TE 106, TET 106-Ex

Isolating amplifier

Operating manual

42/11-13 EN

Rev. 6.0

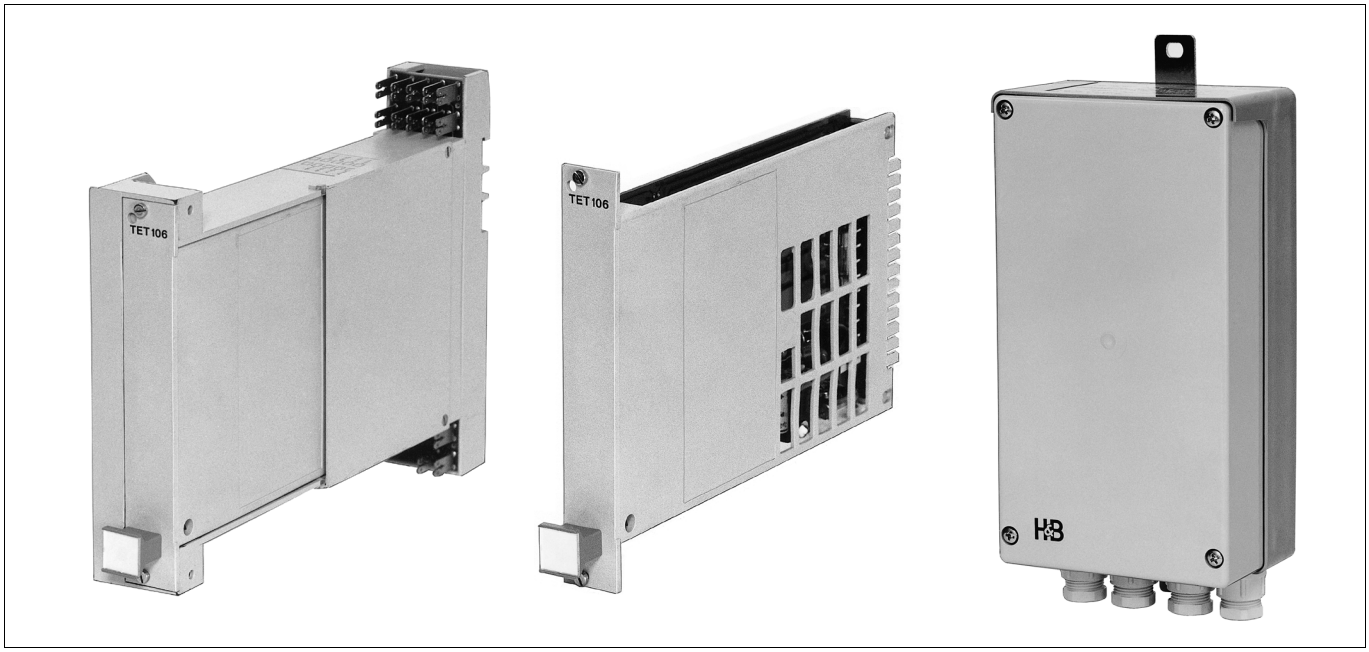


ABB Automation

Contents

Safety notes

This apparatus has been designed and tested in accordance with DIN 57 411 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.

- Before any other connection is made, the protective ground terminal shall be connected to a protective conductor.
- Before switching on the apparatus make sure it is set to the voltage of the mains.
- Any interruption of the protective conductor inside or outside the apparatus or disconnection of the protective ground terminal is likely to make the apparatus dangerous. Intentional interruption is prohibited.
- When the apparatus is connected to its supply, terminals may be live, and the opening of covers or removal of parts (including 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 for any adjustment, replacement, maintenance or repair.
- Any adjustment, maintenance and repair of 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.
- Make sure that only fuses with the required rated current and of the specified type are used for replacement. Short-circuiting the fuse-holder is prohibited.
- Whenever it is likely that the protection has been impaired, the apparatus shall be made inoperative and be secured against any unintended operation.

The industrial standards and regulations (DIN, VDI, VDE etc.) 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 German Federal jurisdiction, the relevant specifications, standards and regulations applicable in the country where the device is used must be observed.

TECHNICAL DESCRIPTION

1 Application

The isolating amplifier TET 106, TET 106-Ex is designed for electrical isolation of direct current and direct voltage signals, for isolation of intrinsically safe and non-intrinsically safe circuits, and for direct current and voltage measurement. The direct current variable to be measured is converted linearly to a standardized output signal. The input, output and power supply of the isolating amplifier are electrically isolated from each other.

2 Technical data

Input

Measuring range (with preamplifier)

Unipolar:
- U_E 0... 50 mV to 0...250 V [1) 4)]
- I_E 0... 100 µA to 0...200 mA

Bipolar:
- U_E − 50 mV...0...+ 50 mV to −100 V ...0...+100 V
- I_E −100 µA ...0...+100 µA to −100 mA...0...+100 mA

For the TET 106-Ex the maximum values of the type test certificate apply.

Suppression of start of range: Up to 90% of upper range value, but minimum span 50 mV or 100 µA.

Measuring range altered by changing fixed resistors.

Fine adjustment: With potentiometers for start of range and end of range
Range of adjustment with ± 5% of span.

Continuous overload capacity: $10 \times U_E$, but max. 250 VDC or 600 VDC with Suppl. No. 310
$2 \times I_E$, max. 400 mA

Input resistance (R_E) with preamplifier:
U_E up to 200 mV; > 100 kΩ
200 mV...100 V; 10 kΩ/V
100 V...250 V; approx. 1 MΩ
> 250 V; approx. 3 MΩ

for I_E up to 200 mA, $R_e = \frac{200\ mV}{I_E}$

without preamplifier R_E = 36 Ω at 20 mA

Output

Load-independent voltage: 0...10 V or −10...0...+10 V
Permitted load 1 kΩ...∞

Load-independent current: −1...0...+1 mA to −20...0...+20 mA
Unipolar 0...50 mA

Permitted load R_a [2)] $= \frac{\text{Load voltage}}{I_a}$

Bipolar
- −20...0...+20 mA
- − 5...0...+ 5 mA

} Load voltage 15 V

Unipolar
- 0... 20 mA
- 0... 5 mA
- 4... 20 mA

} Load voltage 15 V

0...≦ 20 mA load voltage 30 V
> 20 mA...≦ 50 mA load voltage 15 V

Limitation of output current: Approx. $1.3 \times I_A$

Open output: permitted

Ripple content of output variable: 0.5% (peak-to-peak)

Power supply

(See rating plate for rated voltage)

Alternating voltage: −15%...+10%

Frequency: 48....62 Hz

Direct voltage: ± 25%
At 24 VDC 18...33 V
At 24 VAC/DC 19.2...33 V

Residual ripple: ≦ 20% within the tolerance band

Power consumption (with 20 mA/15 V unipolar output)

24 VAC/DC	1.8 W	M 0.4	C
24 VDC	1.8 W	M 0.4	C
48 VDC	2.0 W	M 0.16	C
60 VDC	2.0 W	M 0.16	C
110 VDC	2.1 W	M 0.125	C
220 VDC	2.1 W	M 0.063	C
110 VAC	2.1 W	M 0.125	C
127 VAC	2.1 W	M 0.125	C
220 VAC	2.1 W	M 0.063	C
240 VAC	2.3 W	M 0.063	C

Power consumption increased by
0.9 W with bipolar output or output > 20 mA
0.6 W with 30 V load voltage or Ex output or measuring range 0...20 mA/1:1 without preamplifier

Required connected load of power supply sources: P_{eff} = 1.5 × value of power consumption, current drain not sinusoidal

Environmental capabilities

Construction	19" plug-in card module	Surface mounting case	Field housing
H&B climate group	2 Z with extended upper and lower limit temperature		
Application class to DIN 40040	JSF	JVF	HVD
Ambient temperature	−10...+70°C [3)]	−10...+55°C	−25...+55°C
Transportation and storage temperature		−30...+80°C	

[1)] Up to 600 VDC measuring range or series voltage see Suppl. No. 310
[2)] For version with test jacks 50 Ω load reduction
[3)] Max. + 60°C (application class JUF) for TET 106-Ex with power supply 110/127/220 VAC, for permitted ambient temperature of equipped 19 " sub-racks see Section 6.1.1.
[4)] With test jacks for input max. input or series voltage 60 V DC

Construction	19" plug-in card module	Surface mounting case	Field housing
Annual average relative humidity	≦ 75 %	≦ 75 %	≦ 80 %
Condensation	None	None	Tolerated
Degree of protection to DIN 40050	IP00	IP20	IP54

Mechanical capabilities

in accordance with DIN 40046, sheets 7 and 8

Mechanical test class (company standard 120, 201)	2/2 F	2/2 F	2/2 F

Case and mounting

Electrical connections	32-pole blade connector to DIN 41612 type D[1] or F	6.3 mm tab connectors or screw terminals for 2.5 mm²	Screw terminals for 2.5 mm²
Color	RAL 7032	RAL 7032	RAL 7032
Mounting orientation	Front panel vertical, handle at top or bottom		Cable glands underneath
Class of protection to VDE 0411 or IEC 348	I[2]	II[3]	II
Insulation group to VDE 0110	C	C	C
Weight	Approx. 0.25 kg	Approx. 0.8 kg	Approx. 1.3 kg
Test voltage to VDE 0411	Mains against input / output 3 kV Input / output 3 kV 0.75 kV for test jacks 4 kV where $U_E > 250$ V		
Radio interference level to VDE 0871 / 0875	N with power supply 220 VAC / DC B with power supply 24 VAC / DC		
Surge voltage (IEC 255,4)	1.5 kV, 1.2 / 50 µs ($R_i \approx 500\ \Omega$)		

Characteristics at equilibrium under nominal conditions

Error limit	≦ 0.3 %[4]
Non-linearity at fixed point setting	≦ 0.1 %[4]
Static error	< 0.1 %[4]
Nominal conditions	
Ambient temperature	18...28 °C
Permitted temperature change during measurement	2 K
Long-term drift	≦ 0.2 % / Jear
Power supply	Voltage ± 2 % Harmonic content ≦ 5 % Rated frequency ± 0.5 %
Load	For I_A: $R_{A\,max.}$ For U_A: $R_{A\,min.}$
Warm-up time	≧ 10 minutes for standard measuring ranges

Characteristics at equilibrium when not under nominal conditions

Effect of ambient temperature	≦ 0.2 % / 10 K[4]
Effect of power supply	< 0.1 % / 10 %[1] voltage fluctuation

