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ACTIVE PROBE TYPE OS-150-53

TECHNICAL INSTRUCTIONS

UNITRA
ZRK

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KASPRZAK RADIO WORKS

ACTIVE PROBE TYPE OS-150-53

TECHNICAL INSTRUCTIONS

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1. INTRODUCTION

1.1 Destination

The Active Probe type OS-150-53 is destined for cooperation with the Wide-Band Single-Channel Amplifier type OS-150-1 of the Oscilloscope type OS-150. By increasing the input impedance of the Oscilloscope up to 10 MOhms and 9 pF, the Probe enables observation and measurement of signals of the value $\leqslant$ 0.5 V pp within the 3 c/s and 100 Mc/s range without damping the signal /in contradistinction to the Passive Probe type OS-150-51, which damps the signal by ten times/.

1.2 Specification

1.2.1 Warming-up time: 15 min.

1.2.2 Supply source: Single Channel Amplifier type OS-150-1

1.2.3 Maximum permissible value of the input signal d.c. component: 250 V

1.2.4 Maximum value of the signal variable component: $\pm$ 0.5 V p.p.

1.2.5 Input impedance: 10 MOhm//9 pF

1.2.6 Frequency band and pulse response:

1.2.6.1 Frequency bandwidth of the Probe itself /-3 dB/: 3 c/s - 100Mc/s

1.2.6.2 Probe OS-150-53 with the Oscilloscope OS-150 frequency bandwidth /-3 dB/: 3 c/s - 60 Mc/s

1.2.6.3 Rise time of the Probe itself: 3.5 ns $\pm$ 20 %

1.2.6.4 Probe OS-150-53 with the Oscilloscope OS-150 rise time: 6 ns $\pm$ 20 %

1.2.6.5 Pulse overshoot: $\leqslant$ 2 %

1.2.6.6 Pulse sags /for a pulse of a duration 10 ms/: 15 %

1.2.7 Weight: 0.3 kg

1.2.8 Cable length: approx. 110 cm

1.2.9 Accessories

- exchangeable measuring tips: pin, hook, banana plug
- Technical Instruction

1.3 Climatic conditions

The instrument is intended for continuous duty cycle at ambient temperature within the range from + 10 °C to + 35 °C and at relative humidity up to 80 % /at + 30 °C/. The instrument should withstand the following tests:

- Heat resistance test: + 40 °C during 6 hours /the instrument being disconnected/
- Cold air resistance test: - 5 °C during 6 hours
- Moisture resistance test: 95 % at 25 °C during 48 hours

1.4 Mechanical data

- Resistance to vibrations within the range: 10 - 70 c/s amplitude 0.5 - 0.15 mm, acceleration 0.5 - 2.5 g, during 60 min.
- Resistance to shocks on operation: frequency: 40 c/s amplitude 0.23 mm, acceleration 3 g, during 1 hour
- Resistance to shocks on transport: 4000 shocks, 12 g, during 10 min.

2. SERVICING

2.1 Installing

The active probe OS-150-53 is intended for cooperation with the OS-150-1 plug-in unit of the oscilloscope OS-150. To connect the probe OS-150-53 to the OS-150-1 plug-in unit, the BNC plug of the part including the output amplifier is to be plugged to the input socket. Set the coupling mode change-over switch of the OS-150-1 plug-in unit to the position "~" /AC/.

Insert the 5-pin plug of the probe to the socket with the inscription SONDA /PROBE/, at the front plate of the plug-in unit. Thus, the supply voltages are applied to the probe circuits and the probe is ready for operation.

2.2 Control elements

CAL - Calibration /setting knob/ - enables the gain calibration of the OS-150-53 probe exactly to such a value that the vertical deflection coefficient of the amplifier and probe circuit will be in conformity with the designations on the front plate of the OS-150-1 amplifier.

2.3 Initial actuation of the probe

Below will be described the necessary procedures to obtain correct trace display on the oscilloscope tube screen. Connect the probe to the OS-150-1 plug-in unit acc. to cl. 2.1. Connect the oscilloscope to the supply mains. Set the knobs and switches of the oscilloscope and plug-in

unit in accordance with the technical instruction of the OS-150 oscilloscope, to obtain a horizontal line on the oscilloscope tube screen.

