COMBINATION INSTRUMENT Ц4341

DESCRIPTION AND OPERATING INSTRUCTIONS

V/O MASHPRIBORINTORG·USSR·MOSCOW

COMBINATION INSTRUMENT

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Description and Operating Instructions

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Negligible changes in instrument design and circuit may not be reflected in this manual.

APPLICATION

The combination instrument (avometer and transistor tester) Ц4341 is designed for measuring current intensity and voltage in D.C. and A.C. circuits and D.C. resistance.

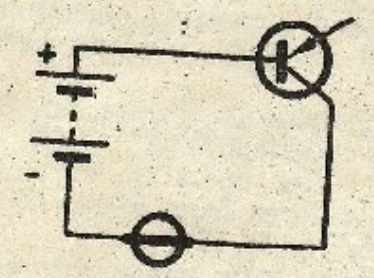


Fig. 1

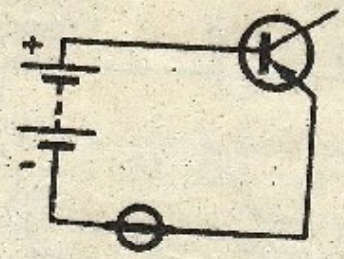


Fig. 2

The instrument is used for measuring the following transistor parameters:

I_{cb} — collector junction back current (collector — base junction). This current is measured as shown in diagram, Fig. 1, with the emitter circuit disconnected.

I_{eb} — emitter junction back current (emitter — base junction). This current is measured as shown in diagram, Fig. 2, with the collector circuit disconnected.

I_{c1} — initial collector current. This current is measured in the circuit with a common emitter (Fig. 3) and

at zero voltage between the emitter and the base ($U_{be}=0$).

β — static current gain factor is measured in the circuit with a common emitter

$$\beta = \frac{\Delta I_c}{\Delta I_b},$$

where ΔI_c is the change of collector current due to change of base current by ΔI_b.

The instrument Ц4341 can be extensively used for various D.C. and A.C. measurements both at factories and in laboratories. Since the instrument is adapted for the measurements of transistor parameters, it can be used in radio engineering, for designing and repairing electronic equipment and in amateur radio practice.

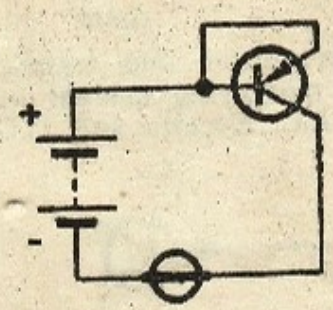


Fig. 3

The instrument comes in the following modifications:

Ц4341 — for operation at ambient temperatures from minus 10 to plus 40°C and relative humidity up to 80%;

Ц4341Т — for indoor operation both under dry and humid climatic conditions at ambient temperatures from minus 5 to plus 45°C and relative humidity up to 95%.

TECHNICAL DATA

Measurement ranges:

D.C. voltage, V	0.3; 1.5; 6; 60; 150; 300; 900
A.C. voltage, V	1.5; 7.5; 30; 150; 300; 750
D.C. intensity, mA	0.06; 0.6; 6; 60; 600
A.C. intensity, mA	0.3; 3; 30; 300
D.C. resistance	0.5 kΩ; 5 kΩ; 50 kΩ; 500 kΩ; 5 MΩ; (2 kΩ; 20 kΩ; 200 kΩ; 2 MΩ; 20 MΩ in non-effective part of scale)

Transistor parameters:

I_{cb}	0—60 μA
I_{eb}	0—60 μA
I_{ci}	0—60 μA
β	10—350

Instrument basic error, %, max:

In measuring D.C. intensity and voltage	±2.5% of finite scale value
In measuring A.C. intensity and voltage	±4% of finite scale value
In measuring D.C. resistance	±2.5% of effective scale length (64 mm) and not more than ±4% in 0.5 kΩ measurement range
In measuring I_{cb}, I_{eb}, I_{ci}	±2.5% of finite scale value

In measurement of β — current gain factor,— in a common emitter circuit rated error does not exceed ±5% of the finite scale value (70 or 350). Actual error due to spread transistor parameters can run up to ±10%.

The instrument basic error does not exceed the above data provided the instrument is used under normal operating conditions.

The normal operating conditions are as follows:

horizontal position within ±2°; ambient temperature plus 20±5°C (for Ц4341) and plus 27±5°C (for Ц4341T).

In determining the basic error for alternating current and voltage measurements the frequency should be within the nominal range (see Table 1).