Effects in the input

Effect of interference by balanced 50 Hz alternating parasitic voltage	< 0.1 % (with a parasitic voltage of 0.1 V and measuring range 100 V)
Unbalanced 50 Hz alternating parasitic voltage	< 0.1 % up to max. 250 V (rms)
Unbalanced common-mode parasitic voltage	< 0.1 % up to max. 250 V
Effect of radio frequency interference	< 0.3 % at 27...460 MHz, 1 W transmission power 0.5 m antenna distance

Effects in the output

Effect of load	
with current output	< 0.05 % in load range
with voltage output	< 0.5 % from 1 kΩ...∞
Effect of noise voltage	
with current output	< 0.1 % where noise voltage ≦ 14.4 V
Effect of parasitic voltage	< 0.1 % per 250 V

Time response (dynamic response)

Abrupt transition from 10 to 90 %, residual error ± 1 %, aperiodic setting

Settling time t_a	≦ 12 ms
Recovery time after interruption of measuring circuit	≦ 20 ms

[1] Suitable for female connectors to DIN 41612 type D
[2] After installation in the 19" sub-rack
[3] Ground connection necessary for TET 106-Ex
[4] Referred to the output span

Explosion protection

Manufacturer's
identification code 49/11-39-Ex
Type test certificate PTB No. Ex-85/2123 X

Type code	Input circuit	Output circuit
TET 106-Ex.B	EEx ib II C	Not explosion proof (up to 1 A, up to 60 V)
TET 106-Ex.C	EEx ib II C	EEx ib II C
TET 106-Ex.D	Not explosion proof (up to 1 A, up to 60 V)	EEx ib II C

Installation outside the hazardous area
Ambient temperature up to + 70°C
Monitoring loop up to 220 V, up to 1 A

Type TET 106-Ex.B, TET 106-Ex.C

Input circuit with type of protection
intrinsic safety EEx ib II C
for connection to active primary elements

Isolating amplifier maximum values

U	8.2 V
I	0.17 mA
P	0.35 mW
L_i	0
C_i	0
Permitted L_a } Permitted C_a	See type test certificate

Type TET 106-Ex.C, TET 106-Ex.D

Output circuit with type of protection
intrinsic safety EEx ib II C
for connection to passive intrinsically safe circuits

Isolating amplifier maximum values

U	19.2 V
I	50 mA
P	0.96 mW
L_i	0
C_i	0
Permitted L_a	0.8 mH or 2 mH
Permitted C_a	93 nF or 78 nF

3 Mode of operation

The isolating amplifiers TET 106 and TET 106-Ex convert direct currents or voltages into an electrically isolated, load-independent direct current or voltage signal. The measured signal is passed via a resistor network (1) that determines the measuring range to the input of the preamplifier (2) which generates a load-independent current and feeds this via the input stage (3) to the inverter (4). The alternating current which is proportional to the measured signal is electrically isolated by the signal transformer (5) and rectified with a diode bridge (6). In the final amplifier (7) the signal is converted to a unipolar load-independent current or load-independent voltage.

For measured signals in the form of a 0...20 mA load-independent direct current with a transformation ratio of 1:1 the preamplifier (2) may be omitted. The measured signal is then connected directly to the input stage (3).

If the output stage (8) is incorporated in place of the final stage (7) the measured signal can be converted to a bipolar output signal. The power for the electronics is supplied via the switching controller (9) and the power supply unit (10). Explosion-proof isolating amplifiers have in addition limiter circuits for the supply voltage (11), the input (12) and/or the output (13).

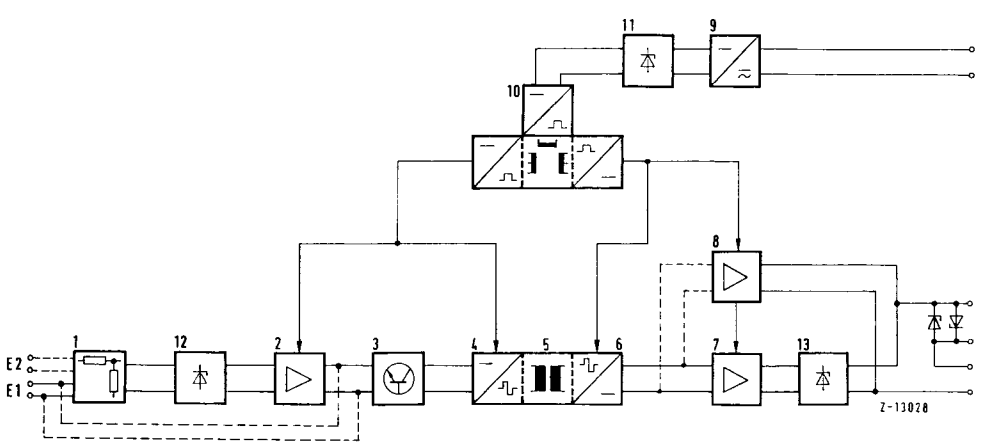


Fig. 1 Functional diagram
1 Resistor network
2 Preamplifier
3 Input stage
4 Inverter
5 Signal transformer
6 Diode bridge
7 Final amplifier
8 ± output stage
9 Switching controller
10 Power supply
11, 12, 13 Ex limitation

4 Construction

4.1 19″ plug-in card module

The 19″ plug-in card module (dimensions 100 mm × 160 mm) is fitted with a 32-pole blade connector.

Fig. 2 shows the position of sub-assemblies on the motherboard. In all versions the arrangement of the electronics on the motherboard is the same.

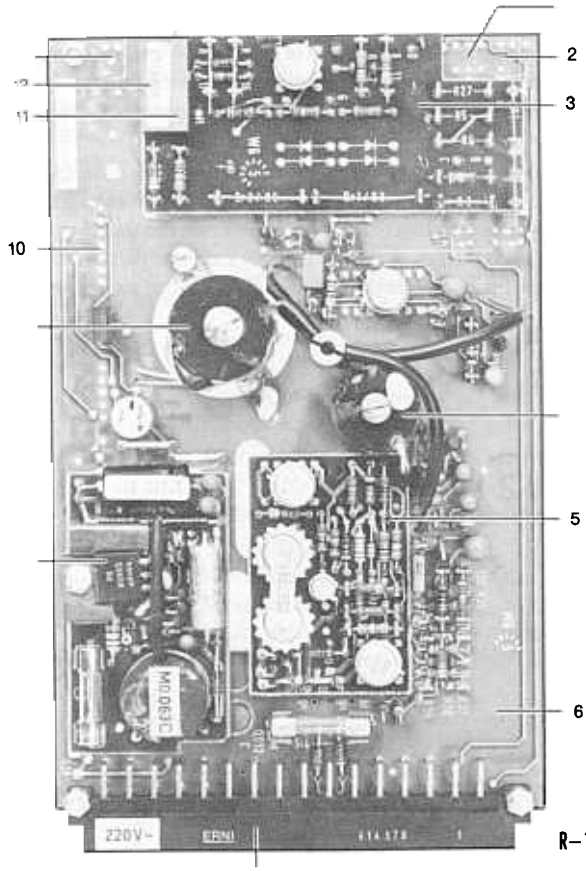
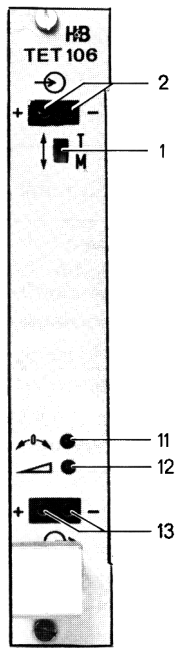


Fig. 2 Construction of 19″ plug-in card module

1 Measure[1]/test selector switch
2 Test jacks[1] for input
3 Function amplifier
4 Signal isolator
5 Voltage limiter for Ex output or bipolar output stage
6 Motherboard
7 Blade connector type D or F
8 Switching power supply
9 Mains isolator
10 Voltage limiter[1] for Ex power supply
11 Potentiometer for start of range
12 Potentiometer for span
13 Test jacks[1] for output



1 Measure/test selector switch
2 Test jacks for input
11 Potentiometer for start of range
12 Potentiometer for span
13 Test jacks for output

Fig. 3 Front panel of 19″ plug-in card module

4.2 IP 20 surface-mounting case

Fig. 4 shows the IP 20 surface-mounting case construction.

A 19″ plug-in card is plugged into the plastics case and fastened with 2 screws. All manual control elements are accessible on the front panel. For the electrical connections, blade-type terminals or screw terminals are attached at the base.

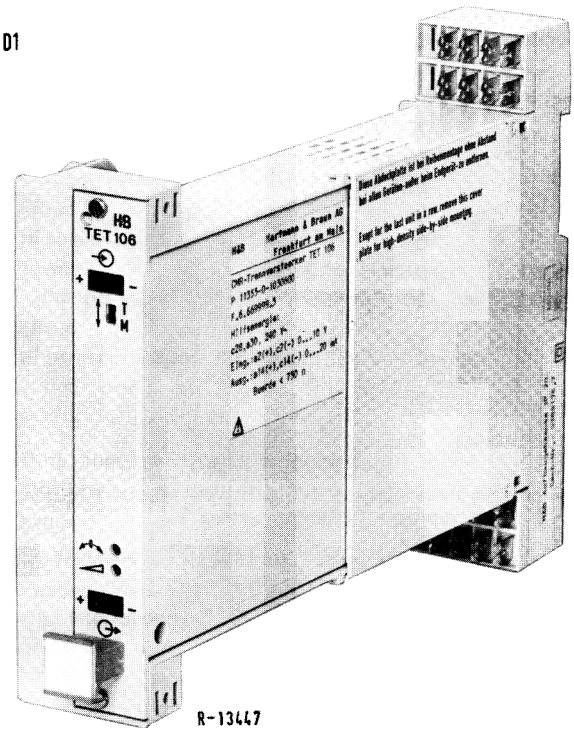


Fig. 4 19″ plug-in card surface-mounting case

[1] Not illustrated

4.3 IP 54 field housing

The transmitter housing protected to IP 54 (Fig. 5) for field installation is made of plastics and comprises the base (2) and cover (not illustrated). The isolating amplifier TET 106 in IP 54 housing contains a motherboard with the entire electronics and a terminal strip for the electrical connections which is soldered in to the circuit board. The motherboard is fastened to the housing base with 4 screws. With the housing cover removed, the potentiometers for start of range and span are accessible.