After a warming-up period of 15 minutes, apply a 40 mV amplitude signal from the calibrator to the probe input. Set the V/cm change-over switch of the plug-in unit to the position 0.01 V/cm. Adjust a stable rectangular waveform display on the screen. Find the optimum setting of the focus and astigmatism knobs. Using the setting knob CAL, if necessary, set the display height exactly to 40 mms.

2.4 Remarks on instrument operation

The instrument circuits are protected against high voltage /up to 250 V/ applied to the input, however, applying the high voltage to the input for a longer period, if not necessary, is not recommended. Prior to commencing measurements, check whether the coupling mode change-over switch is set to position "~" /AC/.

3. CIRCUIT DESCRIPTION

3.1 Input circuit

The signal applied to the measuring tip passes across the capacitor C1 which cuts off the constant component of the measured signal, and controls the field transistor T1 gate. The T1 gate circuit consists a system composed of diodes D1 and D2 as well as R3, C3, which protects the field transistor against damage in case a too high voltage being applied to the input. The T1 transistor operates as a source follower and the proper polarity of its gate is ensured by the resistor R2 of the resistance divider R33, R34, R35. The potentiometer R34 is intended for setting the proper operating point of the transistors within the system. The signal from the transistor T1 source controls the emitter follower system composed of the transistor T2. The system of transistors T1, T2 ensures a very low output impedance, which is necessary for proper controlling the next amplifier stage. Transistor T3, which operates in a common emitter system, together with the T4 transistor and cable K1, constitues a cascode system.

The operation of the cascode system consists in converting the voltage signal from the transistor T3 base into a current signal within the collector circuit of this transistor. The signal controls the transistor T4 within the emitter. Within the collector T4 circuit a voltage signal is being obtained.

3.2 Output circuit

At the end of the cable K1 there is a system composed of: C10, C11, R13 which matches the cable K1 for H.F. Within the collector circuit of the T4 transistor there are the series RC systems which are intended for shaping the proper pulse response of the system. The signal from the T4 transistor collector is applied via the T5 emitter follower to the T6 transistor base, which operates in the common emitter system. The T5 follower performs the duty of a load separator from the collector T4. Within the T6 emitter circuit there are the series RC systems which are intended for shaping the pulse response of the system. The potentiometer R23 within the T6 transistor collector circuit serves for gain control of the system. The signal from the collector is applied to the output plug of the probe, via the T7 emitter follower.

4. REGULATION AND CHECKING THE TECHNICAL DATA

4.1 General information

The procedures being discussed in this paragraph could be applied for resetting the control elements of the probe OS-150-53 in order to restore its original parameters. All adjustments are to be carried out only in case the non-conformity of the parameters with the technical data has been stated, and when the discrepancy has been caused by improper setting of the control elements.

On performing the measurements and adjustments within the probe OS-150-53 interior, particular attention should be paid to eliminate every possibility of accidental short-circuiting two live points of the system. To this end, insulated measuring tips and properly insulated tools are to be used. Failure to observe the above precautions, even in case of a short lasting short-circuit, could bring about a serious damage of the OS-150-53 probe.

4.2 Instruments required

To calibrate and to check the OS-150-53 probe completely, the following measuring instruments or their substitutes are necessary. The instruments being used for measurements must meet the requirements of appertaining Specifications.

a/ Signal generator: frequency range 10 kc/s - 72 Mc/s, output voltage: 2 V, output impedance 50 Ohms, e.g. type TF144/H - Marconi

b/ square wave generator: rise time 1 ns, amplitude from 40 mV up to 200 mV, e.g. GI-932 ZRK

c/ general purpose measuring instrument, e.g. Unigor 38.

4.3 Initial setting

By unscrewing the metal nut, push the cover of the output part against the cable branching, in order to obtain access to the control elements.

The measurements are to be carried out after initial warming-up during 15 minutes.

4.4 Setting the statical operating points

Proceed according to cl. 2.1 of this instruction and measure the T4 transistor collector potential, using the general purpose measuring instrument. The required value is - 1.4 V $\pm$ 0.1 V. Correct the R34 potentiometer setting, if necessary. Using the general purpose measuring instrument, measure the T7 transistor emitter potential. The required value is - 2.1 V $\pm$ 0.2 V.

4.5 Gain calibration

Proceed according to cl. 2.3 of this instruction and check the gain calibration of the probe. Correct the CAL /R23/ potentiometer setting, if necessary.

