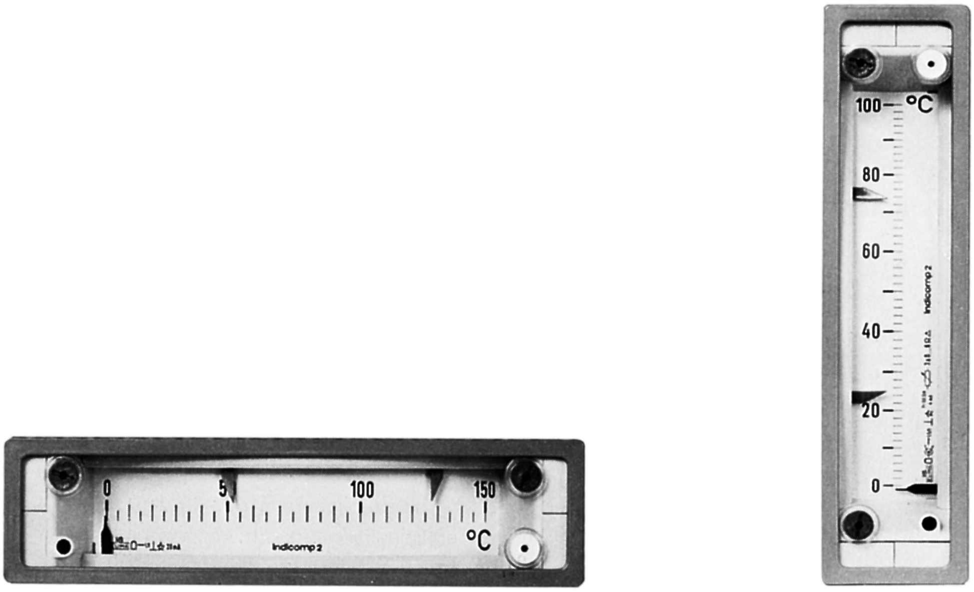
Indicomp 2, Indicomp 2-Ex

Indicator and
alarm signalling unit

Manual

42/30-12 EN

Rev. 06



ABB

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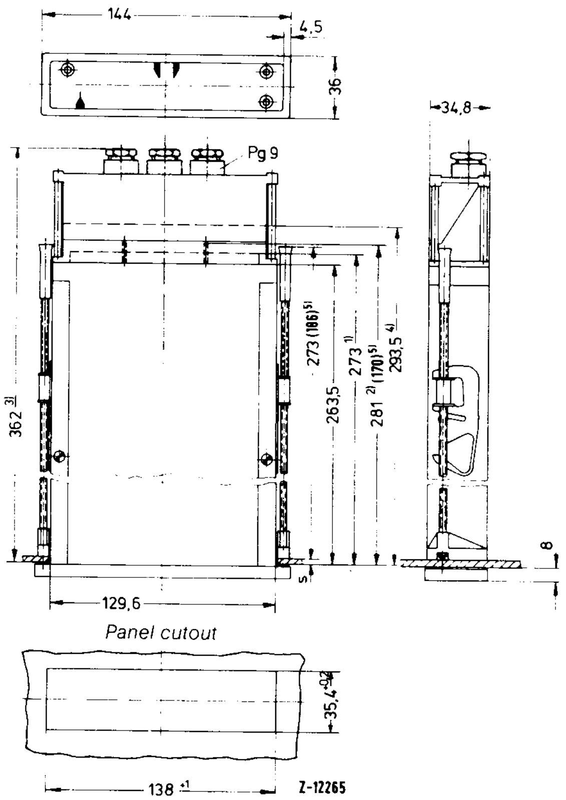
TECHNICAL DESCRIPTION

OPERATING INSTRUCTIONS

This apparatus has been designed and tested in accordance with DIN 57411 Part 1/VDE 0411 Part 1 (based on IEC Publication 348), Safety Requirements for Electronic Measuring Apparatus, and has been supplied in a safe condition. The present Operating Manual contains some information and warnings which have to be followed by the user to ensure safe operation and to retain the apparatus in a safe condition.

The industrial standards and regulations (DIN, VDE, VDI) as well as the directives, specifications and requirements governing explosion protection (ElexV, EX-RL, DIN EN, VDE) referred to in this Operating Manual are applicable in the Federal Republic of Germany. When using this device outside the German Federal jurisdiction, the relevant specifications, standards and regulations applicable in the country where the device is used must be observed.



1) = Instrument with measuring circuit organization 4900
2) = Instrument with blade-type terminals or screw terminals
3) = Instruments with explosion-proof terminal box, type 13-15
4) = Instrument with explosion-proof protective cap, type 11, 12, 21-25

Fig. 1 Dimensional drawing (dimensions in mm)

Cover illustration: R-13067

TECHNICAL DESCRIPTION

1 Field of application

By virtue of its large range of versions and the possibility of individual matching to the particular measuring task, the Indicomp 2 can be used in many sectors of the constructional engineering industry, particularly in the chemical industry.

2 Technical data

Measuring section

Measuring circuit without measuring amplifier

Thermocouple or mV measurement	From 12 mV...60 mV From 12 mV R_i approx. 10 Ω/mV, From 25 mV R_i approx. 8 Ω/mV } Lead balancing 20 Ω In position 2b class 1.5 In position 2a from 25 mV class 2.5 Response time from 12 mV 1.5 s from 25 mV 2.5 s
Direct voltage	> 60 mV...600 V, R_i approx. 1 kΩ/V
Alternating voltage	> 60 mV...1.5 V, power consumption approx.0.2 VA > 1.5 V...600 V, R_i approx. 880 Ω/V
Direct current	From 250 µA...600 mA From 1 mA...50 mA Measuring system resistance approx. 40 Ω at 20 mA, R_i approx. 3 Ω, L_i ≦ 3 mH. Zero correction is not applicable with live zero (zero mechanically suppressed) Class 1.5 Response time < 2.5 s
Alternating current	From 250 µA...6 A, power consumption approx. 0.2 VA
Effect of temperature	< 1 %/10 K
Scale	100 mm

Measuring circuit with mV amplifier

Thermocouple and mV measurement	From 5 mV...60 mV, R_i ≧ 10 MΩ
Lead balancing	Resistance of thermocouple + lead = 0...100 Ω, no balancing >100 Ω, special balancing
Thermocouple break monitor	Built in (R_i = 2 kΩ/mV). Full scale deflection in the event of thermocouple break. Resolderable to zero deflection.
Measuring circuit options	Optional additions: reference junction compensation (20 °C) and/or zero suppression.
Effect of temperature	< 0.5 %/10 K

Measuring circuit with resistance measuring amplifier

Resistance thermometer or teletransmitter	From ΔR = 10 Ω...1 kΩ
Thermometer current	Where ΔR < 15 Ω approx. 5 mA ΔR ≧ 15 Ω approx. 3 mA
Lead balancing	In 2-wire circuit 1 x 10 Ω, in 3-wire circuit 3 = 3 Ω calibrated. No balancing necessary if the measuring leads have equal resistance within the range 0...10 Ω. In 4-wire circuit no balancing where R_{lead} < 100 Ω With resistance teletransmitter 3 x 10 Ω
Effect of temperature	< 0.5 %/10 K

Measuring circuit with Arucomp measuring amplifier 4900

Measuring circuit	Application with	Examples of measuring ranges
W 21	Thermocouple or mV sensor	20...250 °C, type J 20 °C ≙ 0 mV
W 21 KV	Thermocouple with reference junction compensation	20...250 °C, type J 20 °C ≙ 0 mV
W 22 K	Thermocouple or mV sensor with electrical zero elevation	20...250 °C, type J 50 °C ≙ 0 mV
W 22 KV	Thermocouple with reference junction compensation	0...1200 °C, type K
W 23 K	Thermocouple or mV sensor with electrical zero suppression	300...600 °C, type K 20 °C or 50 °C ≙ 0 mV
W 24 K	Resistance thermometer in two-wire circuit	0...25 °C Pt 100 DIN
W 25 K	Resistance thermometer in three-wire circuit	0...25 °C Pt 100 DIN
W 26 K	Resistance teletransmitter in three-wire circuit	50-30-50 Ω
W 28	Current measurement	0...100 µA
W 28 K	Current measurement with zero suppression	4...20 mA

Lead balancing	For mV measurement, with lead resistance in the range 0...40 Ω no balancing is necessary. For resistance measurement in two-wire circuit (measuring circuit W 24 K) balancing resistor 1 x 10 Ω. For resistance measurement in three-wire circuit (measuring circuit W 25 K), no balancing necessary if the measuring leads are of equal resistance within the range 0...10 Ω. For resistance teletransmitters (measuring circuit W 26 K) balancing resistor 3 = 10 Ω.
Input resistance	1000 Ω/mV, but ≧ 20 kΩ
Thermometer current	≦ 2 mA (in measuring circuit W 24 K and W 25 K)

Range limits	From 0…5 mV to 0…250 V From 0…1 μA to 0…500 mA From 0…8 Ω to 0…400 Ω See Table 1 for Ex version

Common technical data for instruments with measuring amplifier

Scale	100 mm
Measuring system	1 mA magnetic core mechanism with jewel bearing
Response time	< 2.5 s
Readout tolerance	To DIN 43780 incl. amplifier tolerance class 1.5
Effect of voltage	≦ 0.5 %/10 % mains voltage fluctuation
Effect of temperature	≧ 0.5 %/10 K

Alarm section

Set points	1 max. and/or 1 min. set point
Switching points	1 switching point for each set point
Range of adjustment	Min. contact 0… 90 % Max. contact 10…100 %
Differential gap	X_{Sd} = 1 % of scale length (including the reaction under nominal conditions)
Switching mean distance	X_S = < ± 0.5 % Effect of temperature < 0.2 %/10 K Effect of voltage on switching mean distance < 0.1 %/10 %
Relay output	Per switching point 1 relay with floating changeover contact for max. 250 V, max. 5 A where cos phi ≈ 0.7, max. 1 A where cos phi≈ 0.5, minimum contact rating > 24 V DC, > 10 mA DC.
Initiator output	Per switching point one initiator as per DIN 19234 (NAMUR) for connection to switching amplifiers with the following data: No-load voltage U_L 7.7…9 V DC. Internal resistance (including connecting lead) R_i = 550…1100 Ω. Switching mean distance adjusted for U_L = 8.2 V DC, R_i = 1000 Ω at 20 °C. Effect of temperature < 0.2 %/10 K. Other adjustment values possible to customer specification.