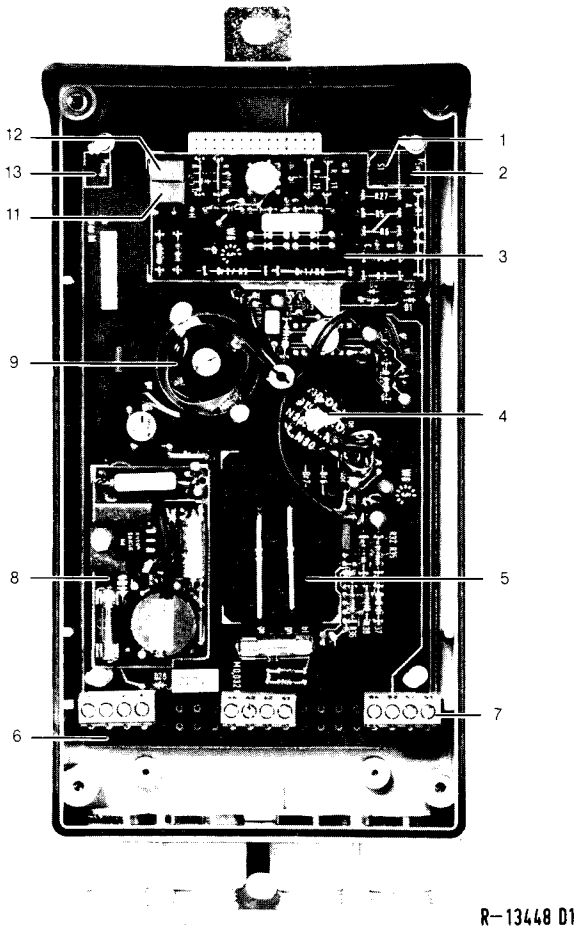


Fig. 5 Isolating amplifier in field housing protected to IP 54

1 Measure[1] / test selector switch
2 Test jacks[1] for input
3 Function amplifier
4 Signal isolator
5 Bipolar output stage[1]
6 Motherboard
7 Terminal strip
8 Switching power supply
9 Mains isolator
11 Potentiometer for start of range
12 Potentiometer for span
13 Test jacks[1] for output

5 Explosion-proof version

The input and output circuit of the isolating amplifier TET 106-Ex is approved for type of protection intrinsic safety EEx ib IIC. The input and output circuts can be installed in hazardous areas, taking due note of the type test certificate (see Section 2). As only the input and output circuits are intrinsically safe, the isolating amplifier must be installed outside the hazardous area.

When carrying out installation of the transmitter, the regulations on electrical apparatus in hazardous areas (ElexV), the regulations on the installation of electrical systems in hazardous operating sites (VDE 0165) and the type test certificate (49/11-39-Ex) must be observed.

If a unit with a certified intrinsically safe output circuit is connected to the intrinsically safe input circuit of the isolating amplifier, the intrinsic safety of the connection must be demonstrated in accordance with VDE 0165. Some approved combinations are mentioned on the type test certificate PTB No. Ex-85/2123 X.

If for operational reasons the intrinsically safe circuit must be grounded by connection to the bonding conductor, grounding may only be effected at one point.

[1] Not illustrated

6 Mounting and connecting instructions

6.1 Mounting the unit

6.1.1 19" plug-in card module

The isolating amplifier TET 106 as 19" plug-in card module is plugged into the slot provided in the 19" sub-rack and fastened with 2 screws at the front panel. The signal and power supply leads must be routed to the appropriate pin-connector (mating connector) and there connected. The space occupied by a 19" plug-in card module is 4 width units (E) ≙ 20 mm, so that up to 21 transmitters can be plugged into one 19" sub-rack. The female connectors must be mounted a corresponding distance apart.

Table 1 shows the permitted ambient temperature of the equipped 19" sub-rack (for installation in cabinets, the permitted number of transmitters and sub-racks per cabinet is given in Data Sheet 92-9.39 EN).

Explosion protection	Power supply	19" sub-rack equipped with	
		TET 106 in 4E spacing	TET 106 in 5E spacing
Yes	110 VAC, 127 VAC, 220 VAC	≤ 40 °C	≤ 50 °C
Yes	24 VAC / DC, 24 VDC	≤ 50 °C	≤ 60 °C
No	110 VAC, 127 VAC, 220 VAC, 240 VAC, 110 VDC, 220 VDC	≤ 50 °C	≤ 60 °C
No	24 VAC / DC, 24 VDC, 48 VDC, 60 VDC	≤ 55 °C	≤ 65 °C
With 5E spacing, a cover plate of width 1E must be placed between the units.			

Table 1

6.1.2 Explosion-proof 19" plug-in card module

The isolating amplifier TET 106-Ex also occupies a space of 4E ≙ 20 mm, i.e. up to 21 isolating amplifiers can be plugged into a 19" sub-rack.

The plug-in card module is fastened with 2 screws at the front panel.

To prevent the possibility of the slot for an explosion-proof 19" plug-in card module being used for any other 19" plug-in card module, coding is attached to the isolating amplifiers. The slot in the 19" sub-rack must be matched with this coding.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	Voltage	Unit
				X	X			X	X		X	X	X	220 V AC	TET 106 - Ex B
				X	X			X	X	X		X	X	127 V AC	
				X	X			X	X	X	X		X	110 V AC	
				X	X			X	X	X	X	X		24 V AC/DC	
				X	X		X			X	X	X	X	24 V DC	
				X	X		X		X		X	X	X	220 V AC	TET 106 - Ex D
				X	X		X		X	X		X	X	127 V AC	
				X	X		X		X	X	X		X	110 V AC	
				X	X		X		X	X	X	X		24 V AC/DC	
				X	X		X	X			X	X	X	24 V DC	
				X	X		X	X		X		X	X	220 V AC	TET 106 - Ex C
				X	X		X	X		X	X		X	127 V AC	
				X	X		X	X		X	X	X		110 V AC	
				X	X		X	X	X			X	X	24 V AC/DC	
				X	X		X	X	X		X		X	24 V DC	

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× = Tooth of circuit board comb broken off.
Comb of terminal side broken off to match circuit board.

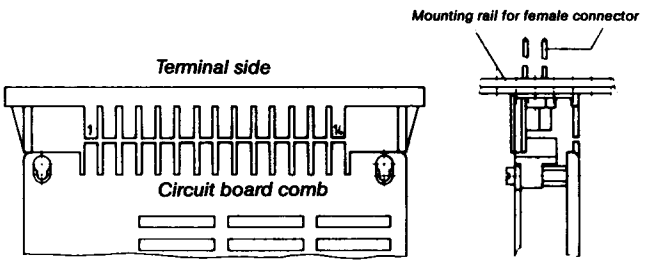
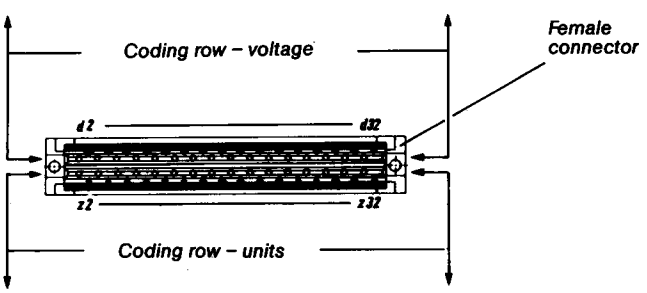


Fig. 6

Coding of the type F connector to DIN 41612

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Voltage
X																220 V AC
	X															127 V AC
		X														110 V AC
			X													24 V AC/DC
				X												24 V DC



Coding the type D connector to DIN 41612

The 19" plug-in card module has a plastics cover that forms a unit with the front panel. On the cover is the rating plate and the coding comb for the different Ex versions in 19" construction with blade connector type D. The mating part for this coding comb must be mounted on the associated slot of the 19" sub-rack.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Unit
				×												TET 106-Ex B
					×											TET 106-Ex D
						×										TET 106-Ex C
								×								TET 106-Ex E
									×							TET 106-Ex F

× = Coding pin inserted in female connector
Blade connector drilled to fit female connector

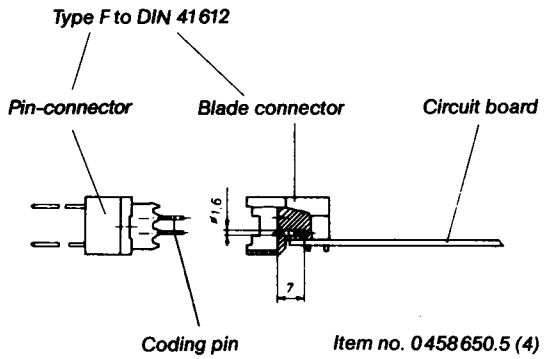


Fig. 7

6.1.3 19" plug-in card in IP 20 surface-mounting case

The surface-mounting case is designed for individual mounting with screw fastening (for fixing hole spacing see dimensional drawing, page 12) or for snap fastening on top-hat rails to EN 50022 (see dimensional drawing page 12). For the electrical connections the case has either blade-type terminals for 6.3 mm tab connectors or screw terminals for wires up to 2.5 mm^2. To obtain degree of protection IP 20, the air slots in the cover of the 19" plug-in card are covered with a cap. If the cases are mounted close-packed in a row, the caps must be removed for better heat dissipation. The cap must be left on the last unit in the row to retain the IP 20 protection. Installation only in horizontal rows, with plug-in card handle optionally at top or bottom. Close-packed installation in vertical rows is not permitted.

In the standard version, the IP 20 cases always have female connectors type D. For Ex versions A, B and C, only cases with female connectors type F can be used (observe coding).

Important! If tab connectors are used, connectors and covers can be removed by hand; if covers are remvoed, live parts are exposed.

Important! To guarantee type of protection IP 20, please observe: Unused tab connectors must be covered by the enclosed 6.3 mm slot liners (Reference No. 0454848). The slot liners need not be used when type of protection IP 20 is guaranteed by other means.

6.1.4 IP 54 field housing

The housing is protected to IP 54 and is designed for field installation. It must be fastened by the projecting straps (see Figure 11 for spacing between fixing holes) in such a way that the cable glands are underneath. With the housing cover removed the electrical connections can be made at the terminals with wires up to 2.5 mm^2.

6.2 Installing the measuring, output signal and mains leads

Beforde any other connection is made the protective ground terminal shall be connected to a protective conductor.