On carrying out the measurements, pay attention that the continuous control knob of the OS-150-1 plug-in unit gain must be set to the extreme right hand side position /position CAL/.

4.6 Measurement of rise time and overshoots

a/ Set the change-over switch acc. to cl. 2.1 of this instruction. Then:

set the V/cm change-over switch of the plug-in unit to	0.01 V/cm
set the time base A to	0.1 µs/cm
set the expansion to	x 0.1

b/ Apply a signal from the GI 932 square wave generator to the probe input. Obtain a stable display of the rising pulse of approx. 50 mms amplitude

c/ Measure the pulse rise time between the points 0.1 and 0.9 of the pulse amplitude. This time should be 6 ns ± 20 %.

d/ Measure the pulse overshoot. It should be less than 2 % of the display height.

e/ Correct the setting of the C10 trimmer and R13 potentiometer, if necessary. These elements influence the pulse shape within the part very close to the slope.

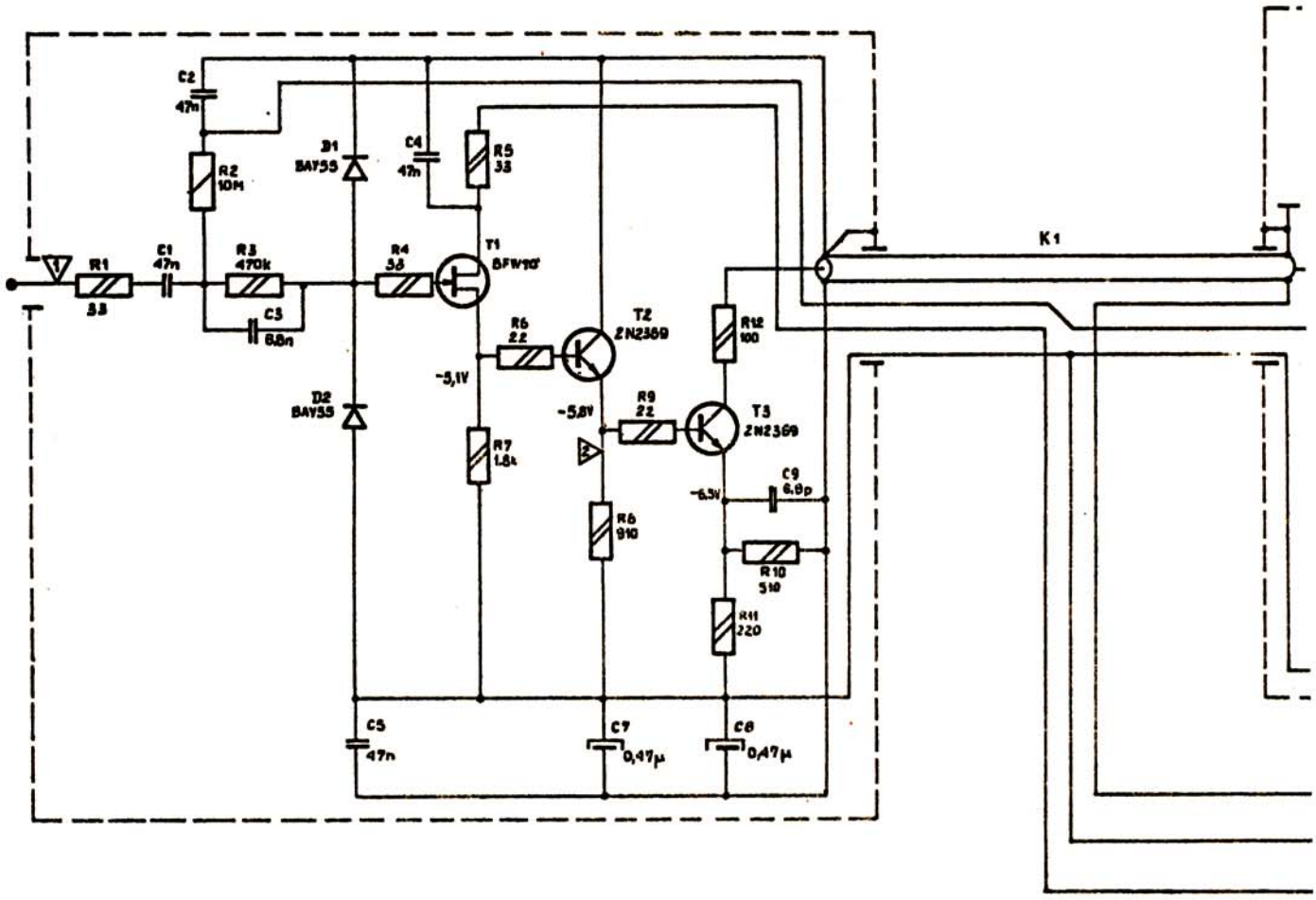
4.7 Bandwidth measurement

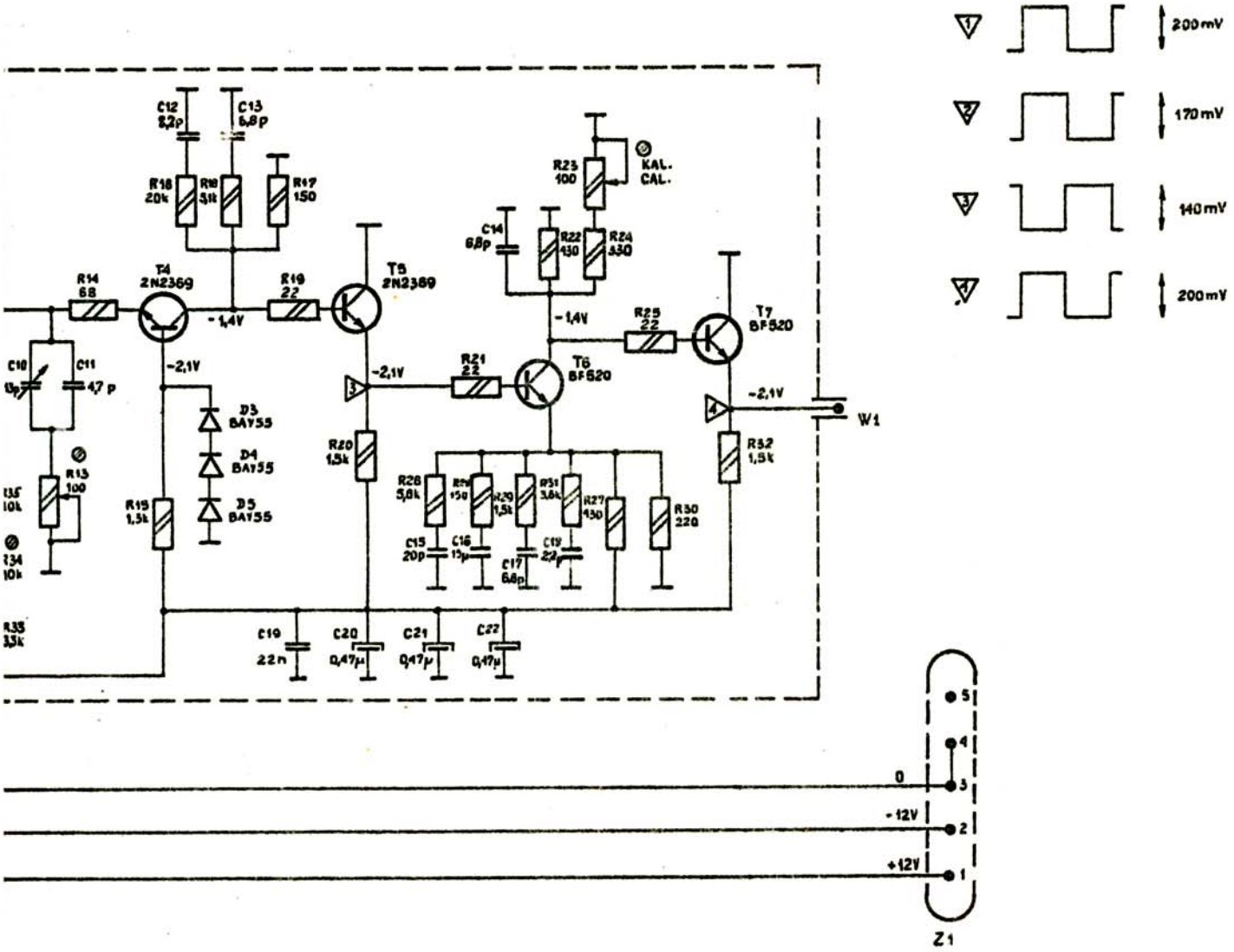
a/ Set the change-over switches as under cl. 4.6a, but the time base change-over switch must be set to the position 50 µs/cm and that of the expansion accordingly to x 1.

b/ Apply a signal from the signal generator closed with a matching resistance of 50 Ohms to the probe input.

c/ Set the generator frequency to 1 Mc/s and the output voltage amplitude so as to obtain the display height of 40 mms.

