11/12 -70

INSTRUCTION MANUAL

Limit Sensor
Type LMS1

From serial No. 166261

RADIOMETER

ELECTRONIC MEASURING INSTRUMENTS
FOR SCIENTIFIC AND INDUSTRIAL USE

Instruction Manual
for

Limit Sensor
Type LMS1

From serial No. 166261

2nd edition

Table of Contents

Limit Sensor
Type LMS1

Section A. Introduction

It is often advantageous at the end of production lines or in acceptance control to provide tolerance bridges or component comparators with a device giving a visual signal when the tolerance of the component parameters is exceeded. It renders manual checking easier and is a necessity in the many instances where a measuring speed of 8 to 10 components per second is required.

The Limit Sensor, type LMS1, is part of a component testing system which comprises a component tester (viz., the R,L,C Impedance Comparator, type TRB11, or the 1 MHz Capacitance Comparator, type CMB12), a Component Jig, type KPH1, and the Limit Sensor, type LMS1.

The Limit Sensor, type LMS1, is a line-operated, solid-state instrument designed for accurate electronic indication of the transgression of two preselected limits. This transgression is indicated by means of two lamps. A yellow lamp is lit when the lower tolerance is exceeded, a red one when the higher tolerance is exceeded. Furthermore, a green lamp is lit if the component is within the tolerances. A relay output is activated at the same time as the lamps. This output can, for example, be used for connecting an automatic sorting device to the Limit Sensor.

Section B. Specifications

SENSITIVITY	0 to ±125 mV
STABILITY	±2%
INPUT	
Impedance:	>1 MΩ
Max. Input Voltage:	15 V
MEASURING SPEED	Up to 10 measurements per second
TEMPERATURE RANGE	0 to 40°C
CONTACT LOAD FOR RELAY OUTPUT	100 V max./1 A
POWER SUPPLY	110 and 220 V ±10%
DIMENSIONS	
Height:	150 mm (6")
Width:	120 mm (4 3/4")
Depth:	230 mm (9 1/4")
WEIGHT	2.4 kg (5 lbs)
ACCESSORIES SUPPLIED	5-conductor cable with Tuchel plugs, code 617-715

Section C. Accessories

ACCESSORIES AVAILABLE

Component Jig, type KPH1

The Component Jig, type KPH1, is an electrically operated unit for rapid clamping of components during measurement. The clamping mechanism is actuated by means of a foot-switch which allows more than 3600 operations per hour. The meter and the input of the Limit Sensor are automatically short-circuited while components are being exchanged in the Component Jig. This setup constitutes a very useful production tool. (For further details, see separate Instruction Manual.)

Section D. General Description

GENERAL

The Limit Sensor, type LMS1, consists of two identical Relay Driver channels feeding a Relay Matrix. The Relay Drivers are fed from an amplifier common to both channels. This amplifier receives its input from the appropriate component tester. The threshold values of either Relay Driver can be individually adjusted by means of the screwdriver potentiometers ADJ. on the front plate. Via the 5-pin socket OUTPUT, two unloaded, all-purpose change-over contacts are available, e.g., to control sorting machines or the like.

The input voltage from the component tester is fed, via the five-pin socket INPUT, to the common amplifier QA_{101}. The input of the amplifier is protected against overloading by R_{107} and the antiparalleled diodes CR_{109} and CR_{110}. The amplified voltage is fed from the output of QA_{101} to the parallel inputs of the Relay Drivers via R_{112} and R_{113}. By means of resistor R_{112} and potentiometer R_3 (alternatively R_{113} and R_2), it is possible to adjust the threshold value of either channel separately by shunting their input.

When the amplified voltage rises above a predetermined value, enough base current runs into transistor Q_{105} (alternatively Q_{103}), and the transistors are then in a more conducting state. This causes transistor Q_{108} (alternatively Q_{107}) to start conducting, as the base goes more negative and supplies base current to transistor Q_{110} (alternatively Q_{109}). As the collector of transistor Q_{110} (alternatively Q_{109}) goes low, the base current, and in turn the collector-emitter current, of Q_{106} (alternatively Q_{104}) decreases, thus forming a positive feedback to Q_{105} (alternatively Q_{103}) to ensure stable switching conditions.

