value.

IV.5.3. - Readings "lag" or "lead" slightly after replacement of the probe crystal mount.

- the same checks as for para. IV.5.2, using same procedure,
- Readjust slightly R 63, if need be.

IV.6 - OVERALL INSTRUMENT RE-CALIBRATION -

IV.6.1. - General

Overall instrument re-calibration is a fairly complex job which necessitates adequate test equipement. In principle, the operation is carried out in our laboratories.

However, we give the following description of the procedure to be followed in order to perform correct re-calibration of the instrument, at 10 Mc/s, for instance after a major fault has been cleared or if some doubt exists as to overall performance of the millivoltmeter.

Note : Re-calibration is not, in principle, necessary after a frequency response check, the crystal mounts being verified at the works prior to delivery as standard equipment or as spares.

IV.6.2. - Preliminary measurements

a) check the power supplies (for $\pm$ 10 % AC line voltage variation)
   drift $\leqslant \pm$ 0.3 V for the + 170 V supply (permissible variation 165 to 172 V)
   drift $\leqslant \pm$ 0.1 V for the - 7.3 V supply (permissible variation -6.8 to -7.8 V)
b) check, and if need be adjust the filament voltage of V 1 to - 6.3 V, by means of R 75,
c) Cut off the AC negative feedback loop at the C5 - R6 junction - place the shielding back in position,
d) set the instrument to the 0.3 V sensitivity setting and adjust (after 60 minutes pre-heating) :

- R 3 (zero) for zero voltage, on the slider,
- R 28, to set the cathode of V3A to zero ($\pm$ 0.02 V),

- adjust C 25 to obtain a 100 kc/s signal of 2 V r.m.s. on the cathode of V3B (as measured on the amplifier voltmeter) next, adjust L2 for maximum signal,
- Readjust C 25 for minimum signal on the cathode of V3B ($\leqslant$ 0.1 V r.m.s.)

IV.6.3. Testing of probe + modulator + AC amplifier circuit

a) Set the instrument to the 10 mV range and readjust slightly the zero of control in order to obtain zero volt on the cathode of V3A,

b) connect an oscilloscope to the anode of V2 : the zero setting must coincide with minimum signal on the anode of V2,

c) the sole voltage now measured is the ripple level of the AC Amplifier $<$ 3 V peak to peak,

d) apply to the probe an RF signal of 2 mV r.m.s. at 20 Mc/s. The output signal of the amplifier must read $\geqslant$ 8 V peak to peak,

e) Reset to zero and switch back to the 30 mV range.

Apply a 10 mV signal (at 20 Mc/s) to the probe. The signal on the anode of V2 must now be $\geqslant$ 20 V peak to peak,

f) If the readings are too low ; check :

- the crystal mount (see para. IV.3.1)
- stage gain in the AC amplifier (see para. IV.3.1.)

IV.6.4. Testing of demodulator

a) Reset instrument to the 0.3 V range and check cathode zero of V3A, in the absence of signal,

b) Apply to the probe an RF voltage of approximately 30 mV r.m.s. in order to obtain 10 V peak to peak on the anode of V2. Measure the DC voltage on the cathode of V3A (positive). The reading will generally be + 1.7 V, minimum value = + 1.6 V.

c) If the cathode voltage on V3A is too low :
- check C 19 and tube V 3.

IV.6.5. Adjustment and checking of varicapt circuit and of 100 kc/s amplifier.

a) set instrument on the 0.3 V range and, after performing the adjustments specified in para. IV.6.2.d, check the following points (with the AC negative feedback being still cut off).

- sensitivity of the varicapt diode : apply to the input of the instrument an RF signal such that the cathode of V3A is + 1 V. Measure the cathode voltage of V3B (for instance, with an A 403 A voltmeter). The voltage reading should be $\geqslant$ 3.5 V r.m.s. and $\leqslant$ 4.5 V r.m.s.).

b) If the 100 kc/s voltage reading is too small, decrease the value of R 44, and vice versa.

IV.6.6. <u>Testing of overall operation and measurement of instrument sensitivity with the AC negative feedback in circuit.</u>

a) Re-connect the AC negative feedback (connection of C5) and switch the instrument to the 10 mV range. If need be, re-set the zero by means of the front panel control.

b) Apply to the probe a standard signal of 10 mV (10 Mc/s) and adjust R 63 so as to bring the pointer of the indicator meter to full scale deflection.

c) Next, make a rapid check of instrument operation on the other ranges by applying the corresponding voltages to the probe. Re-set to zero and again disconnect the negative feedback loop (C 5).

d) Re-set the instrument on 10 mV range. Do not alter any one of the adjustment already performed, except the zero control of the front panel. Apply an RF signal (F = 10 Mc/s) such that the pointer deflects to full scale. Note the value of DC signal. The ratio between the reading and the sensitivity setting on the instrument will provide the value of the AC négative feedback (in dB).

e) Repeat the measurement on all sensitivity settings.
Normally, the following negative feedback values should be found :

Range	10 mV	.... 16 to 20 dB
"	30 mV	.... 17 to 21 dB
"	100 mV	.... 18 to 22 dB
"	0.3 V	.... 18 to 22 dB
"	1 V	.... 18 to 22 dB
"	3 V	.... 20 to 25 dB

f) If the above values do not obtain, carry out the following adjustments :

- on the 10 and 30 mV ranges : only 1 adjustment is required, increase or decrease the value of R 44 (see para. IV.6.5.b),
- on the 0.1 V, 0.3 V and 1 V ranges - (after adjustment of the 10 and 30 mV ranges, re-check the new values of AC negative feedback)

0.1 V range	.... increase or decrease R 11
0.3 V range	.... increase or decrease R 12
1 V range	.... increase or decrease R 13

On the 3 V range : adjust only R 22.