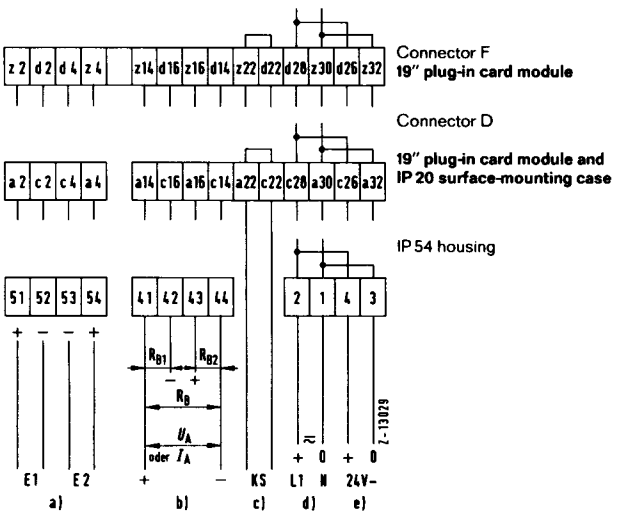
When selecting the lead material and installing the measuring, output signal and mains leads, the requirements of VDE 0100 must be met. For the explosion-proof version, VDE 0165 must also be observed.

The power supply must be disconnectable at all poles. The measuring leads from the primary element to the isolating amplifier must be twisted (length of twist approx. 15 cm). If power lines are located at a distance of less than 1 m from the measuring leads, the measuring leads must be screened. The screening must be provided with insulation. The screen must be grounded at one end.

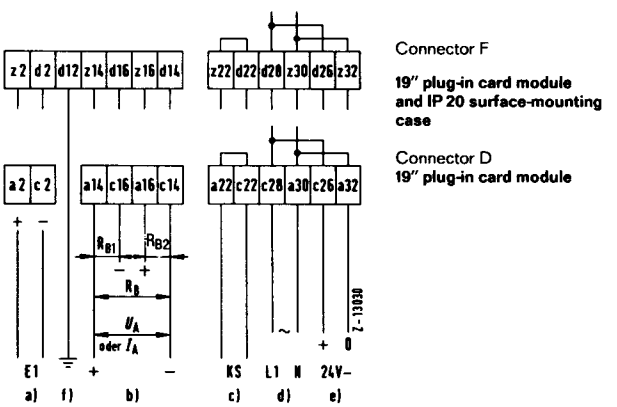
When installing the measuring leads, the Operating Manuals of the relevant primary elements must be followed.

Terminal layout of the measuring (input), output signal and mains leads and the monitoring loop at isolating amplifier TET 106, TET 106-Ex is shown in Fig. 8.

Version without explosion protection (TET 106)



Version with explosion protection (TET 106-Ex)



a) E_1 = Where $U_E > 250$ V connect first input + to 51 and – to 53
E_2 = Second input for sum or difference measurement. E_2 not present in TET 106-Ex

b) Output current or voltage

Permitted load $R_B = \frac{\text{load voltage}}{I_A}$

$R_{B1} = \frac{\text{load voltage} - 4\text{ V}}{I_A}$; $R_{B2} = \frac{1\text{ V}}{I_A}$

(does not apply to TET 106-Ex.C in IP 20 surface-mounting case)

c) Monitoring loop

d) Power supply AC / DC, all voltages except 24 V DC

e) Power supply 24 V DC

f) Only for TET 106-Ex in IP 20 surface-mounting case

Fig. 8 Connection diagrams

7 Commissioning

If a two-way radio is used for communication during commissioning, it must have a transmission power of ≦1 W and be used at a distance of at least 1 m from the transmitter.

7.1 Switching on the unit

The mains voltage can be switched on taking due note of the explosion protection regulations (Section 5). In normal operating conditions the input and output are short-circuit proof. The input and output data of the isolating amplifier are given on the rating plate.

8 Maintenance

The isolating amplifier TET 106, TET 106-Ex requires no maintenance.

Repair work on explosion-proof units

The relevant specifications and requirements such as ElexV, VDE 0105 Part 9, VDE 0110/0111, VDE 0165 etc. must be observed.[1] Repair work on an explosion-proof instrument may be carried out by any person or in any workshop after **removal of the explosion hazard.**

If repairs are carried out on parts or circuits on which the explosion protection depends, before this equipment is returned to operation it must be tested and certified by an expert. This is not necessary if repairs are carried out by authorized personnel of the manufacturer who is able to identify himself with appropriate certification. On completion of the repair work, the date and repairer's mark (e. g. H&B certificate number) must be affixed to the repaired unit.

Work to change the measuring range is excepted from these conditions. This work may be carried out by trained personnel of the user, observing the conditions in Section 9. Note that damage to or short-circuiting of resistors or other components on which the intrinsic safety depends must be avoided under all circumstances. Covering sheets must therefore be used during soldering work.

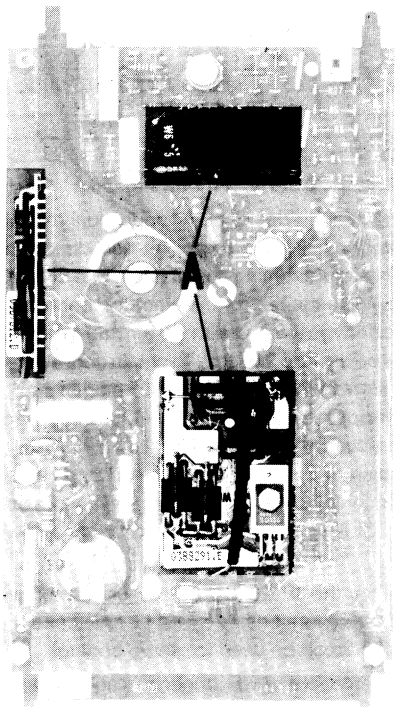


Fig. 9 Soldering operations on TET 106-Ex
A Cover components with a foil

Table of standard ranges

Input signal[2] / Output signal		0...20 mA / 0...20 mA	0...20 mA / 4...20 mA	0...20 mA / 0...10 V	4...20 mA / 0...20 mA	4...20 mA / 4...20 mA	4...20 mA / 0...10 V	0...10 V / 0...20 mA	0...10 V / 4...20 mA	0...10 V / 0...10 V
Resistors on the function amplifier	R1	0	0	0	0	0	0	33 kΩ	33 kΩ	33 kΩ
	R2	0	0	0	0	0	0	33 kΩ	33 kΩ	33 kΩ
	R3	0	0	0	0	0	0	33 kΩ	33 kΩ	33 kΩ
	R4	10 Ω	10 Ω	10 Ω	10 Ω	10 Ω	10 Ω	2 kΩ	2 kΩ	2 kΩ
	R11	0	200 Ω	0	0	0	0	0	200 Ω	0
	R12	0	24 Ω	0	0	0	0	0	24 Ω	0
	R16	0	0	0	1300 Ω	0	1300 Ω	0	0	0
	R17	0	0	0	95 Ω	0	95 Ω	0	0	0
	R19	619 Ω	360 Ω	619 Ω	909 Ω	619 Ω	909 Ω	619 Ω	390 Ω	619 Ω
	R20	43 Ω	30 Ω	43 Ω	43 Ω	20 Ω	43 Ω	43 Ω	24 Ω	43 Ω
Resistors on the motherboard	R32	200 Ω	200 Ω	200 Ω	200 Ω	200 Ω	200 Ω	200 Ω	200 Ω	200 Ω
	R35	51.1 Ω	51.1 Ω	1.2 kΩ	51.1 Ω	51.1 Ω	1.2 kΩ	51.1 Ω	51.1 Ω	1.2 kΩ
	R36	2.32 kΩ	2.32 kΩ	7.5 kΩ	2.32 kΩ	2.32 kΩ	7.5 kΩ	2.32 kΩ	2.32 kΩ	7.5 kΩ
	R37	130 kΩ	130 kΩ	9.1 kΩ	130 kΩ	130 kΩ	9.1 kΩ	130 kΩ	130 kΩ	9.1 kΩ
Connected solder points on the motherboard		14 - 15	14 - 15 16 - 17[3]	14 - 15 26 - 27 28 - 29 31 - 32 34 - 35	14 - 15	14 - 15 16 - 17[3]	14 - 15 26 - 27 28 - 29 31 - 32 34 - 35	14 - 15	14 - 15 16 - 17[3]	14 - 15 26 - 27 28 - 29 31 - 32 34 - 35
Open solder points on the motherboard		11 - 12 13 - 14	11 - 12 13 - 14	11 - 12 13 - 14 22 - 23 24 - 25 29 - 30 32 - 34	11 - 12 13 - 14	11 - 12 13 - 14	11 - 12 13 - 14 22 - 23 24 - 25 29 - 30 32 - 34	11 - 12 13 - 14	11 - 12 13 - 14	11 - 12 13 - 14 22 - 23 24 - 25 29 - 30 32 - 34

Table 2

[1] See note on page 2 regarding the validity of these regulations in other countries.

[2] The diodes D1 ... D4 (type BZX 55- 2.7 V 0.5 W) of the motherboard must be removed when changing the measuring range from current to voltage input. The Z-diodes are necessary when recalibrating from voltage to current input if
a) test jacks exist, or if
b) protection against surge voltage is desired.

[3] For output limitation > 2 mA (Suppl. No. 460)

9 Changing the measuring range and output signal

Subsequent alteration of the measuring range or output signal specified on the rating plate can only be carried out by the user on the version with built-in function amplifier.

See Section 8 regarding work on explosion-proof instruments.

All resistors to be replaced are metal film resistors of DIN size 0207 (unless otherwise specified). Tolerance ± 1%, $\alpha = 50 \cdot 10^{-6}/°C$. Changing the measuring range or output signal is carried out in accordance with Sections 9.1 to 9.3.

To fully utilize the accuracy of the isolating amplifier, only measuring instruments with an error $< \pm 0.1\%$ may be used for adjustment.

All resistors and jumper assignments for changing the standard measuring ranges are listed in Table 2.

9.1 Checking the lower range value

In the event of deviation the output value must be corrected with potentiometer[1] P32. If the range of P32 is insufficient, redefine R11 with a decade.

9.2 Adjusting the upper range value

Apply a measured value corresponding to the upper range value to the input. The changed output signal should appear at the output. In the event of deviation adjust the upper range value precisely with potentiometer[1] P31. If the range of adjustment of P31 is insufficient, change resistor R20. Extend the resistance value by a decade.