When transistor Q_{110} (alternatively Q_{109}) conducts, the relay K_{102} (alternatively K_{101}) operates. If no relay operates, the LOW lamp is lit. When K_{102} is activated, the GO lamp is lit, and if both relays are engergized, only the HIGH lamp indicates.

In order to facilitate the setting of the Limit Sensor, it has been provided with a pushbutton and a METER DEFLECTION knob. When setting the desired range the button is pushed in and the meter deflection of the component tester is adjusted by means of the knob to (e.g.) the lowest acceptable limit of the parameter under observation, with the Limit Sensor acting as a dummy component. By means of a screwdriver, the ADJ potentiometer is adjusted until the LOW indicator is just switched off, and similarly for HIGH.

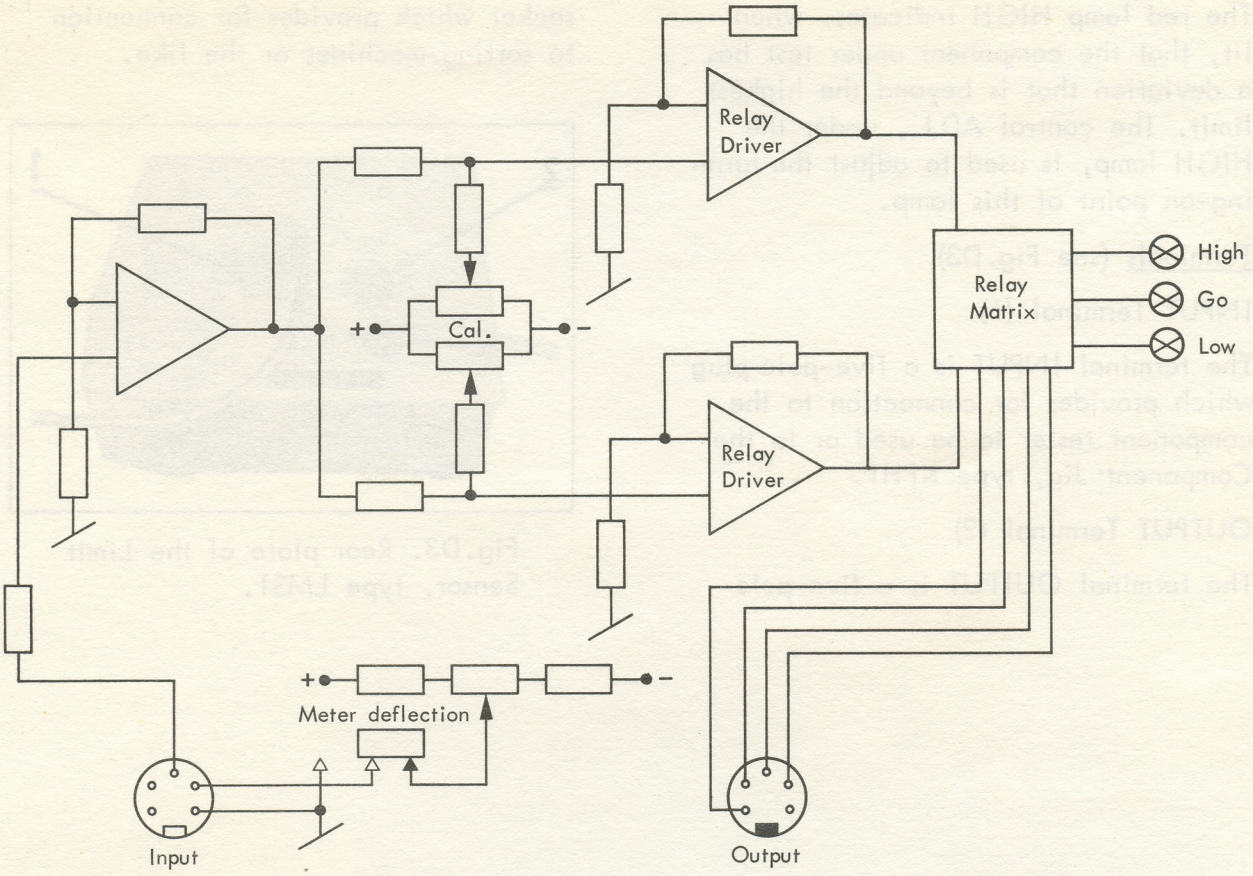


Fig.D1. Block diagram of the Limit Sensor, type LMS1

CONTROLS AND TERMINALS

General

The Limit Sensor, type LMS1, is provided with the following controls and terminals, as shown in Figs.D2 and D3.