IV.6.7. <u>Final instrument calibration</u> (F = 10 Mc/s)

a) Re-connect the AC negative feedback (C 5)

b) Set the instrument to the 0.3 V range and apply the 0.3 V standard voltage. Next, adjust meter deflection by means of R63.

c) Set the instrument to the 10 mV range (if need be, readjust zero setting) and check overlap using an RF standard voltage of :

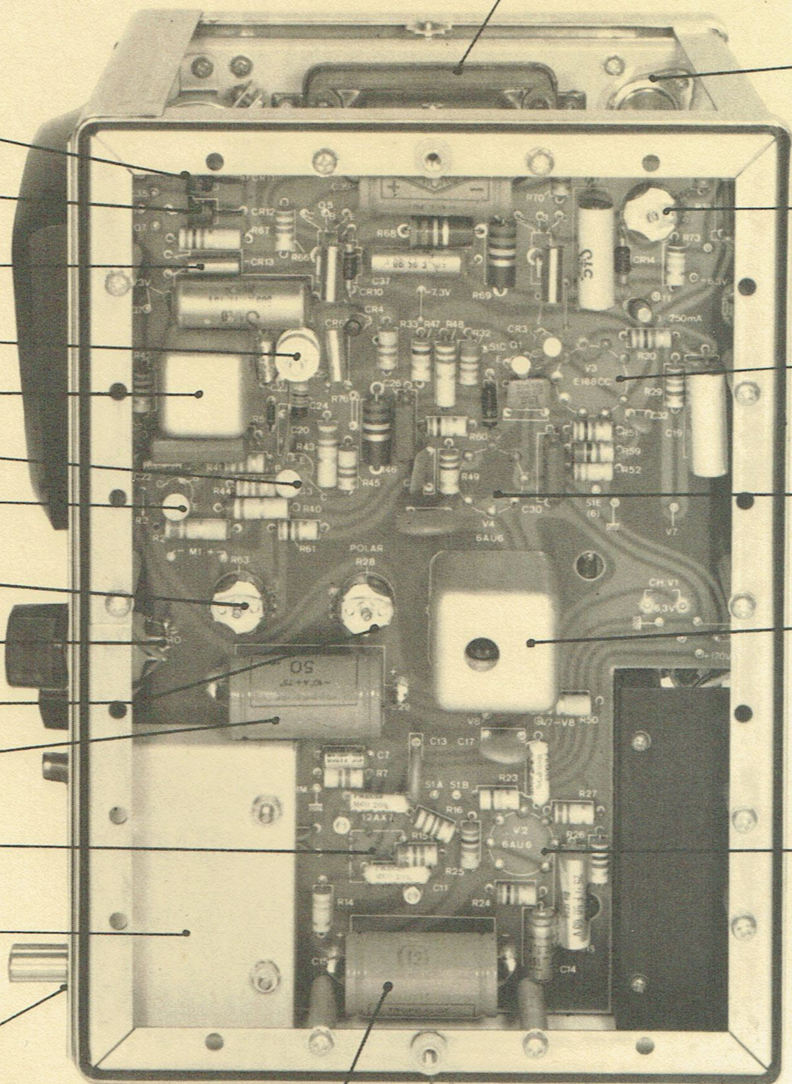
10 mV = difference $\leqslant \pm 2\ \%$

d) Repeat the measurement on the other sensitivity settings.

e) Finally, if need be, readjust slightly R 63 in order to optimize the mean sensitivity of the instrument with regards to the maximum variations noted during the checking.

