TEU 704, TEU 704-Ex

Transmitters
two-wire, for temperature and
direct current variables

Operating manual

Rev. 04
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Safety Notes

This apparatus has been designed and tested in accordance with DIN 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 safe condition.

- Before switching on the apparatus make sure it is set to the voltage of the power supply.
- When the apparatus is connected to its supply, terminals may be live, and the opening of covers or removal of parts 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.
- Whenever it is likely that the protection has been impaired, the apparatus shall be made inoperative and be secured against any unintended operation.
TECHNICAL DESCRIPTION

1 Application
The transmitter TEU 704, TEU 704-Ex is suitable for DC voltage, DC current and resistance measurements (e.g. temperature measurements with thermocouples or resistance thermometers). It converts the input variable into a load-independent 4...20 mA DC current signal.
The type of measurement can be set with solder links and the measuring range with resistors. The transmitter can easily be mounted on pipes or on walls close to the point of measurement.

2 Technical data according to VDI/VDE 2191

**Application**

- for mV transmitters and thermocouples with external or internal reference junction with or without start-of-range displacement
  - linear with voltage
  - linear with temperature
- mV difference or temperature difference with 2 thermocouples
  - linear with voltage
- Resistance thermometer
  - Two-wire circuit
    - linear with resistance
    - linear with temperature
  - for Pt 100 IEC
  - Three-wire circuit
    - linear with resistance
    - linear with temperature
    - for Pt 100 IEC
- 2 resistance thermometers in temperature difference circuit
- Current measurement
  - with or without start-of-range displacement
  - in summation or differentiation circuit (2 current inputs)
- Resistance teletransmitter

**Input**

(for standard measuring ranges see Data Sheet 11–1.00 EN)

<table>
<thead>
<tr>
<th>Setting limits</th>
<th>Span</th>
<th>Lower-range value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring circuit 751, 752</td>
<td>1...100 mV</td>
<td>-13...+150 mV</td>
</tr>
<tr>
<td>771, 773</td>
<td>3.2...250 Ω</td>
<td>10...320 Ω</td>
</tr>
<tr>
<td>772, 774</td>
<td>10...230 Ω</td>
<td>20...320 Ω</td>
</tr>
<tr>
<td>778</td>
<td>3.2...40 Ω</td>
<td>T₁ = T₂</td>
</tr>
<tr>
<td>791</td>
<td>20...1000 Ω</td>
<td>0...270 Ω</td>
</tr>
<tr>
<td>781</td>
<td>0.01...100 mA</td>
<td>0.01...100 mA</td>
</tr>
<tr>
<td>781</td>
<td>lower-range value depending on span</td>
<td></td>
</tr>
<tr>
<td>-6.5...+100 mA (for 1.75...100 mA)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.245...+5.66 mA (for 65 μA...1.75 mA)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.036...+0.85 mA (for 10...65 μA)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔI 200 μA...50 mA</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1

The lower-range value and the span can be set by changing fixed resistors.

**Measuring circuit options**

<table>
<thead>
<tr>
<th>Thermometer circuit</th>
<th>Measuring circuit 781</th>
<th>Measuring circuit 782</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 50 mA</td>
<td>1 Ω</td>
<td>100 mV</td>
</tr>
<tr>
<td>1.75...50 mA</td>
<td>2 Ω</td>
<td>65 μA...1.75 mA</td>
</tr>
<tr>
<td>65 μA...1.75 mA</td>
<td>53 Ω</td>
<td>10 μA...65 μA</td>
</tr>
<tr>
<td>10 μA...65 μA</td>
<td>353 Ω</td>
<td></td>
</tr>
</tbody>
</table>

Table 2

Output signal rising or falling

<table>
<thead>
<tr>
<th>Measuring circuit</th>
<th>Thermometer and wire break monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermocouple break capacitance</td>
<td>Any¹¹</td>
</tr>
<tr>
<td>Permissible measuring circuit resistance</td>
<td>10 Ω/mV</td>
</tr>
</tbody>
</table>

Table 3

<table>
<thead>
<tr>
<th>Output lower value (NP)</th>
<th>Span</th>
</tr>
</thead>
<tbody>
<tr>
<td>min. max</td>
<td></td>
</tr>
<tr>
<td>(-0.55...+0.82) x span</td>
<td></td>
</tr>
<tr>
<td>(-1.2...+1.65) x span</td>
<td>600...1099 digits</td>
</tr>
<tr>
<td>(-2.2...+3.54) x span</td>
<td>300...599 digits</td>
</tr>
<tr>
<td>(-2.6...+7.33) x span</td>
<td>150...299 digits</td>
</tr>
</tbody>
</table>

