TGU5, TGU5-Ex

Transmitter
for angular position

Operating Instructions 42/14-32 EN Rev. 05

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Important instructions!
They must absolutely be read and obeyed!

Proper and safe operation of the TGU5 (-Ex) transmitter presupposes that it is correctly transported and stored, installed and commissioned by experts and carefully operated and maintained.

Only those persons conversant with the installation and commissioning of similar equipment and who possess the necessary qualifications may work on the apparatus. They must observe the contents of these Operating Instructions and the relevant safety regulations for installation and operation of electrical apparatus.

This apparatus has been designed and tested in accordance with IEC 1010-1 (according to DIN EN 61010-1 and DIN VDE 0411 part 1) „Safety requirements for electrical measurement, control and laboratory equipment", and has been supplied in a safe condition. To retain the apparatus in safe condition, the safety instructions with the title „DANGER", „WARNING", „CAUTION" or „NOTICE" in these Operating Instructions must be observed. Failure to comply with these safety instructions can result in death, severe bodily injuries and considerable damage to the apparatus itself or to other equipments.

Should the information given in these Operating Instructions prove to be inadequate at any time please consult the Technical Branch Office, subsidiary, or representative of ABB in your area.

The industrial standards and regulations (e.g. DIN, VDI, VDE) as well as the directives, specifications and requirements governing explosion protection (e.g. ElexV, EX-RL, VDE, DIN EN) referred to in these Operating Instructions are valid in Germany. When using this device in other countries the appropriate and valid national regulations must be observed.

Technical description

1 Application

The transmitter types TGU5 and TGU5-Ex are used for the analog measurement of angular positions. The angular position is converted into a proportional load-independent direct current so that the measured values can be transferred without line balancing, even over large distances.

The type TGU5 or TGU5-Ex is particularly suitable for attachment to angular position sensors producing only a small torque, e.g. scales or float flowmeters. Evens small length changes can be measured by means of a coupling lever.

2 Technical Data

Measuring ranges

Standard measuring ranges

min. 0°... 9°/max. 0°... 11°, set to 0°... 10°
min. 0°... 27°/max. 0°... 33°, set to 0°... 30°
min. 0°... 54°/max. 0°... 66°, set to 0°... 60°
min. 0°... 81°/max. 0°... 99°, set to 0°... 90°
min. 0°...162°/max. 0°...198°, set to 0°...180° 2)
min. 0°...243°/max. 0°...280°, set to 0°...270° 2)
0°...310°, set to 0°...310° 2)

Special measuring ranges (final value adjustment range)

min. 0°... 7,5° /max. 0°... 17° 1)
min. 0°... 15° /max. 0°... 75° 1)
min. 0°... 60° /max. 0°...165° 1)
min. 0°...150° /max. 0°...280° 2)
min. 0°...220° /max. 0°...310° 2)

Final value in adjustment range ±10 % adjustable with potentiometer.

1) Clockwise rotationand anti-clockwise rotation (looking at the shaft): increasing output current

2) Clockwise rotation: increasing output current; anti-clockwise rotation: see Data Sheet

Shaft
∅ 3mm, can be freely rotated

Torque required
approx. 0,15 Ncm

Zero
Approx. ± 5 % adjustable (referred to the output span)

Output and power supply

(see Table 2-2)

Non-linearity
< 1 % (referred to the output span)

Response time
< 50 ms (jump 0 %...100 %)

Long-term influence
< 0.2 % / year

Residual ripple (peak-peak)
Output signal < 1 %
Power supply < 1.5 V

General and safety data

Environment conditions
See Table 2-1

Version	Degree of protection of housing to DIN 40050	Application class to DIN 40040	Required torque
TGU5	IP 30/IP00[2)]	HQE	ca. 0,15 Ncm (15 cmp)
TGU5-Ex		HSE	

Table 2-1 [2)] At cable end

Table 2-2 Output and power supply

Electrical isolation	Power supply U_s	Max. current supply	Max. load	2-wire connection	3-wire connection	4-wire connection	Jumper Br3
without (only Ex version)	12...20 V DC	24 mA	$\frac{(U_S - 12V)}{I_A}$	4...20 mA	–	–	open
without	13.2...36 V DC	24 mA	$\frac{U_S - (13,2V)}{I_A}$	– – – 4... 20 mA	0... 5 mA 0...10 mA 0...20 mA	0... 5 mA 0...10 mA 0...20 mA[3] 4...20 mA[3]	closed closed closed open
without	13.2...26.4 V AC	24 mA	$\frac{U_S - (13,2V)}{I_A} \times 1,4$	– – – –	– – – –	0... 5 mA 0...10 mA 0...20 mA[3] 4...20 mA[3]	closed closed closed open
with	13.2...36 V DC	100 mA	600 Ω	– – – –	– – – –	0... 5 mA 0...10 mA 0...20 mA[4] 4...20 mA[4]	closed closed closed open
with	13.2...26.4 V AC	100 mA	600 Ω	– – – –	– – – –	0... 5 mA 0...10 mA 0...20 mA[4] 4...20 mA[4]	closed closed closed open