Power supply

For instruments with built in measuring amplifier and/or built in switching amplifier with relay

Alternating voltage	220 V ± 10 %, 48…62 Hz, approx. 1.5…4 VA depending on fittings optionally 127 V AC, 110 V AC or 24 V AC, 48…62 Hz or
Direct voltage	24 V DC without isolating transformer[1] or 24 V DC with isolating transformer Tolerance −10…+20 % Permitted ripple content < 1.5 %
Fusing	**Instruments without explosion protection:** With internal fuse to DIN 41571 24 V DC M 0.032 C For version with alternating voltage the instruments are equipped with a short-circuit proof transformer and are not secured internally. **Instruments with explosion protection:** Special fuses, encapsulated in resin. 24 V DC T 0.032 C 24 V AC M 0.1 C M 0.315 C (for relais output) 110…127 V AC T 0.032 C M 0.1 C (for relais output) 220 V DC T 0.032 C

Case and mounting

Case	Plastic (polycarbonate)
Dimensions	See dimensional drawing (Fig. 1)
Terminal box	Cable entry APG 9 x 7.7 DIN 46320 – FS
Color of front frame	Standard grey RAL 7037, optionally black RAL 9005 or grey RAL 7032
Electrical connections	Terminals for solid or stranded wire up to 2.5 mm^2 [1] optional Blade-type terminals 6.3 mm = 0.8 mm[1]
Degree of protection	Case IP 54 Terminals IP 20 with terminal box IP 54 Blade-type terminals IP 00
Test voltage	Between input and relay output 2 kV Between input and initiator output 2 kV Between input and mains 2 kV In explosion-proof instruments 3 kV
Weight	Approx. 0.8…1.4 kg depending on fittings

Mechanical capabilities

	Test class	Impact	Vibration
Standard	1/2	15 g/11 ms	2.5 g, 5…55 Hz
Enhanced (optional)	2/2	30 g/11 ms	2.5 g; 5…55 Hz

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[1] Not in explosion-proof instruments, not in instruments with measuring amplifier 4900

Environmental capabilities

H&B climate group: 2 (DIN 40040, JWE)

Ambient temperature: −10...+50°C

Transportation and storage temperature: −25...+70°C

Relative humidity: ≤ 75% annual average, 95% for short durations, avoid condensation.

Definition of terms

In VDI/VDE Directive 2189, page 1, "Description and investigation of on/off and multi-step controllers without feedback" and in DIN 19221 "Symbols used in process control technology", the action of an on/off controller is defined with the following variables:

- w Set point
- x Controlled variable
- y Output variable
- X_{Sd} Differential gap $(x_2 - x_1)$
- x_M Switching mean $\left(\frac{x_1 + x_2}{2}\right)$
- Switching mean distance $x_M - w$

This corresponds to the distance between the pointer tip for setting the set point w and the switching mean x_M (X_S in Fig. 2).

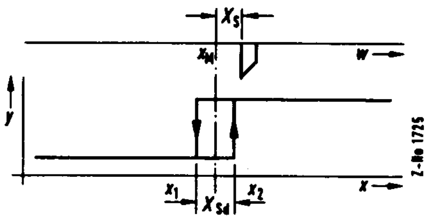


Fig. 2 Characteristics of the on/off controller with differential gap for w = const.

Mounting orientations

Vertical or horizontal scales can be supplied. When ordering, the mounting orientation is marked on the scale in accordance with Fig. 3 (e.g. 3 a = ∢ 70°).

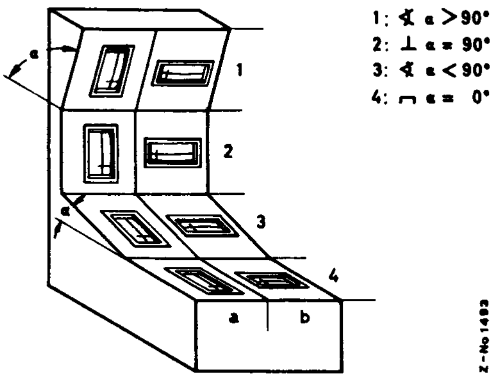


Fig. 3 Mounting orientations

Measuring circuit data for instruments with explosion protection

	Version	11/21 Without measuring amplifier	12/22 Without measuring amplifier	13/23 mV measuring amplifier	14/24 Resistance measuring amplifier	15/25 Arucomp measuring amplifier		
Data for Indicomp 2-Ex	Measuring circuit	Thermocouples	Voltages and currents	Thermocouple	Resistive pickups	W 21, W 21 K W 21 KV W 27 K W 28 K W 28 W 22 K W 23 K W 22 KV W 23 KV	W 28 R_i < 25 Ω	W 24 K W 25 K W 26 K
	L_i	≤6 mH / ≤13 mH	0.02 or 3.1 mH	Negligible				
	C_i	Negligible						
	No-load voltage U_L	Passive		≤ 8.4 V	≤ 8.4 V	≤ 12 V	≤ 3 V	≤ 12 V
	Short-circuit current I_K	Passive		≤ 26 mA	≤ 130 mA	≤ 132 mA	≤ 132 mA	≤ 132 mA
	Max. power	Passive		≤ 0.1 W	≤ 0.3 W	≤ 0.3 W	≤ 100 mW	≤ 0.3 W
	Operating values		< 60 V, < 50 mA		< 10 V, < 10 mA	< 10 V, < 10 mA	< 50 mA	< 6 V, < 10 mA
Data for sensor	L_a	Values for sensor less L_i		≤ 1.8 mH	< 1.7 mH	< 0.6 mH	< 0.6 mH	≤ 1.6 mH
	C_a 1)	Values for sensor		≤ 2.1 µF	< 2.5 µF	≤ 100 nF 2)	≤380 nF / ≤60 nF 2)	≤ 800 nF
	No-load voltage	≤ 1.2 V	≤ 60 V	≤ 1.2 V	–	≤ 13 V	≤ 13 V / ≤ 26 V	–
	Short-circuit current	≤70 mA / <47 mA	≤ 95 mA	≤ 100 mA	–	≤ 50 mA	50 mA	–
	Max. power	–	–	≤ 25 mW	–	≤ 0.2 W	–	–

1) Including line capacitance

2) See certificate of conformity for further data

Table 1

Explosion protection

Type of protection [EEx ib] IIC (Version 21-25)

Manufacturer's identification code	49/30-08 Ex
Certificate of conformity	PTB No. Ex-84/2075
Versions	21 Direct connection to thermocouples 22 Connection to current and voltage sources with certified intrinsically safe circuits 23 With measuring amplifiers for thermocouples and mV sensors 24 With measuring amplifiers for resistive pickups (passive) 25 With measuring amplifier with Arucomp measuring circuit organization 4900
Signal circuit data	See Table 1
Relay output circuits	Alternating current 250 V, 5 A, cos φ ≧ 0.7 Direct current 60 V, 0.5 A, L/R ≦ 200 ms
Initiator output circuits	Operating values U ≦ 10 V, I ≦ 10 mA These circuits can be operated in pairs only as either intrinsically or non-intrinsically safe circuits
non-intrinsically safe	Operating voltage of instrument to be connected < 250 V
intrinsically safe	Type of protection EEx ib IIC Li ≦ 160 µH, Ci ≦ 40 nF For connection to certified intrinsically safe circuits, each circuit having the following max. values: U ≦ 15.5 V, I ≦ 40 mA, P ≦ 160 mW
Degree of protection	Case IP 54, terminals IP 20
Mounting	Outside the hazardous area
Ambient temperature	Up to 50 °C

Type of protection EEx ib IC T4 (version 11, 12)

Manufacturer's identification code	49/30-06 Ex
Certificate of conformity	PTB No. Ex-84/2074
Signal input circuit	Type of protection EEx ib IIC
Signal circuit data	See Table 1
Initiator circuit	Type of protection EEx ib IIC Li ≦ 160 µH, Ci ≦ 40 nF For connection to certified intrinsically safe circuits, each circuit having the following max. circuits: U ≦ 15.5 V, I ≦ 50 mA, P≦ 160 mW

Type of protection (Ex) eis G4 (version 13, 14, 15)

Manufacturer's identification code	49/30-07 Ex
Certificate of conformity	PTB No. III B/E-30135 B
Signal input circuit	Type of protection (Ex) i G5
Signal circuit data	See Table 1
Initiator circuit	Type of protection (Ex) i G5
Electrical data	Same as versions 11, 12
Degree of protection	Case IP 54 Terminals IP 54: version 13, 14, 15 with terminal box IP 20: version 11, 12 with protective cap
Mounting	Inside the hazardous area
Ambient temperature	Up to 50 °C

3 Mode of operation and construction

3.1 General information

The core of the instrument is a moving-coil mechanism with a magnetic core system. The mechanism can either be driven directly by the measured signal or via internal measuring amplifiers.

The measuring amplifiers are divided into mV amplifiers, resistance amplifiers and those with Arucomp 4900 measuring circuit organization. If the latter are used, the measuring ranges can be changed on site simply by exchanging a range box.

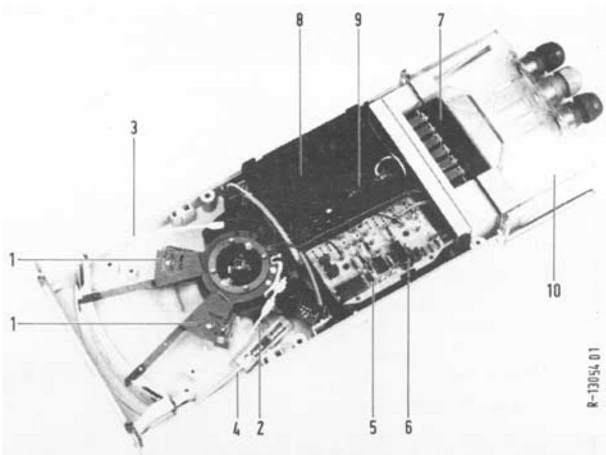


Fig. 4 Indicomp 2 with case half-shell removed
1 HF pickup heads
2 Max. set point adjustment (with disengageable shaft)
3 Min. set point adjustment
4 Zero adjustment (with disengageable shaft)
5 Measuring amplifier
6 Protective amplifier with relay (hidden)
7 Range box 4900
8 Power supply unit
9 Encapsulated fuse (only in Indicomp 2-Ex)
10 Terminal box IP 54

3.2 Alarm system

The alarm signalling version of the Indicomp 2 has 1 or 2 adjustable alarm pointers. The position of the alarm pointer is scanned inductively, i.e. without contact. This ensures high potential separation and reliable alarm signalling even in unfavorable climatic conditions.

