

Electronic Turbine Meter TERZ 94

Operating Instructions



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Introduction

The TERZ 94 / 94-S turbine meter complements the RMG TRZ 03, TRZ 03-L and TRZ 03 K turbine meters (see RMG Publication Nos. 3.161-E and 3.171-E).

The TERZ 94 / 94-S directly measures the flow rate at measurement conditions and integrates the measured values, so that, as a result, the gas volume which flowed through the meter is registered by an electronic totalizing unit. The gas flow drives a turbine wheel whose speed is recorded through non-contact measurement by a sensor. Therefore, the meter is characterized by long-term stability and low wear.

The TERZ 94 / 94-S is provided with HF and LF outputs which allow the device to be used as a flow transducer for control applications and remote transmission.

Features

- For secondary applications
- With electronic totalizing unit
- Flow display
- Display of maximum flow values
- Alarm output
- Detachable meter head (for use as a remote totalizer)
- Digital transmission of meter readings

The two variants TERZ 94 and TERZ 94-S differ in the following features:

TERZ 94

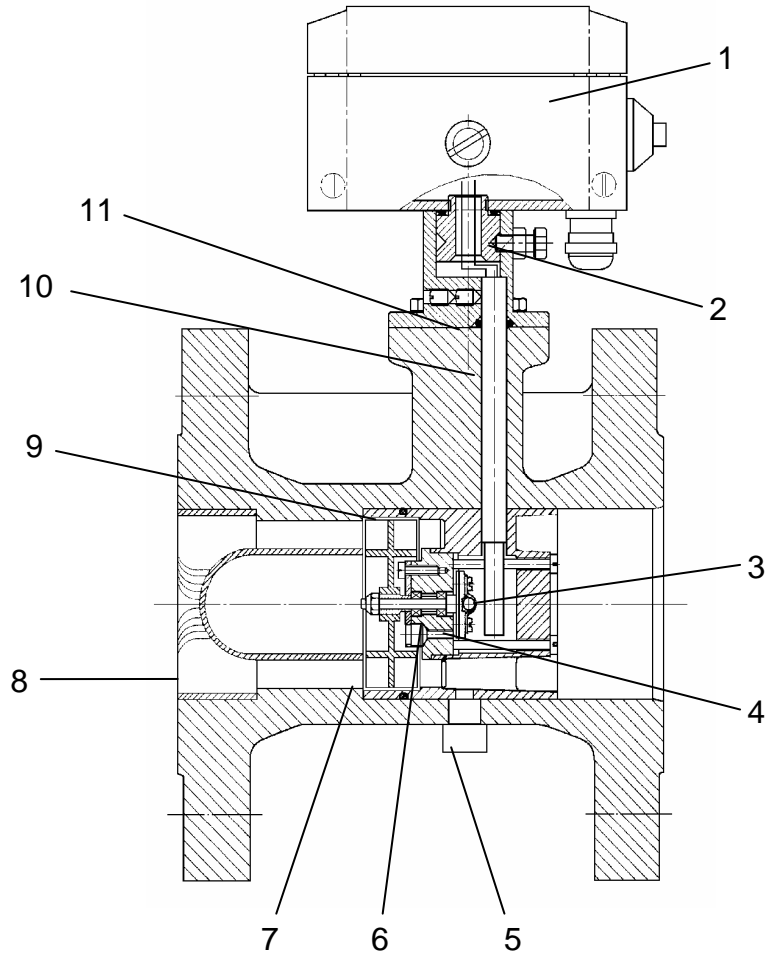
- Battery operation
- Electronic suppression of the slow-down effect of the turbine wheel after flow stop by external shut-down of the totalizer

TERZ 94-S

- External power supply
- 4-20 mA current output for outputting the flow rate

Functional Description

Construction



Part	Designation	Material
1	Meter head	
2	Set screw	Steel
3	Sensor WF01 (1-channel) or WF02 (2-channels)	
4	Permanent magnet	Oerstit 500
5	Lubricator (from DN 200)	
6	Radial ball bearing	Nirosta steel
7	Turbine wheel	Delrin / aluminium
8	Flow straightener	Hostaform

Functional Description

9	O-ring	
10	Sensor sleeve with sensor	Nirosta steel
11	O-ring 8x2.5	83FKM592

The TERZ 94 / 94-S volumeters form a series of uniform construction.

The meters consist of the following principal components:

- meter case
- measuring element (with turbine wheel and sensor) and
- electronic totalizing unit.

An aerodynamic flow straightener (8) fitted into the meter case constricts the effective cross section of the pipe to form a ring-shaped cross-sectional area and substantially eliminates turbulences. The velocity of the flowing gas increases and the gas is directed to the turbine blades.

The turbine wheel (7) is dynamically balanced and mounted with dust-proof ball bearings (6). A permanent magnet (4) located at the end plate of the turbine shaft induces the sensor element (3) to give a voltage pulse with each rotation of the turbine wheel. This pulse is further processed by the electronic system of the meter head (1).

Meter head

Inside the meter head, the number of pulses is divided by the meter factor (number of pulses per m³) and the result is used to calculate the volume at measurement conditions. In the main totalizer, the sum of the volume at measurement conditions which flowed through the meter is formed and you can read the gas volume which flowed through the meter per time unit on the flow rate display.

At the HF output, the unchanged signal frequency of the sensor element is outputted, whereas, for the LF output, this HF frequency can be reduced by two programmable scaling factors.