3) only version V1443xA-xx7xxxx

4) only version V1443xA-xx73xxx

Ambient temperature

-25 °C...+80 °C

Transportation and storage temperature

-40 °C...+80 °C

Relative humidity

< 75 % annual average, occasional condensation permitted

Mechanical stress capabilities

Tested to DIN IEC 68-2-27 and 68-2-6

Impact: 50g/11 ms
Vibration: 5g/± 10 mm/5...150 Hz

EMC

Interference immunity acc. to NAMUR recommendation for industrial standard in 2-wire circuit

Connection, housing, mounting and safety

Electrical connections

Screw terminals for 2.5 mm²
or plug connection Han 7 D (not for Ex)
4-conductor ribbon cable 150 mm long

Mounting orientation

any

Test voltage to IEC 1010-1

(according to DIN EN 61010-1 and DIN VDE 0411 part 1)

Material of housing

Salt-water-proof cast aluminium
Surface anodized
Plastic cover

Weight

approx. 0.2 kg

Explosion protection

see Chapter 8, page 25.

3 Method of operation

Functional diagram see Fig. 3-1.

The transmitter TGU 5, TGU 5-Ex converts the angular position of its shaft contactless and practically reaction-free into a load-independent direct current signal. It comprises a differential capacitor, situated on ball bearings, and a capacitance jumper with a amplifier connected downstream. The angular position of the primary detector is transferred by means of a mechanical coupling to the rotor of the differential capacitor (1). The oscillator (2) supplies the differential capacitor with alternating voltages with phase displacement of 180° by virtue of 2 constants. An alternating voltage is produced at the differential capacitor. This voltage is proportional to the angular position and is passed on to the preamplifier (4) via coupling capacitor (3).

The alternating voltage, proportional to the angular position, is standardized to 1 V peak-peak in the preamplifier and rectified into an 0.9 V direct voltage in the rectifier (5) and finally in amplifier (6) converted into a load-independent direct current of 4...20 mA or 0...20 mA, 0...10 mA, 0...5 mA.

The lower range value is roughly adjusted by turning the rotor with respect to the stator. Fine electrical adjustment of the lower range value (zero adjustment) as well as the end of measurement (span adjustment) is effected with potentiometers R24 and R25.

The voltage source (7) supplies all circuits mentioned. The constant current source (8) is connected in series to the voltage source. From the former's constant current 4 mA, the complete circuit is supplied on one hand, and on the other hand, elevation of zero to 4 mA is implemented in the case of a 2-wire circuit by interconnection with the output current.

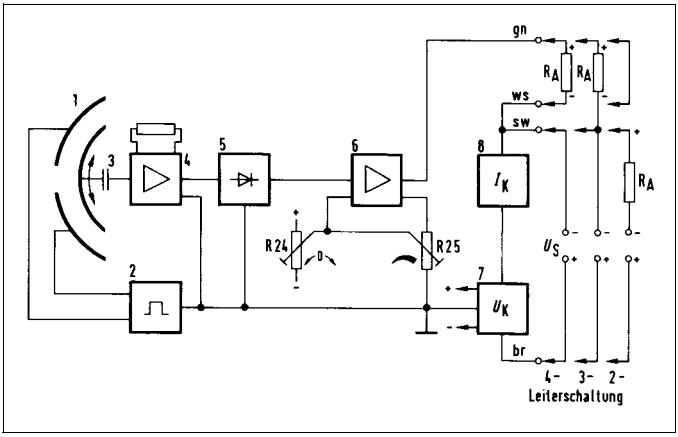

Fig. 3-1 Functional diagram

1 Dlfferential capacitor
2 Oscillator
3 Coupling capacitor
4 Preamplifier
5 Rectifier
6 Amplifier
7 Voltage source (U_k)
8 Constant current source (I_k)
R_A Load
U_S Power supply

4 Construction

The transmitter for angular position consists of the independing measuring modules and case.
The measuring module comprises the subassemblies:
– Differential capacitor (capacitor)
– Electronics circuit board (electronics) with 4-wire connecting line and extra printed circuit board for strain relief.

The subassemblies are mounted on a plastic flange by means of 3 set srews.

Differential capacitor

Depending on the adjustable measuring range (see Table 4-1) there are 5 standard capacitor tapes K1...K5.
The rotor (lug) of the differential capacitor has ball bearings.
The free end of the shaft has a diameter of 3 mm and projects from the flange.
The lug turns between the two circular-shaped stator plates of the capacitor. The angular position is pecked up contactlessly by the lug and transferred to the electronics by a coupling capacitor which can be rotated.

Capacitor type K1	from 0°... 7,5° to 0°... 17°
Capacitor type K2	from 0°... 15° to 0°... 75°
Capacitor type K3	from 0°... 60° to 0°...165°
Capacitor type K4	from 0°...150° to 0°...280°
Capacitor type K5	from 0°...220° to 0°...310°

Table 4-1 Adjustable measuring range

The electronics contain:
– The potentiometer for adjusting the lower range value (zero R24) and end of measurement (span R25).
– The jumpers Br3 and Br/R10 for adjusting the output current.
– The resistors R39, R40 for matching the electronics to the selected measuring range (capacitor type).
– The 4-wire, 150 mm long connecting line with an extra pcb for strain relief.

The components for power limitation are situated on the extra pcb in the housing of instruments protected against explosions.