Important!

If the adjustment error is to be ≦ 0.2%, it is advisable to bring the isolating amplifier to operating temperature under nominal conditions before accomplishing the fine adjustment with potentiometers P31 and P32. If an error ≦ 0.5% is permitted, warm-up under nominal conditions is not necessary.

The position of all solder points and potentiometers needed for recalibration is shown on the components diagram, Figs. 14, 15 and 18.

9.3 Performance test on version with test jacks

9.3.1 Test jacks for output

The output current and the output voltage of the isolating amplifier can be measured at test jack ⊖.

Internal resistance of measuring instrument:
Current ≦ 10 Ω
Voltage ≧ 10 kΩ

9.3.2 Test jacks for input and measure/test selector switch

The input variable can be measured at test jacks ⊕ (Maximum measuring range or series voltage resp. 60 VDC).

For current as voltage drop 0...200 mV. For voltage the input voltage is measured directly.

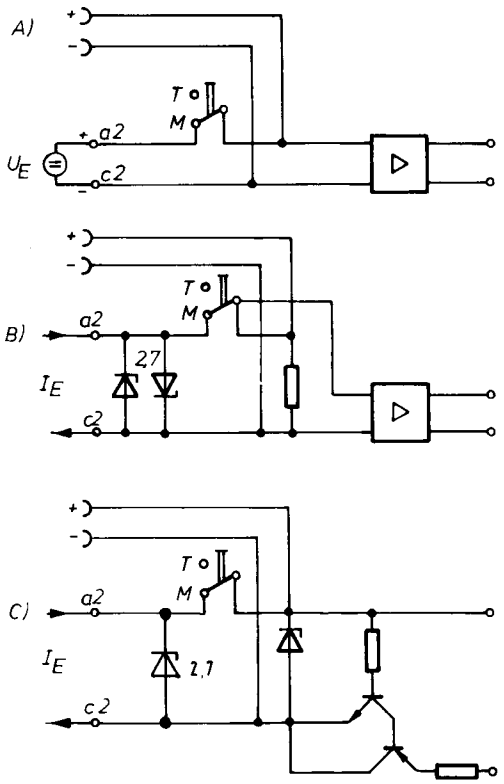
Internal resistance of measuring instrument > 1 MΩ.

9.3.3 Checking the measuring range adjustment

If the adjustment of the isolating amplifier is to be checked, switch from measure to test (M → T), apply the input signal at jack ⊕ and measure the output signal at jacks ⊖.

[1] An insulated screwdriver must be used.
Only valid for version with preamplifier.

Input test jacks



A = voltage input
B = Current input with function amplifier
C = Current input without function amplifier

Output test jacks

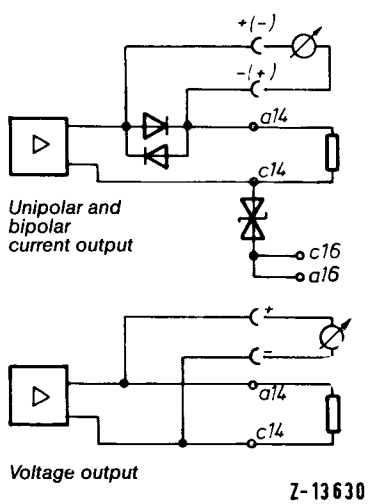


Fig. 10 Test jack circuits

10 Fault finding

⚠ Any interruption of the protective conductor inside or outside the apparatus or disconnection of the protective ground terminal is likely to make the apparatus dangerous. Intentional interruption is prohibited.

- 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 for any adjustment, replacement, maintenance or repair.
- Any adjustment, maintenance and repair of 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.
- Make sure that only fuses with the required rated current and of the specified type are used for replacement. The use of makeshift fuses and short circuiting the fuse holder is prohibited. -
- Whenever it is likely that the protection has been impaired, the apparatus shall be made inoperative and be secured against any unintended operation.

If faults occur, the cause should initially be sought at the primary element and its lead wires. For voltage measurements, this should be done by testing for continuity and rechecking the measured voltage with a suitable measuring instrument, e.g. a portable compensator. Then test the signal circuit (standard: 20 mA circut) by connecting an ammeter. If the input and output circuit to the isolating amplifier are functioning correctly, the fault must be sought in the electronics of the unit.

This fault can be eliminated using the schematic circuit diagram (Fig. 15) or by replacing the circuit board.

11 Packing instructions

If the original packing is no longer available, the isolating amplifier 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 10 cm on all sides.

For overseas shipment the isolating amplifier 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 bitumen paper.

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

12 Spare parts

The isolating amplifier TET 106, TET 106-Ex contains no components subject to wear.

The Components Data Sheet is available from the manufacturer for identifying spare parts. This gives designations and Catalog Nos. (B-Nr.) to be specified in the order to the spare parts service of the manufacturer.

Whenever ordering spare parts or making complaints, please state the P no. and serial no. given on the rating plate.

Note

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. (B-Nr.) is the sole criterion.

Common components

		g. approx.	Catalog No.
Switching controller	220 V AC	150	11304-4-0387367
	110/127 V AC	150	11304-4-0387368
	48/60 V DC[1]	150	11304-4-0387369
	24 V AC/DC	150	11304-4-0387370
	220 V DC[1]	150	11304-4-0387400
	110 V DC[1]	150	11304-4-0388470
	24 V DC	150	11304-4-0388720
Fuse	M 0.4 C	1	94382-4-0882500
	M 0.16 C	1	94382-4-0881475
	M 0.125 C	1	94682-4-0864873
	M 0.063 C	1	94382-4-0882497
	M 0.032 C	1	94382-4-0881525
Transformer A 22 for suppply voltage		90	11304-4-0387851
Transformer A 18 for electrical isolation		80	11304-4-0388636
Bipolar output stage		30	11304-4-0387849
Change-over switch, measuring-testing		5	94682-4-0804634

19" design

Base plate with plug D	150	11304-4-0387847
Base plate with plug F	150	11304-4-0387812
Operational amplifier	30	11304-4-0387848
Operational amplifier Ex	35	11304-4-0388866
Ex ib voltage limitation Power supply	10	11304-4-0387622
Current limitation, output Ex	10	11304-4-0388291
Test jack for input or output	5	94682-4-0862420
Fuse with rubber covering M 0.16 C	1	11304-4-0387652

[1] not for TET 106-Ex

Cover with front panel for TET 106[2]		
without opening	40	11304-4-0388909
with P	40	11304-4-0388910
with P + J + C	40	11304-4-0388911
with P + O	40	11304-4-0388912
with P + J + C + O	40	11304-4-0388913
Cover with front panel for TET 106-Ex[2]		
with P	40	11304-4-0388937
with P + J + C	40	11304-4-0388938
with P + O	40	11304-4-0388939
with P + J + C + O	40	11304-4-0388940
Covercap for pin-connector		
Type A	Set of 1	11391-4-0365276
	Set of 5	11391-4-0365277
Type B	Set of 1	11391-4-0365278
	Set of 5	11391-4-0365484

Design IP 54

Base plate	150	11304-4-0388624
Operational amplifier	30	11304-4-0387813
Case IP 54	520	11304-4-0835507
Test jack for input or output	5	94682-4-0805977

[2] P = Opening for potentiometers
J = Opening for input test jack
C = Opening for change-over switch
O = Opening for output test jack

Surface mounting case IP 20 (weight approx. 350 g)

Connection	Power supply	Catalog No.
for TET 106 with plug connector D		
Tab connectors	all U_H	11304-4-0389176
Terminals	all U_H	11304-4-0389175
for TET 106-Ex, B with plug connector F		
Tab connectors	24 V DC	11304-4-0340246
Tab connectors	24 V AC/DC	11304-4-0340247
Tab connectors	110 V AC	11304-4-0340248
Tab connectors	127 V AC	11304-4-0340249
Tab connectors	220 V AC	11304-4-0340250
Terminals	24 V DC	11304-4-0340258
Terminals	24 V AC/DC	11304-4-0340259
Terminals	110 V AC	11304-4-0340260
Terminals	127 V AC	11304-4-0340261
Terminals	220 V AC	11304-4-0340262
for TET 106-Ex, C with plug connector F		
Tab connectors	24 V DC	11304-4-0340276
Tab connectors	24 V AC/DC	11304-4-0340277
Tab connectors	110 V AC	11304-4-0340278
Tab connectors	127 V AC	11304-4-0340279
Tab connectors	220 V AC	11304-4-0340280
Terminals	24 V DC	11304-4-0340270
Terminals	24 V AC/DC	11304-4-0340271
Terminals	110 V AC	11304-4-0340272
Terminals	127 V AC	11304-4-0340273
Terminals	220 V AC	11304-4-0340274
for TET 106-Ex, D with plug connector F		
Tab connectors	24 V DC	11304-4-0340252
Tab connectors	24 V AC/DC	11304-4-0340253
Tab connectors	110 V AC	11304-4-0340254
Tab connectors	127 V AC	11304-4-0340255
Tab connectors	220 V AC	11304-4-0340256
Terminals	24 V DC	11304-4-0340264
Terminals	24 V AC/DC	11304-4-0340265
Terminals	110 V AC	11304-4-0340266
Terminals	127 V AC	11304-4-0340267
Terminals	220 V AC	11304-4-0340268