For contactless scanning the alarm pointer carries an inductive pickup system (initiator). If the metal tag attached to the measured value pointer dips between the coupling coils (resonant circuit) of the inductive pickup, the oscillation of the oscillator breaks down and the current drain of the inductive pickup system abruptly declines.

The changed current drain is used directly as the output signal for 1 or 2 initiator outputs as per DIN 19234 or to drive a switching amplifier which in turn drives 1 or 2 relays (relay output).

The relays normally work with NC contact operation. They can be converted to NO contact operation by transferring soldered jumpers.

Table 2 shows the individual instrument versions, their schematic operation diagrams and associated connection diagrams.

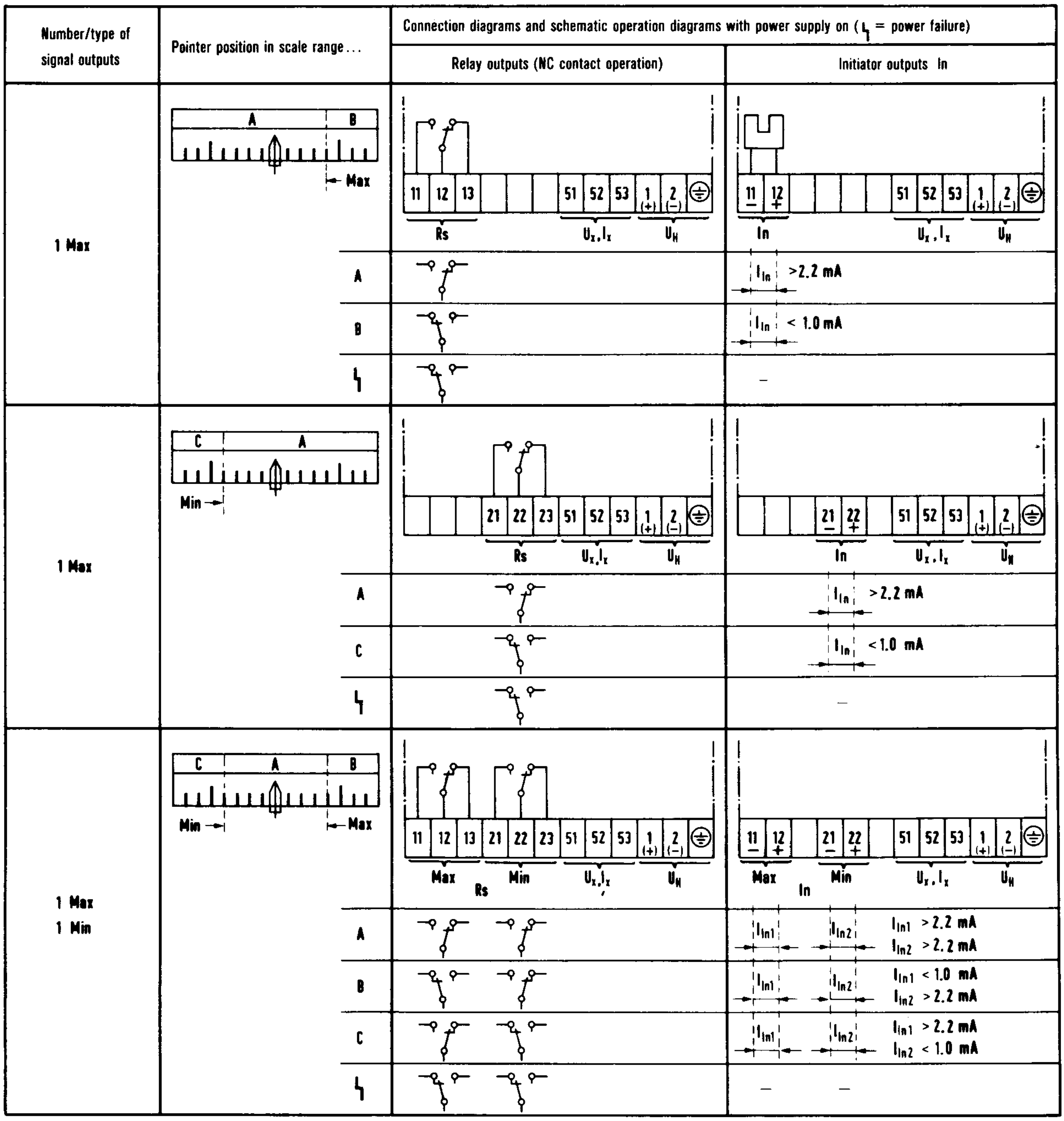


Table 2 Schematic operating diagrams of relay and initiator outputs and connection diagrams.

4 Mounting and connecting instructions

4.1 Selecting the installation site

The Indicomp 2 must only be used when built in.

When selecting the installation site, the environmental conditions specified in the Technical Data must be observed.

If the instruments are mounted close-packed, good ventilation must be ensured between the case walls so that the maximum tolerated ambient temperature is not exceeded in the vicinity of the instruments. The mounting orientation code as shown in Fig. 3 must be observed.

Make sure that the case is not distorted by the weight of the cable harness.

4.2 Mounting the instrument

The Indicomp 2 is designed for mounting in sheet-metal panels and mosaic panel fields.

The instrument is inserted into the panel cutout from the front. The two panel mounting clamps supplied are placed from the rear into the pair of fastening rivets attached to the top of the case wall as shown in Fig. 5, and the threaded rods tightened against the panel with a screwdriver.

The procedure for installation in mosaic panel fields is the same.

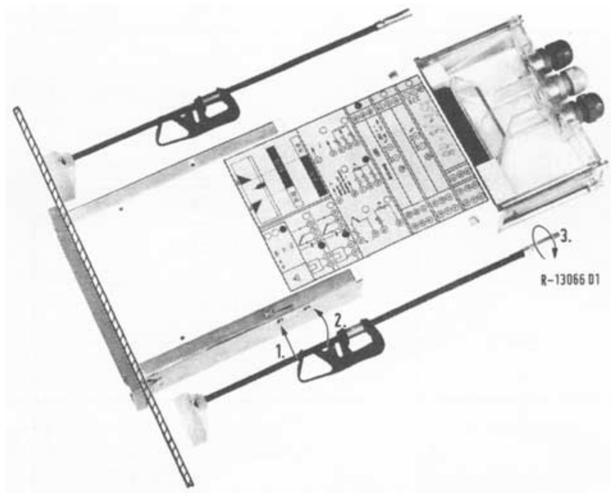


Fig. 5 Fastening to the panel
1. Insert panel mounting clamp
2. Swing in
3. Tighten

4.3 Installing the measuring and signal leads

The signal leads for the measured value and alarm values if present should be laid separately from power lines. To ensure interference-free operation, screened leads must be used. A strain relief must be provided.

4.4 Power supply line

The power supply (note specification on rating plate) must be connected via a two-pole switch.

If a grounding conductor is to be connected, this must be done before any other connection is made.

When selecting and installing the connecting cables, please take note of the electrical regulations applicable in your country for cable installations using mains voltages.

4.5 Connection diagram

The particular instrument version is indicated in the round fields of the printed connection diagram (Fig. 6). The position of the terminals on the back of the instrument is shown in Fig. 7.

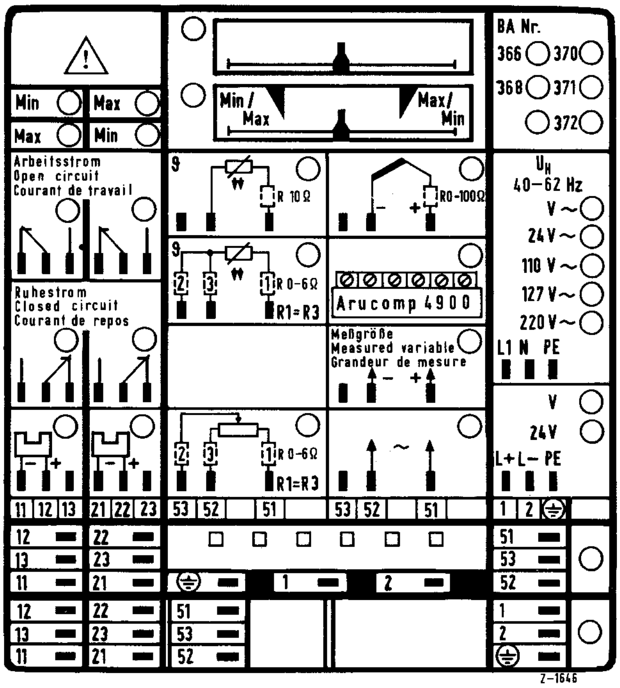


Fig. 6 Connection diagram on the instrument

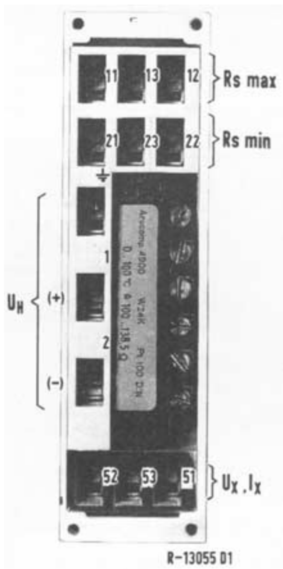


Fig. 7 Position of terminals (illustration with measuring circuit organization Arucomp 4900)

4.6 Connecting the measuring leads

The input variable may be direct or alternating current or direct or alternating voltage.

The connection is made at terminals 51 (+) and 52 (−).

4.6.1 Resistance thermometer connection

Two-wire circuit

Before commissioning the external measuring circuit must be balanced. For this purpose the test resistor supplied is connected in place of the thermometer, and the resistance of the adjustment ring reduced until the instrument indicates the value printed on the test resistor.