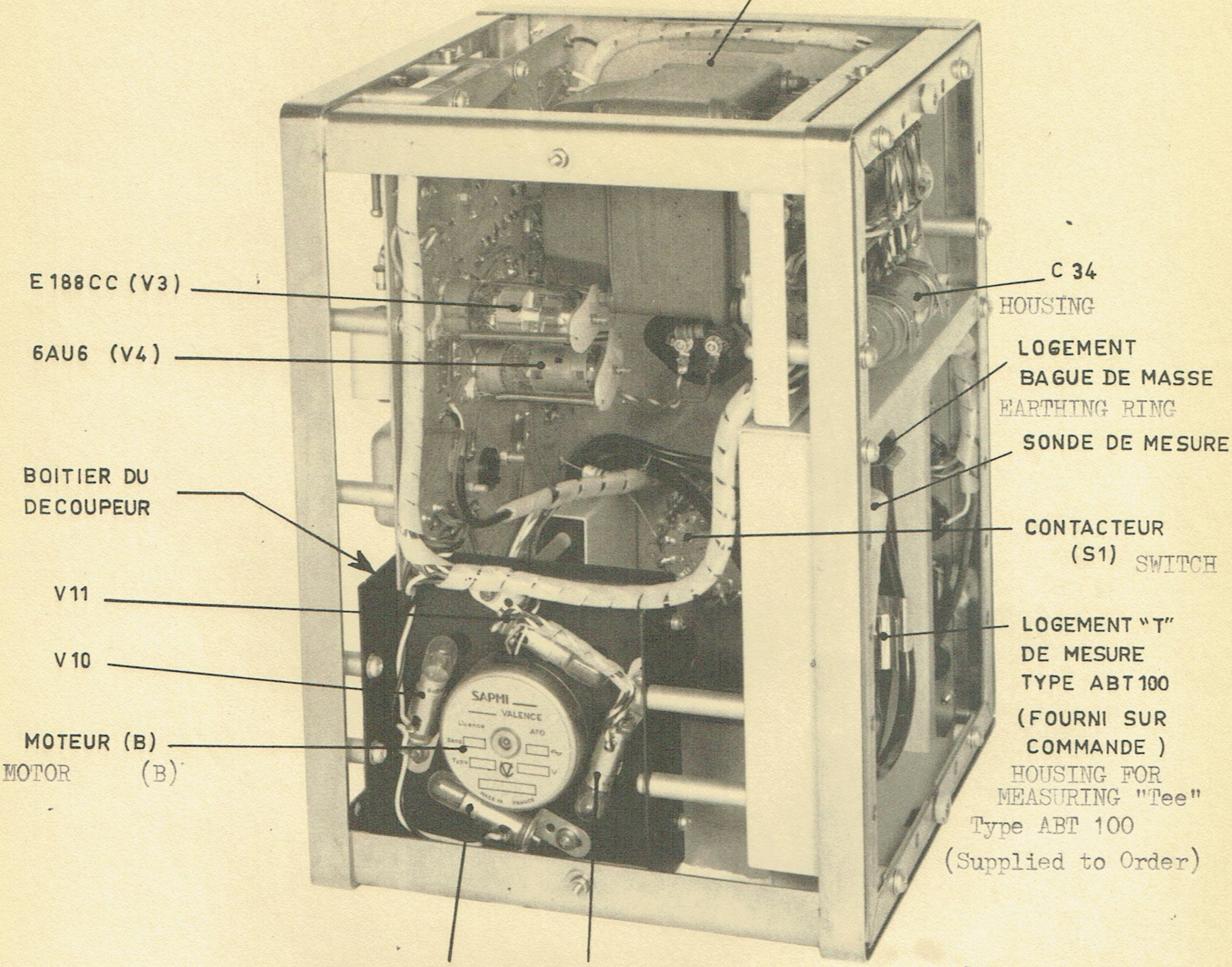
MILLIVOLTMETRE

TYPE AB301



VUE LATERALE DROITE

RIGHT HAND SIDE VIEW



VUE ARRIERE

REAR VIEW

LIST OF COMPONENTS FOR MILLIVOLTMETER

LISTE DES PIECES DETACHEES

POUR LE MILLIVOLTMETRE

Type AB 301

-:-:-:-:-:-:-:-:-:-:-:-:-:-:-

MARK REPERES	DESCRIPTION DESIGNATION	N° STOCK FERISOL	CODE	SUPPLIER'S REFERENCE REFERENCES FOURNISSEURS
	- RESISTANCES - -RESISTORS -			
R.1	470 kΩ ± 10 % 1/4 W		15	Type RM 02 Eurista
R.2	270 kΩ ± 10 % 1 W		3	
R.4	4,7 MΩ ± 10 % 1/2 W		3	
R.5	330 Ω ± 10 % 1/2 W		3	
R.6	1 50 kΩ ± 10 % 1/2 W		3	
R.7	4,7 kΩ ± 10 % 1/2 W		3	
R.8	4,7 MΩ ± 10 % 1/2 W		3	
R.9	1 kΩ ± 10 % 1/2 W		3	
R.10	10 kΩ ± 10 % 1/2 W		3	
R.11	62 kΩ ± 10 % 1/2 W		3	
R.12	150 kΩ ± 10 % 1/2 W		3	
R.13	220 kΩ ± 10 % 1/2 W		3	
R.14	330 kΩ ± 10 % 1/2 W		3	
R.15	10 MΩ ± 10 % 1/2 W		3	
R.16	1 MΩ ± 10 % 1/2 W		3	
R.17	1,5 MΩ ± 10 % 1/2 W		3	
R.18	560 kΩ ± 10 % 1/2 W		3	
R.19	470 kΩ ± 10 % 1/2 W		3	
R.20	82 kΩ ± 10 % 1/2 W		3	
R.21	33 kΩ ± 10 % 1/2 W		3	
R.22	10 kΩ ± 10 % 1/2 W		3	
R.23	47 kΩ ± 10 % 1/2 W		3	
R.24	1 kΩ ± 10 % 1/2 W		3	
R.25	1 kΩ ± 10 % 1/2 W		3	
R.26	1 MΩ ± 10 % 1/2 W		3	
R.27	270 kΩ ± 10 % 1/2 W		3	
R.29	2,2 MΩ ± 10 % 1/2 W..	.../...	3	