13 Dimensional drawings (dimensions in mm)

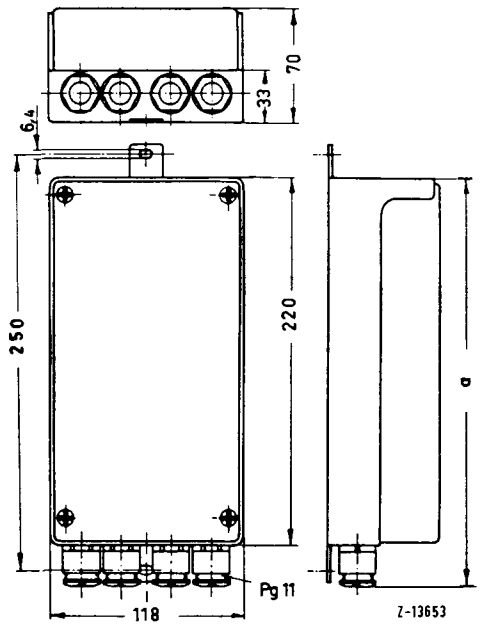


Fig. 11 IP 54 field housing

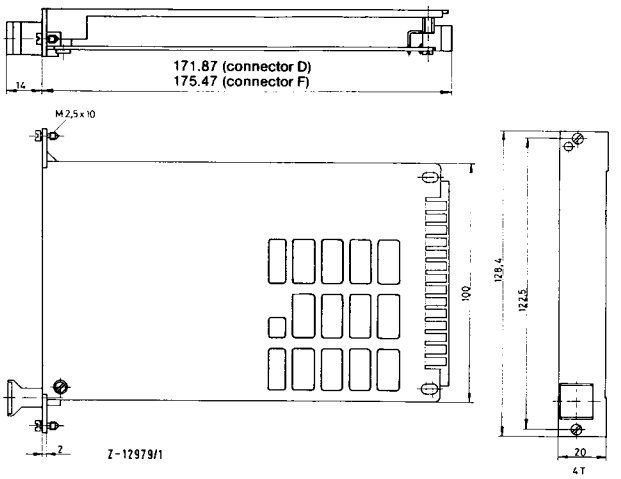


Fig. 13 19" plug-in card module

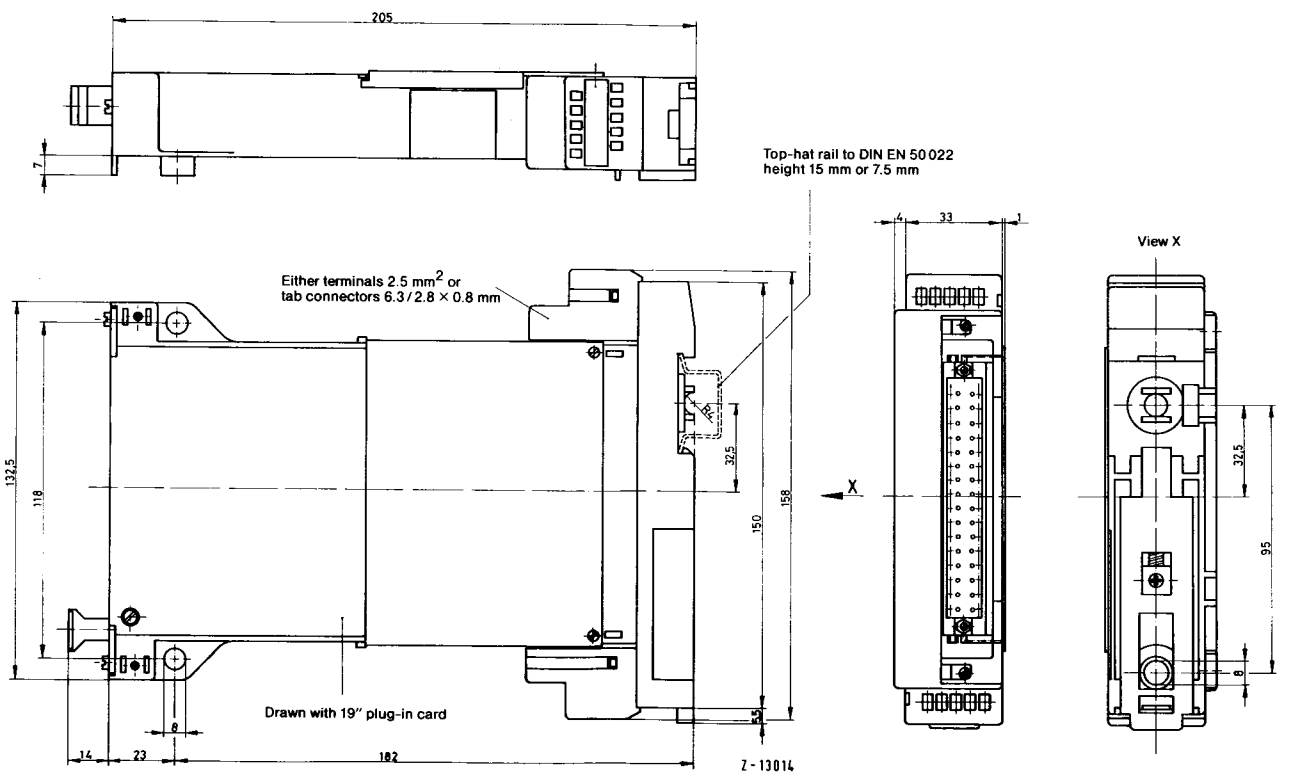
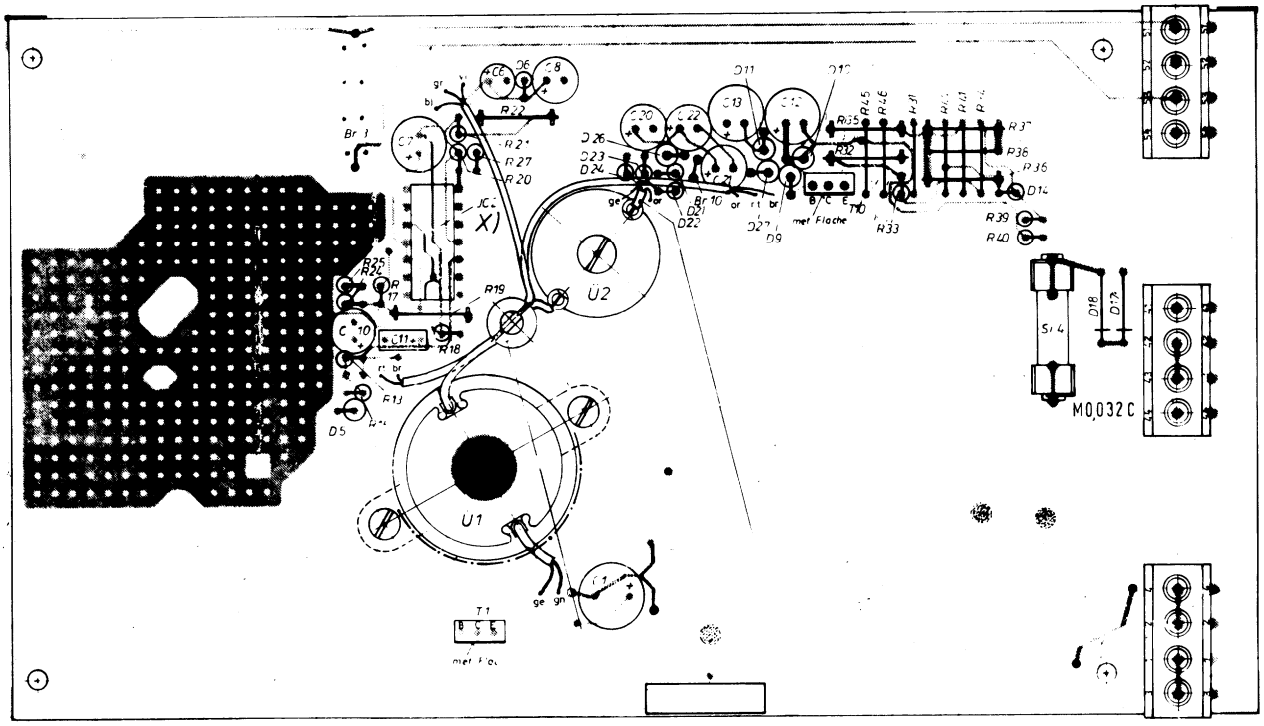


Fig. 12 IP 20 surface-mounting case

14 Circuit boards



6-4831 Bl. 1 (1) "7"