Three-wire circuit

With balanced lines, adjustment can be omitted if the resistance value of each conductor is between 0...6 Ω (e.g. 10 m copper wire 1.5 mm² ≙ 0.12 Ω).

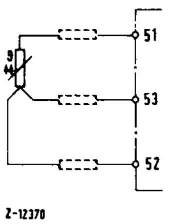


Fig. 8 Connection diagram for three-wire circuit

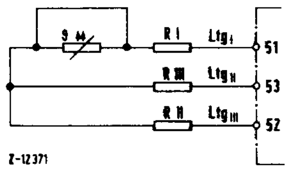


Fig. 9 Lead balancing in three-wire circuit

For line resistances > 6 Ω or unbalanced lines, adjustment is necessary. The procedure is as follows:

The ends of the measuring leads located at the measuring resistance are short circuited (Fig. 9).

At the lead ends connected to the indicator, 3 total resistances (A, B and C) can be measured.[1]

Between 51 and 52: A = RI + RII
Between 52 and 53: B = RII + RIII
Between 51 and 53: C = RI + RIII

From this the lead resistances can be calculated:

$$RI = \frac{A + C - B}{2}; \quad RII = \frac{A + B - C}{2}; \quad RIII = \frac{B + C - A}{2}$$

While lead three only has to be adjusted to 5 %, the other two leads must be adjusted to < 1 % because their errors are incorporated directly in the measurement result.

If no sufficiently precise measuring bridge is available, a coarse adjustment must be carried out for all three leads in accordance with the above schematic diagram. Adjustment to 5% is sufficient for this. After this coarse adjustment, the test resistor supplied is connected in place of the resistance thermometer (remove short-circuit jumper) and the indicator power supply switched on. If the instrument indicates a value **higher** than that printed on the test resistor, the balancing resistance on **lead I must be reduced**. If the instrument indicates a **lower** value, the resistance in **lead II must be reduced**.

If measuring circuit organization 4900 is used in conjunction with measuring circuit W 25 K, no lead balancing is necessary for a span > 10 Ω and with lead resistances between 0...10 Ω, if the individual leads I and II are of equal resistance (balanced). The range box is marked 3 = 0...10 Ω. With a span < 10 Ω, precise balancing must be carried out. In this case the range box is marked e.g. "Lead 3 x 10 Ω".

Four-wire circuit

No lead balancing is necessary for the four-wire circuit. The lead resistance must however be < 100 Ω.

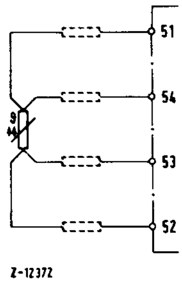


Fig. 10 Connection diagram for four-wire circuit

4.6.2 Resistance pickup/teletransmitter connection

In all cases lead balancing as described in Section 4.6.1, three-wire circuit, is necessary. The fine adjustment can be carried out after the teletransmitter has been connected to the measuring lead. The teletransmitter is set to a value approximately in the center of the scale and the readout compared with the teletransmitter setting. If the readout is too **low**, the balancing resistance in **lead I must be reduced**, if the readout is too **high**, the balancing resistance in **lead II must be reduced** accordingly.

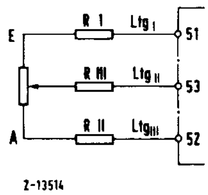


Fig. 11 Connection diagram for teletransmitter

4.6.3 Thermocouple connection

Without reference junction or with internal reference junction

Extension lead wire is laid from the indicator to the thermocouple, it must suit the thermocouple used, and consists of material of equal thermoelectric value. When connecting the extension lead wire to the thermocouple it is essential that the correct polarity is observed. The positive wire of the extension lead wire is marked red.

With external reference junction

Extension lead wire is laid from the thermocouple to the reference junction. From the reference junction to the indicator, copper wire (1.5 mm²) must be used.

Lead balancing (instruments with mV or Arucomp amplifier)

If the resistance value of thermocouple and lead lies within the range of values specified in the Technical Data, no balancing is necessary.

Higher lead resistances necessitate special balancing in the factory.

[1] E.g. with Pontavi Wh2 or Kompavi 10

Lead balancing (instruments without amplifier)

On calibration a resistance of generally 20 Ω is taken into account for the thermocouple and the lead. This value is printed on the scale. When the measuring system is installed, the total resistance of the measuring circuit (resistance of lead wire + reference junction + extension lead wire + thermocouple) must be balanced with this resistance.

To effect balancing, the resistance of the measuring circuit is increased to the value used for calibration with a balancing resistor (balancing ring) supplied.

The resistance of the measuring circuit must be measured with a suitable resistance measuring bridge (e.g. Pontavi Wh2, Kompavi 10).

Note

With PtRh-Pt thermocouples, balancing should be effected with the thermocouple warmed up (the thermocouple resistance changes with temperature). The resistance measurement must then be made twice with connections exchanged respectively at the measuring bridge, since the thermoelectric voltage distorts the resistance measurement result. The average value of two such measurements corresponds to the actual resistance.

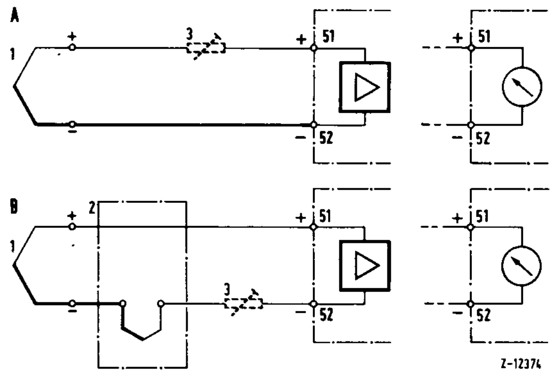


Fig. 12 Connection diagram for thermocouples
A) With or without internal reference junction
B) With external reference junction
1 Thermocouple
2 External reference junction
3 Balancing resistor

4.7 Connecting the signal leads

In the alarm signalling version, the Indicomp 2 has up to a maximum of 2 switching outputs, either relay or transistor outputs.

Relay output

The floating changeover contacts can be wired for NO or NC contact operation. The corresponding contact positions and assigned terminals are shown in the connection diagram (Table 1). The positions shown apply to normal operation.

4.8 Connecting the power supply

The instrument may only be connected to the voltage shown on the rating plate.

Connection should if possible be made with insulated blade sleeves (protection against electric shock) in accordance with the connection diagram.

First connect the grounding conductor to the terminal provided, all other connections can then be made. The reverse procedure should be followed on disconnection: first release all connections, then disconnect the grounding conductor.

5 Explosion-proof version

An explosion-proof version of the Indicomp 2 is available for two applications:

a) Approved for use outside the hazardous area (Indicomp 2-Ex, version 21, 22, 23, 24, 25)

b) Approved for use inside the hazardous area (Indicomp 2-Ex, version 11, 12, 13, 14, 15)

When connecting the Indicomp 2-Ex and its intrinsically safe circuits, the "Regulations on electrical apparatus in hazardous areas" (ElexV), the "Regulations on the installation of electrical systems in hazardous operating sites" (DIN 57165/VDE 0165) and the certificate of conformity or PTB test certificate must be observed.

The power supply must be connected via a two-pole on/off switch. The ground terminal must be connected with the potential equalization. The built in fuse may only be replaced with an encapsulated fuse of the same rating, as listed in the spare parts list.

The leads of the intrinsically safe circuits must be marked light blue.

To the intrinsically safe input circuits may be connected non-certified apparatus or non-certified passive two-terminal or multi-terminal networks (with maximum values as shown in Table 1).

If active two-terminal networks are connected, these must have certified intrinsically safe circuits. The intrinsic safety of the circuit thus formed must be verified. The maximum values including the values for external inductance and capacitance must not be exceeded.

The certified intrinsically safe circuits must be connected to the initiator output circuit; here the maximum values and the values for external inductance and capacitance according to Section 2 must not be exceeded.

In the Indicomp versions 2-Ex 21, 22, 23, 24, and 25 the initiator output circuit may also be operated as a non-intrinsically safe circuit.

For all intrinsically safe circuits, the temperature (ambient temperature plus self-heating) of all apparatuses connected to the intrinsically safe circuits must not exceed the limit temperature of the ignition group in which they are used.

Limit temperature	Ignition group
100 °C	T 5
135 °C	T 4
200 °C	T 3
300 °C	T 2
450 °C	T 1

If repairs or modifications are carried out on the instrument, the safety instructions in Section 8 must be observed without fail.

Note:

If an explosion-proof instrument is used outside the country of manufacture, instead of the DIN standards, VDE regulations and German directives relating to explosion protection referred to in this Operating Manual, the relevant regulations applicable in the country where the instrument is used must be observed.

6 Commissioning

6.1 Switching on the power supply

Before switching on the apparatus make sure it is set to the voltage of the power supply (see rating plate).

After all leads have been connected (measuring leads, control leads, power supply leads) and after the zero has been adjusted as described in Section 6.2, the power supply can be switched on. The Indicomp 2 is then in operation.

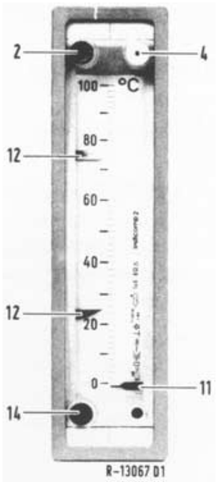


Fig. 13 Front view
2 Max. alarm adjustment
3 Min. alarm adjustment
4 Zero adjustment
11 Measuring system pointer
12 Alarm pointer (upper/lower alarm value)

6.2 Zero adjustment

To effect zero adjustment, the power supply must be switched off. The measuring leads must be disconnected and the open terminals 51 and 52 short circuited. The adjustment is made with the hexagon key supplied, which must be inserted in the white opening (4). Set the measuring system pointer (11) to the lower range value or to the thermocouple reference temperature by turning the key. Then remove the short circuit connection, reconnect the measuring leads and switch on the power supply. A short circuit is not necessary for resistance measurement.

Zero adjustment is omitted in instruments with "live zero" circuit, e.g. 4...20 mA or 2...10 V electrical measuring range, unless expressly required in the order.

If zero adjustment for "live zero" is unavoidable, after the instrument has been opened the plastic shaft that forms an extension from the zero screw to the measuring system must be engaged in its holder. The zero can then be adjusted from the front. To prevent inadvertent displacement during operation, the shaft must be disengaged after adjustment has been accomplished.

