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ELECTRONIC MEASURING INSTRUMENTS

VALVE CHARACTERISTICS METER

Type P 508

Operating Instructions

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CONTENTS

1. APPLICATION

The Valve Characteristics Meter Type P-508 is designed for testing and measuring characteristics of electronic receiving valves as well as some of low power transmitting valves. It is used both for technical and laboratory measurements.

2. TECHNICAL DATA

Values of supply voltages

Filament voltages:
0.6/1.2/1.4/2/2.5/3/4/5/6.3/7.5/10/12.6/14/17/20/25/30/35/40/45/50/55/60/90/110 V

Anode voltages:
1/2/3/5/10/15/20/30/40/50/60/75/90/100/125/150/175/200/225/250/275/300/350/400 V

Screen grid voltages:
1/2/3/5/10/15/20/30/40/50/60/75/90/100/125/150/175/200/225/250/275/300 V

Negative control grid bias voltages:
0...10V, 0...20V, 0...30V, 0...40V, 0...50V
continuously controlled in every range.

Negative second control grid bias voltages:
1V and 2V.

Voltage for measuring insulation between electrodes: 100V

Measuring values

Anode current:	0.05... 100 mA
Screen grid current:	0.05... 100 mA
Characteristic slope	$\left(\frac{\Delta Ia}{\Delta U_G}\right)$ at Ua=const from 0.1 to 50mA/V
Characteristic slope	$\left(\frac{\Delta Ia}{\Delta U_{G3}}\right)$ at Ua = const and U_s = const above 0.05 mA/V
Characteristic slope	$\left(\frac{\Delta Ia}{\Delta U_G}\right)$ at Ua = const and U_s = const from 0.1 mA/V to 50 mA/V

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Characteristic slope $\left(\frac{\Delta I_s}{\Delta U_{G3}}\right)$ at U_a = const and U_s = const above 0.05 mA/V

Insulation resistance between cathode and remaining electrode 0 to 10 M Ohms.

Insulation resistance between a cathode and a heater: 0 to 10 M Ohms.

Detection of a break in the heater filament.

Ion current in the first grid: 3 µA to 150 µA

Power input at maximum load 100 VA

Dimensions: 520 x 200 x 280 mm

Weight: approx. 20 kg

3. DESCRIPTION

3.1. Principle of operation

The Instrument is provided with supply sources which are indispensible for testing the valves listed in the "Elpo" Catalogue.

The heater and anode voltages are taken direct from the supply transformer and they are adjusted in steps.

The screen grid voltage is taken from the transformer via diodes protecting the valve against the harmful effects of the secondary emission current from the screen grid. This voltage is adjusted in steps.

The control grid voltage is rectified and adjusted in steps and continuously within 0 to /-50V/ range. The voltage for the suppressor grid is taken from the same rectifier as that for the first grid and it is /-2V/ or /-1V/ and 0 obtained by connecting that grid with the cathode. Due to the application of the selector switch there is a possibility to connect each valve pin to any supply source.

As it is apparent from the source description, the tested valve is supplied with the a.c. voltage and it operates in the positive half-cycle of the anode alternating voltage.

The ferritic cores located on the wires connecting valve pins, eliminate the parasitic oscillations, which could appear under certain valve working conditions.
The slope measurement is made in the current compensating system based on E1/EL84/ valve.
In the anode circuit of this valve there is the R16 resistance, which is simultaneously connected to the tested valve anode circuit.
This resistance is shunted by the R15 and R13 resistance when larger currents are measured.
The voltage drop on the R16 resistance constitute supply source of the indicating meter. When measuring the anode current- the E1 valve is blocked by the large negative potential on the control grid and a meter is fed with the voltage drop produced.
Lowering of the negative grid potential with R48 potentiometer by the anode current of the tested valve results in the conducting of the anode current through resistance R16 in the reverse direction to the tested valve anode current. Due to this the compensation of the measured current is obtained.
This compensation is valid only for the voltage supplied to the meter. The anode current passing actually through the tested valve practically is not affected. Application of the current compensation enables accurate measurement of the anode current rise due to voltage change on the tested valve control grid.
In order to avoid overload of the supply transformer the instrument is provided with the protection gear.
The instrument principle of operation is illustrated by the schematic diagram fig. 1.

3.2. Construction

The instrument is assembled in the metal enclosure.
On the instrument top plate the various types of valve sockets, sockets with additionally tapped voltages, selec-

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tor switch and links, are assembled.