Block diagram

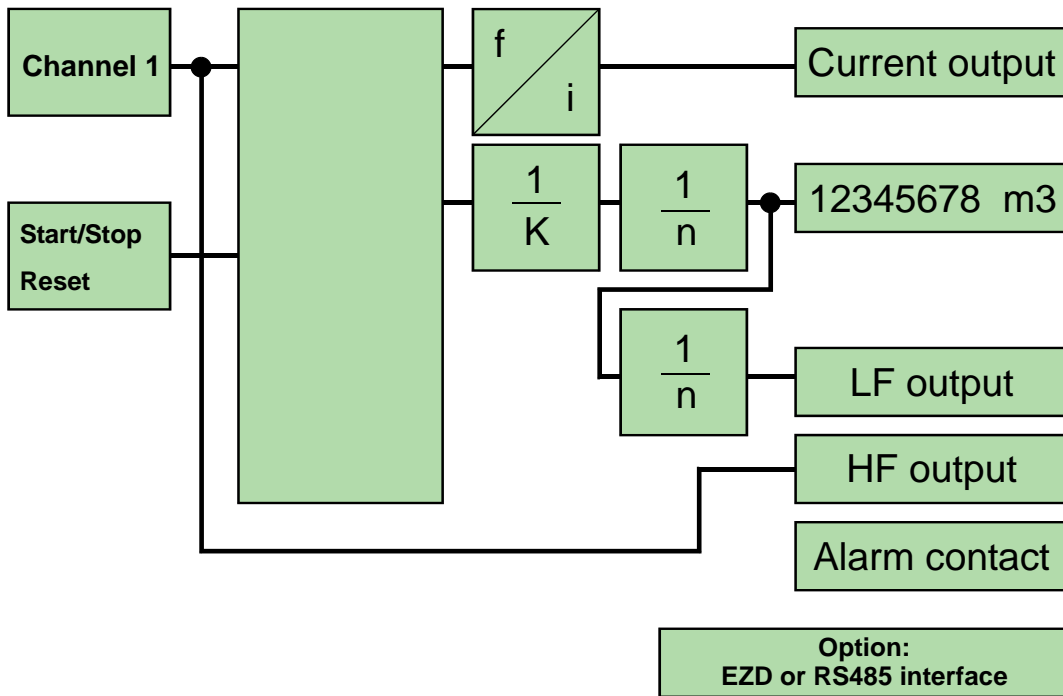
TERZ 94

In the display field of the TERZ 94 (not with the TERZ 94-S), a start-stop totalizer or a resettable totalizer can be optionally displayed. Through the free sensor input X5, either the volume metering of the start-stop totalizer is interrupted or the resettable totalizer is reset (depending on the programming of the TERZ 94).

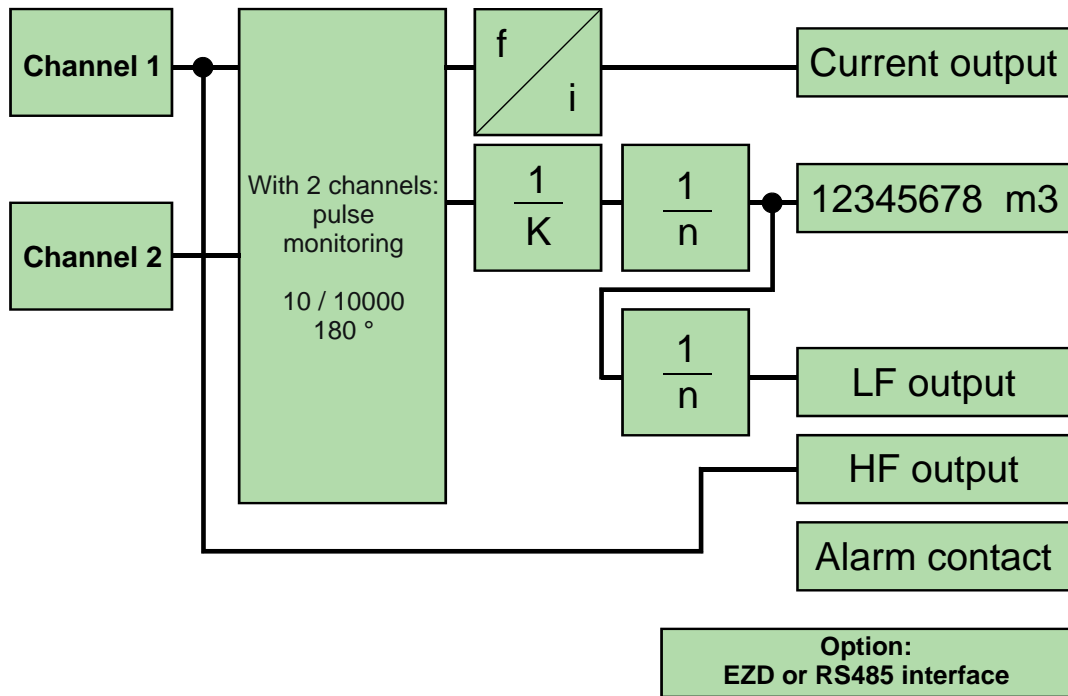
TERZ 94-S

The TERZ 94-S volumeter has a current-loop connection (X2_0 with current module TERZ94trm) which serves as power supply and 4 to 20 mA current output at the same time. For this purpose, a power supply unit is required which is to be connected to this output. The TERZ 94-S cannot be battery-operated.

TERZ 94 1-channel



TERZ 94 2-channel



Safety Instructions

The TERZ 94 / 94-S volumeter is used for measuring the volume at measurement conditions of non-corrosive gases and fuel gases. Measurement of corrosive gases is only permitted if the special designs are used which have been developed for such purpose. These meters are not suitable for measuring liquids, otherwise they will be destructed.

The TERZ 94 / 94-S complies with currently applicable standards and regulations. However, failure to operate them properly may cause hazards.

Persons who install or operate the TERZ 94 / 94-S volumeter in areas subject to explosion hazards, must be familiar with the currently applicable explosion protection standards and regulations.

The electronic totalizing unit of the explosion-protected design has been approved for use in areas subject to explosion hazards and its code is:

II 2 G EEx ib[ia] IIC T3, T4

The appropriate certificate of conformity can be found in the annex and its reference number is:

TÜV 02 ATEX 1970

Please observe the following signs:



Danger of explosion

In the manual, this symbol warns you of an explosion hazard. Please observe the instructions given next to this symbol. As to the danger of explosion, please note the following in particular:

- Only the explosion-protected design of the TERZ 94 / 94-S may be used in areas subject to explosion hazards.
- The battery must be changed in an area without explosion hazards.