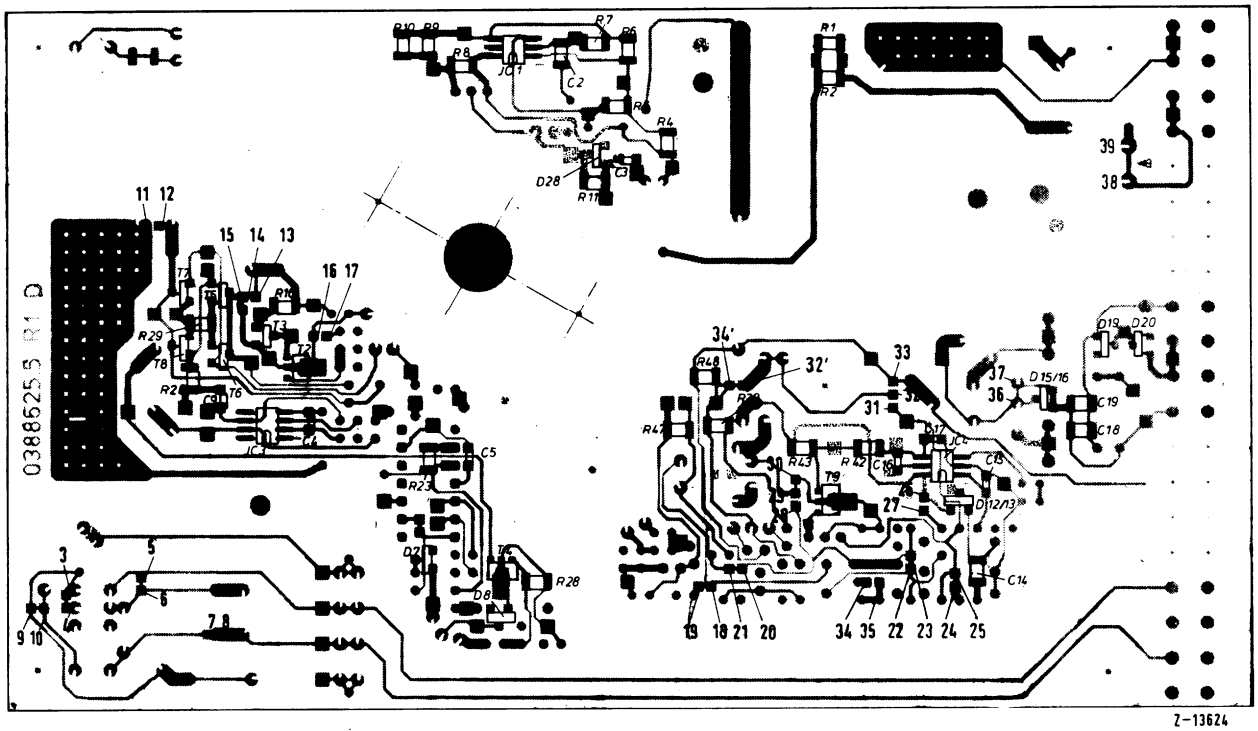
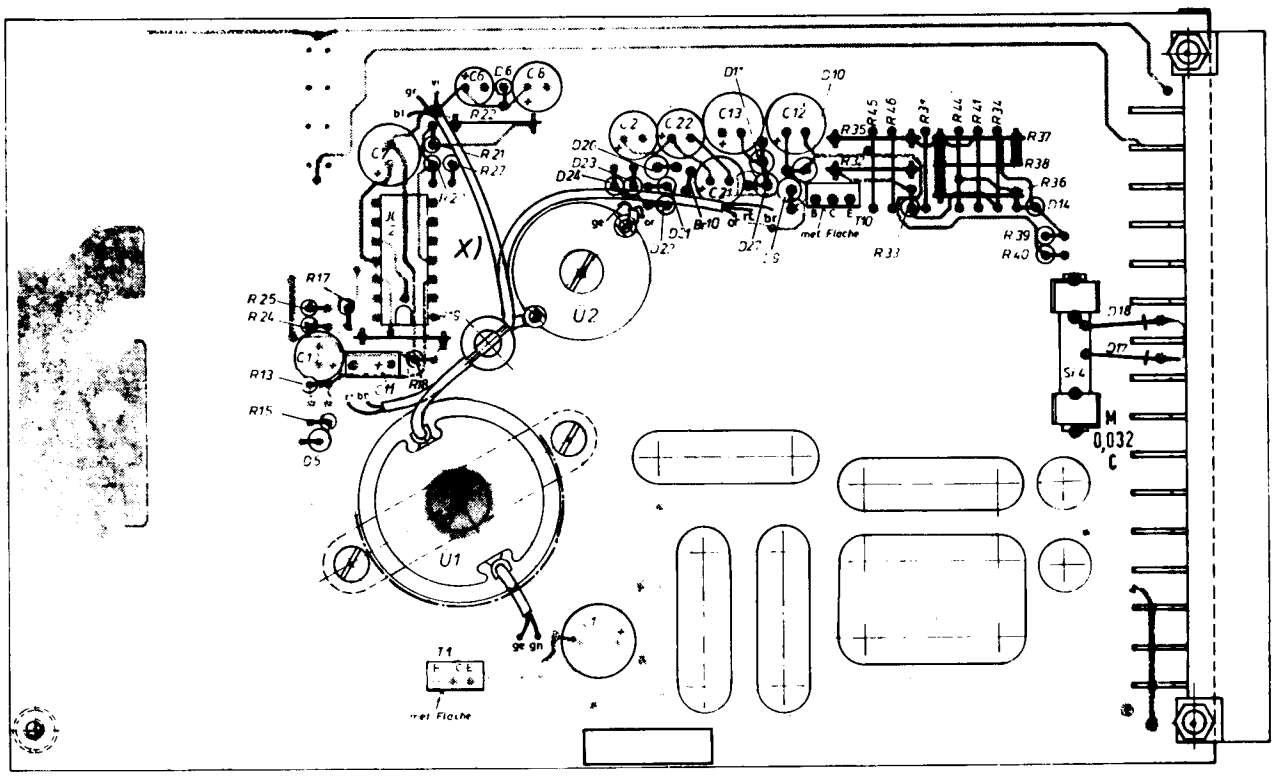


Fig. 14 Motherboard for IP 54 version



6-4831 Bl. 2 (1) "7"

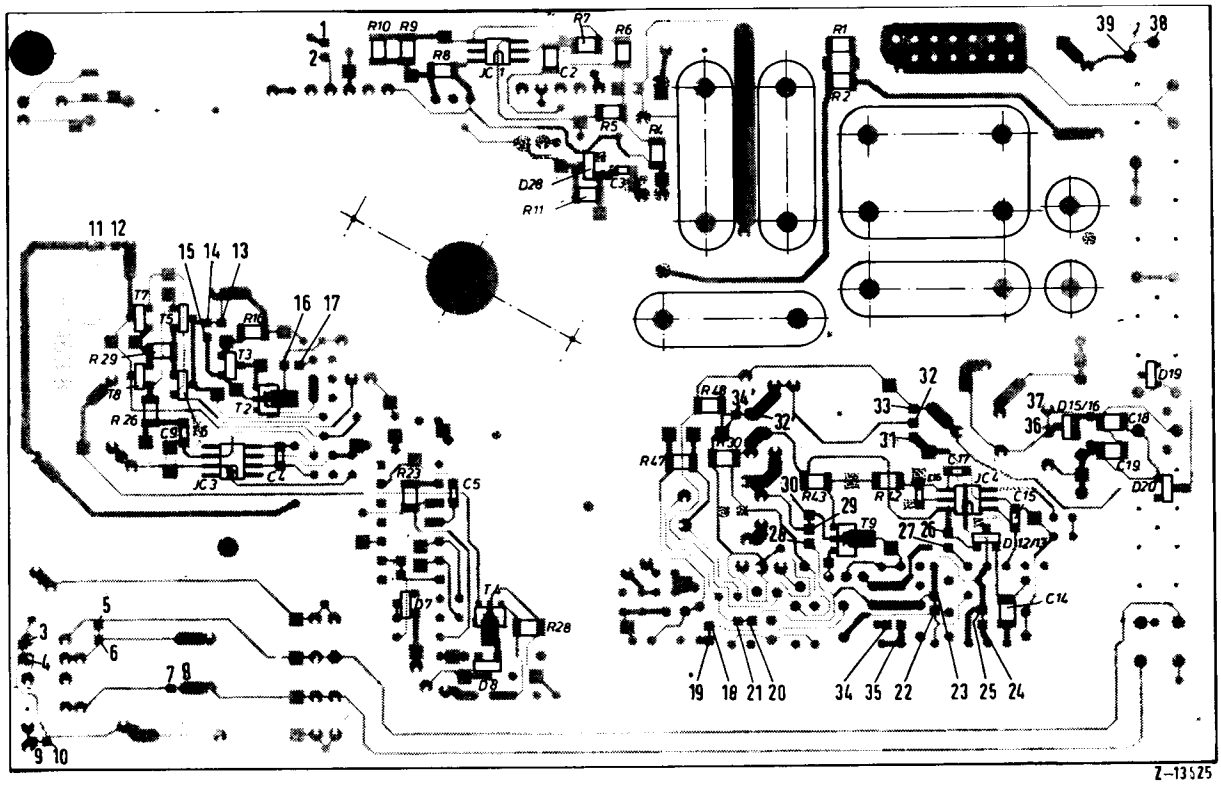


Fig. 15 Motherboard for 19" version

15 Schematic circuit diagrams

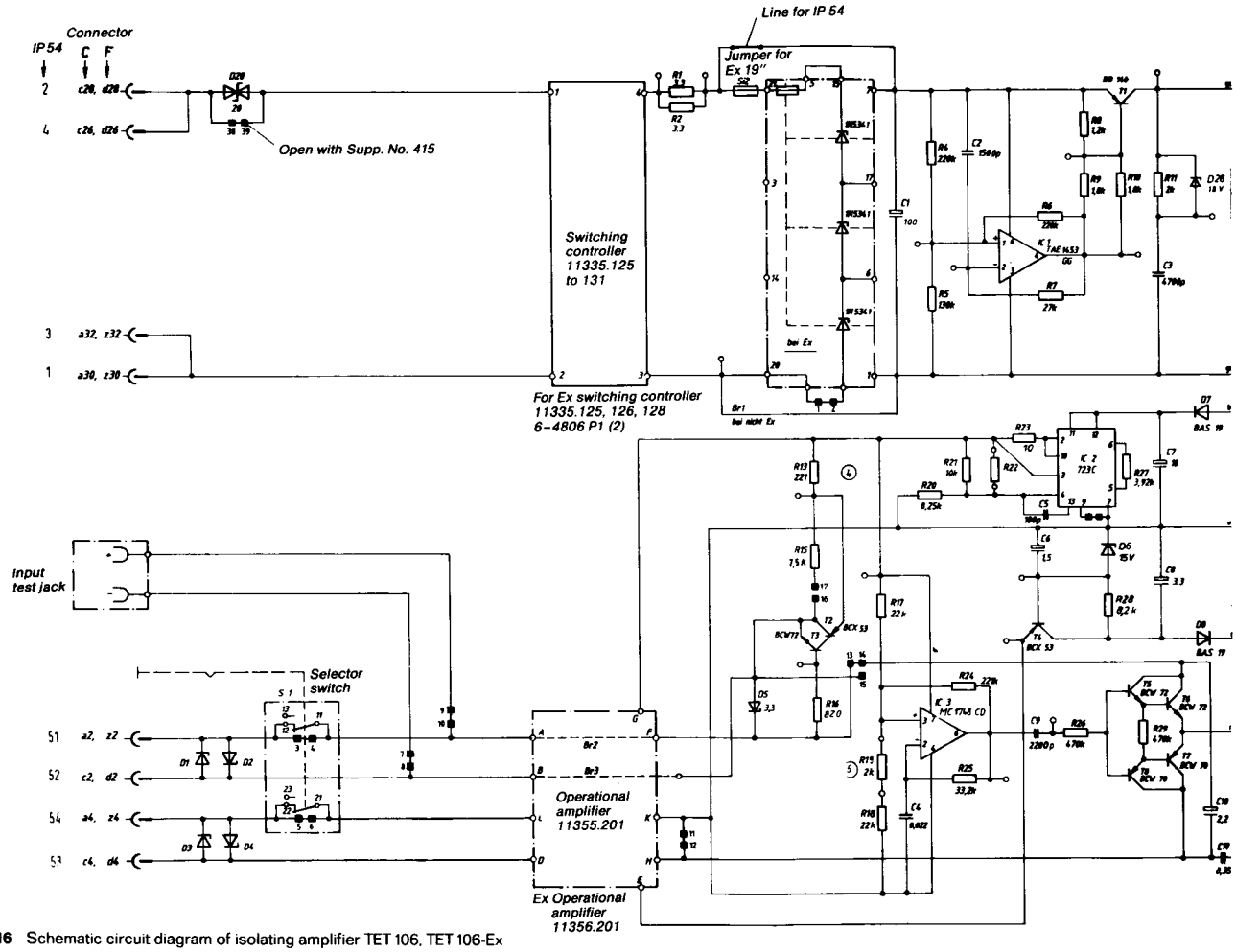
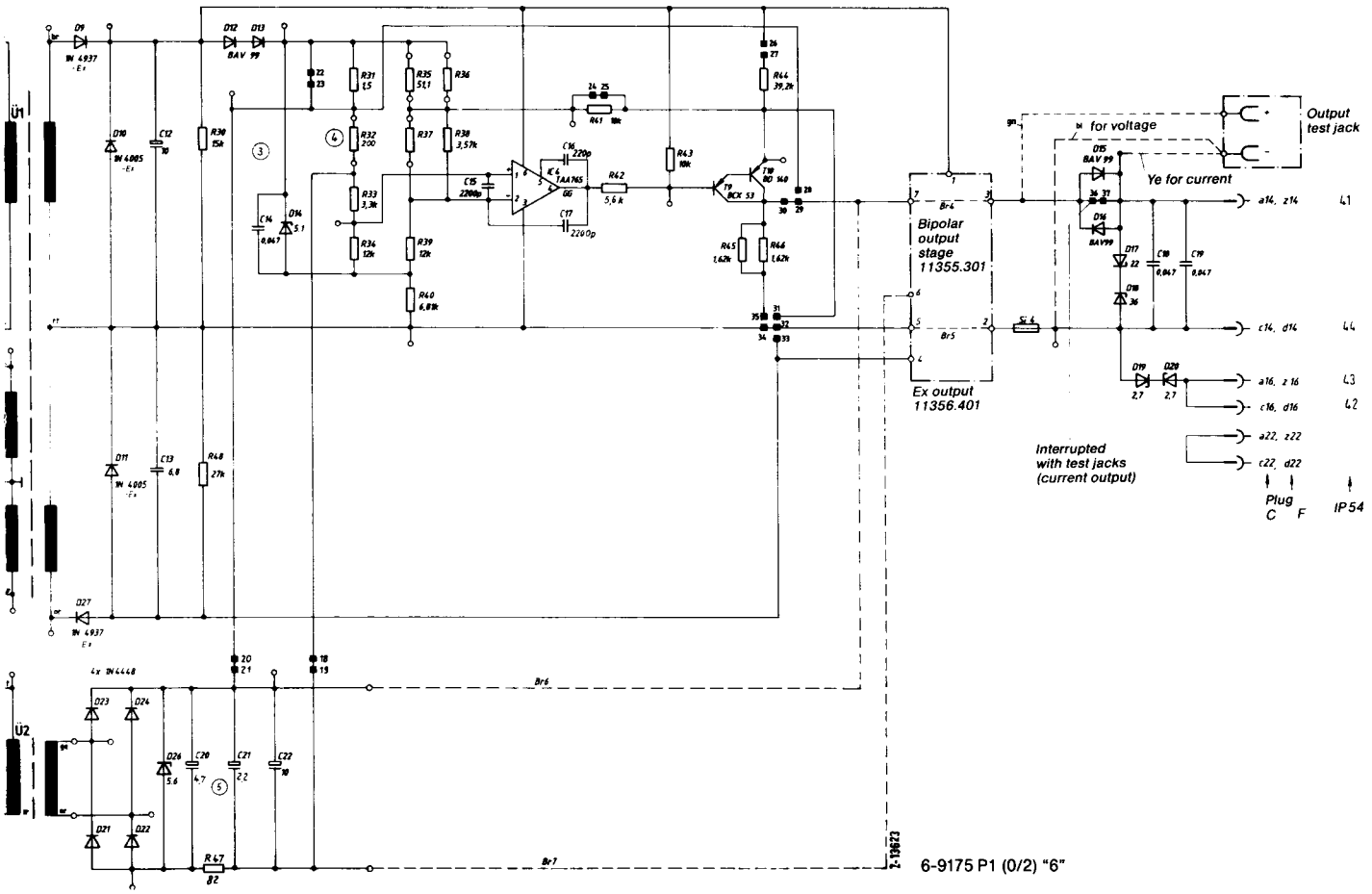