Table 4

Overflow: Display only figure "1""
### Output

**Output signal**
- 4…20 mA load-independent DC from DC voltage source

**Supply**
- $U_{\text{min.}} = 12$ V
- $U_{\text{max.}} = 36$ V (26 V for TEU 704-Ex)

**Terminal voltage**
- $U_{\text{min.}} = 12$ V (13 V for TEU 704-Ex with electrical isolation and digital display)
- $U_{\text{max.}} = 36$ V (26 V for TEU 704-Ex)

**Current drain**
- 4…20 mA

**Permissible load**
- \[ R_\text{p} = \frac{U_s - U_{\text{min.}}}{0.02} \] (Ω; supply voltage)

**Permissible load of supply voltage**
- 1.5 V (peak to peak $< 120$ Hz)

**Residual ripple of output signal**
- $< 1\%$ (peak to peak)

**Limit of output current**
- Version without electrical isolation: $< 27$ mA
- Version with electrical isolation: $< 36$ mA

**Underranging**
- Limitation of output current between 2…4 mA

### Mechanical capabilities

**Tested to**
- DIN IEC 68 Part 2-6, 2-27

**In operation**
- Impact: 50 g/11 ms
- Continuous impact: 25 g/6 ms/1000 per axis
- Vibration: 2.5 g/±0.17 mm/s/5…150 Hz
- 5 g/±0.4 mm/s/5…55 Hz

**Seismic capability class**
- II based on DIN 40046 Part 55

**Vibration**
- 1 g/5…35 Hz

### Environmental capabilities

**H&B climate group**
- According to WN 120-005: 3

**Application class**
- According to DIN 40040: HSD

**Ambient temperature**
- $-25\ldots+70^\circ$C
- $-20\ldots+70^\circ$C (with Display)

**Transportation and storage temperature**
- $-30\ldots+80^\circ$C

**Relative humidity, annual average**
- $\leq 80\%$

**Condensation permissible**
- Degree of protection: IP54 or IP65

### Case and mounting

**Electrical connections**
- Screw terminals for max. 1.5 mm²

**Material**
- Glass-fibre reinforced polyester

**Color**
- TEU 704-Ex black RAL 9011
- TEU 704 gray RAL 7032

**Operating orientation**
- Cable glands downwards

**Weight**
- Approx. 1 kg

**Imprint on the rating plate**
- In German, English, French

**Class of protection**
- According to VDE 0411 or IEC 348

**Insulation group**
- According to VDE 0110

**Test voltage**
- According to VDE 0411

**Radio interference level according to VDE 0875**
- N

**Features in steady-state condition under nominal conditions**

**Basic shape**
- Of characteristic: linear

**Characteristics coincidence at limit point setting**
- Measurement error $< \pm 0.5\%$
  
  - (0.25% as "option")
  - Digital display $< \pm 0.2\%$ ± 1 digit
  - With internal reference junction: add. 0.5 K

**Non-linearity**

- Measuring circuit: Type J, K, E $< 0.4\%$
  
  - Type L, T $< 0.6\%$
  
  - Type R, S, U $< 0.65\%$
  
  - Type B $< 0.7\%$
  
    - Depending on shape of curve
  
    - 752.1: $< 0.3\%$
  
    - 774: $< 0.2\%$

**Ambient temperature**

- Nominal conditions: 18…28°C
- Permissible temperature change during measurement: 2 K
- Supply voltage: $U_{\text{min.}} \ldots U_{\text{max.}}$
- Load: $\leq R_\text{p}$
- Heating up time: $\leq 5$ seconds

**Nominal conditions**
- Ambient temperature: 18…28°C
- Permissible temperature change during measurement: 2 K
- Supply voltage: $U_{\text{min.}} \ldots U_{\text{max.}}$
- Load: $\leq R_\text{p}$
- Heating up time: $\leq 5$ seconds

- (without internal reference junction) $^8$

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1. For TEU 704-Ex note certificate of conformity
2. Relative to output voltage
3. With lower-range value $\leq 50^\circ$C
4. $< 0.8\%$ for type E with lower-range value $\leq 200^\circ$C
5. $< 1.5\%$ for type R, S with lower-range value $\leq 400^\circ$C
6. For lower-range value $\leq 800^\circ$C
7. The curve is divided into 4 equidistant sections, which are parallel to the Y-axis. The max. error is the distance between the curve and the straight lines, which are formed by the intersection of curve/cutting line
8. With internal reference junction, temperature compensation is required between reference junction and terminals

---

4
Mounting of transmitter in the case of all TEU 704-Ex types within zones 1 and 2 or outside the hazardous areas.

Mounting of the intrinsically safe measuring circuit in zone 0 for types TEU 704-Ex.A and D together with a suitable measuring transmitter can be certified by a Test Authority.