3.2.1. Types of valve sockets:

The instrument is provided with the following sockets:

1. Side-contact / 8 contacts/
2. Finger-grip /5 + 1 = 6 contacts/
3. USSR 8-pin /8 contacts/
4. Loctal 8-pin /8 + 1 = 9 contacts/
5. Octal international /8 contacts/
6. USSR 9-pin /9 + 1 = 10 contacts/
7. Subminiature 5-pin
8. Steel v-ariety /8 contacts/
9.
10. USSR 7-pin /7 contacts/
11. USSR 7-pin /6 pins + 1 thick pin = 7 contacts/
12. European 5-pin /old type valves = 5 contacts/
13. American 4-pin /2 thick pins = 4 contacts/
14. Miniature 7-pin /7 contacts/
15. Novalov 9-pin /9 contacts/
16. Miniature 3-pin /3 contacts/
17. Rimlock 8-pin /8 contacts/
18. American 7-pin /2 thick pins = 7 contacts/
19. USSR 5-pin /5 contacts/
20. USSR 5-pin, thin pin /5 contacts/
21. Subminiature 8-pin

3.2.2. Sockets with additional voltage tappings.

The left part of the top plate is provided with seven radio sockets. The marking of these sockets conforms to the tested valve electrodes.

Across the appropriate pairs of sockets there exist the following voltages:

between "C" and "S" - screen grid voltage
between "C" and "G" - control grid voltage
between "C" and "A_2" - second anode voltage
between "C" and "A_1" - first anode voltage
between "H"- and "H"+ - heater voltage

These voltages are independent of the selector switch position- they depend however on the "Circuit Selector" switch position.
In the "Ins" position of this switch only the heater voltage is available.
In the remaining positions there appear all the above mentioned voltages- and if there is a nominal voltage of the first anode then the second anode voltage is applied via the 5 k Ohms resistance and vice - versa.
The discussed radio sockets are used for connecting electrodes brought out from the tested valve bulb, to the suitable supply source. They can also be used for supplying of a t ested valve having untypical base and also for controlling the voltages by means of an external voltmeter.

3.2.3. Selector switch

The switch is provided with 9 selector steps marked from 1 to 9.
Numbers are located on the top part of the switch and they conform to the numbering of the valve pins.
Each selector step is intended for one valve pin which could be connected to any supply source.
Due to this, there is a possibility of testing valves with the typical bases of optional electrode combination.
Rotating the selector enables setting each of these in one /any/ out of ten positions which are marked as follows:

1	2	3	4	5	6	7	8	9	0
C	H-	H+	G	S	A_1	A_2	D_1	D_2	-

These numbers are provided for easy remembering and recording of electrode connections. Letters located under the numbers denote the respective valve electrodes related to the respective pins, and namely:
/1/ C denotes cathode or electrode which is connected to the cathode i.e. G_3 in case of the pentodes.

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/2/ H- denotes heater filament lead being connected to the cathode
/3/ H+ denotes second heater filament or the filament mid-top lead
/4/ G denotes the first control grid
/5/ S denotes the screen grid or third anode in the treble diodes or anode in stabilivolts
/6/ A_1 denotes the single or multiple valve anode
/7/ A_2 denotes the second anode of double triodes and of double or treble diodes
/8/ D_1 denotes the second control grid, i.e. third grid in hexodes and other multi-grid valves.
/9/ D_2
/0/ denotes the valve pin that is not connected to any source /free pin/.

3.2.4. Links

At the right hand side of the top plate there are five links enabling breaking of the second grid, first anode, second anode /in case of double valves/, heater and cathode circuits.

In place of "S", "A_2", "A_1", "C" links an ohmic resistance of any value /in case of laboratory measurements/ can be connected.

In the cathode circuit the maximum ohmic resistance should not exceed 10 k Ohms.

Each link can also be replaced by an external d.c. meter. This meter will indicate half of the value read on the built-in meter, because it shows the mean value of the half-cycle rectified current of the tested valve.

- Inside the meter casing there are two transformers: one Tr1 heater voltage one and one Tr2 anode, screen grid and control grid voltage one.
  The meter protective circuit against damage during overloads is fixed on a separate plate together with a printed circuit Pł 1, while other instrument elements are mounted on the plate Pł 2.