MARK REPERES	DESCRIPTION DESIGNATION	N° STOCK FERISOL	CODE	SUPPLIER'S REFERENCE REFERENCES FOURNISSEURS
	- RESISTORS - - RESISTANCES - (suite)			
R.30	1 kΩ ± 10 % 1/2 W		3	
R.32	2,7 kΩ ± 10 % 1/2 W		3	
R.33	4,7 kΩ ± 10 % 1/2 W2		3	
R.34	1 kΩ ± 10 % 1/2 W		3	
R.35	3,6 MΩ ± 10 % 1/2 W		3	
R.36	150 kΩ ± 10 % 1/2 W		3	
R.37	10 kΩ ± 10 % 1/2 W		3	
R.38	1,5 kΩ ± 10 % 1/2 W		3	
R.39	270 Ω ± 10 % 1/2 W		3	
R.40	180 kΩ ± 10 % 1 W		3	
R.41	220 Ω ± 10 % 1/2 W		3	
R.42	1 kΩ ± 10 % 1/2 W		3	
R.43	270 kΩ ± 10 % 1 W		3	
R.44	2,2 kΩ ± 10 % 1/2 W		3	
R.45	470 Ω ± 10 % 1/2 W		3	
R.46	22 kΩ ± 10 % 2 W		36	Type HB
R.47	10 kΩ ± 10 % 1/2 W		3	
R.48	560 kΩ ± 10 % 1 W		3	
R.49	100 kΩ ± 10 % 1/2 W		3	
R.50	6,2 kΩ ± 10 % 1 W		3	
R.51	1 kΩ ± 10 % 1/2 W		3	
R.52	270 kΩ ± 10 % 1/2 W		3	
R.53	684 Ω ± 0,5 % 1/2 W		9	RCMF coeff. K 3
R.54	216 Ω ± 0,5 % 1/4 W		9	RCMF coeff. K 3
R.55	68,4 Ω ± 0,5 % 1/4 W		9	RCMF coeff. K 3
R.56	21,6 Ω ± 0,5 % 1/4 W		9	RCMF coeff. K 3
R.57	6,84 Ω ± 0,5 % 1/4 W		9	RCMF coeff. K 3
R.58	3,16 Ω ± 0,5 % 1/4 W		9	RCMF coeff. K 3
R.59	10 MΩ ± 10 % 1/2 W		3	
R.60	10 kΩ ± 10 % 1/2 W		3	
R.61	1 kΩ ± 10 % 1/2 W		3	
		.../...		

MARK REPERE	DESCRIPTION DESIGNATION	N° STOCK FERISOL	CODE	SUPPLIER'S REFERENCE REFERENCES FOURNISSEURS
	- RESISTORS - - RESISTANCES - (suite)			
R.62	8,2 kΩ ± 10 % 1/2 W		3	
R.64	470 Ω ± 10 % 1,8 W		23	Type CTN réf. B 8-320-08 P/470E
R.65	330 Ω ± 10 % 2 W		3	
R.66	2,2 kΩ ± 10 % 1/2 W		3	
R.67	100 Ω ± 10 % 1 W		3	
R.68	18 kΩ ± 10 % 2 W		36	Type HB
R.69	27 kΩ ± 10 % 2 W		36	Type HB
R.70	3,3 kΩ ± 10 % 1/2 W		3	
R.71	6,8 kΩ ± 10 % 1/2 W		3	
R.73	18 kΩ ± 10 % 1/2 W		3	
R.74	4,7 kΩ ± 10 % 1,8 W		23	Type CTN réf. B8-320-08 P/4,7 k
R.76	470 Ω ± 10 % 0,6 W		23	Type CTN réf. B 8-320-07 P/470E
	- POTENTIOMETERS - - POTENTIOMETRES -			
R.3	25 kΩ ± 20 % courbe linéaire	104 635	9	PE 25 LIS
R.28	10 kΩ ± 20 % courbe linéaire	107 560	9	P 50 JIF
R.63	22 kΩ ± 20 % courbe linéaire	107 723	9	P 50 JIF
R.72	5 kΩ ± 20 % courbe linéaire	107 636	9	P 50 JIF
R.75	10 Ω 3 W semi-fixe	A.4 198	22	
	- CAPACITORS - - CONDENSATEURS -			
C.1	4,7 kpF	107 501	15	Fournir plan
C.2	3 kpF 300 V - 20 +80 % céramique		3	Type 831
C.3	22 kpF 125 V céramique		15	DQX 714
C.4	22 kpF 125 V céramique		15	DQX 714
C.5	10 kpF 125 V céramique		15	DQX 710
C.6	0,1 uF 250 V mylar		60	Type M 60

.../...