**Table 4**

<table>
<thead>
<tr>
<th>Type key</th>
<th>Electrical isolation</th>
<th>Measuring circuit Type of protection</th>
<th>Transmitter connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEU704-Ex.A</td>
<td>built in</td>
<td>EEx ia II C</td>
<td>active transmitter measuring circuits 751, 752, 753, 758</td>
</tr>
<tr>
<td>TEU704-Ex.B</td>
<td>built in</td>
<td>EEx ib II C</td>
<td></td>
</tr>
<tr>
<td>TEU704-Ex.C</td>
<td>not built in</td>
<td>EEx ib II C</td>
<td></td>
</tr>
<tr>
<td>TEU704-Ex.D</td>
<td>built in</td>
<td>EEx ia II C</td>
<td>passive transmitter measuring circuits 771, 772, 773, 774, 778, 791</td>
</tr>
<tr>
<td>TEU704-Ex.E</td>
<td>built in</td>
<td>EEx ib II C</td>
<td></td>
</tr>
<tr>
<td>TEU704-Ex.F</td>
<td>not built in</td>
<td>EEx ib II C</td>
<td></td>
</tr>
</tbody>
</table>

Supply and signal current circuit Type of protection intrinsic safety EEx ib II C only for connection to certified intrinsically safe circuits with the following maximum values:

- U = 26 V
- I = 35 mA
- P = 0.6 W

Effective internal inductance

- ≤ 60 μH

Effective internal capacitance

- ≤ 2 nF

Measuring current circuit type of protection intrinsic safety (see Table 4)

Maximum values of transmitter Type TEU 704-Ex.A

- Ex.B U = 12.5 V I = 9 mA P = 28 mW
- Ex.C
- Ex.G

For maximum permissible La and Ca see Certificate of Conformity.

Type TEU 704-Ex.D

- Ex.E U = 12.5 V I = 15 mA P = 47 mW
- Ex.F
- Ex.H

Maximum permissible La

- TEU 704-Ex.D
- TEU 704-Ex.E, F, H

Ca

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Referred to the output span

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**Explosion protection**

Manufacturers identification code 49/11–41 Ex

Type test certificate PTB No. Ex-87.B.2037

Type of protection Intrinsically safe “i”

Marking EEx ib IIC T5/T6 or EEx ib [ia] II CT5/T6

Temperature class

- T6 at ambient temperatures up to +50°C
- T5 at ambient temperatures up to +65°C

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**Features in steady-state condition with deviation from nominal conditions**

Effect of ambient temperature

- ≤ 0.2%/°K at zero
- ≤ 0.1%/°K over span

Additional error with built-in reference junction compensation about 0.3%/°K with PT 100 IEC for spans < 50 K: 0.05%/°K over span

Digital indicator < 0.1%/°K on 2000 digits

Effect of supply voltage < 0.1%/°K between U_min. and U_max.

**Effects on input**

Parasitic voltage effect of a symmetrical

- 50 Hz AC voltage < 0.1% within output range 5 ... 100% with 2 x span increased residual ripple

unsymmetrical

- 50 Hz AC voltage < 0.1% up to max. 60 V rms

unsymmetrical DC voltage < 0.1% up to max. 60 V

Effect of radio frequency (interference) < 0.3% at 27 ... 460 MHz 1 W transmission power 0.5 m from aerial

**Effects on output**

Effect of load < 0.05% in load range

Effect of voltage < 0.1% per 60 V (with electrical isolation)