- On the instrument front plate there is a meter and control knobs /fig. 2/ of the following switches:

1. Change-over switch "HEATER VOLTS" enabling selection of 25 different heater voltage values given in volts.
2. Change-over switch "SCREEN VOLTS" and "ANODE VOLTS" supplying anode and screen grid alternating voltages. Positions of these switches are marked in d.c. voltage values equivalent to the actual a.c. voltage. Measured RMS values of the a.c. voltage supplied to electrodes differ from the values marked on the switches if in the circuit there is no valve under test.
3. Change-over switch and potentiometer "NEG. GRID VOLTS" enable continuous control of the control grid voltage in five ranges.
4. Change-over switch "INSULATION" indicates the electrodes across which the insulation against the cathode is tested. In the "H-test" position the break in the heater filament is detected.
5. Change-over switch "GAS"-"MAINS ADJ." enabling checking of the vacuum and instrument calibration.
6. Change-over switch "MAINS ADJ." selecting the proper tapping at the primary side of the supply transformer /one graduation of this switch corresponds to 2% supply voltage change/.
7. Change-over switch "CIRCUIT SELECTOR" enabling the following measurements:
   a/ in the "INS." position the insulation between the heater and the cathode and also between the remaining elements and cathode, are checked.
   b/ in the "A_1" position the anode current and characteristic slope are measured.
   c/ in the position "A_2" the anode current and characteristic slope of the double valve second part, are measured.

d/ in the position "S" the screen grid current and characteristic slope and also the anode current of the treble diode third part, are measured.

e/ in the position "GAS" the control grid current is measured.

8. Change-over switch "METER RANGE" enables measurements of the current in 4 ranges and measurement of characteristic slope in 3 ranges.

9. Potentiometers "COMPENSATION" - COARSE" and "FINE" enable compensation of the anode current or screen grid before measuring the characteristic slope.

4. SHIPPING, UNPACKING AND STORING INSTRUCTIONS

The P-508 Valve Meter, packed in accordance with the requirements of the drawing may be shipped by road or rail. Obeying remarks on the packing guarantees full efficiency of the instrument after unpacking.

During the unpacking care should be taken not to damage the varnish coating of the meter and control knobs.

In case of finding any defects, claims should be sent to the address given on the guarantee card, and-in case of damaged packing - to the appropriate shipping company.

The meter should be stored in a room the relative humidity in which does not exceed 80%, the ambient temperature is within the limits of +10°C to 35°C and the atmosphere is not corrodive. The compartment should be protected against rain-falls and rapid temperature changes.

5. STARTING AND SERVICING INSTRUCTIONS

5.1. Starting procedures are as follows:

- check the position of the link ensuring the correct voltage supply to the instrument /should be the same as the existing mains voltage/
- set "METER RANGE" switch into 100 mA position
- set "COMPENSATION" knobs into zero positions /"0"/

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- basing on catalogue information set "HEATER VOLTS", "SCREEN VOLTS", "ANODE VOLTS" and "NET GRID VOLTS" switches in the positions ensuring the appropriate voltages for a given valve.
- set the selector in accordance with the catalogue requirements
- insert the tested valve into the appropriate valve holder and if necessary connect the leads on the valve bulb
- plug in the instrument
- set "GAS-MAINS ADJ." switch into "MAINS ADJ." position
- by means of the "MAINS ADJ." switch set the meter pointer in the black area of calibration /in the mid position if possible/
- set the "GAS-MAINS ADJ." switch in the mid position.

5.2. Measurement of insulation

- set the "CIRCUIT SELECTOR" switch into "INS." position
- check the insulation by means of the "INSULATION" switch.

5.3. Measurement of anode current

- set the "CIRCUIT SELECTOR" switch into "A_1" position, read the anode current and adjust the reading range if necessary by means of the "METER RANGE" knob.

5.4. Measurement of the $\left(\frac{\Delta Ia}{\Delta U_G}\right)$, at Ua = const

- by means of the "COMPENSATION" knobs, bring the anode current to zero.
- carry out the accurate compensation with the "METER RANGE" switch set into "2.5 mA" position.
- set the "METER RANGE" switch into "50 mA/V", 25 mA/V or 5 mA/V position depending on the slope value and take its reading on the meter.
- after completing the measurement set the "METER RANGE" switch to "100 mA" position and then set the "COARSE

COMPENSATION" knob to "0" /zero/ position.

N o t e: In case of double diodes or triodes repeat the current measurement and if necessary the slope one at the position "A_2" of the "CIRCUIT SELECTOR" switch.