Controls (see Fig.D2)

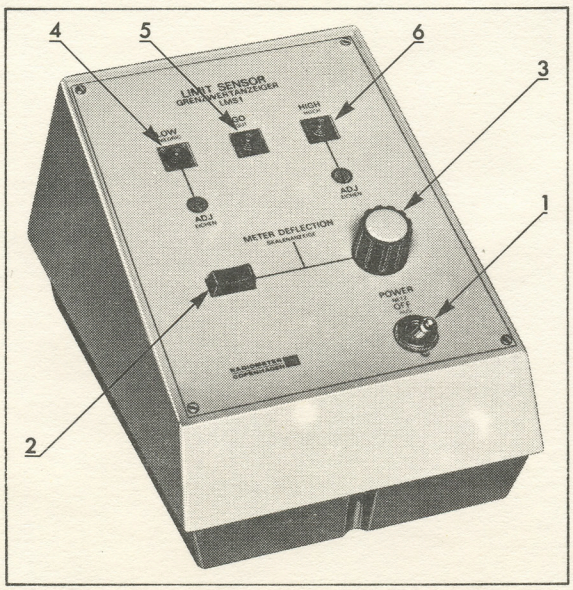


Fig.D2. Front plate of the Limit Sensor, type LMS1.

POWER-OFF Switch (1)

The switch POWER-OFF is a toggle switch used to turn the instrument on.

METER DEFLECTION Pushbutton (2) and Potentiometer (3)

The pushbutton METER DEFLECTION is used when setting the limits in conjunction with the potentiometer METER DEFLECTION.

LOW Lamp and ADJ control (4)

The yellow lamp LOW indicates, when lit, that the component under test has a deviation that is beyond the lowest limit. The control ADJ, under the LOW lamp, is used to adjust the turning-on point of this lamp.

GO Lamp (5)

The green lamp GO indicates, when lit, that the component under test is within the limits.

HIGH Lamp and ADJ control (6)

The red lamp HIGH indicates, when lit, that the component under test has a deviation that is beyond the highest limit. The control ADJ., under the HIGH lamp, is used to adjust the turning-on point of this lamp.

Terminals (see Fig.D3)

INPUT Terminal (1)

The terminal INPUT is a five-pole plug which provides for connection to the component tester to be used or to the Component Jig, type KPH1.

OUTPUT Terminal (2)

The terminal OUTPUT is a five-pole socket which provides for connection to sorting machines or the like.

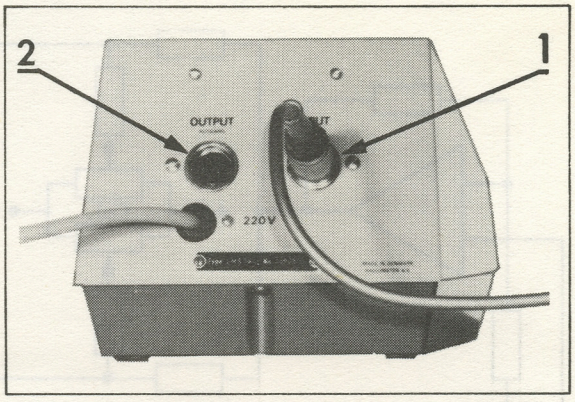


Fig.D3. Rear plate of the Limit Sensor, type LMS1.

Section E. Operating Instructions

CONNECTING THE LIMIT SENSOR TYPE LMS1, TO THE COMPONENT JIG, TYPE KPH1, AND TO A COMPONENT TESTER

1) The use of a Component Jig, type KPH1, is recommended, as the meter and the input of the Limit Sensor are automatically short-circuited while components are being exchanged on the Component Jig. In this manner, parasitic deflection on the meter of the component tester, as well as activation of any sorting devices via the recorder output of the component tester, is avoided.