Damage to property

In the manual, this symbol warns you of possible damage to property. The instructions given next to this symbol inform you about what you can do to avoid damage to the TERZ 94 volumeter.

It is essential to observe the warning information in these operating instructions and the generally applicable safety rules.

No warranty claims can be asserted if there is unauthorized interference with the device!

Installation

Operating conditions

Permissible types of gases

The **standard design** of the TERZ 94 or TERZ 94-S can be used for all non-corrosive gases, such as

Natural gas	Air
Town gas	Acetylene
Methane	Helium
Ethane	Carbon dioxide (dry)
Propane	Nitrogen
Butane	Hydrogen

Special designs (PTFE lining, special lubrication, special material, etc.) can be used for corrosive and humid gases, such as

Ethylene	Digester gas
Biogas	Sulphur dioxide
Acid gas	etc.

Permissible temperature ranges

For the standard design, the following fluid temperature and ambient temperature ranges are permitted:

Fluid temperature range:	-10°C to +50°C
Ambient temperature range:	-20°C to +60°C resp. +40°C

Pressure loss

The pressure loss is calculated using the following formula:

$$\Delta p = Z_P \cdot \rho \cdot \frac{Q_M^2}{DN^4}$$

where

Δp	is the pressure loss	[mbar]
Z_P	is the pressure loss coefficient	
ρ	is the density	[kg/m ³]
Q_M	is the flow rate at measurement conditions	[m ³ /h]
DN	is the nominal diameter of the meter	[mm]

The pressure loss coefficient Z_P is constant for all volumeters of the types TERZ 94 and TERZ 94-S. It is:

$$Z_P = 5040$$

This is an approximate mean value. The exact value is calculated from the pressure loss which is determined on testing the volumeter.

Example of calculation:

$Q_M = 650 \text{ m}^3/\text{h}$; $DN = 150$; $\rho = 1.3 \text{ kg/m}^3$ [natural gas, 600 mbar]

$$\Delta p = Z_P \cdot \rho \cdot \frac{Q_M^2}{DN^4} = 5040 \cdot 1.3 \cdot \frac{650^2}{150^4} = 5.5 \text{ mbar}$$

Therefore, the pressure loss Δp with a volumeter of the type TERZ 94 is 5.5 mbar in this case.

Installation

The gas flow must be free of shocks and pulsations as well as free of foreign particles, dust and liquids. Any components affecting the gas flow must absolutely be avoided directly upstream of the TERZ 94 volumeter.

To achieve the highest possible accuracy (measuring error <1%), an inlet pipe of 2 DN in length with a perforated-plate straightener should be installed upstream of the meter.

You can install the meters in any position (vertical or horizontal) up to and including the nominal diameter of DN 200. From the nominal diameter of DN 250, only the position stated in the purchase order is possible.

When you install the volumeter, please observe the direction of flow indicated on the case!

The meter head (1) can be turned after the set screw (2) has been loosened. Turn the meter head by max. 360°, otherwise the signal wires can become twisted and break.

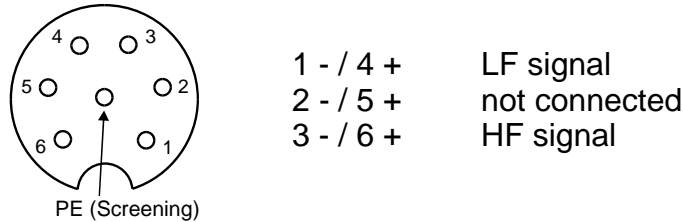
You can install the meter head also vertically. To do this, you must proceed as follows:

- Unscrew the cover of the meter head.
- Disconnect the two wires from terminal X5 (remember the polarity!).
- Loosen the set screw (2). Now you can remove the case of the meter head and an aluminium assembly part will appear.
- On the side of the case, there is a hole which is covered with a screw. Mount the retainer part to this hole and close the hole in the rear panel by means of the screw.
- Thread the signal wires through the retainer part, place the meter head onto the turbine case, turn it into the desired position and retighten the set screw (2).
- Connect the signal wires again to terminal X5 (make sure that the polarity is correct!) and screw on the cover again.

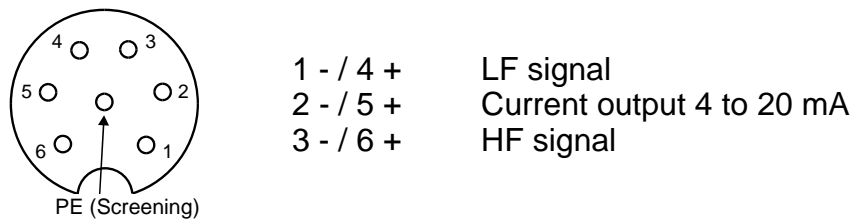
Electrical connections

The LF and HF volume pulses and the current output in non-Ex devices are led out of the meter head by a 7-pin connector (Binder). All other connections have to be made at the terminals on the board.

Standard connection TERZ 94 (Ex and non-Ex devices) and TERZ 94-S (Ex devices):