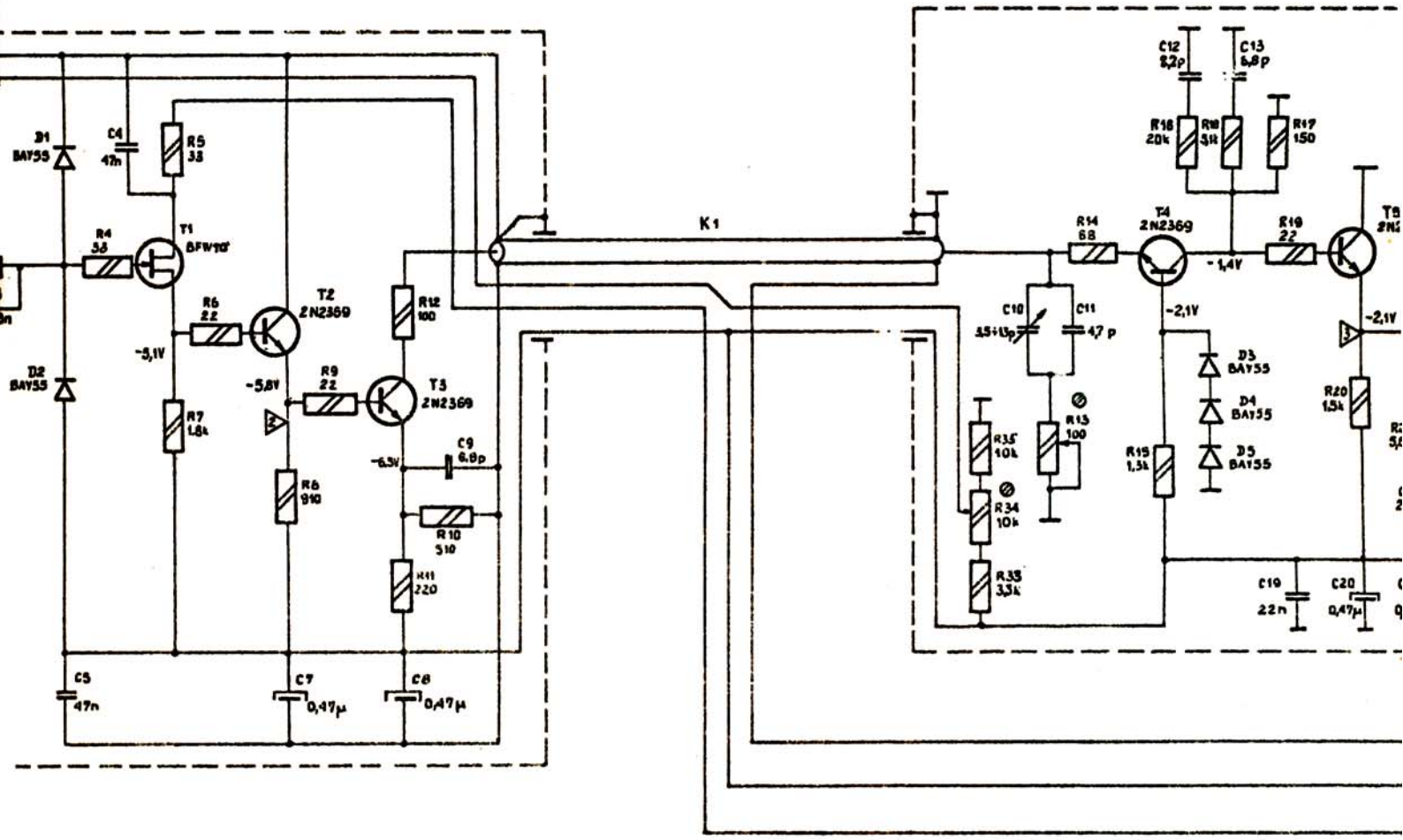
d/ By maintaining the constant value of the generator output voltage, check that the frequency at which the display height decreases down to 28 mms, is not less than 60 Mc/s.