Instrument consumption:

full deflection current in measuring D.C. voltage is 60 μA (which corresponds to input resistance at 16.7 kΩ/V);

full deflection current in measuring A.C. voltage is 300 μA (which corresponds to input resistance of 3.3 kΩ/V);

drop of voltage across instrument terminals is not over 1.3 V in A.C. measurement;

in D.C. measurements not over 0.3 V.

Resistance measurements are made with the use of a built-in battery. The maximum current drawn from the battery does not exceed 80 mA. The same battery is used for measurements of transistor parameters.

Instrument damping time is not more than 4 s.

Scale length (max) — 86 mm.

The insulation between insulated electric circuits and the instrument housing at normal temperatures withstands a test voltage of 3 kV of practically sinusoidal shape, 50 Hz, for 1 min.

Variation of Readings Due to Various Factors

Variation of readings due to change of frequency from the nominal range boundary to any value in the adjacent part of the expanded range does not exceed ±4%.

Variations in readings of instrument Ц4341 caused by a change of ambient temperature from the normal (plus 20±5°C) to any temperature in the range from minus 10 to plus 40°C do not exceed ±2.5% (±1.25% for ohmmeter) for D.C. measurements and ±4% for A.C. measurements per every 10°C of temperature change.

Variations in readings of instrument Ц4341T caused by a change of ambient temperature from the normal (plus 27±5°C) to any temperature in the range from minus 5 to plus 45°C do not exceed ±2% (±1.25% for ohmmeter) for D.C. measurements and ±3% for A.C. measurements per every 10°C of temperature change.

Table 1

Finite scale values	Frequency ranges, Hz	
	Nominal	Expanded
150 V	45—1000	1000—15000
300 V	45—1000	1000—5000
750 V	45—500	500—2000
All other values (current and voltage)	45—5000	5000—20000

Variations in instrument readings caused by a deviation of the current or voltage curve from practically sinusoidal (distortion factor not more than 2%) due to 2-nd, 3-rd or 5-th harmonic component, equal to 10% of the effective value of the measured current or voltage, do not exceed the maximum basic error.

Variations in instrument readings caused by the influence of a constant uniform magnetic field of 400 A/m intensity do not exceed ±2.5% in case of the most unfavourable direction of the field.

Variations in instrument readings caused by the influence of a uniform magnetic field, sinusoidally changing in time at frequency equal to frequency of current flowing through the instrument being tested do not exceed ±2.5%, intensity being 400 A/m at frequencies

from 45 Hz to f_k inclusive at intensity evaluated by the equation:

$$H = \frac{400 f_k}{f} \text{ A/m},$$

where: f — frequency, Hz;
f_k — frequency 160 Hz; for frequencies f greater than f_k.

Variations in instrument readings caused by its deviation from the normal (horizontal) position through 15° to any side do not exceed the permissible basic error.

Instrument overall dimensions — 115×215×90 mm.

Mass of instrument without case and accessories is not over 1.2 kg (Ц4341) and not over 1.6 kg (Ц4341Т).

PRINCIPLE OF OPERATION

The measuring mechanism used in the instrument is of the magneto-electric type with inside-frame magnet and moving part on braces.

The measurement ranges are expanded with the help of range multipliers and a universal shunt.

Alternating currents and voltages are measured through a rectifying semi-conductor bridge with the measuring mechanism connected in the bridge diagonal.

The instrument measures the average alternating current or voltage value but is graduated in the effective values with practically sinusoidal shape of curve (shape factor $K_{sh} = 1.11$).

D.C. resistances are measured acc. to the series magnetoelectric ohmmeter circuit.

As the basis for the measurement of gain factor β is accepted the technique of measuring the collector increment current when the base current varies, since $\beta = \frac{\Delta I_c}{\Delta I_n}$.

DESIGN

The instrument is enclosed in a plastic housing consisting of two parts — base and cover.

The measurement ranges are given on the face plate and the basic rules for the use of the instrument are explained on the back plate.

The instrument is provided with two switches.

The resistor plate, switches, measuring mechanism are all attached to the housing cover.

The measuring mechanism is enclosed in a separate housing.

SAFETY RULES

In measuring high-voltage currents strictly observe the valid accident prevention rules.

Warning!

During measurements of high voltages as well as currents and voltages in circuits which are under high voltage, terminals "⏚", "U, I, $-r_x$" and jack "Б", "К", "Э" are under high potential, so avoid touching them for it is life-hazardous.