Housing with cover

The housing consists of a cylindrical cup, on the bottom of which the free shaft end of the measuring module, which is secured with 3 screws, projects. The power transistor of the electronics is srewed for cooling purposes by means of a single screw on the housing side.

The potentiometer for lower range value (zero) and upper range value (span) are accessible through hole in the housing cover which is fitted into a circumferential groove.

The transmitter can be fastened to the angular position sensors by means of brackets in the circumferential groove on the housing bottom or by means of 3 screws to threaded holes which are situated on the frontside, offset by 120°.

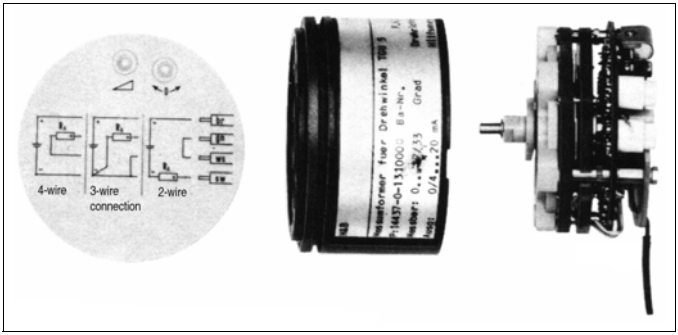

Fig. 4-1 Transmitter construction

5 Mounting and connection instructions

5.1 Unpacking the instrument

The transmitter is shipped in packaging that protects it, particularly, its shaft from damage. The transmitter should remain in this packaging until mounted.

5.2 Mounting location

The transmitter can be attached to the angular position sensor in any position, care being taken that the potentiometers situated on the rear for electrical adjustment of lower range value and upper range value can be operated.

5.3 Direction of rotation

The direction of rotation given on the rating plate is to be understood as looking at the shaft. By turning right or left, the transmitter produces an increasing output signal.

5.4 Mounting the transmitter

The transmitter is to be attached to the angular position sensor in such a manner that the shafts of both instruments are in alignment as much as possible.

The shafts must not be rigidly joined to one another, rather the connection must be free of forces and backlash.

This coupling should allow axial, parallel and angular offset of the shafts.

The transmitter is fastened by means of 3 or 4 small angle brakkets,

which are to be fitted in a circumferential groove on the transmitter case, either directly or by means of an intermediate flange to rotate on the angular sensor. The case is lathed on the face to a diameter of 54 mm, in order to enable precise centering. The intermediate flange and angular position sensor should likewise have corresponding centering surfaces. Otherwise, suitable centering tools must be used.

The threaded holes M4 for the screws of the angle brackets should be evenly distributed on a hole-circle diameter.

Direct fastening is also possible, using three threaded holes (hole-circle diameter 43 mm) located on the case bottom.

Fig. 5-1 Marking the lower range value (zero) on the housing

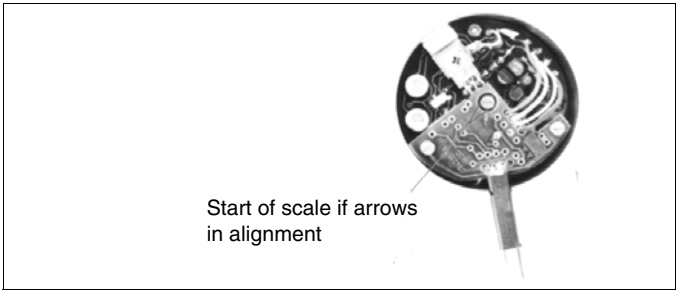

Fig. 5-2 Lower range value (zero) marking at shaft end

5.5 Electrical connection

Electrical connection is made at the 4-wire connecting line.
The direct voltage source must dispose of adequate filtering (permissible residual ripple < 1.5 V peak-peak) of the supply voltage.

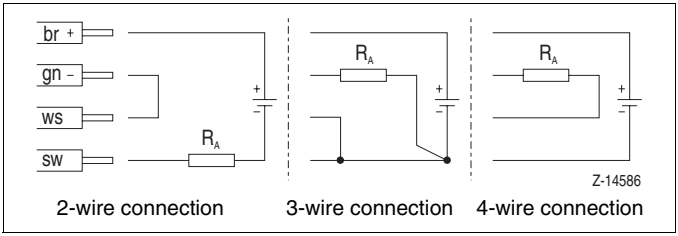

Fig. 5-3 Connection diagram
br = brown / gn = green / ws = white / sw = black

Note

The transmitter may only be operated with low functional voltages having a safeguarded separation vis-à-vis the greater mains voltage.

See Chapter 2, page 5 for nominal-mains voltage and permissible load.

If the supply voltage is incorrectly poled, the transmitter is not damaged, however it does not produce any output signal.

5.6 Grounding

The case, projecting shaft and one of the 4 connecting lines may be grounded.

The electronics and differential capacitor are electrically isolated from the housing.

5.7 Protection against overvoltage transients

Overvoltage transients and interference pulses are created for example, when switching capacitive or inductive loads, in static converter systems etc. and can be coupled in the transmitter leads electrically, capacitively or inductively. The amplitude and/or slope steepness of such interferences can be so great that particularly semiconductor elements in electronic circuits can be destroyed.