C2
47n
R2
10M
D1
BAY33
C4
47n
R5
33
R1
33
C1
47n
R3
470k
C3
6,8n
R4
33
T1
BFW10
R6
22
T2
ZN2369
-5,1V
D2
BAY33
R7
1,8k
-5,8V
R9
22
T3
ZN2369
R12
100
C9
6,8p
-6,5V
R8
910
R10
510
R11
220
K1
C5
47n
C7
0,47µ
C8
0,47µ



Opracował	inż. R. Wojna	10.3.71	SONDA CZYNNA ACTIVE PROBE TYP: OS 150 - 53		ZDAE przy ZRK
Kreślił	A. Banaszek	5.7.71			
Sprawdził	mgr inż. I. Bujakowski	12.7.71			
Zatwierdził	mgr inż. I. Bujakowski	12.7.71	arkuszy 11	arkusz 13	

12.


D1
BAY55
C4
47n
R5
33
T1
BFW10
R4
33
R6
22
T2
2N2369
-5,1V
R12
100
-5,8V
R9
22
T3
2N2369
D2
BAY55
R7
1,8k
-6,3V
C9
6,8p
R8
910
R10
510
R11
220
C5
47n
C7
0,47µ
C8
0,47µ
K1
C12
2,2p
C13
6,8p
R16
20k
R18
3k
R17
150
R14
68
T4
2N2369
R19
22
-1,4V
C10
3,5+13p
C11
4,7 p
-2,1V
D3
BAY55
D4
BAY55
D5
BAY55
R35
10k
R13
100
R34
10k
R15
1,3k
R33
3,3k
R20
1,5k
C19
22n
C20
0,47µ

ACTIVE PROBE

OS-150-53

T1	Silicone field transistor	BFW 10			import
T2	Silicone transistor	2N2369			import
T3	Silicone transistor	2N2369			import
T4	Silicone transistor	2N2369			import
T5	Silicone transistor	2N2369			import
T6	Silicone transistor	BF520			TEWA
T7	Silicone transistor	BF520			TEWA
D1	Silicone diode	BAY55			TEWA
D2	Silicone diode	BAY55			TEWA
D3	Silicone diode	BAY55			TEWA
D4	Silicone diode	BAY55			TEWA
D5	Silicone diode	BAY55			TEWA
C1	Polyester capacitor	0.047 µF	20 %	250 V	MKSE-011
C2	Polyester capacitor	47 nF		25 V	KFPr-IIF
C3	Ceramic capacitor	6.8 nF		250 V	KFP-IIE
C4	Ceramic capacitor	47 nF		25 V	KFPr-IIF
C5	Ceramic capacitor	47 nF		25 V	KFPr-IIF
C6	Liquid capacitor	0.47 µF		16 V	KTD
C7	Liquid capacitor	0.47 µF		16 V	KTD
C8	Liquid capacitor	0.47 µF		16 V	KTD
C9	Ceramic capacitor	6.8 pF	5 %	250 V	KCP-d-I
C10	Ceramic trimmer	3.5-13 pF			import
C11	Ceramic capacitor	5.1 pF	5 %	250 V	KCP-d-I
C12	Ceramic capacitor	9.1 pF	5 %	250 V	KCP-d-I
C13	Ceramic capacitor	6.8 pF	5 %	250 V	KCP-d-I
C14	Ceramic capacitor	6.8 pF	5 %	250 V	KCP-d-I