PREPARING THE INSTRUMENT FOR OPERATION AND GENERAL INSTRUCTIONS FOR USE

To obtain accurate results in measurements and prevent possible damages of the instrument in using it, observe the following general rules:

before measurements place the instrument into the horizontal position;

set the instrument pointer with the aid of the corrector to the initial marks of the scales;

set the mode switch to position corresponding to the value being measured; and the measurement range selector to position corresponding to the value excepted in

the measurement. In case the latter is not known even approximately, start measurements from the maximum range, passing gradually over to the most appropriate range;

connect the instrument to the measuring circuit in compliance with the marking of the terminals.

In measuring high-frequency currents excessive errors may be caused by capacity leakage currents between instrument elements and surrounding objects. To avoid this, the circuit should be wired so that the instrument common terminal (marked "⋇") may be connected to the grounded terminal of the voltage being measured;

avoid switching the instrument over when it is energized;

the measurements over, set the measurement range selector to the position "900 V", and the mode switch — to the position "~".

The connecting cords are to be connected to the instrument by means of plug tips or detachable flat tips fitted on the latter.

If a prolonged contact is required fit either the detachable flat tips or the alligator clips to the ends of the connecting cords which are to be connected to the measuring circuit.

USING THE INSTRUMENT

Current Measurements

Set the mode switch to the position "—" (in measuring direct current) or to the position "~" (in measuring alternating current). Set the measurement range selector to the position corresponding to the value of current being measured. Connect the instrument to the measuring circuit with the help of terminals marked "⋇" and "*U, I, —r*$_x$".

Reading of the value being measured is taken off the scale marked "—" (in measuring direct current) or off the scale "~" (when measuring alternating current).

Voltage Measurements

Set the mode switch to the position "—" (in measuring D.C. voltage) and to the position "~" (in measuring A.C. voltage).

Set the measurement range selector to the position corresponding to the value of voltage being measured. Connect the instrument to the measuring circuit by means of terminals marked "⋇" and "*U, I, —r*$_x$".

Reading of the value being measured is to be taken off the scale marked "—" (in measuring D.C. voltage), off the scale marked "~" (in measuring A.C. voltage) and off the scale "~ 1.5 V" (in measuring within the range "~ 1.5 V").

Measuring D.C. Resistance

The built-in battery serves as the power source. Set the mode switch to the position "*r*$_x$", the measurement range selector at that moment should be in one of the positions "×0.1", "×1", "×10", "×100", depending on the expected value of resistance being measured.

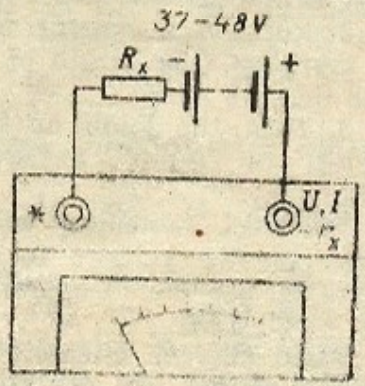


Fig. 4

The connecting cords should be short-circuited and, by turning the knob "Zeroing", "Calibr.", set the instrument pointer to the zero mark of scale "kΩ", "MΩ". If the instrument

pointer cannot be set to zero in this way the battery should be replaced. The range of adjustment by knob "Zeroing", "Calibr." is designed for the battery voltage from 3.7 to 4.7 V.

On completing the instrument adjustment, disconnect the connecting cords and connect to them the resistance to be measured.

Read the value being measured off the scale "kΩ" or "MΩ", taking into account the multiplier.

When measuring in the range "5 MΩ" (Fig. 4) the built-in battery should be cut out: an external power supply with a voltage of 37—48 V should be used. The contact plates of the built-in power supply have to be closed. Readings are to be taken from scale "kΩ", "MΩ".

Measuring Transistor Parameters

Measuring I_{cb} and β

1. Set the measurement range selector to position "Calibr." to avoid a possible voltage application to the transistor being connected. Turn knobs "Base current" ("Coarse", "Fine"), "Zeroing", "Calibr." counterclockwise to the extreme position.

2. Put the transistor leads into the jacks according to marking (the length of transistor leads should not be less than 15 mm).

3. Turn the knob of the mode switch into position "p-n-p" or "n-p-n", depending on the type of the transistor.

Incorrect switching will result in the feed of a reverse-polarity voltage to the transistor which may damage it. Set the measurement range selector to position I_{cb} (—60 μA).

Read current intensity I_{cb} off scale "—", bearing in mind that the full deviation of the pointer corresponds to current of 60 μA.