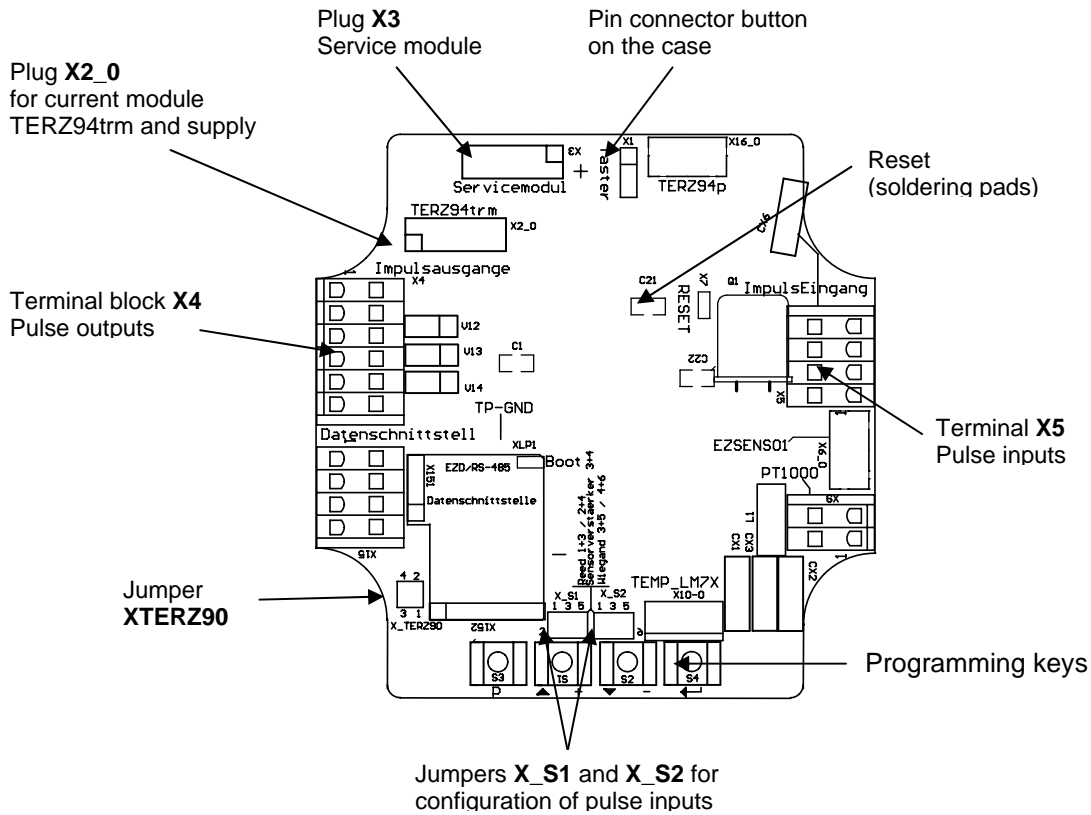
Standard connection TERZ 94-S (non-Ex devices):



In areas subject to explosion hazards, the TERZ 94 must only be connected to certified intrinsically safe circuits. Make sure that the limiting values from the conformity certificate (see appendix) for the devices, which have to be connected, are not exceeded.

If one or more electric circuits are used, it is to ensure that with the cable selection the permissible limiting values according to the EEC design inspection certificate are not exceeded. Each ex signal circuit has to be wired in its own cable, which is to be led through the appropriate cable gland. A fixed installation of the intrinsically safe cables is mandatory. The connecting cables have to be provided with core-end sleeves.

To reach the electrical connections on the board, you must first remove the cover of the meter head.



To convert from the meter head directly mounted on the meter case to the remote totalizing unit and vice versa it is necessary to change the positions of some jumpers (see inputs and outputs in the annex).

	X_ S1 (and X_ S2*)	X_ TERZ90
Meter head mounted on meter case	3-5 and 4-6	all open
Remote totalizing unit	3-5 and 4-6	1-2 (and 3-4*)

* for 2-channel measurement only

TERZ 94:

Controlling the start-stop totalizer or resetting the resettable totalizer (depending on the programming of the electronic totalizing unit) is performed through input X5 terminals 1 and 2.

As soon as input X5 terminals 1 / 2 has been short-circuited through an external contact, interruption or resetting is performed.

⇒ For this purpose, set jumpers at the positions identified with XS 2 to the “reed contact” function.

TERZ 94-S:

In the case of the TERZ 94-S, terminal X22 (on current module TERZ94trm) is used as current-loop connection to supply the device and as output current (4-20 mA).

The output signals can be picked up at the following terminals:

HF signals: Output X4, terminals X4,4 (+) / X4,3(-)

LF signals: Output X4, terminals X4,2 (+) / X4,1(-)

Now connect the cables and then put the cover again on the lower part of the housing.

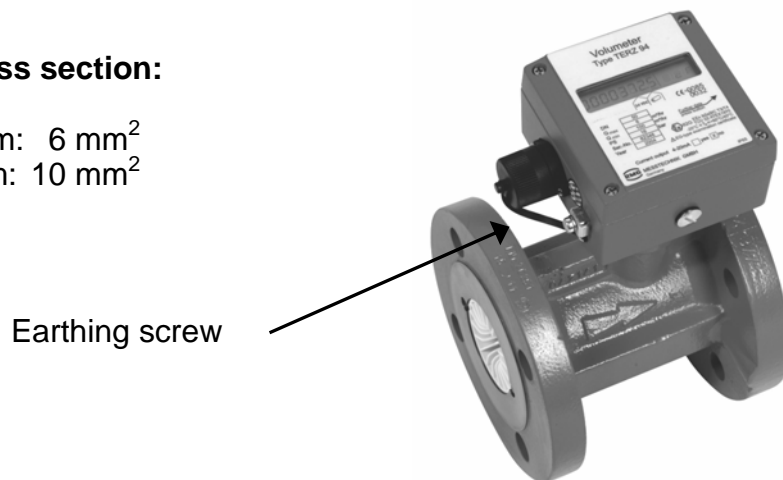
To connect the cables to the spring terminals, you need a screwdriver with a blade width of a maximum of 2.5 mm. Introduce the blade into the intended slot and press down the screwdriver to open the spring terminal.

Earthing

To prevent measuring errors caused by electromagnetic interference, you **must not fail** to earth the case of the meter head via the earthing screw on the left side of the case.

Minimum cable cross section:

up to a length of 10 m: 6 mm²
from a length of 10 m: 10 mm²



Cables

Use 2-core or multicore **shielded** cables which are twisted together in pairs (type LIYCY) for the signal lines (LF output, HF output, current-loop

connection, control input). The shielding must always be connected to earth on both sides. In the case of the TERZ 94, you must proceed as described in the chapter "Cable glands".