The transmitter is designed for overvoltage transients up to 1 kV; 1.2/50 µs, source resistance 500 Ω. For adequate protection against overvoltages deriving from atmospheric discharges (lightning), special precautionary measures, e.g. overvoltage barriers should be provided.

6 Commissioning

With the type of connection selected acc. to section 5.5, preliminary commissioning for adjustment of lower range value (zero) and upper range value (span) takes place. A test instrument, class ≤0.5 indicating the output current is to be used.

The transmitters are set at the factory (if not stated otherwise on the rating plate) to 0...20 mA output signal and have 3 or 4-wire connection.

The output signal can be changed to 4...20 mA for 2-wire connection by replugging jumper Br3 (see section 7.1).

6.1 Setting the lower range value (zero adjustment)

The angular position sensor, on which the transmitter is mounted acc. to section 5.4, is brought into the position in which the output current of the transmitter should have the starting value of 0 or 4 mA.

Remove plastic plugs in housing cover so as to be able to operate the potentiometers.

Direction of action of potentiometers referred to the output signal:

Start of scale 

End of scale 

Turning left: current decreases,
Turning right: current increases

Coarse adjustment of the start of scale (zero).
The potentiometer for the starting value is in the center position. Observe the remarks on Fig. 5-1 and Fig. 5-2.

– When mounting the transmitter by means of the angle brackets, having loosened the brackets the transmitter case can be turned until the output current increases to somewhat more than 0 or 4 mA.
– When mounting directly the transmitter case cannot be turned. Here the transmitter shaft must be turned with respect to the loosely plugged coupling until the output current increases to somewhat more than 0 or 4 mA. The transmitter shaft can be turned with a spanner (width: 5.5 mm, thickness ≤2 mm).

If the angular position sensor is turned slightly against the direction of operation, the output current must increase uniformly.

Having carried out adjustment, tighten the angle brackets or coupling and set lower range value precisely with the potentiometer.

6.2 Setting the upper range value (span adjustment)

The angular position sensor is brought into the position in which 100 % output current (5 mA, 10 mA, 20 mA) should flow.

Then the output current is set with the potentiometer for upper range value to 100 %.
If it is not possible to set the angular position sensor to the upper range value, balancing of the span on the transmitter can be omitted as long as the angle of rotation to be measured precisely corresponds to that of the transmitter as indicated on the rating plate and no changes were made

on the zero-adjust and span adjust potentiometers.
After balancing replace the plastic plugs in the potentiometer holes of the case cover.

7 Changing the output signal, measuring range or direction of action

7.1 Changing the output signal

Table 7-1 shows how the output signal can be changed with jumper Br3 and fixed resistor R10 (metal-film resistance ±1 % var. 0207) .

Output signal	Type of connection (see Chapter 5.5)	Jumper Br3	Resistor Br/R10
0...20 mA	3 or 4-wire connection	closed	jumper
4...20 mA	2 or 4-wire connection	open	jumper
0...10 mA	3 or 4-wire connection	closed	51.1 Ω
0... 5 mA	3 or 4-wire connection	closed	154 Ω

Table 7-1

Note

Electric elevation of lower range value (zero) to 4 mA is required for 4-wire connection with output signal 4...20 mA.
These instruments are designated with Code No. 370 on the rating plate and **cannot** be changed to 0...20 mA by replugging jumper Br3 and cannot be operated in 2-wire connection.
If in transmitters with output signal 0...20 mA in 3- or 4-wire connection the lower range value (zero) is set to 4 mA by turning the shaft (output signal 4...20 mA), the span is shortened by approx. 20 %.

Connection lines to the capacitor differential.
Ilustrated, turning reight, if turning left (K4 and K5) the lines are crossed

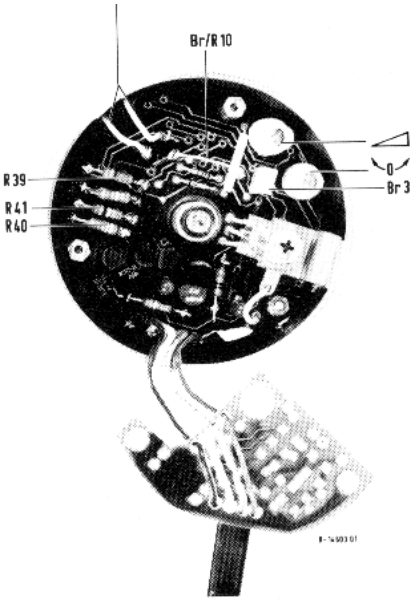

Fig. 7-1 Position of Br/R10, BR3, R40, R39

Jumper Br3 repluggable

open		4...20 mA
closed		0...20 mA

7.2 Changing the measuring range

The rating plate gives the measuring range set when the instrument is delivered. The given measuring range final value can be changed by approx. ± 10% with the potentiometer  for upper range value (see section Chapter 6).