MARK REPERE	DESCRIPTION DESIGNATION	N° STOCK FERISOL	CODE	SUPPLIER'S REFERENCE REFERENCES FOURNISSEURS
	- CAPACITORS - - CONDENSATEURS - (suite)			
C.7	10 uF 12/15 V électrochimique		40	Type minisic
E.8	22 kpF 1 25 V céramique		15	DQX 7 14
C.9	22 kpF 125 V céramique		15	DQX 714
C.10	1 kpF 125 V céramique		15	DQX 704
C.11	0,1 uF 250 V mylar		40	Type M 60
C.12	0,1 uF 250 V mylar		40	Type M 60
C.13	10 kpF céramique		15	DIX 615
C.14	100 uF 16 V électrochimique		33	C.426 AM/E 100
C.15	50 uF 200 V électrochimique		13	Type crotale
C.16	25 uF 50/60 V électrochimique		40	Type minisic
C.17	10 kpF céramique		15	DIX 615
C.18	0,1 uF 250 V mylar		60	M 60
C.19	2,2 uF 160 V		40	Type plastisic M sorties radiales modèle plat
C.20	0,1 uF 90 V céramique		15	DLY 7 13
C.21	10 kpF 500 V ± 2 % mica		8	Type CA 19
C.22	10 uF 12/15 V électrochimique		40	Type minisic
C.23	10 uF 12/15 V électrochimique		40	Type minisic
C.24	15 pF 0 + 30 tubulaire		15	CPC 310 isolé
C.25	Cond. ajustable mica	104 534	23	Type 82 753/25 E 4-25 pF
C.26	390 pF 500 V ± 10 % mica		8	CA 17
C.27	22 kpF 500 V céramique		15	DPX 623
C.28	390 pF 500 V ± 5 % mica		8	CA 17
C.29	50 uF 200 V électrochimique		13	Type crotale
C.30	390 pF 500 V ± 10 % mica		8	CA 17
C.31	22 kpF 125 V céramique		15	DQX 7 14
C.32	1 kpF 500/1500 V céramique		15	DIX 608
C.33	22 kpF 125 V céramique		15	DQX 714
C.34	50 uF 350 V électrochimique		13	Type boa
C.35	3200 uF 16/20 V		40	Type Felsic 70
C.36	500 uF 12/15 V électrochimique	.../...	40	Type minisic

MARK	DESCRIPTION			SUPPLIER'S REFERENCE
REPERE	DESIGNATION	N° STOCK FERISOL	CODE	REFERENCES FOURNISSEURS
	- CONDENSATEURS - (suite) - CAPACITORS -			
C.37	50 uF 25/30 V électrochimique		40	Type minisic
C.38	2,2 uF 160 V		40	Type plastisic M sorties radiales modèle plat
C.39	50 uF 200 V électrochimique		13	Type crotale
	- MISCELLANEOUS - - ELEMENTS DIVERS -			
DS.1	Lampe néon 110 V	107 141	1	N ° 2875
F.1	Fusible 0,25 A pour 220 V/secteur	107 449	14	D1/0,25
F.2	Fusible 0,5 A pour 110 V/secteur	107 449	14	D1/0,5
T.1	Transformateur d'alimentation	A.27 769	22	
M.1	Galvanomètre 160 µA 1400 Ω	107 729	2	Fournir norme
	-TUBES - - TUBES UTILISES -			
V.1	12 AX 7		5	
V.2	6 AU 6		5	
V.3	E 188 CC		5	
V.4	6 AU 6		5	
V.5	ORP 60		5	
V.6	ORP 60		5	
V.7	ORP 60		5	
V.8	ORP 60		5	
V.9	6,3 V 0,1 A	106 925	27	
V.10	6,3 V 0,1 A	106 925	27	
V.11	6,3 V 0,1 A	106 925	27	
V.12	6,3 V 0,1 A	106 925	27	
CR.1	T 13 G } ensemble moulé et apairé	A.27 788	22	
CR.2	T 13 G			
CR.3	OAZ 206		5	
CR.4	OA 5		5	
CR.5	BA 102	.../...	5	

MARK REPERES	DESCRIPTION DESIGNATION	N° STOCK FERISOL	CODE	SUPPLIERS-REFERENCE REFERENCES FOURNISSEURS
	TUBES			
	- TUBES UTILISES - (suite)			
CR.6	OAZ 200 (cristaux)		5	
CR.7	OA 73		5	
CR.8	OA 211		5	
CR.9	OA 211		5	
CR.10	DZ 15 A			
CR.11	10 J 2		34	
CR.12	10 J 2		34	
CR.13	OAZ 205		5	
CR.14	DZ 10 B			
Q.1	OC 77 (transistors)		5	
Q.2	AF 115		5	
Q.3	AF 115		5	
Q.4	ASZ 15		5	
Q.5	OC 74		5	
Q.6	OC 74		5	
Q.7	ASZ 15		5	
	- ACCESSORIES -			
	- ACCESSOIRES -			
	Sonde de mesure	A.27 790	22	point vert
	Douille vissée (type "N")	A.21 231	22	
	Fiche vissée (type "N")	A.27 636	22	
	Bague de masse	A.20 631	22	
	Fil de masse	105 234	26	BM/3212 incolore/BM n oir 10cm Lg libre
	Pince crocodile	100 255	22	

Ets GEFFROY & Cie
" FERISOL "
S.A. Cap. 3.250.000 F
18, Av. P. Vaillant-Couturier
TRAPPES (S & O)
Tél. 923.08.00
(5 lignes groupées sous ce numéro)