6.3 Alarm setting

The alarms can be set during operation. For this purpose the hexagon key supplied is inserted in the appropriate red opening for min.(14) or max.(2) alarm setting. By turning the key gently the alarm pointer can be set to the desired value.

7 Operational check

If the measured value lies within the scale range of the Indicomp 2, the switching function can be checked by slowly adjusting the set point across the scale range. When the set point pointer passes the measuring system pointer, on instruments with relay output the relay must be observed to switch over.

8 Changing the measuring range and replacing the scale

Warning

When the apparatus is connected to its supply, terminals may be live, and the opening of covers or removal of parts (except those to which access can be gained by hand) is likely to expose live parts.

The apparatus shall be disconnected from all voltage sources before it is opened.

Any work on the opened apparatus under voltage shall be avoided as far as possible and, if inevitable, shall be carried out by a person who is aware of the hazard involved.

Capacitors inside the apparatus may still be charged even if the apparatus has been disconnected from all voltage sources.

8.1 Repairs and modifications to the Indicomp 2-Ex

On site maintenance and repair work may be carried out by any person in any workshop **after the explosion hazard has been removed**.

If repairs or modifications are carried out on parts of the instrument on which the explosion protection depends, prior to recommissioning an expert must test and certify that in the features essential for explosion protection in respect of configuration and version the instrument conforms with the apparatus described in the certificate.

If a repair is carried out by the manufacturer, for instance by an employee of the Hartmann & Braun Service who is able to identify himself with an appropriate certificate, or if it is accomplished in the factory of origin, an identifying mark is made on the rating plate concerning the repair carried out and the subsequent individual test. A demonstration before an expert is then not necessary.

Excepted from this is work carried out to change the measuring range. This work can be accomplished by trained personnel of the operator, but the conditions in Section 8 must be observed. Care must be taken to ensure that damage to or short circuiting of resistors or other components is avoided. Protective sheets should be used if necessary during soldering work.

Make sure that **only original spare parts** are used in repair work.

8.2 Opening the instrument

The metal rails located on the side of the instrument and the six screws on the bottom of the case must be removed. The upper half-shell can then be lifted off.

8.3 Changing the measuring range in instruments with mV amplifier

Resistors R5 and R6 are measuring range dependent. The span (Ue) depends on the thermocouple type and is determined from the difference between the thermoelectric voltages at the lower range value and the upper range value.

The resistances are determined as follows:

$R5\,(\Omega) = Ue(mV) \cdot 10^3$

$$R6\,(\Omega) = \left(\frac{500}{Ue(mV)} - 1\right) \cdot R5\,(\Omega)$$

The nearest standard value is used. It is not so much the individual value that is important but the ratio of resistors R6/R5.

For example:

Measuring range 0...400 °C
Thermocouple type J (Fe-CuNi) $Ue = 21.85$ mV

$R5 = 21.85 \cdot 10^3 = 21.85\ k\Omega$

$$R6 = \left(\frac{500}{21.85\ mV} - 1\right) \cdot 21850\ \Omega$$

$R6 = 478150\ \Omega$ or $478.15\ \Omega$

$$\frac{R6}{R5} = \frac{478.15}{21.85} = \frac{21.88}{1}$$

A combination such as $R5 = 10\ k\Omega$, $R6 = 215\ k\Omega$ is permitted.

- After calculating R5 and R6, solder in the nearest resistances in the standard series.

mV amplifiers without options

- Short circuit terminals 51 and 52.
- Switch on power supply
- Set pointer to start of scale with potentiometer R12 (zero adjustment)
- Remove short circuit jumper between terminals 51 and 52.
- Connect mV source (e.g. Kompavi 10) to terminal 51(+) and 52(−) with copper wires and set upper range value (referred to 20 °C).
- Set pointer to end of scale with potentiometer R16 (end-point adjustment).

mV amplifier with zero suppression (N)

Resistor R4 and trimmer R11 determine the zero suppression. Their values are shown in Table 5.

- Connect mV source to instrument terminals 51(+) and 52(−) with copper wire.
- Switch on power supply.
- Set mV value for lower range value (referred to reference junction temperature).
- Set pointer to start of scale with potentiometer R11 (zero adjustment).
- Set mV value for upper range value (referred to reference junction temperature).
- Set pointer to end of scale with potentiometer R16 (end-point adjustment).

Example:

Measuring range 300...600 °C, type K (NiCr-Ni)

$Ue = 24.91\ mV - 12.21\ mV = 12.7\ mV$

$R5 = 12.7 \cdot 10^3\ \Omega = 12.7\ k\Omega \rightarrow 12.7\ k\Omega$

$$R6 = \left(\frac{500}{12.7} - 1\right) \cdot 12.7\ k\Omega = 487{,}3\ k\Omega \rightarrow 487\ k\Omega$$

$\Delta U = 12.21\ mV \rightarrow R4 = 2\ k\Omega,\ R11 = 1\ k\Omega$

mV amplifier with reference junction (K) with or without zero suppression (N)

For instruments with zero suppression, the values for R4 and R11 must be taken from Table 3.

Since instruments with internal reference junction have a thermocouple built in, calibration cannot be effected simply by applying a source voltage. A circuit with an additional reference junction (50 °C) must be constructed. Extension lead wire must be used in the wiring.

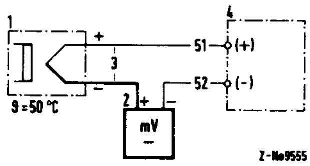


Fig. 14 Balancing the mV amplifier with reference junction
1 External reference junction (e.g. TTY 121)
2 mV source (e.g. Kompavi 10)
3 Extension lead wire
4 Indicator
Note: A matching thermocouple with suitable extension lead wire must be used for connection.

- Construct balancing circuit (note polarity).
- Set mV value for start of range (referred to 50 °C).
- Set pointer to start of scale with potentiometer R11 (zero adjustment).
- Set mV value for end of range (referred to 50 °C).
- Set pointer to end of scale with potentiometer R16 (end-point adjustment).

Type of thermocouple	Suppressed voltage (mV)	R4	R11 (pot.)
Type (Fe-CuNi) and Fe-CuNi (DIN 43710)	-2.82 – 1.48 -1.47 – 4.94 3.69 – 9.24 8.07 – 11.6 9.93 – 14.4 13.4 – 20.0 18.2 – 18.4	3300 Ω 2700 Ω 2200 Ω 2000 Ω 1800 Ω 1500 Ω 1200 Ω	2000 Ω 2000 Ω 1000 Ω 500 Ω 500 Ω 500 Ω 500 Ω
Type K (NiCr-Ni)	-3.41 – 2.48 1.92 – 8.33 8.22 – 15.0 13.3 – 17.8 16.8 – 23.4 21.8 – 31.8 25.8 – 40.2	3900 Ω 2700 Ω 2000 Ω 1800 Ω 1500 Ω 1200 Ω 1000 Ω	5000 Ω 2000 Ω 1000 Ω 500 Ω 500 Ω 500 Ω 500 Ω
Type S (Pt10Rh-Pt)	-0.46 – 0.46	20 k	100 k

Table 3 Resistance values for R4 and R11

Depending on the measuring range, the voltage to be suppressed should be taken from the thermocouple EMF table and the resistance value for R4 and R11 determined from Table 3.

8.4 Changing the measuring range in instruments with resistance amplifier

Resistors R2...R6 (see Fig. 20) are measuring range-dependent. The values for R2, R4 and R6 can be taken from Table 4. R3 and R5 are calculated.

The measuring system current is always 1 mA.

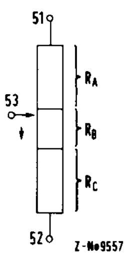
Two-wire, three-wire, teletransmitter circuit				Four-wire circuit				
Span ΔR1	I_K	R2 = R4	R6	Span ΔR1	I_K	R2	R4	R6
10...20 Ω	5 mA	200 Ω	150 Ω	10...20 Ω	5 mA	200 Ω	2000 Ω	233 Ω
> 20...500 Ω	3,03 mA	330 Ω	187 Ω	> 20...500 Ω	3,03 mA	330 Ω	2000 Ω	374 Ω

Table 4

	Two-wire circuit	Three-wire circuit	Four-wire circuit	Teletransmitter circuit
R3	$R1_A + R2$	$R1_A$	$\frac{I_K \cdot R1_A}{0.5\ mA}$	$R_B + R_C - R_A$
R5	$\frac{\Delta R1 \cdot I_K}{1\ mA}$			

Table 5

R_{1A} = Lower value of resistance thermometer
$\Delta R1$ = Alterable resistance value (span)
I_K = Constant current through resistance thermometer
For teletransmitters: $\Delta R1 = 2 \cdot R_B$



E.g.:
$R_A = 50\ \Omega$
$R_B = 30\ \Omega$
$R_C = 50\ \Omega$

Fig. 15 Teletransmitter connection

Balancing

Before the resistance amplifier is balanced, the scale must be replaced (see Section 8.6) and the mechanical zero adjusted (see note in Section 6.2). The power supply must be switched off for this.

Coarse adjustment

- With potentiometer R10 at test point P4 set the value 1.040 V ± 2 mV
- With potentiometer R12 at test point P5 set 1 V ± 2 mV
- With potentiometer R15 at test point P6 set 1 V ± 2 mV

To effect adjustment, the lower value is set with R15, the upper value with R12.

Note:

A resistance source with a tolerance of 0.1% must be used for calibration (e.g. Kompavi 10 or Kompavi 3).

8.5 Changing the measuring range in instruments with measuring circuit organization 4900

In this version the change is effected by replacing the range box fastened to the rear of the instrument. The appropriate scale must again be fitted (see Section 8.6).

8.6 Replacing the scale

After opening the instrument as described in Section 8.2 the upper half shell can be lifted off. After removing the red set point pointer from the set point arm, the scale can be withdrawn upwards. The new scale is then inserted and assembly carried out in the reverse order.

9 Maintenance

The Indicomp 2 is completely maintenance-free.

Faults and unusual circumstances

Whenever it is likely that the protection has been impaired, the apparatus shall be made inoperative and be secured against any unintended operation.

It must be assumed that the protection has been impaired when

- the apparatus has visible signs of damage;
- the apparatus no longer functions;
- the apparatus has been stored in unfavorable conditions for a long time;
- the apparatus has been subjected to adverse transport conditions.