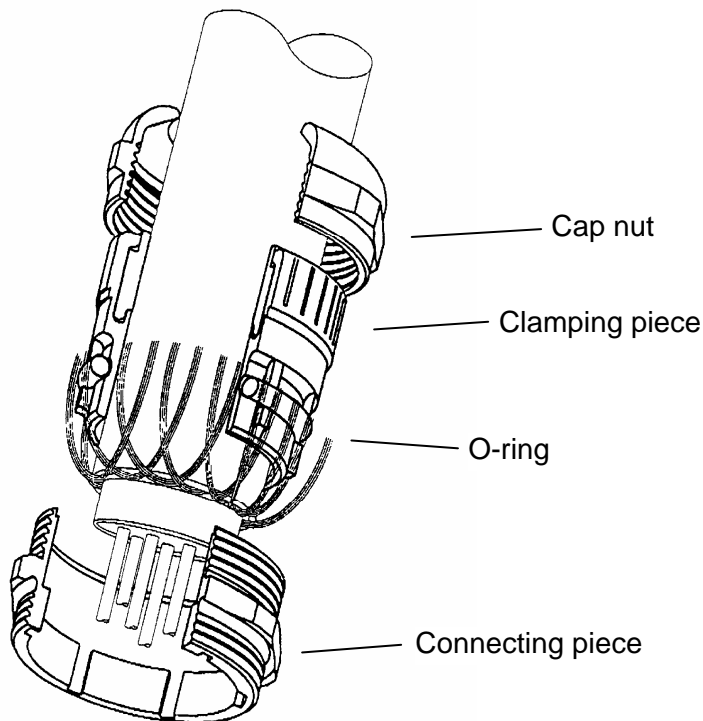
We recommend that cable cross sections between 0.25 mm² and 0.5 mm² are used. Due to the cable gland, the outside diameter must be between 4.5 mm and 6.5 mm.

When the device is used in areas subject to explosion hazards, the maximum cable length is limited by the limit values for intrinsically safe circuits and depends on the inductance and capacitance of the cable!

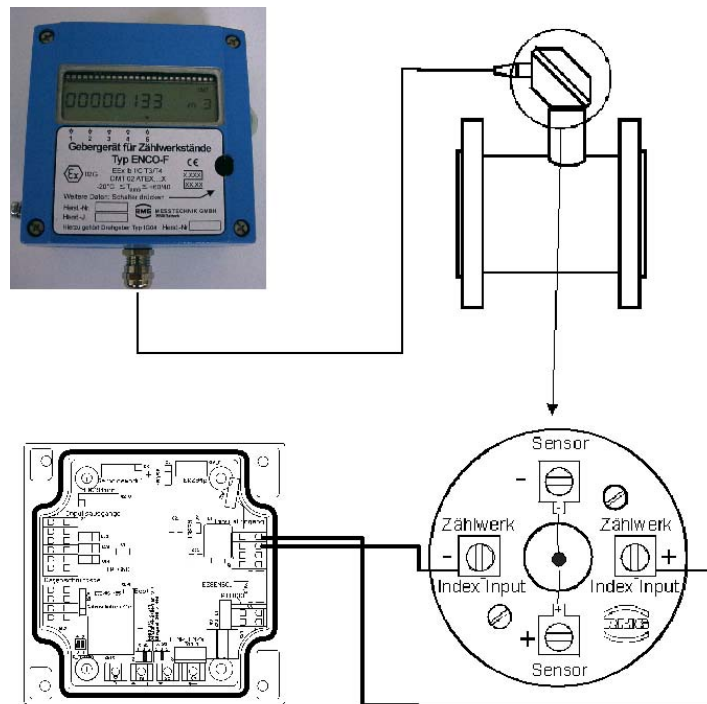
Cable glands

Clamp the shielding **on both sides**, as shown in the picture below, into the cable glands located on the outside of the case:

- Unscrew the cap nut.
- Pull out the plastic clamping piece.
- Push the cable end through the cap nut and the clamping piece and bend the shielding backwards.
- Put the clamping piece back into the connecting piece.
- Screw on the cap nut again.



Installing the remote totalizing unit



If your TERZ 94 is designed for remote totalizing, you can install the totalizing unit at a distance of up to 50 m from the meter case. Usually, the cable has already been connected to the sensor and the totalizing unit when the TERZ 94 is delivered. Should this not be the case, you will have to connect the connecting cable to Input-terminal X5, clamp 3 (+) and clamp 4 (-) of the display board and the terminals marked “Zählwerk / Index Input“ on the terminal head. Use only shielded cables of the type:

LIYCY - 2 x 0.75 blue
 Maximum cable length: 50 m

Connect the wires of the sensor to the terminals marked “Sensor +“ and “Sensor -“ of the terminal head (make sure that the polarity is correct!).

Furthermore, you must check the plug-in jumpers XS1, XS2 and XTERZ90 on the display board.

Settings at XS1 and XS2: jumpers 3-4

Start-up

Connecting the gas flow



Do not fill any downstream pipelines or station sections through the TERZ 94. This may speed up the turbine wheel and lead to excessively high flow rates with resultant damage.

Short-time overload operation of 20% above the maximum flow rate Q_{\max} is permissible. No damage will occur in the case of a return flow without shocks.

Before starting up the device, make sure that all lines have been correctly installed and connected in the terminal compartment.
The case must be completely closed.

Initializing the totalizing unit

When you start up the device for the first time, set the totalizing unit in the desired condition.

Check the programming of the pulse width, the LF decade scaler, etc.

TERZ94-S:

Check the programming of the current output mode.

NOTE:

All parameters can only be changed after the cover of the meter has been removed.