2) Two component testers are compatible with the Limit Sensor, type LMS1, viz:

R,L,C Impedance Comparator, type TRB11

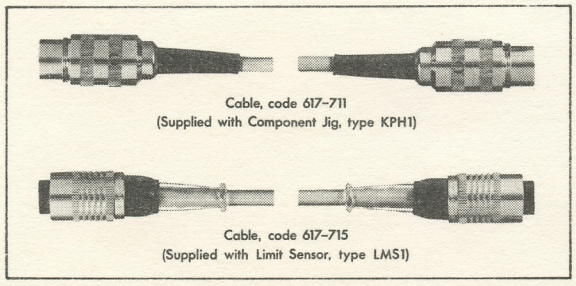


Fig.E1. Cables required for connection of a Limit Sensor, type LMS1, to a Component Jig, type KPH1, and to a component tester.

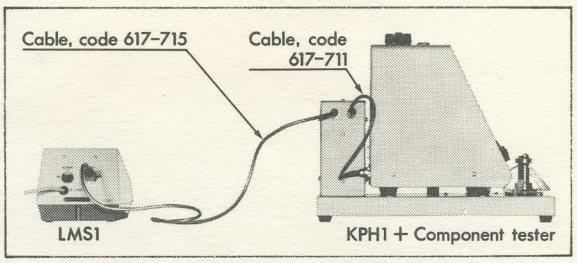


Fig.E2. How to connect the Limit Sensor, type LMS1, to a Component Jig, type KPH1, and to a component tester.

1 MHz Capacitance Comparator, type CMB12

(for further details, see the respective instruction manuals).

STEP-BY-STEP OPERATION

1) Connect the Limit Sensor, type LMS1, to the Component Jig, type KPH1, by means of the Cable, code 617-715, supplied with LMS1 (see Fig.E1). To do so, refer to Fig.E2.

2) Connect the component tester to the Component Jig, type KPH1, by means of the Cable, code 617-711, supplied with KPH1 (see Fig.E1). To do so, refer to Fig.E2.

3) Turn the screwdriver control ADJ under the LOW lamp of the Limit Sensor clockwise, and that under the HIGH lamp fully counterclockwise, so that the GO lamp lights up.

4) Prepare the component tester for measuring (see separate instruction manual).

5) Push in the pushbutton METER DEFLECTION of the Limit Sensor, and, at the same time, set the desired lower limit by turning the potentiometer METER DEFLECTION of the Limit Sensor until the pointer of the component tester settles at this limit.

6) With the pushbutton METER DEFLECTION still pressed in, turn the screwdriver control ADJ under the lamp LOW counterclockwise until the lamp lights up.

7) Push in the pushbutton METER DEFLECTION and set the desired higher limit by turning the potentiometer METER DEFLECTION of the Limit Sensor until the pointer of the component tester settles at this limit.

8) With the pushbutton METER DEFLECTION still pressed in, turn the screwdriver control ADJ under the lamp HIGH clockwise until the lamp lights up.

9) The Limit Sensor is now ready to indicate whether the component to be tested is within the preset limits or not.

Section F. Parts List

In the following parts list a group code prefix number is used. To facilitate the use of this code, the different types of parts and their corresponding group code prefixes are listed below:

Standard resistors	100- to 139-
Precision resistors	140- to 152-
Non-linear resistors	160-
UHF resistors	170- to 172-
Carbon potentiometers	180- to 185-
Wire-wound potentiometers	190- to 195-
Mica capacitors	200- to 208-
Ceramic capacitors	210- to 214-
Paper capacitors	220- to 222-
Metal-paper capacitors	224- to 229-
Plastic capacitors	240- to 245-
Electrolytic capacitors	260- to 267-
Variable capacitors	280- to 286-
Special tubes	310-
Rectifiers	340- to 341-
Diodes	350-
Transistors	360-
Integrated circuits	364-
Lamps, batteries, fuses	400- to 486-
Switches	500- to 580-
Coils, coil material and transformers	700- to 785-

As we are continually improving our instruments, it is important, when ordering spare parts, that you include the following information:

The code number and description of the part

The circuit reference from the wiring diagram

The complete type designation of your instrument

The serial number of your instrument

Please note that the position of any part can easily be found by referring to the last column of the parts list. This indicates on which figure the part can be located.