10 Packing instructions

Before packing the Indicomp 2, terminals 51 and 52 must be short circuited and the glass panel covered.

If the original packing is no longer available, the Indicomp 2 must be wrapped in paper and packed in a sufficiently large crate lined with shock-absorbing material (excelsior, spun rubber or similar). If excelsior is used, the packed layer should be at least 15 cm on all sides.

For overseas shipment the instrument must additionally be sealed airtight in 0.2 mm thick polyethylene together with a dessicant (e.g. silica gel). Furthermore, for this type of shipment the crate should be lined with a layer of kraft paper.

These packing instructions also apply when returning the instrument to the manufacturer (e.g. for recalibration and repair).

11 Spare parts list

All spare parts sales are handled by means of EDP. Thus the catalog designation (= object) on the order confirmation, shipping papers and invoice are subject to the laws of automatic data processing. Verbal deviations are possible in the paperwork of the manufacturer.

The Catalog No. is the sole criterion.

Designation	Catalog No.
Transformer:	
For instruments with and without mV and resistance measuring amplifier	
220 V AC	30404-4-0784874
220 V AC Ex version (21-25)	30404-4-0784874
220 V AC Ex version (13-15)	30404-4-0784762
127 V AC	30404-4-0784872
127 V AC Ex version (21-25)	30404-4-0784872
127 V AC Ex version (13-15)	30404-4-0784761
110 V AC	30404-4-0784870
110 V AC Ex version (21-25)	30404-4-0784870
110 V AC Ex version (13-15)	30404-4-0784760
24 V AC	30404-4-0784862
24 V AC Ex version (21-25)	30404-4-0784862
24 V AC Ex version (13-15)	30404-4-0784759
For instruments with measuring circuit organization 4900 and initiator output	
220 V AC	30404-4-0784758
220 V AC Ex version (13-15)	30404-4-0784762
127 V AC	30404-4-0784759
127 V AC Ex version (13-15)	30404-4-0784761
110 V AC	30404-4-0784756
110 V AC Ex version (13-15)	30404-4-0784760
24 V AC	30404-4-0784755
24 V AC Ex version (13-15)	30404-4-0784759
For instruments with measuring circuit organization 4900 and relay output	
220 V AC	30404-4-0784875
220 V AC Ex version (21-25)	30404-4-0784874
127 V AC	30404-4-0784873
127 V AC Ex version (21-25)	30404-4-0784872
110 V AC	30404-4-0784871
110 V AC Ex version (21-25)	30404-4-0784870
24 V AC	30404-4-0784863
24 V AC Ex version (21-25)	30404-4-0784862
Direct voltage power supply with isolating transformer	
24 V DC	30404-4-0785393
Encapsulated fuse for Ex version	
24 V DC indicator 32 mA	30404-4-0784751
24 V AC indicator 100 mA	30404-4-0784752
110-220 V AC indicator 32 mA	30404-4-0784753
24 V DC relay or initiator output 32 mA	30404-4-0784754
24 V AC initiator output 100 mA	30404-4-0784897
24 V AC relay output 315 mA	30404-4-0785407
220 V AC relay 32 mA	30404-4-0785408
110-127 V AC relay output 100 mA	30404-4-0785409
110-220 V AC initiator output 32 mA	30404-4-0785408
Switching amplifier with relay	
Max.	30404-4-0784312
Min.	30404-4-0784313
Max. and min.	30404-4-0784314
Relay	30404-4-0804562
Measuring amplifier for measuring circuit organization 4900	30404-4-0784864
Inductive pickup, red, SJ 3.5 N	30404-4-0854938
Inductive pickup, green, SJ 3.5 N	30404-4-0854907
Holder for inductive pick-up	30404-4-0493158
Countersunk screw for inductive pick-up	30404-4-0190829
Shaft (flexible) for set point adjustment	30405-4-0491402
Set point key	62404-4-0810357
Scale, blank, white	94301-4-0582398
Front frame grey RAL 7037	30405-4-0491410
Front frame black RAL 9005	30405-4-0491409
Panel mounting clamp	30405-4-0854808
Resistance measuring amplifier[1]) 2-wire	30404-4-5434
3-wire	30404-4-5436
4-wire	30404-4-5438
mV measuring amplifier[1])	
without K, N	30404-4-5435
with reference junction	30404-4-5437
with reference junction and/or zero suppression	30404-4-5439

Key: K = Reference junction compensation
N = Zero suppression

[1]) State precise version and measuring range in clear text with order

12 Circuit and component diagrams

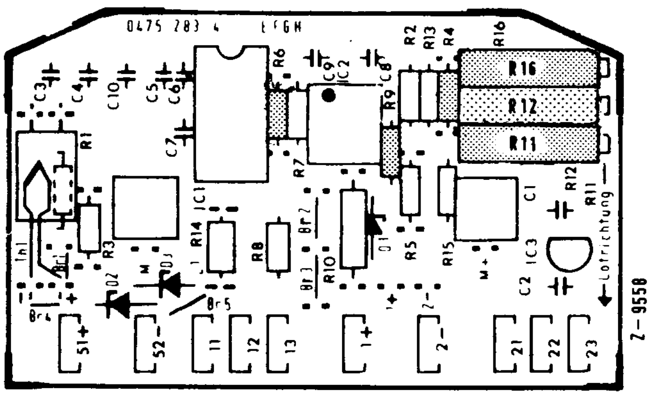


Fig. 16 mV amplifier circuit board

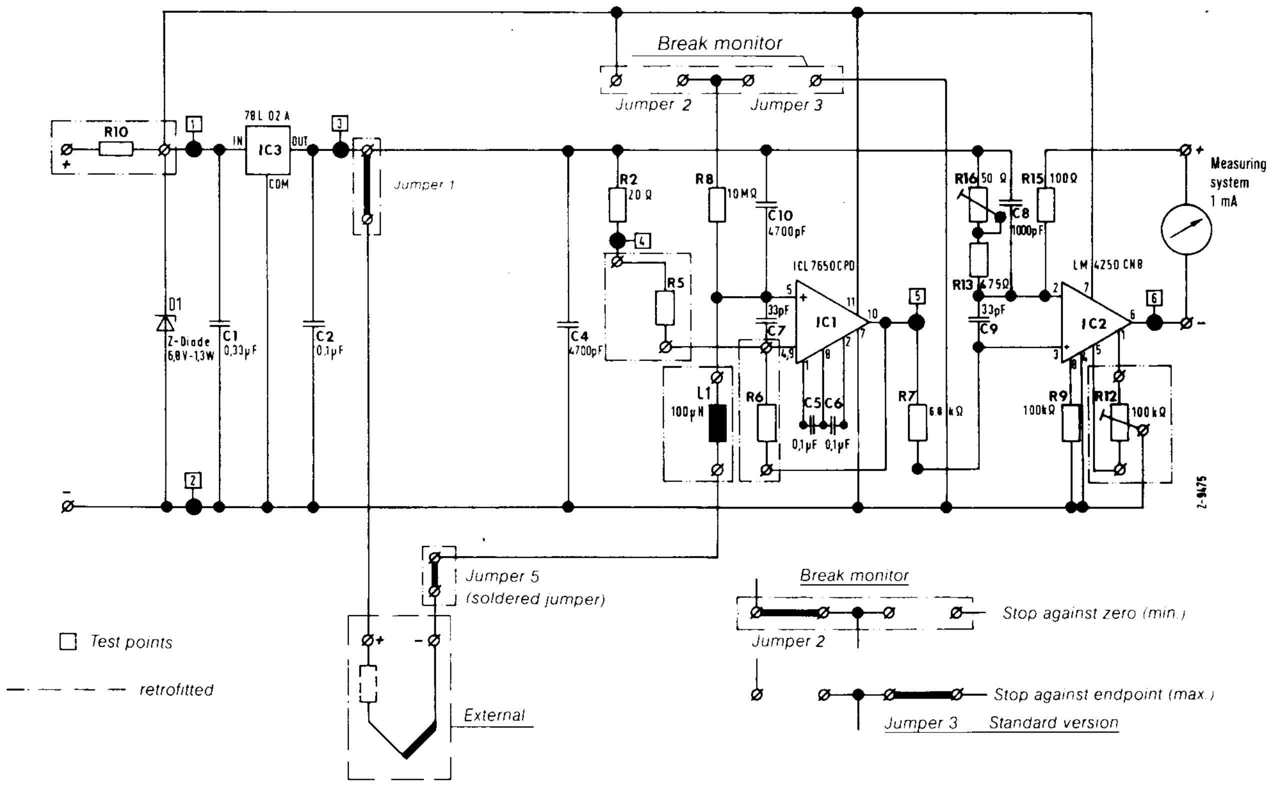


Fig. 17 mV/chopper measuring amplifier without options (also for measuring circuit organization 4900)