5.5. Checking of the valve vacuum

- set the "GAS-MAINS ADJ." switch to "GAS" position.
- set the "CIRCUIT SELECTOR" switch to "GAS" position.
- the meter indicates the grid current.

N o t e: During readings the "METER RANGE" switch should be in "100 mA" position.

5.6. Detecting a break in the heater filament

- set the "INSULATION" switch in "H-test" position.
- set the "HEATER VOLTS" switch in "0" position.
- when the heater filament is in good condition, the meter pointer shows the short circuit. When the filament is broken, the pointer does not deflect.

5.7. Measurement of the $\left(-\frac{\Delta Is}{\Delta U_G}\right)$ characteristic slope at Ua const and Us const

- is carried out in the same manner as $\left(\frac{\Delta Ia}{\Delta U_G}\right)$ measurement, but the "CIRCUIT SELECTOR" switch is in the Is position.

5.8. Measurement of the $\left(\frac{\Delta Ia}{\Delta U_{G3}}\right)$ characteristic slope at Ua = const, at Us = const and U_G = const

- is carried out similarly as in case of $\left(\frac{\Delta Ia}{\Delta U_G}\right)$ measurement, with the exception that the anode current is compensated in such a manner that the meter will show 1 mA in the 2.5 mA range.
- at such a compensation the selector of the switch on which a figure 9/D2/ is set, turn by one step for obtaining the 8 /D_1/ position, it is equivalent to increasing the third grid potential by one volt.

5.9. Measurement of the characteristic slope $\left(\frac{\Delta I_s}{\Delta U_{G3}}\right)$ U_a = const, U_s = const, U_G = const

- is carried out in the same manner as $\left(\frac{\Delta I_a}{\Delta U_{G3}}\right)$ measurement but the "CIRCUIT SELECTOR" switch is in the "S" position.

5.10. Measurement of the internal resistance

- the anode voltage is increased, the reading of the anode current rise is taken and then $\rho a = Ua/Ia$ is calculated, whilst the compensation is utilized.

5.11. Testing of diodes

Is carried out at low anode voltages /not exceeding 30 V/; the diode is considered as correct if the meter pointer deflection is at least 30% of the full scale. In case of diodes in the combined valves the deflection may be even less. The current values given in the "Elpo" Catalogue correspond to the meter range.

5.12. Testing of tuning indicators

During this test the plug with the appropriate resistance is connected into the anode circuit instead of "a" link.
The resistance value is given in the catalogue.
The tuning indicator /magic eye/ is correct if the screen grid negative potential changes cause the changes of glow angle.

5.13. Testing of stabilivolts

It is based on checking whether there is a firing. For testing the stabilivolt the screen voltage is used which increases gradually from zero till firing is achieved. During this test the "CIRCUIT SELECTOR" switch is set into "S" position. It should be remembered that the peak value of the voltage applied to the stabilivolt electrodes is approx. 1.5 times the voltage engraved on the switch.

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For example: Stabilivolt of the firing voltage equal to 100 V requires setting of 75 V only.
When testing the stabilivolt, in the screen grid circuit a 5 to 10 k Ohms resistance should be connected instead of "S" link.

6. OVERHAUL INSTRUCTIONS

LIST OF POSSIBLE FAULTS, THEIR CAUSES AND METHODS OF REMEDIES

It	Fault description	Cauge	Remedy
1	2	3	4
1	The instrument plugged into the mains, the control lamp does not glow, the "GAS-MAINS ADJ." switch is in the calibration position, the meter pointer does not deflect.	a/ no voltage in the mains b/ fuse blown out c/ mains switch /W/ faulty d/ short-circuit in the terminal or transformer winding e/ P1 switch faulty	a/ change the supply mains b/ replace the fuse c/ replace the mains switch /W/ d/ locate and remove the fault, replace the transformer e/ replace P1 switch
2	The "GAS-MAINS ADJ." switch in the calibration position. Turning of the "MAINS ADJ." switch does not change the position of a meter pointer.	P1 switch faulty	Replace the P1 switch
3	The "GAS-MAINS ADJ." switch in the calibration position. Turning of the "MAINS ADJ." switch causes switching off the control lamp.	One or several resistors from R51 to R61 faulty	Replace the faulty resistor
4	No heater voltage	a/ Faulty P 3/1 switch b/ the selector switch faulty c/ the P 7 switch faulty	a/ replace first plate of the P 3 switch b/ repair the selector switch c/ repair or replace the P 7 switch