4. Prior to measuring the β factor, set the measurement range selector to position "Calibr." and the mode switch to position "p-n-p" or "n-p-n" (depending on transistor type) and by means of knobs "Zeroing" and "Calibr." set the instrument pointer to the mark "0" of the "β" scale.

5. Turn the measurement range selector to position "β×5". Using the knobs "Base Current" ("Coarse" and "Fine"), set the instrument pointer to mark "0" of the "β" scale.

6. Turn the measurement range selector to position "β" and take readings off scale "β". Factor β being measured will be equal to the value read off the scale multiplied by 5.

7. If factor β is less than 70, turn the measurement range selector to position "β×1". Using knobs "Base Current" ("Fine" and "Coarse") set the instrument pointer to mark "0" of the "β" scale. In this case the factor β being measured is read off scale "β" with multiplier "×1".

The obtained value of factor β is measured in a circuit with the common emitter at supply voltage 3.7—4.7 V and resistance 500 Ω in collector circuit.

If in measuring the gain factor β the instrument pointer cannot be set to "0" of scale "β" by means of knobs "Coarse" and "Fine" (pointer deviates off scale), factor β at given value of I_{cb} is greater than the value corresponding to this current (Table 2).

For example, the measured collector back current is 10 μA. In measuring factor β the instrument pointer cannot be set to "0" of scale "β". It appears that β>165 (see Table 2).

Low-duty transistors which simultaneously have a great back current (I_{cb}>5 μA) and great gain factor (β>150) cannot be used practically in most cases.

When measuring gain factor of silicon transistors instrument readings should be multiplied by 1.1. For

example, the instrument reads β=50. The actual value of factor will be:

$$\beta = 50 \cdot 1.1 = 55.$$

Some differences in instrument readings obtained in measuring factor β of one and the same transistor in ranges "β×1" and "β×5" cannot serve as evidence of a faulty operation of the instrument. It can be explained by the variation of factor β due to operation of the transistor at different values of collector current and voltage and connected with the presence of a 500 Ω resistance in the collector circuit.

Table 2

I_{cb}, μA	2	3	4	5	6	7	8	9	10
β	300	270	250	230	210	200	185	175	165

I_{cb}, μA	11	12	13	14	15	16	17	18	19
β	155	150	140	135	130	125	120	115	110

Measuring I_{eb}, I_{cl}

When connecting the transistor to the instrument, the measurement range selector should be set to position "Calibr.", the mode switch — to position "p-n-p" or "n-p-n", depending on the transistor type.

Measurement of I_{eb}, I_{cl} are carried out similarly to the measurement of I_{cb} (first measure transistor back currents, then all other parameters).

In measuring I_{eb} insert the transistor with its emitter contact into jack "К", with the base contact — into jack Б"; in this case the transistor collector contact either is not connected or, for convenience, is connected to jack "Э". The value of I_{eb}, is to be read off scale "—"; full deviation of the instrument pointer corresponds to 60 μA, as in the measurement of I_{cb}.

In measuring I_{cl} connect the interconnected transistor contacts "Emitter" and "Base" to jack "Б" and collector contact — to jack "К". The current intensity is read off scale "—" (full deviation of the instrument pointer corresponds to 60 μA). The measurements over, the mode switch should not be left in position "p-n-p" or "n-p-n" and the measurement range selector — in position "Calibr.", since the battery discharge current amounts to 23 μA which reduces battery service life.

Replacing the Battery

To replace the battery remove the back plate by turning out three screws. Having taken out the old battery, insert a new one, paying attention to the polarity.

INSTRUMENT STORAGE

The instruments should be stored indoors in their cases at ambient temperature from plus 10 to plus 35°C and relative humidity up to 80%. The air should be free from harmful admixtures liable to cause corrosion.

TROUBLE SHOOTING

The most characteristic trouble in instrument operation is a break of one of the resistors or failure of one of the germanium diodes.

The break of any of the resistors in the voltage

measuring circuit can be easily detected by absence of instrument readings in the respective range of D.C. voltage measurement.

The break of any of the resistors in the universal shunt will result in absence of readings in the upper current measurement ranges (in the lower ranges instrument readings will have a great position error).

Faulty germanium diodes are revealed by wrong readings in all the A.C. intensity and voltage measurement ranges (while the instrument readings in the D.C. intensity and voltage measurement ranges are correct).

To remedy a trouble, the instrument should be opened. For this purpose it is necessary to turn out three screws and remove the instrument back plate. Then turn out four screws which fasten the cover and remove the latter. Thus, the access is opened to the panels carrying all the circuit components.