SUPPLIERS LIST WITH CODE FOR COMPONENT REPLACEMENT

CODE N°	SUPPLIERS
1	ARNOULD 16, rue de Madrid PARIS (8ème)
2	Brion-LEROUX 40,Quai de Jemmapes PARIS (10ème)
3	CANETTI (ALTER) 16, rue d'Orléans NEUILLY (Seine)
4	M.C.B. 11, rue Pierre Lhomme COURBEVOIE (Seine)
5	RADIOTECHNIQUE 130, Avenue Ledru Rollin PARIS (11ème)
6	RADIOPHON (SPRAGUE) 50, Fbg Poissonnière PARIS (10ème)
7	SAFCO TREVOUX 44, rue du Capitaine Glarner St OUEN (Seine)
8	STEAFIX 128, rue de Paris MONTREUIL s/Seine
9	SFERNICE 8 bis, Avenue de la Rochefoucauld BOULOGNE (Seine)
10	FRANKEL (EFCO) 20, rue Rochechouart PARIS (9ème)
11	DRALOWID 206, rue Lafayette PARIS (10ème)
12	OHMIC 69, rue Archereau PARIS (19ème)
13	MICRO (Boîte Postale n° 4) MONACO
14	CEHESS 68, Avenue de Choisy PARIS (13ème)
15	L.C.C. 128, rue de Paris MONTREUIL s/Seine
16	ARENA 35, Avenue Faidherbe MONTREUIL-sous-Bois (Seine)
17	L.P.E. 4 & 6, rue des Montibœufs PARIS (20ème)
18	RADIO-FIL 82, rue d'Hauteville PARIS (10ème)
19	
20	MARELLI 75, rue Victor Hugo COURBEVOIE (Seine)
21	MEGEX 105, Quai Branly PARIS (7ème)
22	FERISOL 18, Avenue P. Vaillant-Couturier TRAPPES (S & O)
23	C.O.P.R.I.M. (TRANSCO) 7, Passage Dalery PARIS (11ème)
24	SOCAPEX PONSOT (RADIO AIR) 9, rue Edouard Newport SURESNES (Seine)
25	R.T.F. 73, Avenue de Neuilly NEUILLY s/Seine (Seine)
26	RADIALL 17, rue Crussol PARIS (11ème)
27	MAZDA (ou METOX) 29, rue de Lisbonne PARIS (8ème)
28	JEAGER 2, rue Baudin LEVALLOIS PERRET (Seine)
29	C.S.F. 55, rue Greffulhe LEVALLOIS PERRET (Seine)
30	M.T.I. 25, rue du Pré-St-Gervais PARIS (9ème)
31	S.A.P.M.I. 76, Avenue de la République PARIS (11ème)

January 1964

CODE N°	SUPPLIERS
32	CHAUVIN-ARNOUX 190, rue Championnet PARIS (18ème)
33	S.I.R.E. 1, rue Frédéric-Sauvage TOURS (Indre & Loire)
34	SESCO 41, rue de l'Amiral Mouchez PARIS (13ème)
35	REGUL 61, rue Labrouste PARIS (15ème)
36	BUREAU DE LIAISON (ALLEN BRADLEY) 113, rue de l'Université PARIS (7ème)
37	DACO 4, Cité Griset PARIS (11ème)
38	YOUNG-ELECTRONIC 9 bis, rue Roquepine PARIS (8ème)
39	JAHNICHEN 27, rue de Turin PARIS (8ème)
40	S.I.C. 95 à 107, rue Bellevue COLOMBES (Seine)
41	DYNA 34, Avenue Gambetta PARIS (20ème)
42	L.M.B. Usine d'Objat (Corrèze)
43	AEM GP 115, Avenue Jean-Baptiste Clèment BOULOGNE (Seine)
44	Sté FRANCAISE DES CONDENSATEURS 30, rue N.-D. des Victoires PARIS
45	ELEKTRONEST 39, rue St-Croix FORBACH (Moselle)
46	Cie DES COMPTEURS 12, Place des Etats Unis MONTROUGE (Seine)
47	OTTAWA 37 bis, rue Gauthey PARIS (17ème)
48	PHILIPS 130, Avenue Ledru Rollin PARIS (11ème)
49	C.I.F.T.E. (THOMSON) 14, rue J.P. Timbaut COURBEVOIE (Seine)
50	BERNIER 19, rue Malte Brun PARIS (20ème)
51	I.R.C. 65, rue Richelieu PARIS (2ème)
52	JIVECO-ELECTRONICS 21, Avenue Victor Hugo PARIS (16ème)
53	PEKLY 33, rue Boussingault PARIS (13ème)
54	S.E.P.E. 2 bis, rue Mercoeur PARIS (11ème)
55	COGIE 3& 5, Boulevard A. France AUBERVILLIERS (Seine)
56	SILEC 64 bis, rue de Monceau PARIS (8ème)
57	PRECIS 8, Boulevard de Ménilmontant PARIS (20ème)
58	TRANSITRON 29, Avenue de l'Opéra PARIS (1er)
59	FAIRCHILD 38, rue de l'Yvette PARIS (16ème)
60	HEITO 13, rue Augereau PARIS (7ème)

CODE LETTERS AND ABREVIATIONS

USED IN CIRCUIT DIAGRAM

Framed indications

These correspond to components accessible on front panel

e.g. $\boxed{\text{AF OUTPUT}}$

Designation of component elements

These elements are illustrated on the diagram and on the chassis by code letters associated with one or several digits. These figures relate to an arbitrarily choses order number.

Ex : R 57 refers to the 57th resistor.

List of code letters

R : ohmic resistor

C : capacitor

CR : rectifier crystal

M : meter

T : transformer

L : inductance coil

V : electron tube

I or DS : indicator light or dial signal

F : fuse

S : selector or ST switch (this code letter, used in association with an order number, can be followed by a circuit identification letter).