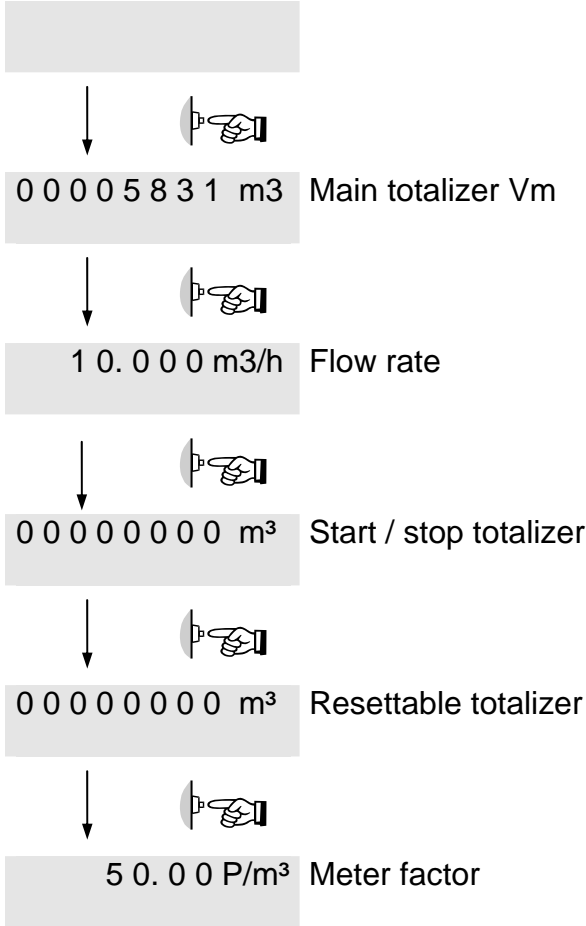
Operation

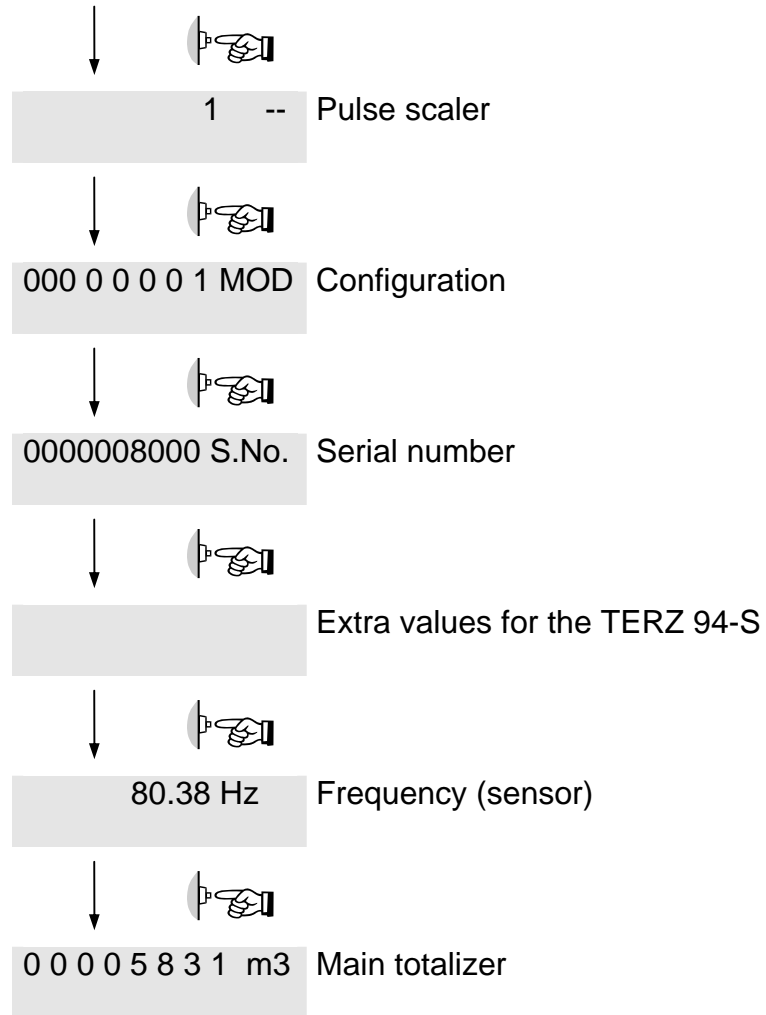
Display

In normal operating mode, the main totalizer is displayed. When you press the control button on the right side of the case, all values will be shown. After the preset display wake-up time has elapsed, the main totalizer will appear again.

If the display of the TERZ 94 does not show anything, the device is in energy-saving mode. In this mode, the display is switched off. However, incoming pulses are processed and the outputs are set. As soon as you press the control button, the display values will appear again.

Display switched off:





An overview of parameters and the complete matrix are shown in the annex.

NOTE:

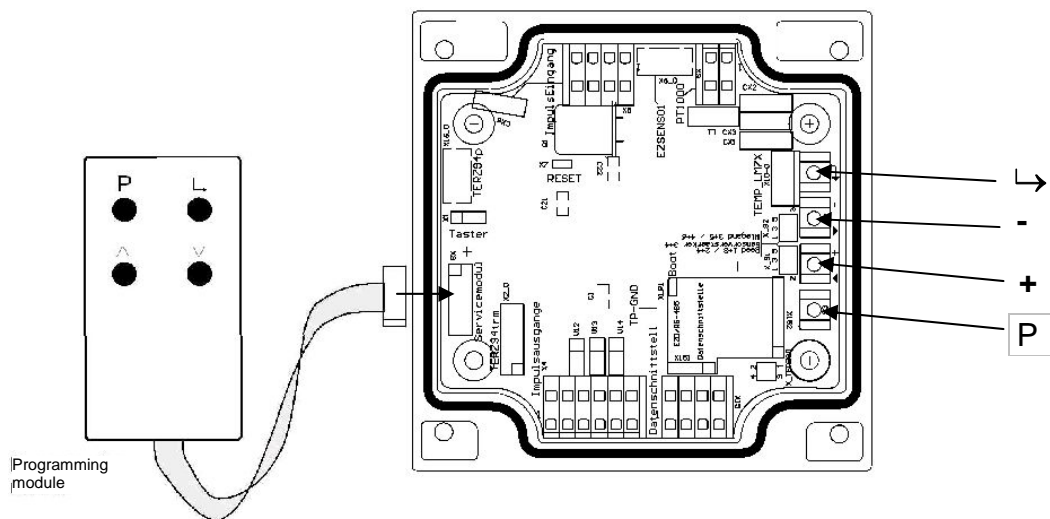
The button located externally on the case reacts when it is released and not when it is pressed. The duration of pressing the button is evaluated and results in different reactions of the device.