Measuring ranges outside the adjustment limits but within the measuring limits of the differential capacitor given in Table 4-1 can be implemented as follows:

– Bring potentiometer for final value to the center position
– Remove printed circuit board with connecting line.
– Unsolder resistor R40 and replace by resistance decade (adjustment range to 60 kΩ).
– Set start of scale acc. to section 6.1.
– Turn shaft to the desired angle and set the output signal to 100%, using the resistance decade.
– Read resistance value from the decade and solder on as fixed resistor (metal-film resistance, ± 1%, Gr. 0207) instead of R40.
  Set upper range value exactly with potentiometer  .

Position of R40 see Fig. 7-1.

7.3 Changing the direction of action

The start of scale position is marked depending on the direction of rotation of the transmitter when delivered (turning right or left loocking at the shaft, increasing output current).

As shown in Fig. 7-2, Fig. 7-3, Fig. 7-4, Fig. 7-5, Fig. 7-6 and Fig. 7-7 the transmitters have, depending on the measuring range of the built-in., differential capacitor (see Table 4-1) up to 6 actions and reverse actions characteristics.

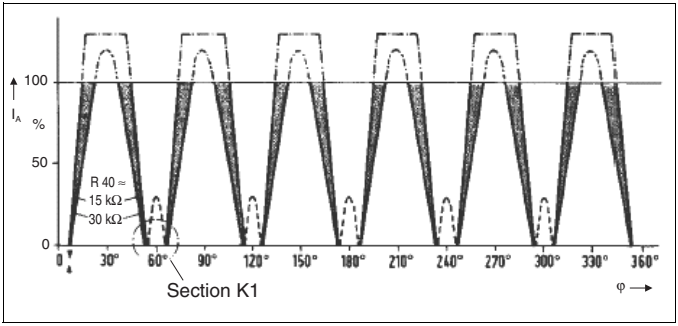

Fig. 7-2 Capacitor type K1
Measuring range adjustable from 0°...7,5° to 0°...17°

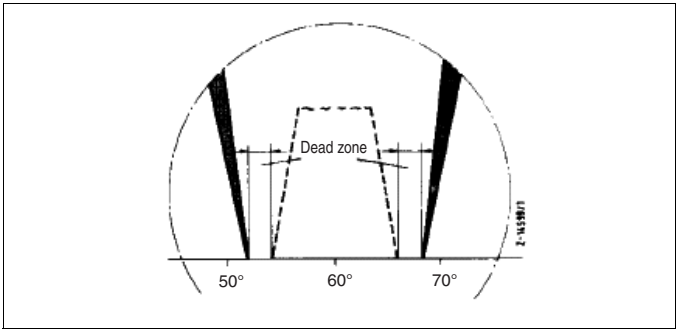

Fig. 7-3 Section K1

———	Usable characteristics
------	Non-usable characteristics
– · –	Overshot output signal
■	Setting ranges
▼	Zero (lower range value) marking

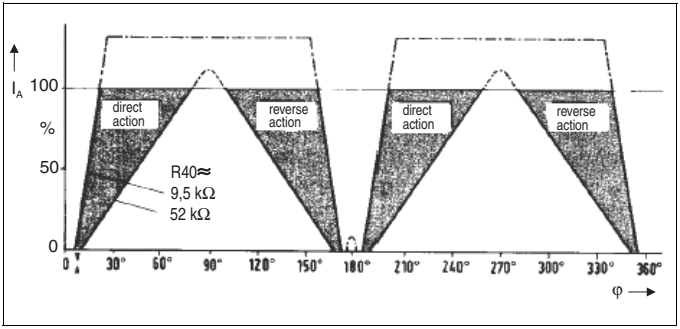

Fig. 7-4 Capacitor type K2
Measuring range adjustable from 0°...15° to 0°...75°

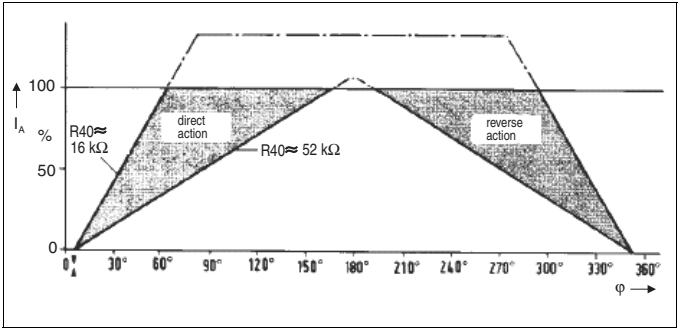

Fig. 7-5 Capacitor type K3
Measuring range adjustable from 0°...60° to 0°...165°

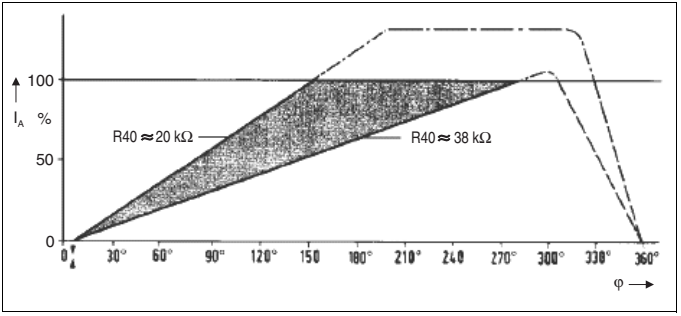

Fig. 7-6 Capacitor type K4
Measuring range adjustable from 0°...150°/max. 0...280°