**Time behavior (dynamic behavior)**

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

<table>
<thead>
<tr>
<th>Setting time (Ta)</th>
<th>mV, mA measurement</th>
<th>Q measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 mV/ΔU (mA)</td>
<td>100 ms</td>
<td>100 Q/ΔR (Ω) · 100 ms</td>
</tr>
<tr>
<td>Recovery time after interruption of measuring circuit</td>
<td>20 mV/ΔU (mA) · 0.5 s</td>
<td>100 Q/ΔR (Ω) · 0.5 s</td>
</tr>
</tbody>
</table>

Table 3

Long time effect < 0.2%/year

---

**Table 3**

<table>
<thead>
<tr>
<th>Setting time (Ta)</th>
<th>mV, mA measurement</th>
<th>Q measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 mV/ΔU (mA)</td>
<td>100 ms</td>
<td>100 Q/ΔR (Ω) · 100 ms</td>
</tr>
<tr>
<td>Recovery time after interruption of measuring circuit</td>
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<td>100 Q/ΔR (Ω) · 0.5 s</td>
</tr>
</tbody>
</table>

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**Explosion protection**

Manufacturers identification code 49/11–41 Ex

Type test certificate PTB No. Ex-87.B.2037

Type of protection Intrinsically safe “i”

Marking EEx ib IIC T5/T6 or EEx ib [ia] II CT5/T6

Temperature class

- T6 at ambient temperatures up to +50°C
- T5 at ambient temperatures up to +65°C

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Referred to the output span

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3 Mode of operation

3.1 General principle of operation

The input signal is supplied to the amplifier (2) via the input circuit (1) determining the type of measurement and measuring range and is converted into a load-independent DC current in the output stage (3). This flows via the electrical isolation stage and the negative feedback resistor RK, on which it produces a voltage drop, which is fed to the input. The output current changes until the difference between the input voltage and the feedback voltage is nearly zero. The constant voltage source (5) supplies the components with a stabilized voltage.

In the version without electrical isolation, the constant voltage source (5) and the output stage (3) are connected directly to the output terminals.

The isolating stage consists of the prestabilization (9), the multivibrator with transistor chopper (8), the isolating transformer (7) and the rectifier (6).

The current is supplied via the output line by the basic current of 4 mA, on which a current up to 20 mA proportional to the measured variable builds up. The output current or the measured variable can be read off on the built-in digital indicator (10). With the linearization module (11) an output signal linear with temperature is produced when measuring with thermocouples. For measurements with resistance thermometers, linearization is effected with the supply current of the Pt 100 DIN IEC 751. If the measuring circuit is interrupted, the output signal is controlled by the line break monitoring device (4) so that the lower or upper range value is exceeded.

3.2 Applied circuits

Matching to type of measurement and span is done by soldered links and resistors. In principle all measuring circuits can be implemented. A measuring circuit number 7... is assigned to each type of measurement.

The measuring range of each measuring circuit is roughly balanced by fitting resistors and is exactly balanced by the built-in potentiometers.

Measuring circuits 751, 752, 753

DC voltages in the mV range are converted by the compensation method into output signals proportional to the input value. For measuring circuits 751 and 753, the output variable is linear with voltage and for measuring circuit 752, the output variable is linear with temperature. The measuring circuit 752 is suitable mainly for linearizing thermocouple voltages.

A copper coil is soldered in for internal reference junction compensation.

Measuring circuits 771, 772

These measuring circuits are suitable for connection to resistance thermometers Pt100 IEC in two-wire circuit. One can decide by wiring (solder link) whether the output current is to be proportional to the change of resistance or to the change of temperature.

The linearization (measuring circuit 772) is effected by the Pt100 measuring current dependent on the amplifier control. The measuring current passing through the resistance thermometer is about 0.7 mA.

Measuring circuits 773, 774

The measuring circuits 773, 774 are provided for the connection of resistance thermometers Pt 100 DIN IEC in three-wire circuit. One can decide by wiring whether the output current is to be proportional to the change of resistance or to the change of temperature. Linearization (measuring circuit 774) is done in the same way as for measuring circuit 772. The measuring current is about 0.7 mA.

Measuring circuit 778

The measuring circuit 778 is intended for differential temperature measurement with 2 resistance thermometers. The two thermometers supplied with current form "half a bridge", where the difference in resistance is amplified and transformed into a linearized output signal over the working range.

Measuring circuit 781, 782

For current measurement, the input current to be measured is switched to a shunt and thus led back to a voltage measurement.
OPERATING INSTRUCTIONS

5 Instructions for mounting and connection

5.1 Mounting the unit

The case is of degree of protection IP54 or IP65 and is suitable for pipe and wall mounting in the field. It must be fixed on the projecting strap (for fixing hole spacing see Fig. 7), so that the cable glands point downwards. After removing the case lid, the electrical connections on the terminals can be made with wires up to 1.5 mm².