Resistor and capacitor values

The values are indicated in ohms or micro-microfarads (picofarads).
The following letters indicate the multiplying factor :

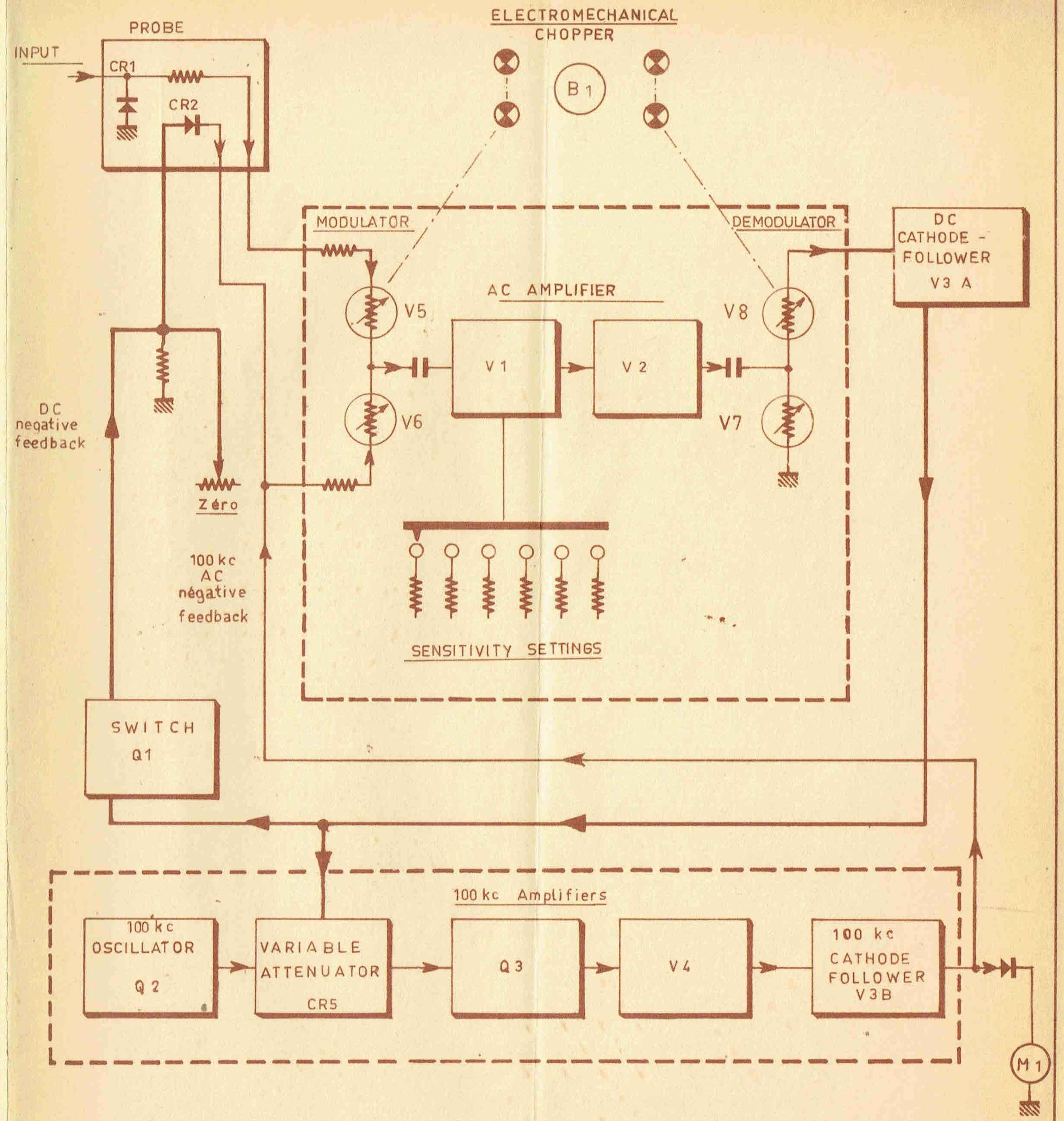
$$\left.\begin{array}{l} K = 10^3 \\ M = 10^6 \end{array}\right\} \text{ in the case of resistors}$$

$$\left.\begin{array}{l} K = 10^3 \\ \mu F = \text{microfarad} \end{array}\right\} \text{ in the case of capacitors}$$

Special coding applicable to resistors and potentiometers

Tolerance not mentioned	: ± 10 %
Power rating not mentioned	: $\frac{1}{2}$ Watt
Semi-fixed adjustment	:
Adjustable value	: *


PROBE
INPUT
T13G
(CR1–CR2)
ORP60
(V5)
1/2 12AX7
(V1A–V1B)
(V1A)
(V1B)
6AU6
(V2)
1/2 E188CC
(V3 A)
ORP60
(V6)
(V7)
ORP60
(V8)
ORP60
OAZ
206
(CR3)
MODULATOR
DEMODULATOR
ZERO
S1A
S1 B
HF AMPLIFIER
OA5
(CR4)
BA102
(CR 5)
AF115
(Q3)
AF115
(Q2)
OAZ200
(CR 6)
6AU6
(V4)
1/2 E188CC
(V3 B)
OC77
(Q1)
S1C
S1D
S1 E
OA73
(CR7)
M1
OA211
(CR8)
OA211
CR9
ASZ15
(Q4)
OC74
(Q5)
OC74
(Q6)
DZ15A
(CR10)
DZ10B
(CR14)
10J2
(CR11)
10J2
(CR12)
ASZ 15
Q7
OAZ205
(CR13)
AC LINE
POWER SUPPLY
FILAMENT
VOLTAGE SUPPLY
12AX7 (V1)
SENSITIVITY RANGES
S1A to S1E
VOLTS
dB
NOTE RESISTORS
POWER RATINGS (WHEN NOT SPECIFIED) : 1/2W
TOLERANCES (WHEN NOT SPECIFIED) : 10%
CONTROLS ACCESSIBLE
ON FRONT PANEL
* VALUE TOBE ADJUSTED
FERISOL
CONST^R PARIS
HF-VHF MILLIVOLTMETER
TYPE AB301
9.10.64