Any element of the circuit can be easily located with the aid of the instrument circuit diagram and specification.

The troubles can be revealed by inspections and tentative measurements, for instance, with the aid of a similar instrument. Damaged parts should be either repaired or replaced by new ones. After a repair involving change in instrument parameters (such as replacement of the germanium diodes, rewinding of the instrument frame, etc.) the instrument must be readjusted. The succession of procedures of complete instrument adjustment is given below. Depending on the nature of repair the adjustment can be started at this or that stage, provided the indicated sequence of procedures is adhered to.

All the resistors, except the adjusting ones, should be adjusted to the values specified.

If the measuring mechanism has been repaired with the dismantling of the magnetic system, its full deflection current should be adjusted to 42.5±0.5 μA by

means of magnetizing and gradual demagnetizing of the system. Frame resistance should be 635±3 Ω. The moving part of the measuring mechanism is fastened on braces type Пл. Ср. 20 М 0.25 (the tension is 40±5 gf).

The resistance of resistor *R26* should be adjusted until minimum error in D.C. measurement ranges is obtained.

Having put the measuring mechanism in place, check whether the finite marks coincide in all finite scale values in D.C. ranges. After replacement of the diodes (total back current must be not over 5 μA at 300 mV), adjust the instrument in the alternating current.

For this purpose connect the instrument in one of the A.C. intensity or voltage measurement ranges to an A.C. supply, 50 Hz, with distortion factor not more than 2% and, using the standard instrument, set in the circuit of the instrument under adjustment the current or voltage value equal to the chosen.

The resistance of resistor *R25* should be of such value that under the indicated conditions the measuring mechanism pointer would deviate to the finite scale mark; after that the intermediate numbered marks of the A.C. scale should be checked for conformity.

It should be borne in mind that the resistors which consist of two resistors (*R4—R9, R11, R16—R23, R29*) can be made up of one or several resistors (МЛТ, МТ, ОМЛТ, УЛИ, УЛМ, ВЛП, МГП, etc.) in such a manner as to ensure the total resistance value indicated in the Specification notes.

PERIODIC CHECK-UP

At least once a year the instrument must be checked for accuracy of readings.

In all the current intensity and voltage measurement ranges the instrument is checked by comparing its readings with the readings of standard instruments. The

standard instruments should be not less than 0.5 class of accuracy in direct and alternating current.

The standard instruments should be so selected that the finite values of their scales would not exceed the respective finite values of the instrument checked by more than 25%.

In the resistance measurement ranges the instrument is checked with the aid of a resistance box connected for this purpose to the instrument. The resistance value corresponding to the scale mark being checked is picked up on the resistance box. The magnitude of the error is read directly off the instrument scale.

The class of accuracy of the resistance box should be not less than 0.5.

To check the current gain factor β for accuracy of measurement, measure the current variation in the base circuit I_b and in the collector current I_c determined from diagram of Fig. 5, the following designations being:

"μA" — D.C. microammeter with finite scale value 50—150 μA, internal resistance being up to 200 Ω, class of accuracy 0.5;

"mA" — D.C. milliammeter with finite scale value 6 mA, class of accuracy 0.5;

"*R*" — rheostat up to 2000 Ω.

Supply voltage should be 4.1 V, the transistor at this check-up is to be absent.

Factor β Error Measurement

1. Turn knobs "Base Current" ("Coarse" and "Fine" — resistors *R1* and *R3*) counterclockwise to the extreme position.

2. Set the measurement range selector to the position "Calibr." and the mode switch — to position "p-n-p" and connect the instrument as shown in the diagram of Fig. 5.

3. By means of knob "Zeroing", "Calibr." (resistor *R24*) set the pointer of instrument Ц4341 to the mark "0" on scale "β".

4. Set the measurement range selector to position "β". By means of rheostat *R* set the pointer of instrument Ц4341 to the mark "0" on scale "β" and take the reading I_c of instrument "mA".

The "μA" instrument readings should not exceed 2 μA.

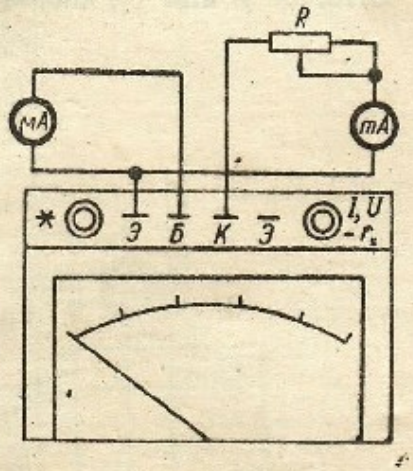


Fig. 5

5. Set the measurement range selector to position "β×5" and back to position "β" and determine the obtained variation in readings ΔI_{b5} of instrument "μA".