5.2 Installing the measuring and output signal leads

The requirements of DIN VDE 0100 must be met in the choice of lead material and laying of the measurement and output signal leads. VDE 0165 must also be followed for the explosion protected version.

5.3 Connection diagrams and key

MK measuring circuit.

a) Thermoelectric voltage and mV measurement with and without reference junction correction.

b) Differential temperature measurement with 2 thermocouples.

c) Temperature measurement with resistance thermometer Pt100 two-wire circuit, internal compensation for line resistance.

d) Temperature measurement with resistance thermometer Pt100 three-wire circuit.

e) Differential resistance measurement T2 – T1, balancing of line resistance with zero potentiometer.

f) μA, mA measurement.

h) Current summation or difference measurement with I₁ ± I₂

i) Resistance teletransmitter measurement, internal line resistance balancing (11 start of teletransmitter, 12 teletransmitter tap, 13 end of teletransmitter).

j) 1 = connection of supply voltage for transmitter without built-in digital indicator

2 = connection for external field indicator with R₁ < 15 Ω.

k) Connection of supply voltage for transmitter with built-in digital indicator.

Fig. 2 Motherboard with components (non-plug-in version)
6 Commissioning

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

6.1 Switching on the unit

After switching on the supply voltage, the unit will be operative. The input and output data of the transmitter can be seen on the rating plate. Setting of the potentiometers may be done also with uninsulated tools. In normal working conditions, the input and output are open circuit-proof and shortcircuit-proof.

6.2 Balancing the measuring leads

Lead balancing is not necessary for thermocouples and for detectors in the mV and mA range. However, the maximum source resistance given in the "Technical data" must be observed.

For resistance thermometers in a three-wire circuit, no lead balancing is required if the resistances of the leads are equal up to 10 Ω/core. However, it is pointed out that, particularly for low resistance ranges (ΔR < 15 Ω), unequal lead resistances can lead to considerable zero point errors. Small asymmetries (<2.5 Ω) can be compensated for by the zero potentiometer P2.

In the two-wire circuit and the differential temperature measurement with resistance thermometers, and when connecting resistance teletransmitters, lead balancing is necessary.

Lead balancing can be done as follows:

a) With the built-in lead balancing resistor.

The lead balancing resistor is available on the motherboard. It consists of fixed resistors R42, R43 and R44 for coarse balancing and the zero potentiometer P2 for fine balancing. The bridge A–B, A–C, C–D and D–B must be unplugged for coarse balancing.

The following resistances are assigned to the plug-in jumper:

| A–B | 0 Ω |
| B–D | 2.67 Ω |
| C–D | 5.48 Ω |
| A–C | 7.42 Ω |

b) With the potentiometer for the start of measurement.
6.3.3 Change of direction of action (rising/falling)

The action of the amplifier in producing a falling or a rising output signal is decided by solder links and resistors on the motherboard, and can be changed there, as shown in Table 6. After a change, the transmitter must be recalibrated (see section 7).

<table>
<thead>
<tr>
<th>MK Version for measured circuit</th>
<th>Measuring accessory none</th>
<th>With output signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 751, 753, 752.x</td>
<td>N - O</td>
<td>O - P</td>
</tr>
<tr>
<td>B 771, 772</td>
<td>X - Z</td>
<td>X - Y</td>
</tr>
<tr>
<td>B 773, 774</td>
<td>O - N</td>
<td>O - P</td>
</tr>
<tr>
<td></td>
<td>Z - X</td>
<td>X - Y</td>
</tr>
<tr>
<td></td>
<td>R1 = 3.9 kΩ</td>
<td>R1 = 3.9 kΩ</td>
</tr>
<tr>
<td>B 778</td>
<td>X - Z</td>
<td>X - Z</td>
</tr>
<tr>
<td></td>
<td>Solder link Br10 closed</td>
<td></td>
</tr>
</tbody>
</table>

Table 6: Resistors and bridge wiring at measuring circuit break monitoring

6.4 Internal reference junction compensation

For measurements with thermocouples, the reference junction compensation can also be done in the transmitter. The reference junction compensation consists of a copper coil, and is soldered directly next to the input terminals. The internal reference junction compensation is designed for 20°C, and can be used for different types of couples.