$^{\times}$indicates special parts manufactured by Radiometer.

CAPACITORS

Designation	Type	Value	Code No.	Shown Fig.
C101	electrolytic	100 µF 35/40 V	260-013	F1
C102	electrolytic	250 µF 25 V	260-042	F1
C103	ceramic	150 pF 5%	211-315	F1
C104	ceramic	47 nF -20/+80% 30 V	213-016	F1
C105	ceramic	47 nF -20/+80% 30 V	213-016	F1
C106	ceramic	0.1 µF -20/+80% 12 V	213-017	F1
C107	ceramic	0.1 µF -20/+80% 12 V	213-017	F1

DIODES

Designation	Type	Code No.	Shown Fig.
CR101	diode BAX16	350-023	F1
CR102	diode BAX16	350-023	F1
CR103	diode BAX16	350-023	F1
CR104	diode BAX16	350-023	F1
CR105	zener diode BZY94C12	350-605	F1
CR106	zener diode BZY94C12	350-605	F1
CR107	zener diode BZY88C5V6	350-629	F1
CR108	zener diode BZY88C5V6	350-629	F1
CR109	diode BAX16	350-023	F1
CR110	diode BAX16	350-023	F1
CR111	diode BAX16	350-023	F1
CR112	diode BAX16	350-023	F1
CR113	diode BAX16	350-023	F1
CR114	diode BAX16	350-023	F1
CR115	diode BAX16	350-023	F1
CR116	diode BAX16	350-023	F1
CR117	zener diode BZY88C7V5	350-621	F1
CR118	diode BAX16	350-023	F1
CR119	diode BAX16	350-023	F1

LAMPS

Designation	Type	Code No.
I1	lamp, yellow	400-806
I2	lamp, green	400-807
I3	lamp, red	400-805

TERMINALS

Designation	Type	Code No.
J1	multiplug	805-202
J2	multiplug	805-203
P100	terminal strip	805-623

RELAYS

Designation	Type	Code No.	Shown Fig.
K101	relay, 24 V, 1700 Ω	570-026	F1
K102	relay, 24 V, 1700 Ω	570-026	F1

TRANSISTORS

Designation	Type	Code No.	Shown Fig.
Q101	transistor 2N1711	360-047	F1
Q102	transistor 2N2905A	360-073	F1
Q103	transistor BC149C	360-072	F1
Q104	transistor BC149C	360-072	F1
Q105	transistor BC149C	360-072	F1
Q106	transistor BC149C	360-072	F1
Q107	transistor 2N3906	360-062	F1
Q108	transistor 2N3906	360-062	F1
Q109	transistor 2N1711	360-047	F1
Q110	transistor 2N1711	360-047	F1