Fig. 16 Schematic circuit diagram of isolating amplifier TET 106, TET 106-Ex


Output test jack
for voltage
Ye for current
Bipolar output stage 11355.301
Ex output 11356.401
Interrupted with test jacks (current output)
Plug C F
IP54
a14, z14
c14, d14
a16, z16
c16, d16
a22, z22
c22, d22
41
44
43
42
4x IN 4448
R47 82
Br4
Br5
Br6
Br7
2-13673

6-9175 P1 (0/2) "6"

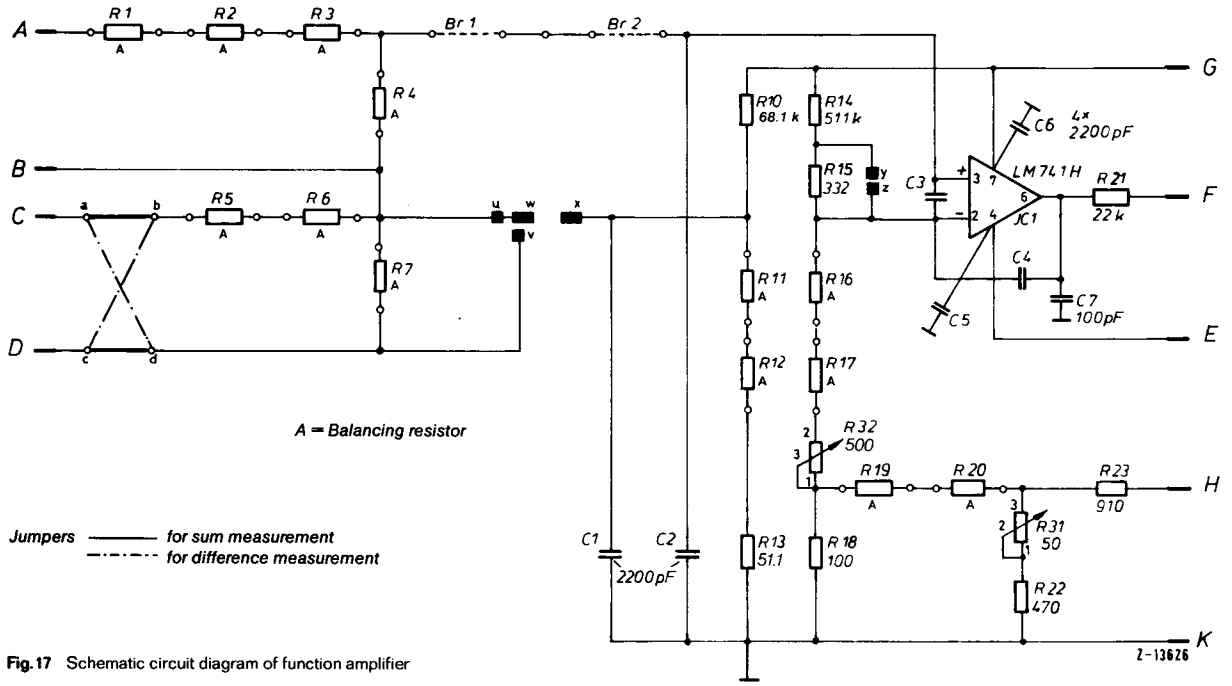
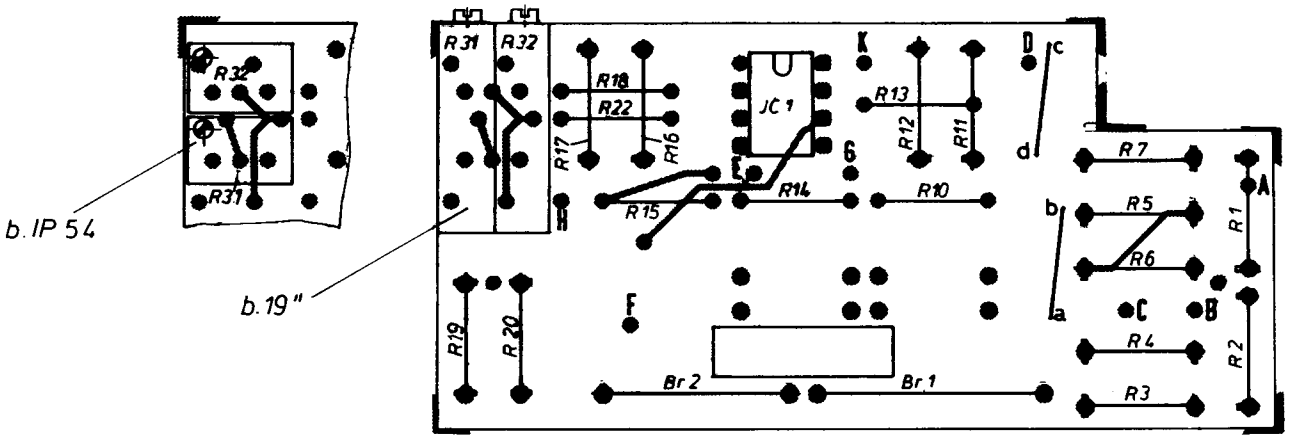


Fig. 17 Schematic circuit diagram of function amplifier

0387848.8 P1 (3) "2"



Jumpers for	
sum measurement	difference measurement
a – c c – d	a – d c – b

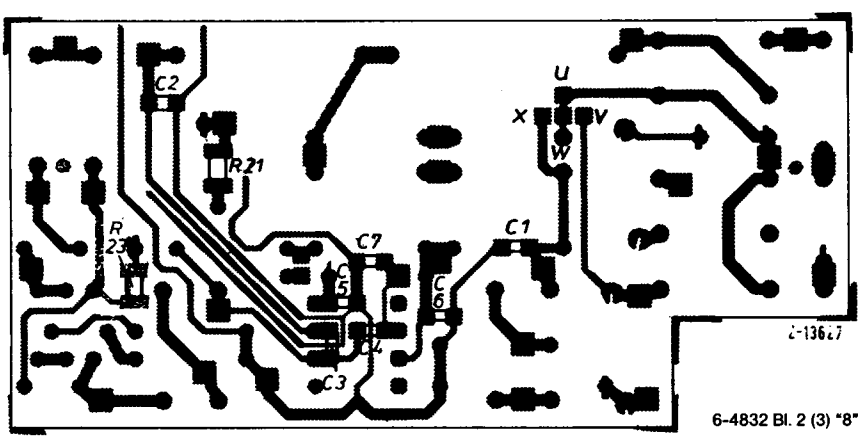


Fig. 18 Function amplifier circuit board

6-4832 Bl. 2 (3) "8"

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