Pressing the button for a short time causes the display to show the next display value, while pressing the button for a longer time (more than 2 seconds) will activate all segments of the display (segment test) and then the display will switch over to showing the Vm totalizer.

The following text describes procedures where the button is normally pressed for a short time.

Programming

For programming the TERZ 94 / 94-S, there are four buttons on the rear side of the board. Alternatively, you can program the device with the programming module (available as an accessory). The programming module is to be connected to the pin connector indicated in the picture below.



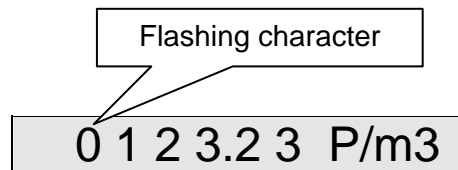
Programming with the programming module is to be performed in the same way as with the buttons..The external and internal buttons correspond to each other in the following way:

Int. button	Ext. button	Meaning
P	P	<p>Display mode: Switch over to programming mode (Press the button longer than 2 seconds)</p> <p>Programming mode: Set the decimal point.</p>
+	^	<p>Display mode: Switch over to the next higher level.</p> <p>Programming mode: - Increase the decimal by 1. - Scroll in the list. (Value identified with "L")</p>
-	∨	<p>Display mode: Switch over to the next lower level.</p> <p>Programming mode: - Decrease the decimal by 1. - Scroll in the list. (Value identified with "L")</p>
↳	↳	<p>Display mode: Short-time view of the coordinate (e.g. A01)</p> <p>Programming mode: Go to the right by one decimal place (if the last decimal has been reached: Quit programming mode).</p>

Principle of programming

For programming, you must always proceed as follows:

- First change over to the display value to be modified.
 - To do this, press either the control button (only forwards)
 - or the internal buttons “+” and “-” or the external buttons “^” and “v” (forwards and backwards).
- Change to programming mode by pressing “P” for at least **2 seconds**. On the left side of the display, a flashing character or cursor will appear. If necessary press the “↳” key so many times until a flashing character appears.



- You can now modify the flashing decimal by pressing either “+” or “^” (+1) or “-” or “v” (-1).
Example: If you press the “^” button three times, the first decimal will be increased from 0 to 3. If an “L” appears on the far left side of the display, this value is a list. With a list, you can only scroll in the specified values.
- After you have completed your programming of the first decimal, press “↳” once and the next character will start to flash.
Now proceed with your programming until you have reached the last decimal place.
- Then you must press “↳” once again to have the set value accepted and quit programming mode.
- Press the “P” button to set the decimal point behind the flashing digit.
With totalizers, modes and integers, no decimal point is permitted.
- Press the control button if you have made an error or if you want to discontinue inputting data.

Display values

Measured values, such as flow rate, frequency, etc. are display values and cannot be directly modified. However, there are many parameters which influence the formation of these measured values. These parameters are described in the following section.

Examples of display values:

- Flow rate
- Version number
- Year of construction
- Serial number
- Value of the current output in mA
- etc.

Parameters and Modes of the TERZ 94 / 94-S

In the following text, the individual parameters are described in detail.

1. Meter factor (pulse value)

TERZ 94 / 94-S

With the meter factor (pulse value), the relevant flow rate at measurement conditions is calculated from the signal frequency of the sensor element in the electronic totalizing unit:

$$Q_M = \frac{f}{K} \cdot 3600 \left[\frac{\text{m}^3}{\text{h}} \right]$$

f: Signal frequency (Hz)

K: Meter factor (pulses/m³)

Q_M: Flow rate at measurement conditions (m³/h)

The meter factor has been calibrated in the factory in such a way that working cubic metres are directly displayed. Its value can be read from a label located on the left side of the case.

Any modification of this adjustment is within the sphere of responsibility of the operating company.



NOTE!

The new value is immediately used for all calculations performed after each modification of the meter factor.

The uninfluenced signal frequency of the sensor element is available at the HF output.

The frequency range can be determined from the meter factor K and the minimum and maximum flow rates at measurement conditions of the meter in accordance with the following formulae:

$$f_{\min} = \frac{Q_{M\min}}{3600} \cdot K$$

$$f_{\max} = \frac{Q_{M\max}}{3600} \cdot K$$

Q_{Mmin}: Minimum flow rate at measurement conditions

Q_{Mmax}: Maximum flow rate at measurement conditions

K: Meter factor (pulse value)

Example:

$$Q_{M\min} = 16 \text{ m}^3/\text{h}$$

$$Q_{M\max} = 250 \text{ m}^3/\text{h}$$

$$K = 2362 \text{ pulses/m}^3$$

$$f_{\min} = \frac{16}{3600} \cdot 2362 \text{ Hz} = 10.5 \text{ Hz}$$

$$f_{\max} = \frac{250}{3600} \cdot 2326 \text{ Hz} = 164 \text{ Hz}$$

2. LF pulse scaler

TERZ 94 / 94-S

The frequency of the LF pulses is set by a pulse scaler (A07). There are the following setting options: 0.01; 0.1; 1; 10; 100.

Other values can not be programmed, it is only possible to scroll in the list of these values ('t' key vesp. '_' key).

This pulse scaler has only effect on the frequency of the LF pulses not on the display. The number of displayed digits after decimal point or a multiplier are programmed as an operating mode (A08)

Recommended values (= values set in the factory)

DN [mm]	Pulse scaler [pulses/m ³]	LF decade scaler	Pulse rate [pulses/m ³]	Maximum output frequency [Hz] ¹⁾
25	10	1	10	0.1
40	10	10	1	0.1
50	10	10	1	0.1
80	10	10	1	0.1
100 ²⁾	10	10	1	0.1
150	1	1	1	0.3
200	1	1	1	0.6
250	1	1	1	0.7
300	1	1	1	1.1
400	1	10	0.1	0.2
500	1	10	0.1	0.3
600	1	10	0.1	0.4

¹⁾ Rounded values

²⁾ In the case of the design with $Q_{\max}=650 \text{ m}^3/\text{h}$, the LF decade scaler is set at 1.