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1	2	3	4
5	No voltage on screen	a/ the D8 diode faulty b/ the P3/3 switch faulty c/ the D 9 diode faulty d/ the R36 resistor faulty e/ the P8 change over switch faulty	a/ replace the D8 diode b/ replace the third plate of the P 3 switch c/ replace the D9 diode d/ replace the R36 resistor e/ repair or replace the P8 change over switch
6	No anode voltage	a/ the P9 change over switch faulty b/ the P 3 faulty	a/ repair or replace the P9 change over switch b/ replace the fourth plate of P3 switch
7	No voltage on the first grid	a/ the R32 resistor faulty b/ the P2 switch faulty c/ the R18 potentiometer faulty	a/ replace the R32 resistor b/ replace the P2 switch c/ replace the R18 potentiometer
8	The first grid voltage lowered by half the set value	a/ the D2 diode faulty b/ the D3 diode faulty	a/ replace the D2 diode b/ replace the D3 diode
9	Turning the R47 potentiometer /initial compensation/ does not cause changes of meter readings	a/ the R48 potentiometer faulty b/ the D6 diode faulty c/ the R 47 resistor faulty	a/ replace the R48 potentiometer b/ replace the D6 diode c/ replace the R 47 resistor
10	When the initial compensation os operating- the fine compensation does not operate	a/ the D7 diode faulty b/ the R50 potentiometer faulty	a/ replace the D7 diode b/ replace the R50 potentiometer

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7. LIST OF PURCHASE PARTS

It.	Element No.	Description	Marking	St'd No.	Makers
1	L 1	Electronic valve	EL 84	BN-63/3271-04	
2	D1-D9	Germanium diode	DZG-7	WT-64/24	Tewa
3	D4,D5	" "	DZG-4	"	"
4	D10	Germanium blade diode	DOG-58	WT-63/21	"
5	R2	Resistor	OWS-311-1W-430Kohm±1%-I	WT-63/D-16050	Telpod
6	R6	"	OWS-311-1W-10Kohm±1%-I	"	"
7	R9	Layer-type resistor	1W-1363ohm±1%-I	"	import
8	R10	"	1W-9145,5ohm±1%-I	-	"
9	R11	Resistor	OWS-311-1W-300ohm±5%-I	WT-63/D-16050	Telpod
10	R13	Layer-type resistor	1W-10ohm±1%-I	-	import
11	R20-R23	"	1W-600ohm±1%-I	-	"
12	R24	Resistor	OWS-311-1W-7,5kohm±1%-I	WT-63/D-16050	Telpod
13	R25	Layer-type resistor	1W-2,5kOhm±1%-I	-	import
14	R26	"	1W-125kohm±1%-I	-	"
15	R28	Resistor	OWS-212-0.5W-220kohm±5%-I	WT-63/D-16050	Telpod
16	R31	"	OWS-311-1W-750ohm±1%-I	-	"
17	R32	Layer-type resistor	1W-810ohm±1%-I	-	import
18	R33	Resistor	OWS-311-1W-10kohm±1%-I	WT-63/D-16050	Telpod
19	R34 R35	Layer-type resistor	1W-163ohm±1%-I	-	import

1	2	3	4	5	6
20	R36	Resistor	OWS-311-1W-150ohm±5%-II	RN-57/MPM-14008	Telpod
21	R37	"	MŁT-0,5-2 kohm	WT-I-270-005	Omig
22	R39	"	MŁT-0,5-3,3 kohm,±5%	"	"
23	R40	"	MŁT-0,5-10 kohm±5%	WT-I-270-005	"
24	R41	"	MŁT-0,5-1 kohm±5%	"	"
25	R42	"	MŁT-0,5-100 ohm±5%	"	"
26	R43	"	MŁT-0,5-680 ohm±5%	"	"
27	R44	"	MŁT-0,5-470 ohm±5%	"	"
28	R45	"	MŁT-0,5-220 ohm±5%	"	"
29	R46	"	OWS-311-1W-10ohm±5%-II	RN-57/MPM-14006	Telpod
30	R47	"	OWS-212-0,5 W-200ohm±5%-I	WT-63/D-16050	"
31	R49	"	OWS-212-0,5W-3kohm±5% II	RN-57/MPM-14006	"
32	R51-R61	"	RDL-120-IIB-5-2W-566		Toral
33	R17	"	OPd-PE-15kohm±10%	=	Supplied by Mysłowice
34	R1	Adjustable potentiometer	Pkd-300 vert. pos. /100 kohm	WT-I-243-005	Omig
35	R12	Potentiometer	DG-101T-220ohm±10% 1W axis 12P3	ZN-59/MPC-14-009	Telpod
36	R27	"	D-101T-560ohm±10% 1W axis 12P3	"	"
37	R29 R30	"	DG-101T-1,8kohm±10%1W 12P3	"	"
38	R48	"	PA-102-5kohm-A-2W axis 25 P-1	ZN-58/MPC-14-060 27	
39	R50	"	PA-102-2,5kohm-A-2W axis 25 P-1	"	