6. Evaluate the measurement error of factor β in the range "β×5" using the equation:

$$\gamma_5 = \left[1 - \frac{I_c}{463.5 \cdot \Delta I_{b5}} + \frac{R_0}{540000}\right] \cdot 100\%,$$

where: I_c — collector current, A;

R — resistance of instrument "μA", Ω.

7. Set the instrument range selector to position "β×1" and back to position "β" and determine obtained variations "ΔI_{b1}" in readings of instrument "μA".

8. Evaluate the measurement error of factor β in the range "β×1", using the equation:

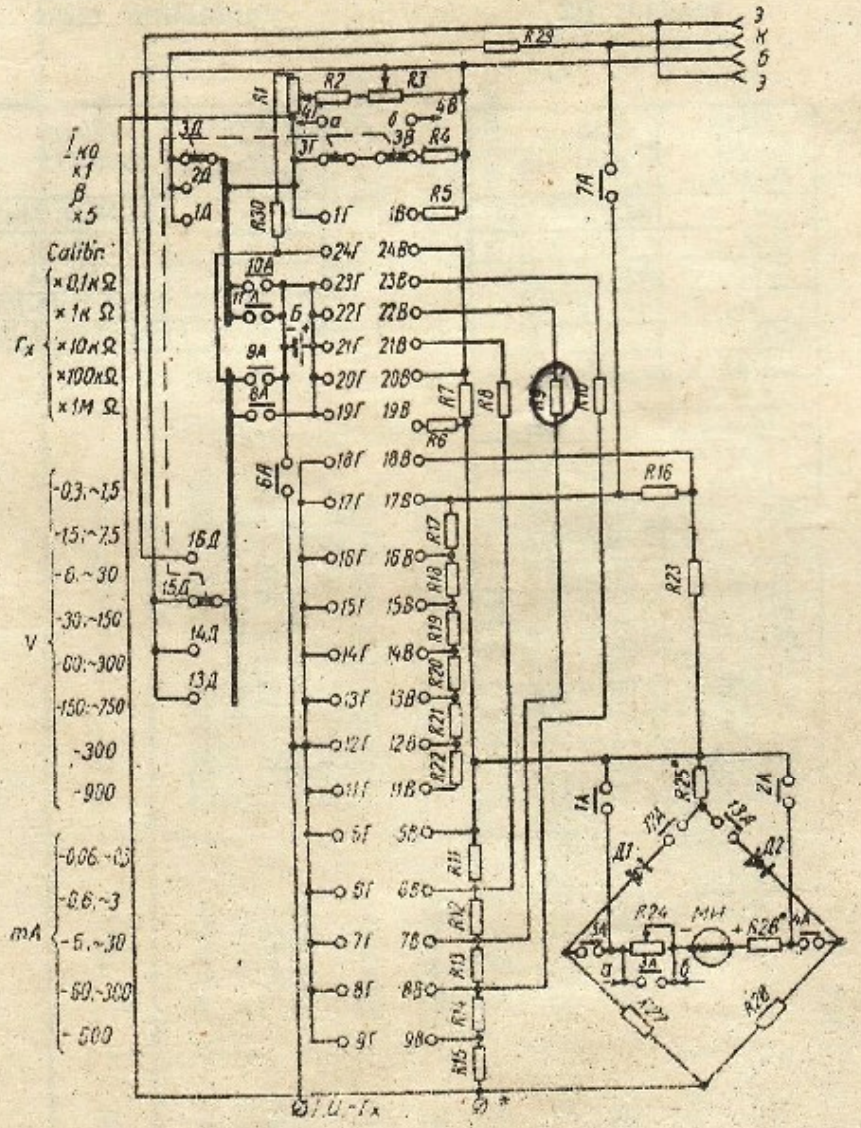
$$\gamma_1 = \left[1 - \frac{I_c}{92.7 \cdot \Delta I_{b1}} + \frac{R_0}{108000}\right] \cdot 100\%.$$

In calculations take into account the corrections and the resistance of the standard instruments.

9. Repeat the operations of items 4—8 for position "n-p-n" of the mode switch by reversing the polarity of connection of the instruments "μA" and "mA".