INTEGRATED CIRCUITS

Designation	Type	Code No.
QA101	amplifier 809C	364-004

RESISTORS

Designation	Type	Value	Code No.	Shown Fig.
R1	carbon pot.	10 kΩ lin.	180-007	
R2	carbon pot.	5 kΩ lin.	180-006	
R3	carbon pot.	5 kΩ lin.	180-006	
R101	carbon film	6.8 kΩ 5% 0.3 W	106-468	F1
R102	carbon film	6.8 kΩ 5% 0.3 W	106-468	F1
R103	carbon film	680 Ω 5% 0.3 W	106-368	F1
R104	carbon film	5.6 kΩ 5% 0.3 W	106-456	F1
R105	carbon film	5.6 kΩ 5% 0.3 W	106-456	F1
R106	carbon film	680 Ω 5% 0.3 W	106-368	F1
R107	carbon film	1 kΩ 5% 0.3 W	106-410	F1
R108	carbon film	1 kΩ 5% 0.3 W	106-410	F1
R109	carbon film	33 kΩ 5% 0.3 W	106-533	F1
R110	carbon film	15 kΩ 5% 0.3 W	106-515	F1
R111	carbon film	15 kΩ 5% 0.3 W	106-515	F1
R112	carbon film	15 kΩ 5% 0.3 W	106-515	F1
R113	carbon film	15 kΩ 5% 0.3 W	106-515	F1
R114	carbon film	22 kΩ 5% 0.3 W	106-522	F1
R115	carbon film	22 kΩ 5% 0.3 W	106-522	F1
R116	carbon film	22 kΩ 5% 0.3 W	106-522	F1
R117	carbon film	22 kΩ 5% 0.3 W	106-522	F1
R118	carbon film	2.7 kΩ 5% 0.3 W	106-427	F1
R119	carbon film	4.7 kΩ 5% 0.3 W	106-447	F1
R120	carbon film	2.7 kΩ 5% 0.3 W	106-427	F1
R121	carbon film	4.7 kΩ 5% 0.3 W	106-447	F1
R122	carbon film	3.9 kΩ 5% 0.3 W	106-439	F1
R123	carbon film	3.9 kΩ 5% 0.3 W	106-439	F1
R124	carbon film	1.8 kΩ 5% 0.3 W	106-418	F1
R125	carbon film	1 MΩ 5% 0.3 W	106-710	F1
R126	carbon film	1 MΩ 5% 0.3 W	106-710	F1

SWITCHES

	Designation	Type	Code No.
	S1	main switch	500-102
x	S2	switch	550-991

TRANSFORMER

	Designation	Type	Code No.	Shown Fig.
x	T101	power transformer	770-600	F1

CABLES

Designation	Type	Code No.
W1	power lead with plug	615-005
W2	coaxial cable RG174M, 0.07 m	600-008