1	2	3	4	5	6
40	R38	Adjustable potentiometer	Pkd-300 level /2,5kohm	WT-I-243-005	Omig
41	C1	Electrolytic capacitor	KEM-50/15-insulated	PN-63/T-80006	Elwa
42	C2	Mica capacitor	KSO-6-1000-A-2700-I	GOST-6119-54	Miflex
43	C3	Capacitor	KEM-20/50-766	PN-63/T-80006	Elwa
44	C4,C5	"	KEK-100/50-766	"	"
45	C6	"	MPHP-2-200-A-1-II	WT-59/E-16161	Telpod
46		Additional resistor	OWS-221-0,25W-2,2Mohm±5%-II	R-N/57/MPM-14008	"
47		"	OWS-221-0,25W-2Mohm±5%-II	RN-57/MPM-14008	"
48		"	OWS-221-0,25W-1Mohm±5%-II	"	"
49		"	OWS-221-0,25W-510kohm±5%II	"	"
50	T1,T2	Germanium transistor	TG-51	WT-64/05	Tewa
51	T3	Transformer	Td-4	ZN-61/MPC14/L18-001	Omig
52	Socket 1	Socket PB-448A		PN-63/T-80257	
53	" 7	Socket PS-445A		PN-63/T-80258	
54	" 8	Socket to series E11		"	import
55	" 17	Socket Rimlock			"
56	" 21	Socket PS-445B		PN-63/T-80258	
57	Ż1,Ż2	Scale bulb	E10 6,3V/0,3V		

1	2	3	4	5	6
58	A 2	Tube relay	PRu 1-1/432 8-4441-oo2-3	WT/I-244-016	Tafla
59	B 3	"	RU-922/125W a.c. /P6	PN-63/R-88504	
60	W6	High speed switch	PB8-A		Porad
61	P6	Inter. switch	Cat. No. 254053	Cat. 16-T	
62	M	Microammeter	MEA-1/150μA/TS/≠ 2,5mm/10	ZN-59/MPC/ 17-23048	"Era"

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Strona 19

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8. LIST OF OWN MANUFACTURE PARTS

It	Element No.	Description	Marking	Dwg.No.	Manufacturer	Remarks
1	R3	Special resistor	221ohm ±0,5%	E-2145	Elpo W-w	"a" version
2	R4	" "	7,12kOhm ±5%	E-2145	" "	"b" "
3	R5	" "	5,6 kohm selected	E-2145	" "	"c" "
4	R14	" "	102,51ohm ±0,5%	E-2145	" "	"d" "
5	R15	" "	34,17ohm ±0,5%	E-2145	" "	"e" "
6	R16	" "	349,5 ohm ±0,5%	E-2145	" "	"f" "
7	R19	" "	8,5 k ohm selected	E-2145	" "	"g" "
8	R18	Potentiometer 1	5 kohm	D-2006	" "	
9	Socket 2	Socket 2		E-2047	" "	
10	" 3	" 3		E-2055	" "	
11	" 4	" 4		E-2056	" "	
12	" 5	" 5		E-2046	" "	
13	" 6	" 6		E-2052	" "	
14	" 10	" 10		E-2053	" "	
15	" 11	" 11		E-2054	" "	
16	" 12	" 12		E-2043	" "	
17	" 13	" 13		E-2042	" "	
18	" 14	" 14		E-2050	" "	
19	" 15	" 15		E-2049	" "	
20	" 16	" 16		E-2051	" "	
21	" 18	" 18		E-2048	" "	
22	" 19	" 19		E-2045	" "	
23	" 20	" 20		E-2044	" "	
24	T1	Transformer I		C-2133	" "	
25	T2	Transformer II		C-2134	" "	

Opracował

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Sheet

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