FERISOL

CONST^r PARIS

HF - UHF MILLIVOLTMETER
TYPE AB301

BLOCK DIAGRAM

20.10.64

FERISOL

Ets GEFFROY & Cie
S. A. Capital 3.250.000 F
18, Avenue Paul-Vaillant-Couturier - TRAPPES (S.-&-O.)
TÉLÉPHONE : 923-08-00
(5 lignes groupées sous ce N°)

PROCÈS-VERBAL DE RÉCEPTION DU VOLTMÈTRE ÉLECTRONIQUE

Type : AB 301 N° 829

Essai effectué par M. l'Ingénieur .... de ....

et par M. l'Ingénieur .... de la Société FERISOL.

I. ESSAIS MÉCANIQUES.

Vérification du bon fonctionnement et de la bonne tenue de tous les organes en service normal.

Potentiomètres - Interrupteurs - Contacteurs - Galvanomètre.

OBSERVATIONS

NORMAUX

II. ESSAIS ÉLECTRIQUES.

1°) Intensité prise au réseau.

Volts Secteur	120	220
I en Ampères	0,3	0,15

2°) Rigidité diélectrique : application de 2 U + 1.000 volts alternatifs entre secteur et masse de l'appareil pendant une minute.

BONNE

III. VÉRIFICATION DE L'ÉTALONNAGE.

Méthode de mesure : comparaison du voltmètre à essayer avec un voltmètre étalon, les 2 appareils étant montés en parallèle sur la source.

1°) Tensions alternatives (0 à ...... volts). F. d'essai : 10 MHz.

Gamme : 10mV		Gamme 30mV		Gamme 100mV		Gamme 300mV		Gamme : 1 V		Gamme : 3 V		Gamme :	
Etalon	V. E.	Etalon	V. E.	Etalon	V. E.	Etalon	V. E.	Etalon	V. E.	Etalon	V. E.	Etalon	V. E.
3	3	10	10	30	30	100	100	0,3	0,3	1	1		
6	6	20	20	60	60	200	200	0,6	0,6	2	2		
10	10	30	30	100	100	300	300	1	1	3	3		

2°) Tensions continues ou alternatives (0 à ...... volts). F. d'essai : ...... Hz.

Gamme :		Gamme :		Gamme :		Gamme :		Gamme :		Gamme :	
Etalon	V. E.	Etalon	V. E.	Etalon	V. E.	Etalon	V. E	Etalon	V. E.	Etalon	V. E,

2.000

Septembre 1964

T. S. V. P.

V. L. A.

3°) **Tensions continues ou alternatives. F. d'essai :** .... **Hz.**

Gamme :		Gamme :		Gamme :		Gamme :		Gamme :		Gamme :	
Etalon	V. E.	Etalon	V. E.	Etalon	V. E.	Etalon	V. E.	Etalon	V. E.	Etalon	V. E.

IV. VARIATION DE L'ÉTALONNAGE EN FONCTION DE LA FRÉQUENCE.

F = 100kHz.		F = 300 MHz.	F = 500M Hz.	F = 600 MHz.	F = 700M Hz.	F = 900M Hz.
Etalon	V. E.	V. E.	V. E.	V. E.	V. E.	V. E.
9mV	9,1	9,1	9,6	9,8	9,8	10,7
90mV	90	90	94	96	97	102
900mV	890	900	800	870	860	860

V. MESURE DE L'IMPÉDANCE ET DE LA CAPACITÉ D'ENTRÉE DE LA SONDE.

F en kHz. — R en Mégohms — C en pF.				
F.	$\frac{1{,}59 \quad 10^2 \quad Q_1 \,.\, Q_2}{F. \quad C1 \quad (Q_1 - Q_2)}$	= R	$C_1 - C_2 = C$	
1 MHz	$\frac{1{,}59 \times 10^2 \times 280 \times 204}{308 \times 74 \times 1000}$	0,39	308-306,2	1,8

Méthode d'essai :
Amortissement d'un circuit oscillant lorsque la sonde du voltmètre électronique est placée en parallèle.

VI. CONTROLE DE LA RÉGULATION.

Méthode d'essai : un auto-transformateur fait varier la tension d'alimentation du voltmètre à vérifier de ± 10 % par rapport à sa valeur nominale.

U	Tensions continues		Tensions alternatives	
Secteur	Etalon	V. E.	Etalon	V. E.
— 10 %				# 9 mV
nominale			9 mV	# 9 mV
+ 10 %				# 9 mV

VII. CONTROLE DE L'ÉTALONNAGE EN OHMMÈTRE.

Etalon	10 Ω	100 Ω	1 kΩ	10 kΩ	100 kΩ	1 MΩ	10 MΩ	100 MΩ
V. E.								

Fait à Trappes, le Mai *196*6

L'Ingénieur de l'Administration,

L'Ingénieur de la Société Ferisol,