6.4.1 Retrofitting the reference junction compensation

If a transmitter is converted to a measuring circuit with internal reference junction compensation, the reference junction can be ordered from the Works under Cat. No. 11 004-4-0371 549. The reference junction can only be fitted if the four screws of the motherboard are loosened (see section 7).

7 Change of function or of measuring range

The information required for changes to the measurement type, measuring ranges or functions is part of the conversion instructions "TEUKON 7" which can be ordered from the manufacturer. The conversion instructions comprise a software program for calculating the resistors, which are to be replaced, and for assignment of the bridges (see spare parts list). The program operates under operating system MS-DOS for IBM Personal computers or compatibles.
8 Balancing the field indicator

The following equipment is required to adjust the field indicator:
Constant current source, screwdriver and soldering iron. This work must be done in accordance with the mounting and commissioning instructions.

The PCB of the field indicator is screwed to the plastic hinges of the motherboard and can be folded back after slackening one screw (see Fig. 4).

The IC7126 is plugged into the appropriate IC socket. This work must be done in accordance with the mounting and commissioning instructions.

The field indicator is connected to the soldered joints U and V of the motherboard by two stranded wires.

8.1 Defining the extent of indication

The extent of indication (span) must be at least 150 digits, regardless of the position of the decimal point. The largest possible extent of indication should always be selected. No decimal point is required if the top value of indication is ≥ 200.

<table>
<thead>
<tr>
<th>Display</th>
<th>COM 1-2-3</th>
<th>COM 2-3</th>
<th>COM 1-3</th>
<th>COM 1-2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>without DP</td>
<td>DP = 1</td>
<td>DP = 2</td>
<td>DP = 3</td>
</tr>
<tr>
<td>000...1999</td>
<td>000...1999</td>
<td>000...1999</td>
<td>000...1999</td>
<td></td>
</tr>
</tbody>
</table>

The resistor R1 (see Fig. 4) and the solder links to be made must be taken from Table 8.

The solder links and the associated setting ranges are selected so that there is a minimal effect of the zero potentiometer for the required range:

Solder links and resistances depending on the range of measurement are determined as follows:

a) Fit bridges for decimal point depending on extent of indication
b) Fit R1 according to span to be indicated
c) Determine ratio NP/SP for suppressed ranges or NP/MBE for raised ranges and fit the solder links and resistors shown in the appropriate column (see table 8).

Example 1 Extent of indication 800°C...1600°C ~ 4...20 mA
R1 = 6.2 Q (span 800 digits)
NP/MBE = 800/1600 = 0.5
according to column 2 (NP raised 0.36...0.52) mini-Melf across G-H with 6.8 kΩ and L-M bridged by mini-Melf with 26.7 kΩ.
Open 0-P and fit R15 as mini-Melf of 5.1 kΩ.

Example 2 Extent of indication 0.80...3.2 bar ~ 4...20 mA
Decimal point COM 1-3; DP = 2
R1 = 1.5 Q (span 240 digits)
NP/MBE = 0.8/3.2 = 0.25
according to column 1 (NP raised 0.15...0.61) G-H
Open 0-P and fit R15 as mini-Melf of 5.1 kΩ.

Example 3 Extent of indication ~30.0...+20.0 mA
Decimal point COM 2-3; DP = 1
R1 = 3.3 Q (span 500 digits)
NP/SP = -30/50 = -0.6
according to column 2 (NP suppression ~2.6...-1.1) Bridge J-K and G-H, Bridge L-M with 26.7 kΩ mini-Melf.

Table 8 Extent of indication
NP zero point
MBE upper-range value
SP span

Table 7 Bridge assignment for decimal point (DP) on field indicator
(see fig. 5)
8.2 Adjustment procedure

One pole of the connection to the motherboard of the transmitter must be interrupted and the constant current source connected to solder pins 1 and 2 (see Fig. 4). The positive pole of the current source must be connected to “2” and the negative pole to “1". The required display lower-range value is set on the digital indicator using the zero potentiometer (P2) and a value of 4 mA. With a current input of 20 mA from the constant current source, the display upper-range on the digital indicator is set using the span potentiometer (P1).

This procedure must be repeated several times. Disconnect the constant current source and solder wire 1 to U and wire 2 to V.