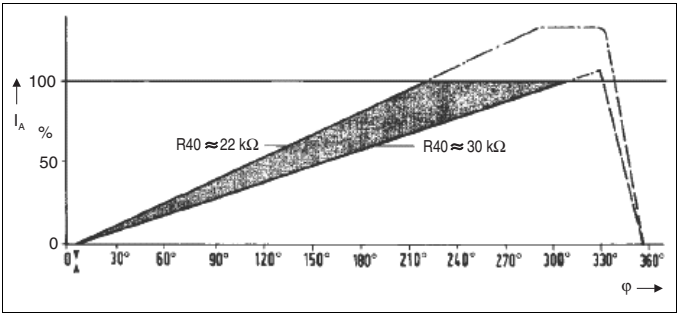

Fig. 7-7 Capacitor type K5
Measuring range adjustable from 0°..220°/max. 0...310°

Transmitters with adjustable span

The measuring ranges
from 0°...7,5° to 0°... 17° (capacitor type K1)
from 0°... 15° to 0°... 75° (capacitor type K2)
from 0°... 60° to 0°... 165° (capacitor type K3)
can be changed by turning the case or shaft against the direction of action given on the rating plate, starting at the start of scale marked position, turning from right to left or left to right.

The measuring ranges

from 0...150° to 0...280° (capacitor type K4) and

from 0...220° to 0...310° (capacitor type K5)

require the following additional changes:

Resolder yellow connection lines between differential capacitor and the solder terminals on the electronic circuit board (see Fig. 7-1 on page 19).

Turning right: connection lines straight

Turning left: connection lines crossed

Change resistor R39 acc. to Table 7-2 and resistor R40 acc. to Table 7-3.

Measuring range		**Direction of rotation**	
		turning right	turning left
min. 0...150° max. 0...280°	R41 178 kΩ	R39 45.3 kΩ	R39 27.4 kΩ
min. 0...220° max. 0...310°	200 kΩ	51.1 kΩ	25.5 kΩ

Table 7-2

Measuring range	**Direction of rotation**	
	turning right	turning left
0...180°	R40 24.9 kΩ	R40 20.9 kΩ
0...270°	37.4 kΩ	30.9 kΩ
0...310°	30.1 kΩ	23.7 kΩ

Table 7-3

For measuring ranges other than those in Table 7-3 resistance R40 must be calculated acc. to section 7.2.

The position of resistors R39 and R40 is shown in Fig. 7-1.

8 Explosion-protected version

DANGER

When mounting the transmitter TGU5-Ex the „Specifications for electrical equipment in hazardous areas (ElexV)“, the „Requirements for erection of electrical equipment in hazardous areas“ DIN EN 60079 (DIN VDE 0165, part 1) and the EC-Type-Examination Certificate PTB 03 ATEX 2118 must be observed.

Work on an explosion-protected device may be performed after eliminating the risk of explosion.
However, befor the equipment can be placed back in operation, it must be tested and certified by an authorized inspector. This is not necessary if the work has been performed by authorized personnel of the equipment manufacturer.
The person conducting repairs must have appropriate credential. After repairs are completed, the date and identification code of the person conducting repairs must be affixed to the repaired equipment.
Exempted from these requirements are operations to adjust the start and end of scale.
These operations can also be performed by the user, even on the hazardous area, taking into consideration the locally required safety measures.
The unit must be disconnected from all voltage sources before maintenance work is carried out or parts replaced which necessitate that the unit be opened.

Whenever it is likely that protection has been impaired, the unit must be rendered inoperative and secured against any unitended operation.
It must be assumed that the protection has been impaired when
- **the unit bears visible signs of damage**
- **the unit no longer functions**
- **the unit has been stored under unfavourable conditions for a long period of time**
- **the unit has been subjected to adverse transport conditions.**

8.1 Technical data explosion-protected version

Only with 2-wire connection

EC-Type-Examination Certificate

PTB 03 ATEX 2118

Code

II 2 G EEx ib IIC T6 or
II 2 G EEx ib IIC T4

Type of protection

Intrinsic safety „i“

Temperature class

T6: permissible range of ambient temperature -25 °C...+40 °C
T4: permissible range of ambient temperature -25 °C...+70 °C
Transmitter must be powered from an intrinsically safer certified current source, suitable for connection to the transmitter's power supply circuit.
In the case of a 2-wire connection, the output signal is shown as a change of the current consumption.

Mounting

Within hazardous areas of Zone 1 or Zone 2

Supply and signal current circuit

For connection to a certfied intrinsically safe current circuit with the following maximum values:
U_i = 20 V, I_i = 35 mA, P_i = 700 mW

Effective internal inductance L_i

Negligibly low

Effective internal capacitance C_i between the connections

Negligibly low

Effective internal capacitance C_i between the connections and housing (ground)

≤6 nF

Power supply circuit

with type of protection „intrinsic safety“ II 2 G EEx ib IIC

Terminals brown (+) and black (-)

Rated values

Voltage	12...20 V DC

Current

with 2-wire connection	bis 20 mA

Output circuit

with type of protection „intrinsic safety“
EEx ib IIC

The power supply circuit and output circuit are identical for the 2-wire connection. In the event of a fault, the maximum values of the-power supply circuit will also occur in the output circuit.