MISCELLANEOUS

Type	Code No.
knob, 21$^{\phi}$, black	852-601
cover for knob	852-602

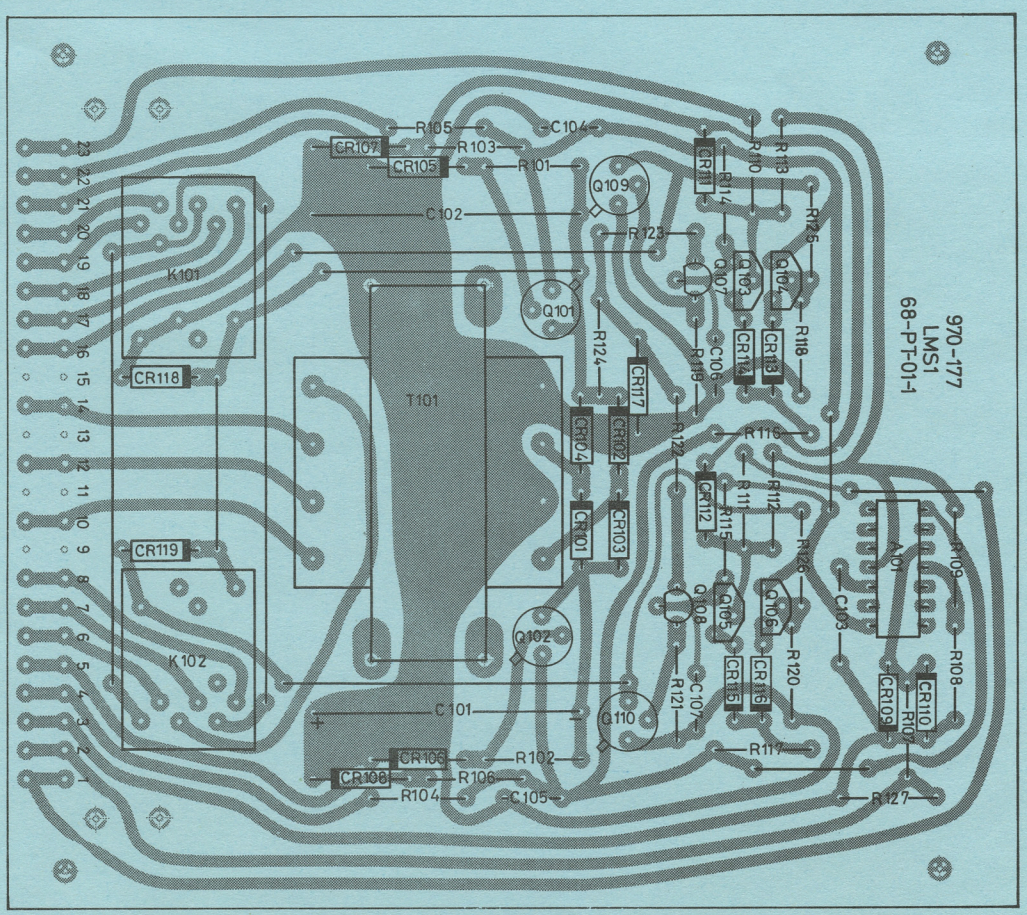
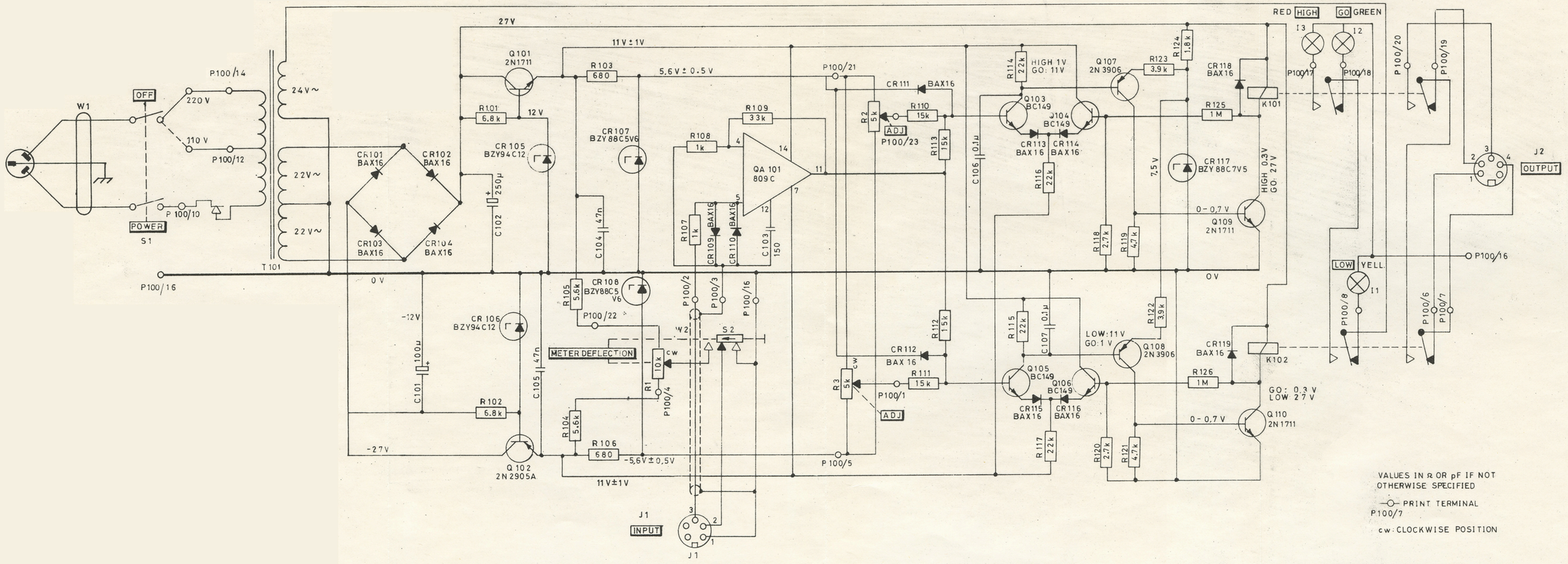


Fig. F1.



VALUES IN Ω OR pF IF NOT OTHERWISE SPECIFIED

—○— PRINT TERMINAL
P100/7

cw: CLOCKWISE POSITION

Rt.Nr.	Fra Fab. Nr.	Dato	Rt. af	Kont.	Norm.
1	155261	144.69	NH		PK

RADIOMETER COPENHAGEN
72 EMDRUPVEJ NV

Malestok /

Tegn	J.Hu	25.10.68
Kont		
Norm		

LIMIT SENSOR

TYPE LMS1a
From no. 127726 to no.

Erstatter

1209-A1

Erstattes af