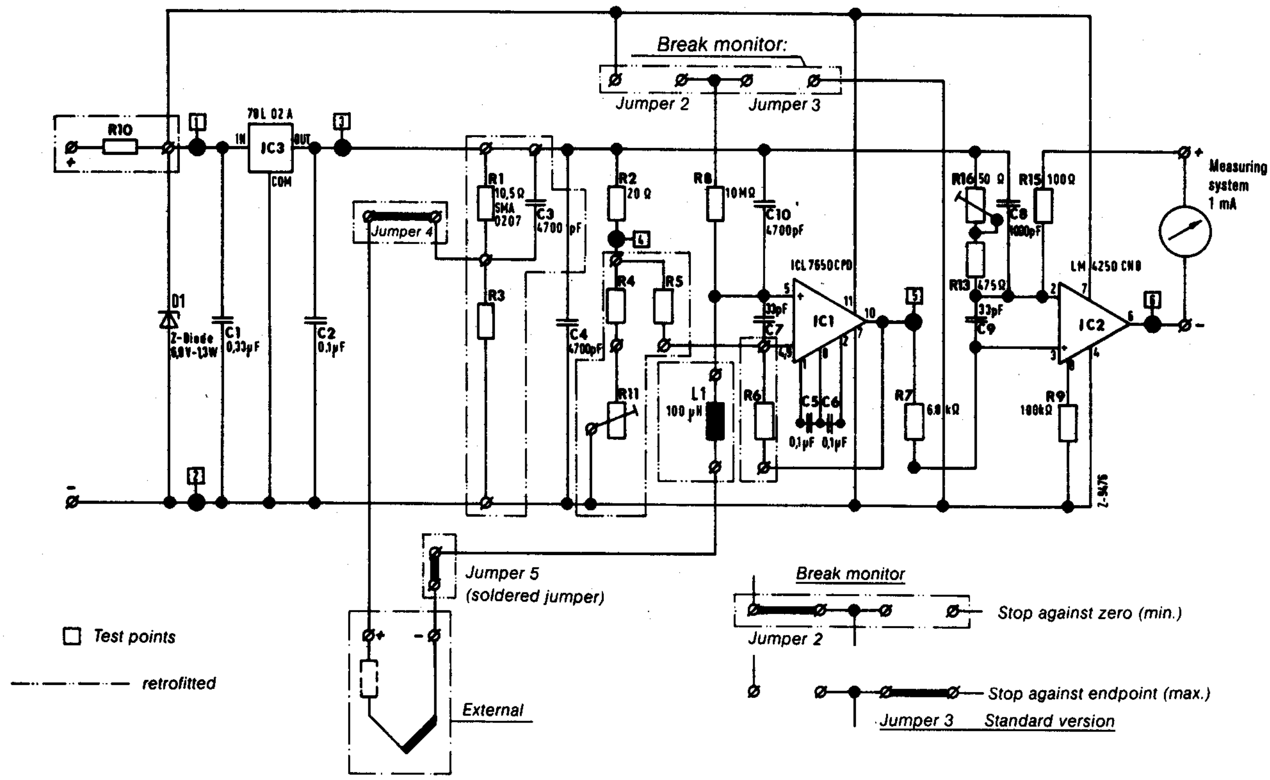


Fig. 18 mV/chopper measuring amplifier with zero suppression (N)

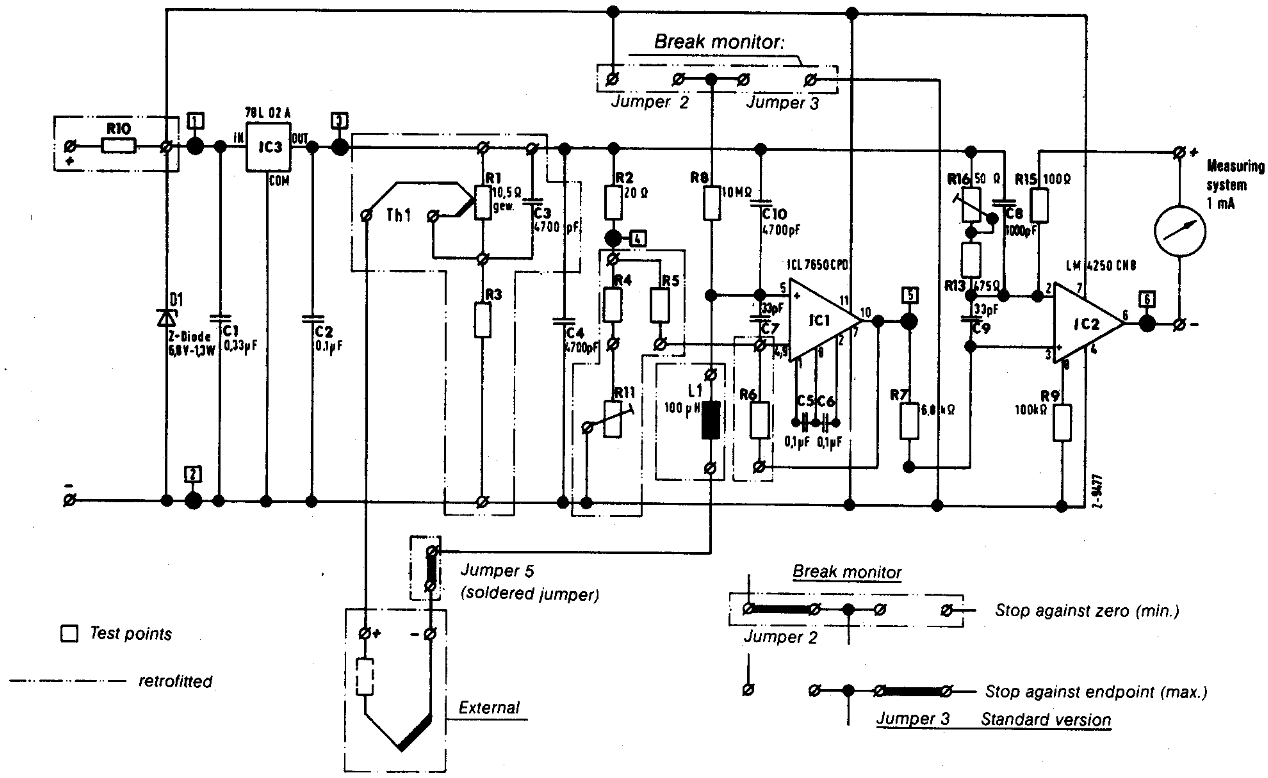


Fig. 19 mV/chopper measuring amplifier with zero suppression (N) and reference junction (K)