C15	Ceramic capacitor	20 pF	5 %	250 V	KCR-3
C16	Ceramic capacitor	15 pF	5 %	250 V	KCR-3
C17	Ceramic capacitor	6.8 pF	5 %	250 V	KCP-d-I
C18	Ceramic capacitor	2.4 pF	5 %	250 V	KCP-d-I
C19	Ceramic capacitor	22 nF		25 V	KFR-d-IIF
C20	Liquid capacitor	0.47 µF		16 V	KTD
C21	Liquid capacitor	0.47 µF		16 V	KTD
C22	Liquid capacitor	0.47 µF		16 V	KTD
R1	Metallized resistor	33 Ohms	10 %	0.25 W	MŁT-B
R2	Resistor	10 M	5 %		import
R3	Metallized resistor	470 k	5 %	0.25 W	MŁT-B
R4	Metallized resistor	33 Ohms	10 %	0.25 W	MŁT-B
R5	Metallized resistor	33 Ohms	10 %	0.25 W	MŁT-B
R6	Film resistor	22 Ohms	10 %	0.125 W	OWS123
R7	Metallized resistor	1.8 k	5 %	0.25 W	MŁT-B
R8	Metallized resistor	910 Ohms	5 %	0.25 W	MŁT-B
R9	Film resistor	22 Ohms	10 %	0.125 W	OWS123
R10	Metallized resistor	510 Ohms	5 %	0.25 W	MŁT-B
R11	Metallized resistor	220 Ohms	5 %	0.25 W	MŁT-B
R12	Metallized resistor	100 Ohms	5 %	0.25 W	MŁT-B
R13	Film potentiometer	100 Ohms		0.1 W	PKd-400
R14	Metallized resistor	68 Ohms	10 %	0.25 W	MPT-B
R15	Metallized resistor	1.3 k	5 %	0.25 W	MŁT-B
R16	Metallized resistor	20 k	5 %	0.25 W	MŁT-B
R17	Metallized resistor	150 Ohms	5 %	0.25 W	MŁT-B
R18	Metallized resistor	5.1 k	5 %	0.25 W	MŁT-B
R19	Film resistor	22 Ohms	10 %	0.125 W	OWS123
R20	Metallized resistor	1.5 k	5 %	0.25 W	MŁT-B

R21	Film resistor	22 Ohms	10 %	0.125 W	OWS123
R22	Metallized resistor	430 Ohms	5 %	0.25 W	MŁT-B
R23	Film resistor	100 Ohms		0.1 W	PKd-400
R24	Metallized resistor	330 Ohms	5 %	0.25 W	MŁT-B
R25	Film resistor	22 Ohms	10 %	0.125 W	OWS123
R26	Metallized resistor	5.6 k	5 %	0.25 W	MŁT-B
R27	Metallized resistor	430 Ohms	5 %	0.25 W	MŁT-B
R28	Metallized resistor	150 Ohms	5 %	0.25 W	MŁT-B
R29	Metallized resistor	1.5 k	5 %	0.25 W	MŁT-B
R30	Metallized resistor	220 Ohms	5 %	0.125 W	MŁT-B
R31	Metallized resistor	3.6 k	5 %	0.25 W	MŁT-B
R32	Metallized resistor	1.5 k	5 %	0.25 W	MŁT-B
R33	Metallized resistor	3.6 k	5 %	0.25 W	MŁT-B
R34	Film potentiometer	1 k		0.1 W	PKd400
R35	Metallized resistor	6.2 k	5 %	0.25 W	MŁT-B

K1	Coaxial cable	LW75-0.39/2.3
Z1	5-pin plug	ZW-5
W1	Plug BNC-50-3/W1	

ZAKŁADY RADIOWE KASPRZAKA

PRODUKUJĄ:

Nowoczesną laboratoryjną, elektroniczną aparaturę kontrolno-pomiarową o różnym przeznaczeniu.

ZAKŁAD DOŚWIADCZALNY APARATURY ELEKTRONICZNEJ
PRZY ZAKŁADACH RADIOWYCH KASPRZAKA

opracowuje

i

wykonuje

JEDNOSTKOWO ORAZ MAŁOSERYJNIE UNIKALNE ZESTAWY PRZYRZĄDÓW ELEKTRONICZNYCH DLA CELÓW KONTROLI PROCESÓW TECHNOLOGICZNYCH JAK RÓWNIEŻ BADAŃ LABORATORYJNYCH

DYSTRYBUTOR PRZYRZĄDÓW PRODUKCJI SERYJNEJ
BIURO ZBYTU SPRZĘTU POMIAROWO-KONTROLNEGO
POZNAŃ, UL. WIELKA 21

PRZYRZĄDY TECHNOLOGICZNE NALEŻY ZAMAWIAĆ
BEZPOŚREDNIO U WYTWÓRCY

ZAKŁAD DOŚWIADCZALNY APARATURY ELEKTRONICZNEJ PRZY ZAKŁADACH RADIOWYCH KASPRZAKA

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