9 Explosion protected versions

The TEU 704-Ex is approved for type of protection intrinsic safety EEEx ib IIC T5/T6 or EEEx ib [ia] IIC T5/T6. It can be installed without limitation by explosion groups in hazardous areas of zones 1 and 2 up to an ambient temperature of 65/50°C.

When mounting the TEU 704-Ex, the ordinance for electrical equipment in hazardous areas (ExExV), the regulations for installing electrical equipment in hazardous area workshops (VDE 0165) and the Certificate of Conformity must be observed.

The TEU 704-Ex must be supplied by a certified intrinsically safe circuit, reference EEEx ib IIC or (Ex) I G5. Fig. 6 shows applications for the transmitter with and without electrical isolation.

If an instrument with a certified intrinsically safe output circuit is connected to the intrinsically safe input circuit of the transmitter, the intrinsic safety of the current circuits has to be maintained in this combination. Some admissible combinations are given in the certificate of conformity PTB No. Ex 87.B.2037. This has to be attested according to VDE 0165/9.83. If for functional reasons the intrinsically safe circuit has to be grounded by connection to the equipotential bonding, the earthing may only be done at one, but arbitrary place. The equipotential bonding must then be present over the whole area of the intrinsically safe circuit.

Work on explosion protected equipment must be done by anyone or in any workshop: however, the equipment must be checked and certified by an expert before recommissioning. This is not required if work has been done by the authorized staff of the equipment manufacturer. The repairer must furnish appropriate identification.

After a repair has been done, the date and reference (H&I Certificate No.) of the repairer must be attached to the repaired equipment. Work involving changing the measuring range is excepted from these conditions.

This may be done by the operator’s skilled staff, where the conditions of section 7 must be observed. One should take care that damage to or shortcircuiting of resistors or other components must always be avoided. Covers should be used when soldering.

10 Trouble-shooting

If faults occur, the cause should first be sought at the source and its incoming leads. This can be done for voltage measurements by testing for a through circuit and checking the measuring voltage with a suitable measuring instrument (e.g. a portable compensator). Then check the indication circuit by connecting the ammeter in. For resistance measurements, the resistance to be measured must be simulated and the correctness of the current checked at the output of the transmitter.

If the incoming and outgoing circuits of the transmitter are in order, the fault must be sought in the transmitter electronics. This fault can be remedied using the wiring diagram and by replacing electronic units.

11 Maintenance

The TEU 704 transmitter requires no routine maintenance.

12 Packing instructions

If the original packing is no longer available, then the transmitter must be packed for transport protected against shock, in a sufficiently large box with shock-absorbing material (e.g. excelsior, spun rubber etc.) If excelsior is used, the layer should be at least 10 cm thick on each side. The instrument should first be wrapped in paper.

For overseas transport, the transmitter must also be welded airtight in polyethylene foil at least 0.2 mm thick, with a desiccant (e.g. silica gel). With this type of transport, the transport container must be lined with a layer of double bitumen paper on the inside.

This packing instruction also applies for equipment returned to the manufacturer (change of calibration, repair).
13 Spare parts list

The following components of the transmitters TEU 704 and TEU 704-Ex can be obtained from the Spare Parts Service Department of the manufacturer by giving the designation and catalogue number.

For spare parts orders or complaints of any kind, the equipment number stated on the nameplate should always be quoted.

<table>
<thead>
<tr>
<th>Designation</th>
<th>Cat. No.</th>
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</thead>
<tbody>
<tr>
<td>Equipment lid, grey with window</td>
<td>11004-4-0341392</td>
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<td>Case, black, with window</td>
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<td>Mounting bracket 2''</td>
<td>11004-4-0367583</td>
</tr>
<tr>
<td>Pipe clamp 2''</td>
<td>11005-4-0367584</td>
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<td>Cable gland Pg 11</td>
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<td>Digital indicator</td>
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<td>Software for transposing measuring tasks</td>
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</tbody>
</table>

1) For transmitter without electrical isolation
2) For transmitter with electrical isolation

14 Dimensional drawings

Mounting bracket for vertical pipes (standard accessory)

Pipe clamp for horizontal pipes (see Suppl. No. 525)

Fig. 7 Dimensional drawings and examples of mounting

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. is the sole criterion!
Fig. 9 Linearization device
Fig. 10 Layout of the resistors and bridges determining the function and the type of measurement in plug-in version.

Fig. 11 Layout of the resistors and bridges determining the function and the type of measurement in not plug-in version.
Fig. 14 Field indicator