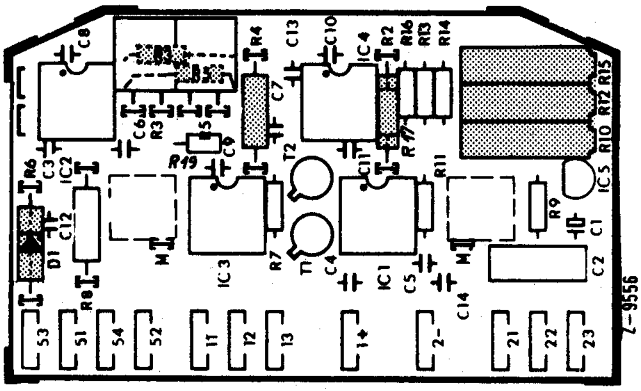


Fig. 20 Resistance amplifier circuit board

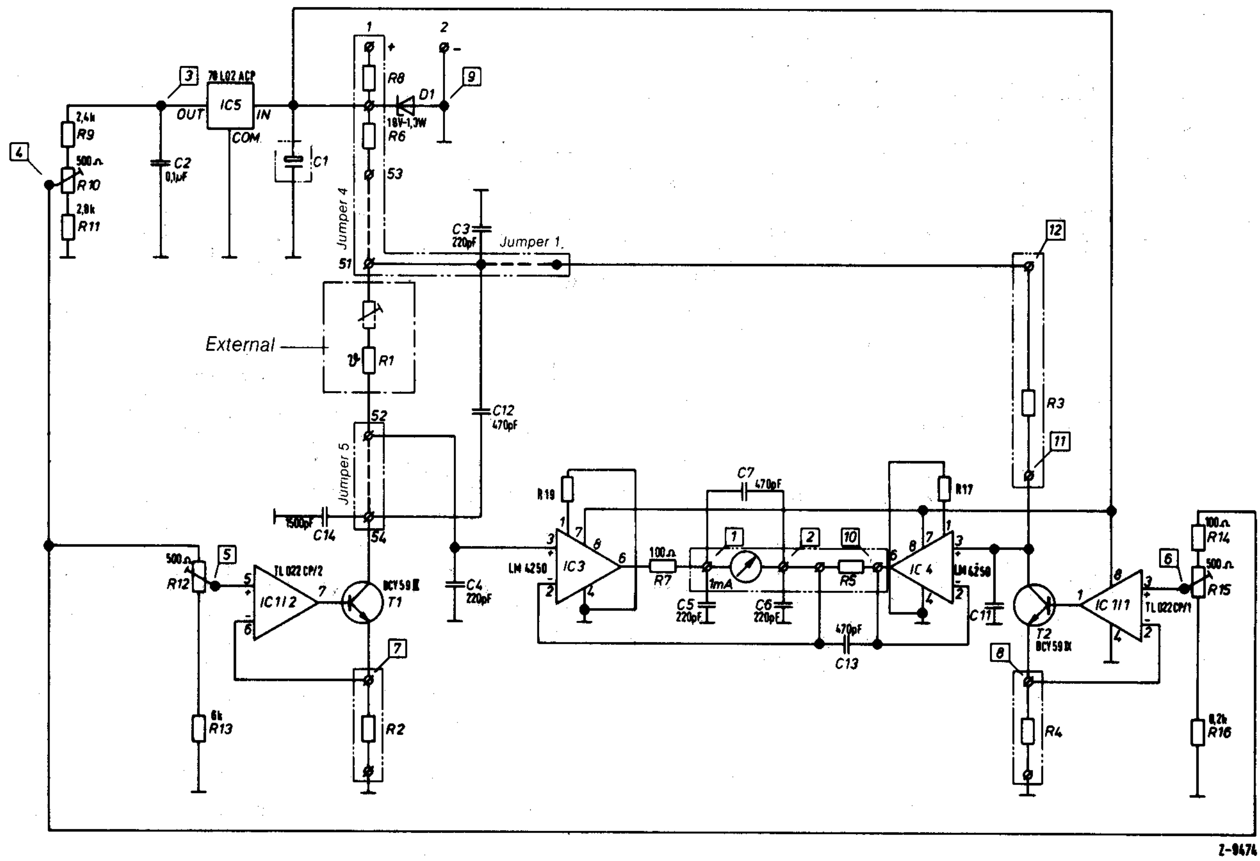


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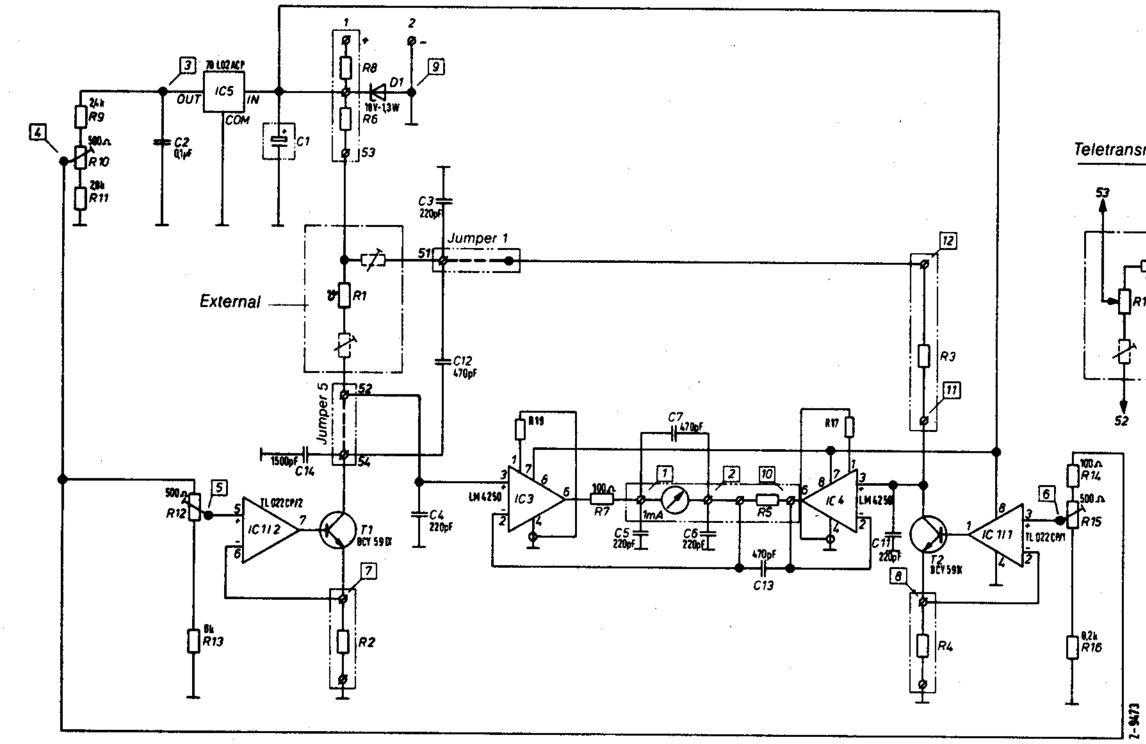
Fig. 21 Two-wire circuit



Teletransmitter circuit

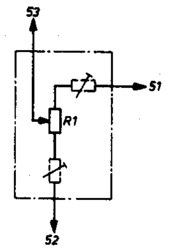


Fig. 22 Three-wire circuit

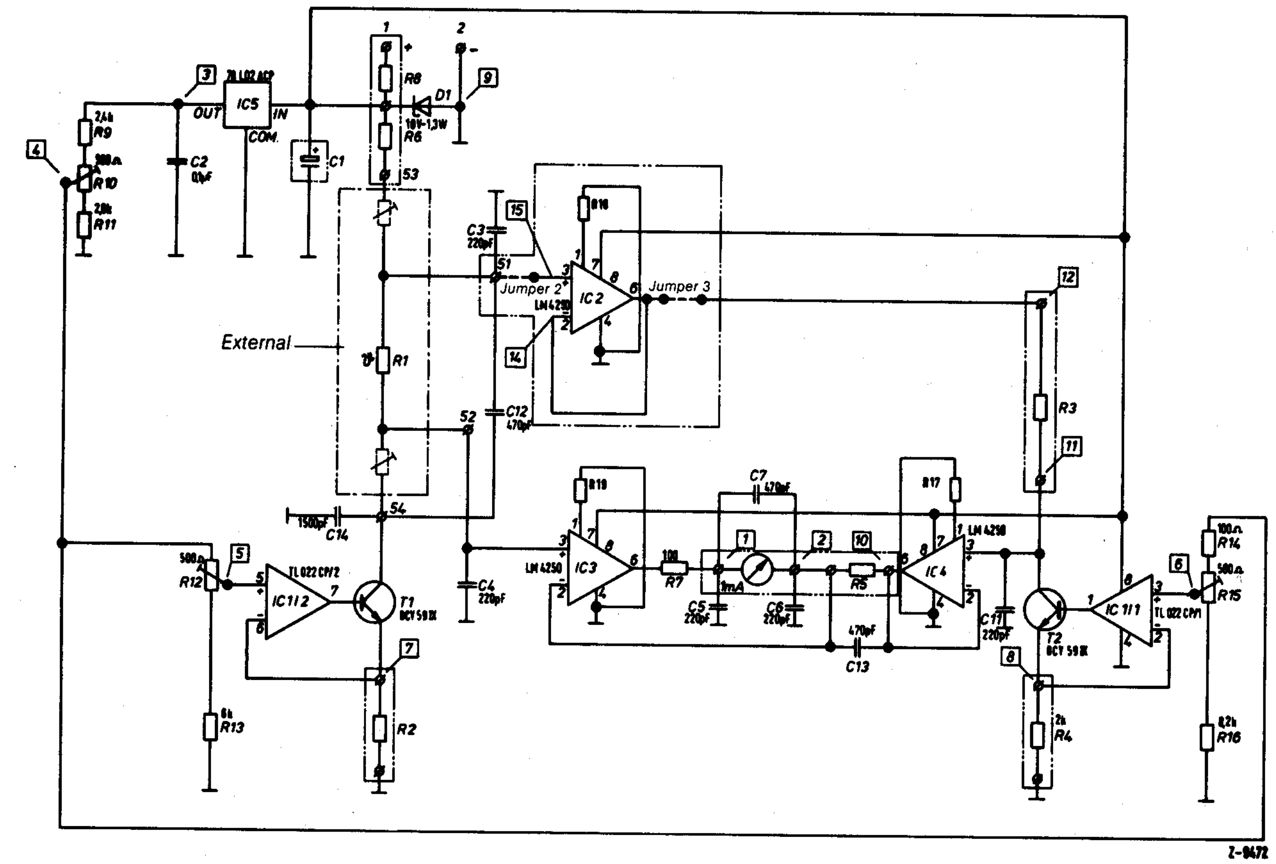


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Fig. 23 Four-wire circuit

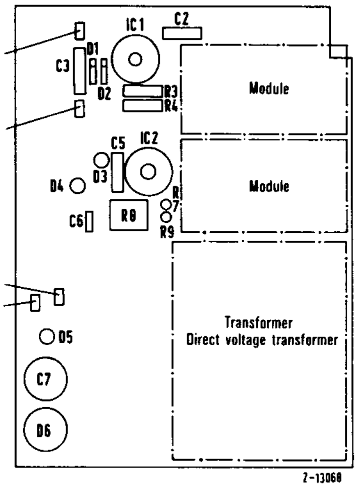

Fig. 24 Power supply circuit board

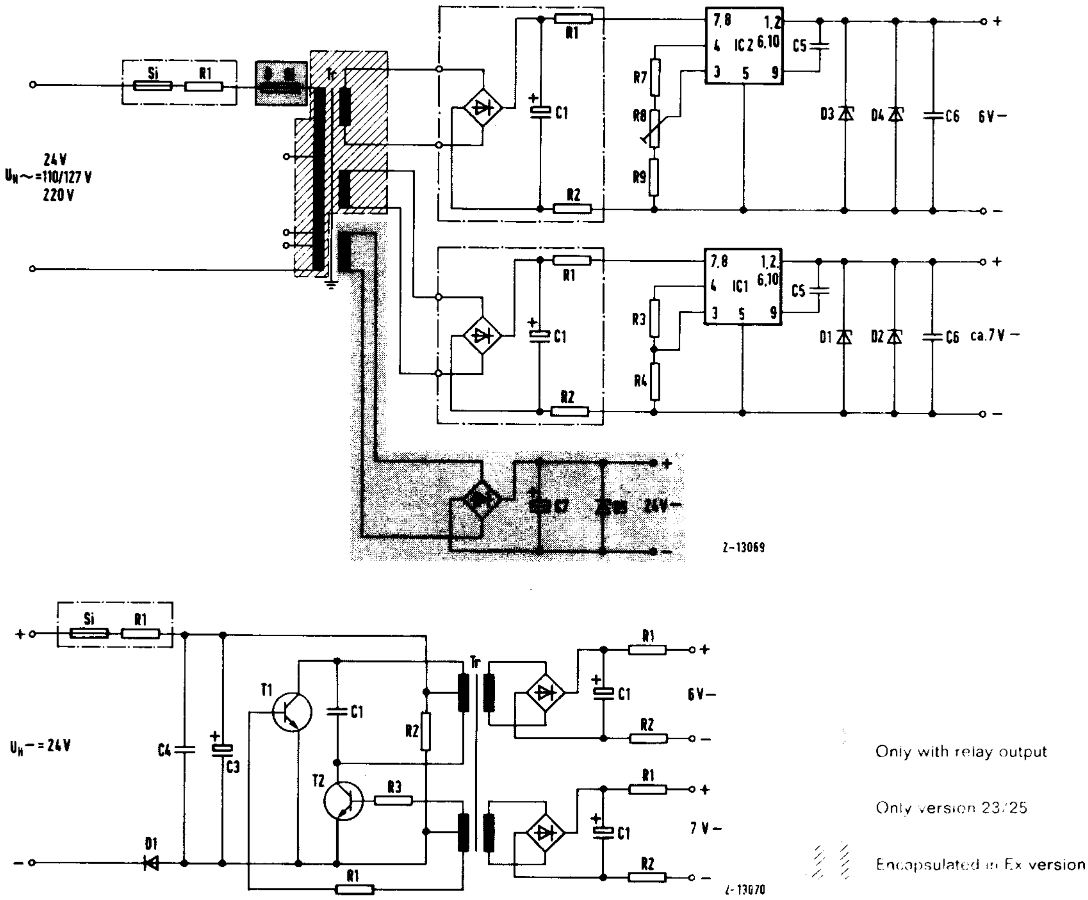

Fig. 25 Power supply unit

Alternating voltage input		Direct voltage input	
R1, R2	100 Ω	R1, R3	50 Ω
R3	3 kΩ	R2	15 kΩ
R4	20 kΩ	R1, R2 (output side)	150 Ω
R7	1.2 kΩ	C1	1500 pF
R8	1 kΩ	C2	470 pF
R9	10 kΩ	C3	15 µF
C1	SF 22-5020-35	C4	4700 pF
C2, C3, C5, C6	0.047 µF	C1 (output side)	SF 22-5020-35
C7	BZA-47-5010-40	D1	1N 4005
D1, D2	BZX 85	T1, T2	BC546B
D3, D4	1N5343	Gr	B40C800
D5	1N5361		
Gr	B40C800		
IC1, IC2	723 C		
For fuses see Section 2, Technical Data			

Parts list for Fig. 25.

Subject to technical changes.

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