Error of γ_1 and γ_5 should not exceed ±5%.

Instrument Ц4341 Elementary Diagram



R* — to be selected by adjustment.

Measurement range selector П2 contacting table

Finite scale values	Make contacts
×1	3Д; 3Г, 3В, 15Д
β	2Д; 14Д
×5	1Д, 1Г, 1В, 13Д
1кΩ	4Г, 4В, 16Д
Calibr	24Г, 24В
×0,1кΩ	23Г, 23В
×1кΩ	22Г, 22В
×10кΩ	21Г; 21В
×100кΩ	20Г, 20В
×1МΩ	19Г, 19В
-0,3; ~1,5V	18Г, 18В
-1,5; ~7,5V	17Г, 17В
-6; ~30V	16Г, 16В
-30; ~150V	15Г, 15В
-60; ~300V	14Г, 14В
-150, ~750V	13Г, 13В
-300V	12Г, 12В
-900V	11Г, 11В
-0,06; ~0,3mA	5Г, 5В
-0,6; ~3mA	6Г, 6В
-6; ~30mA	7Г, 7В
-60, ~300mA	8Г, 8В
-600mA	9Г, 9В

Mode switch П1 contacting table

Mode of operation	Make contacts
~	3А; 4А; 5А; 12А; 13А
—	2А, 3А, 5А
r_x	2А; 5А; 6А
p-n-p	2А, 5А, 7А, 8А, 11А
n-p-n	1А; 4А; 7А; 9А, 10А

Specification to Circuit Diagram

Ref.	Item	Electric Data and Type	Q-ty	Notes
R1	Resistor	СП3-9-25-100 kΩ±20%	1	
R2	Resistor	МЛТ-0.5-3 kΩ±20%	1	
R3	Resistor	СП3-9-25-1.5 MΩ±30%	1	
R4	Resistor	МЛТ-0.5-51 kΩ±5%	1	Total resistance 108±0.54 kΩ
		МЛТ-0.5-56 kΩ±5%	1	Total resistance 540±2.7 kΩ
R5	Resistor	МЛТ-0.5-270 kΩ±5%	2	Total resistance 590±6 kΩ
R6	Resistor	МЛТ-0.5-300 kΩ±5%	2	Total resistance 58±0.6 kΩ
R7	Resistor	МЛТ-0.5-22 kΩ±5%	1	Total resistance 5.58±0.06 kΩ
		МЛТ-0.5-36 kΩ±5%	1	Total rcsistance 558±5.5 Ω
R8	Resistor	МЛТ-0.5-2 kΩ±5%	1	
		МЛТ-0.5-3.6 kΩ±5%	1	
R9	Resistor	МЛТ-0.5-200 Ω±5%	1	
		МЛТ-0.5-360 Ω±5%	1	
R10	Coil	53±0.55 Ω	1	Total resistance 3150±15 Ω
		ПЭМС Ø 0.2 mm	1	
R11	Resistor	МЛТ-0.5-1.5 kΩ±5%	1	
		МЛТ-0.5-1.6 kΩ±5%	1	

Continued

Ref.	Item	Electric Data and Type	Q-ty	Notes
R12	Coil	315±1.5 Ω ПЭМС Ø 0.1 mm	1	
R13	Coil	31.5±0.15 Ω ПЭМС Ø 0.2 mm	1	
R14	Coil	3.15±0.015 Ω ПЭМС Ø 0.4 mm	1	
R15	Coil	0.35±0.0015 Ω ПЭМС Ø 0.6 mm	1	
R16	Resistor	МЛТ-0.5-10 kΩ±5%	2	Total resistance 20±0.1 kΩ
R17	Resistor	МЛТ-0.5-36 kΩ±5% МЛТ-0.5-39 kΩ±5%	1 1	Total resistance 75±0.37 kΩ
R18	Resistor	МЛТ-0.5-200 kΩ±5%	2	Total resistance 400±2 kΩ
R19	Resistor	МЛТ-0.5-200 kΩ±5% МЛТ-0.5-300 kΩ±5%	1	Total resistance 500±2.5 kΩ
R20	Resistor	МЛТ-0.5-750 kΩ±5%	2	Total resistance 1.5±0.0075 MΩ
R21	Resistor	МЛТ-0.5-1.2 MΩ±5% МЛТ-0.5-1.3 MΩ±5%	1 1	Total resistance 2.5±0.012 MΩ
R22	Resistor	МЛТ-0.5-2 MΩ±5% МЛТ-0.5-3 MΩ±5%	2 2	Total resistance 10±0.05 MΩ
R23	Resistor	МЛТ-0.5-2 kΩ±5%	2	Total resistance 3.97±0.018 kΩ
R24	Resistor	СП3-9-25-3.3 kΩ±20%	1	
R25	Resistor	МЛТ-0.5 up to 350 Ω	1	To be selected by adjustment
МИ	Measuring mechanism	530±100 Ω ПЭВ-1 Ø 0.03 600 turns	1	Total resistance 635±3 Ω
R26	Resistor	МЛТ-0.5 up to 400 Ω	1	To be selected by adjustment
R27	Resistor	МЛТ-0.5-430 Ω±5%	1	Resistances of *R27* and *R28* should not differ by more than 1%
R28	Resistor	МЛТ-0.5-430 Ω±5%	1	
R29	Resistor	МЛТ-0.5-240 Ω±5% МЛТ-0.5-270 Ω±5%	1 1	Total resistance 510±2.5 Ω
R30	Resistor	МЛТ-0.5-62 kΩ±5%	1	
Б	Battery	3336	1	
Д$_1$, *Д*$_2$	Germanium diode	Д9Д	2	May be replaced by Д9М, Д2В