If active, intrinsically safe circuits are connected to the output circuit, the sum total of the maximum values of the active, intrinsically safe-circuits, connected to the output circuit, including the maximum values of the power supply circuit may not exceed the following values:

Voltage	to 20 V
Current	to 35 mA
Power	to 0,7 W

8.2 Application

DANGER

When mounting the transmitter TGU5-Ex the „Specifications for electrical equipment in hazardous areas (ElexV)“, The „Requirements for erection of electrical equipment in hazardous areas“ DIN EN 60079 (DIN VDE 0165) and the EC-Type-Examination Certificate PTB 03 ATEX 2118 must be observed.

Mounting in hazardous areas is permissible if power is taken from a voltage source having a certified intrinsically-safe circut.

WARNING

Before operating the unit, computational or measuring proof of the intrinsic safety of such a circuit must be produced.

Work on an explosion-protected device may be performed after eliminating the risk of explosion.
However, befor the equipment can be placed back in operation, it must be tested and certified by an authorized inspector.
This is not necessary if the work has been performed by authorized personnel of the equipment manufacturer.
The person conducting repairs must have appropriate credential. After repairs are completed, the date and identification code of the person conducting repairs must be affixed to the repaired equipment.
Exempted from these requirements are operations to adjust the start and end of scale.
These operations can also be performed by the user, even on the hazardous area, taking into consideration the locally required safety measures.

Fig. 8-1 gives an application example in 2-wire connection.

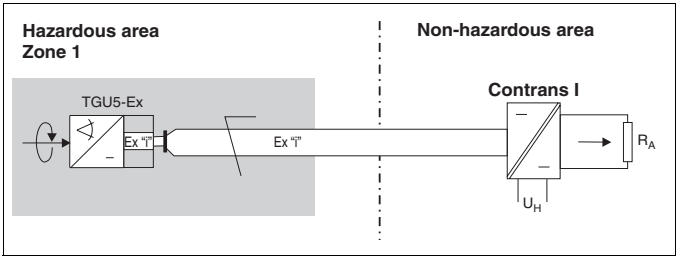

Fig. 8-1 Application example in 2-wire connection of TGU5-Ex

Remarks concerning Fig. 8-1

The transmitter supply unit isolates the intrinsically safe loop to the transmitter from the subsequent control room device.

Standard versions of the equipment can be connected to the ouput of the transmitter supply unit.

Supply from the transmitter supply unit Contrans I with electrical isolation.
Connection of the supply unit to the potential equalisation is not necessary.

9 Maintenance

The transmitters TGU 5, TGU 5-Ex require no regular maintenance. The ball bearings of the shaft are permanently lubricated.

Degree of protection IP 30 means that the instrument is protected against dust only subject to certain conditions.

Cleaning
Remove measuring module from the case. Blow out case and measuring module with clear and dry air.

10 Troubleshooting

Before troubleshooting is **concentrated** on the transmitter, the power supply, power supply circuit, output circuit and display unit should **always** be checked for defects, reversed polarity, open lead etc.

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 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 an expert 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.

The most frequent causes of failure

Fault

Heavy load-dependence
Pointer of meter fluctuates intensely, non-linear relationship between angle of rotation and output current.

Cause

– Residual ripple of supply voltage too high due to lack of or defective filter capacitor,
  maximum permissible is 1.5 V (peak-peak).
– Too low supply voltage.
– Too high a load.

Fault

No output signal

Cause

– Polarity of power supply reversed.
– Semiconductor components in electronic circuit damaged due to superimposed extraneous voltages.

10.1 Repairs

Repairs to the measuring module of the transrnitters cannot generally be made by the customer due to the extensive fixtures and test equipment required. Therefore in case of disturbances the entire measuring module or the entire transmitter should always be returned to the manufacturer for repairs.

11 Circuit diagrams

(See Fig. 11-1 and Fig. 11-2.)