Notes:

1. *R25* and *R26* can be composed of two resistors connected in series.
2. Items *R2*, *R4—R9*, *R11*, *R16—R23*, *R26—R30* can be made up of resistors Type МЛТ-0.5 with permissible departure ±10%.
3. Resistors of one pair can be of any rated values provided the preset total resistance value is ensured.
4. The parts and units of instrument Ц4341Т are tropicalized.

Measurement ranges:

D.C. intensity, mA	0.06; 0.6; 6; 60; 600
A.C. intensity, mA	0.3; 3; 30; 300
D.C. voltage, V	0.3; 1.5; 6; 30; 60; 150; 300; 900
A.C. voltage, V	1.5; 7.5; 30; 150; 300; 750
D.C. resistance, kΩ	0.5; 5; 50; 500; 5000 (2; 20; 200; 2000; 20000 within non-effective scale range)
parameters of transistors I_{ci}; I_{eb}; I_{cb}, μA	0–60
current gain factor B	10–350

Instrument basic error in measurements, not more than, %:

D.C. intensity and voltage (from end value of scale)	±2.5
A.C. intensity and voltage (from end value of scale)	±4.0
D.C. resistance for all ranges, except "×0.1kΩ" (from effective scale range)	±2.5
D.C. resistance for the range "×0.1 kΩ" (from effective scale range)	±4.0
parameters of transistors I_{cb}, I_{eb}, I_{ci}	±2.5
current gain factor B in circuit with common emitter at rated error (from the scale end value 70 or 350)	±5

N o t e. Actual error due to the spread of transistor parameters up to ±10%.

Overall dimensions, not more than, mm	115×215×90
Mass, not more than, kg	1.2

COMPLETE SET

Combination instrument (avometer-transistor tester) Ц4341	1 pc
Changeable battery 3336 (built into the instrument)	1 "
Connecting cord of 1 m length with terminal and probe	2 pcs
Detachable flat terminal	2 "
Detachable alligator clips	2 "
Case containing the instrument and accessories	1 pc
Spare parts:	
germanium diode	2 pcs
brace Пл. Ср-20 М 0.25	1 pc
Certificate	1 copy
Description and Operating Instructions	1 "

ACCEPTANCE CERTIFICATE

The instrument has been tested; it meets all technical requirements and is approved for operation.

Date of mfr. 10 — 1 19__

Q.C.D. L.S. ОТК

Official of Q.C.D. _____

Vneshtorgizdat, 3110 V/72.
Order No. 1306 ЛОП.

A

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COMBINATION INSTRUMENT

(AVOMETER- TRANSISTOR TESTER)

Ц4341 No. 159029 *CERTIFICATE*

PURPOSE

The combination instrument (avometer-transistor tester) Ц4341 is designed for measuring current intensity and voltage in D.C. and A.C. circuits with frequency from 45 to 15000 Hz D.C. resistance and basic transistor parameters at ambient temperature from minus 10 to plus 40 °C and relative humidity up to 80 % (at temperature of 30 °C).

TECHNICAL DATA

Class of accuracy of instrument at measurements:

in D.C.	2.5
in A.C.	4.0

Комбинированный прибор Ц4341. Техническое описание и инструкция по эксплуатации на английском языке

Vneshtorgizdat, 4271У/73 (2230).