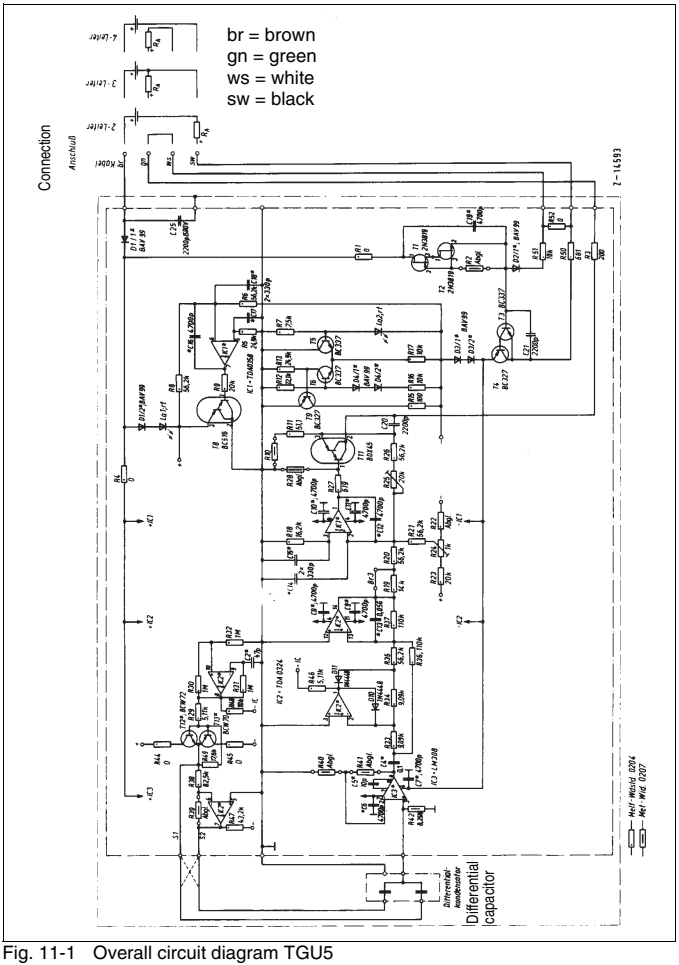

Fig. 11-1 Overall circuit diagram TGU5

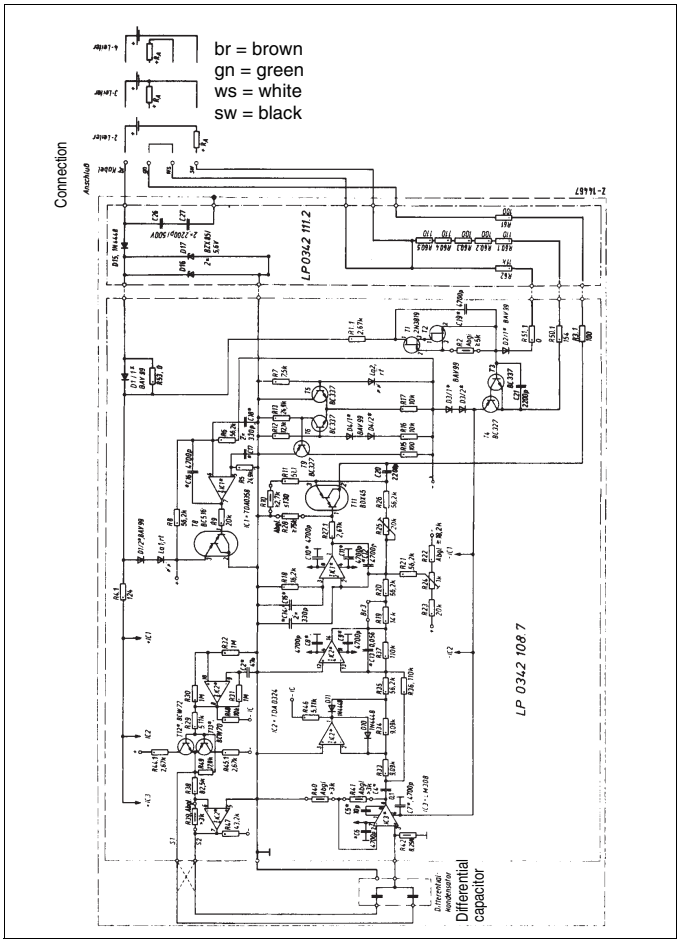

Fig. 11-2 Overall circuit diagram TGU5-Ex

12 Dimensional drawings

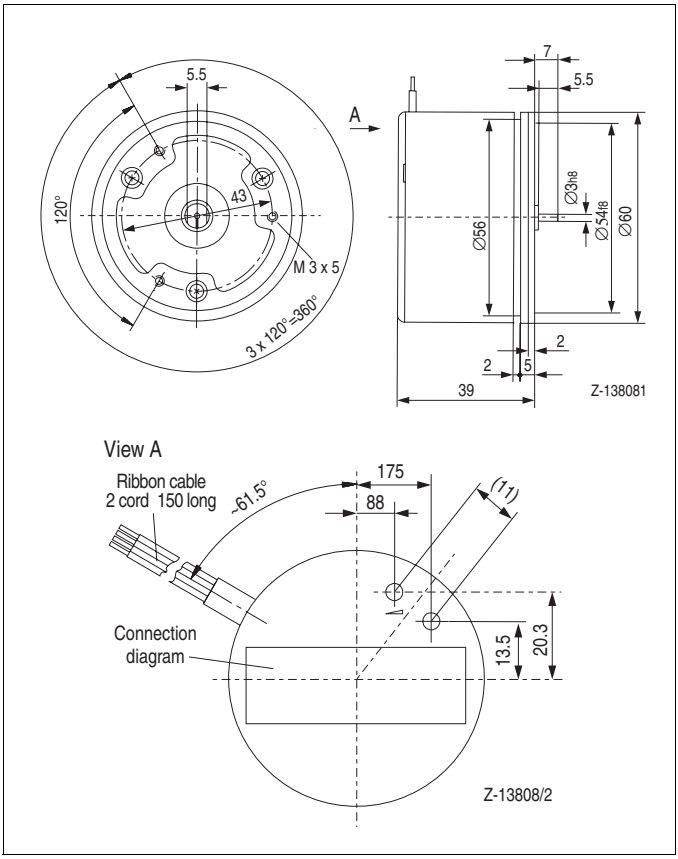

Fig. 12-1 Dimensional drawings (all dimensions in mm)

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