3. Configuration

The basic configuration of the TERZ-94 is implemented via an 8-character display value (A08). This “TERZ mode” defines the operating mode of the device.

Some parameters require a specific hardware or hardware configuration.

NOTE!

Hardware and software configurations must coincide.

Any modifications of these parameters can cause malfunctions.

Let's start on the left side of the display: (operating alignment italic)

– **Internal parameters**

For testing and diagnostics (no influence on the metering result).

0: *Menu for standard operation.*

1: Menu for service

9: All parameters visible.

– **Main totalizer mode**

This parameter defines the unit for the gas volume

0: *m³ (cubic meter).*

1: cf (cubic foot).

– **LF pulse width**

The LF pulse width can be set at 125 ms or 250 ms.

0: 125 ms

1: *250 ms*

– **Cut-off time of the display**

A few minutes after you have operated the device for the last time, the display will switch off to expand the service life of the battery of the TERZ-94. There are the following times for selection:

0: 1 minute

1: *5 minutes*

2: 10 minutes

3: 15 minutes

4: 1 hour (for test purpose only!)

– **Interface protocol**

0: *OFF*

1: EZD protocol 0x00 / Standard Vo protocol (NAMUR)

2: EZD protocol 0x7f / Vo protocol for external devices (NAMUR)

3: Test protocol

– **Pulse scale**

In this operating mode the display is set. To get the real totalizer readings the displayed value must be multiplied with the multiplier.

- 0: 2 digits after decimal points, multiplier: 1
- 1: 1 digit after decimal points, multiplier: 1
- 2: *no digits after decimal points, multiplier: 1*
- 3: no digits after decimal points, multiplier: 10
- 4: no digits after decimal points, multiplier: 100

– **Current output**

- 0: OFF
- 1: Current output is active
- 2: Current output is active and faults are signalled (3,5 mA)
- 3: Current output is active and faults are signalled (21,8 mA)

– **TERZ operating modes**

There are the following operating modes at the moment:

- 0: ENCO-F
- 1: ENCO-M
- 2: TERZ 94 1 channel
- 3: TERZ 94 1 channel with start / stop totalizer
- 4: TERZ 94 1 channel with reset totalizer
- 5: TRZ03-TE/TEL 2 channels with pulse monitoring (SW), Vm Stop
- 6: TRZ03-TE/TEL 2 channels with pulse monitoring (SW), Vm Run
- 7: TRZ03-TE/TEL 2 channels with pulse monitoring (HW), Vm Stop
- 8: TRZ03-TE/TEL 2 channels with pulse monitoring (HW), Vm Run
- 9: TRZ03-TE/TEL 2 channels without pulse monitoring

SW means “pulse monitoring by software”, HW by hardware; Vm Stop means totalizer is stopped in case of a fault whereas the counting continues in the mode Vm Run.

Example:

00110112 MOD

- 2: TERZ – 1 channel
- 1: Current output is active, faults are not signalled.
- 1: Display of 1 digit after decimal point
- 0: Interface protocol off
- 1: Display cut-off time: 5 minutes
- 1: LF pulse width: 250 ms
- 0: Display in m³
- 0: Operating mode: No diagnostics mode is activated

4. Pulse comparator

The 2-channel version of the TERZ-94 (TRZ03 TE / TEL) provides for pulse monitoring.

Pulse monitoring requires two input pulses which are out of phase.

If a pulse occurs at the same time on channel 1 **and** channel 2, a fault counter is increased. If there is a missing pulse on one of the two channels, a fault counter is increased, too.

If this fault counter reaches the value **X**(A10) before **Y**(A11) undisturbed pulses have entered one of the two channels, a fault will be outputted.

This fault will not be erased until **Y** undisturbed pulses have been counted.

5. Flow rate at 4 mA

With this parameter, you set the flow rate (in m³/h) which corresponds to an outputted current of 4 mA. Generally, the minimum flow rate Q_{\min} of the meter is set here. (This setting is made in the factory.)

6. Flow rate at 20 mA

With this parameter, you set the flow rate (in m³/h) which corresponds to an outputted current of 20 mA. Generally, the maximum flow rate Q_{\max} of the meter is set here. (This setting is made in the factory.) Then the current which will be outputted for flow rates within the programmed limits will be between 4 and 20 mA and results from linear conversion.

7. Current default value (calibration current)

With this parameter, you set the value of the calibration current. A constant calibration current is outputted if the current output mode parameter is set to default. The value of the calibration current must be within the following limits:

Minimum value: 4 mA

Maximum value: 20 mA

8. Current output mode

Here you define the measured or default value which is to be outputted.

0: Default value (see above)

1: Flow rate Q_m

All other values are not permitted!

9. Current damping

Here you define how the current output is to be damped.
Permissible values for D are 0 to 0.9 !

Output current = (1-D) x value + D x old value

10. Correction factors for current offset and current rise

The current output is adjusted in the factory through two correction factors (offset and rise).

In the event that a recalibration should really be necessary, there is a PC-based program available which will define the new offset and rise values for you.

Power Supply

Depending on the type of the device, there are different options of power supply.

1. The basic TERZ 94 model is supplied by an internal lithium battery which enables to operate the device continuously for a period of six years. This, however, is conditional on the device being read once a week or “woken up” by pressing the external button.
2. If an interface module is used for transmitting data, such as the ENCO with external supply, the service life of the battery is more than 10 years.
3. The TERZ 94-S (current transmitter) is completely supplied through a current loop. If pulse processing is to be maintained even in the case of a power failure of the current loop, a standby battery (available as an option) should be installed which will bridge the power supply during a period of up to 6 months.

Maintenance

Lubrication

The TERZ 94 is fitted with permanently lubricated bearings up to and including the nominal diameter of DN 150. From the nominal diameter of DN 200, the meter is fitted with a lubricator. The type of lubricator and the lubrication instructions depend on the nominal diameter and the pressure rating:

Nominal dia.	Pressure rating	Lubricator	Lubrication instructions
DN 200	PN 10 to 16, ANSI 150	Oil gun (supplied)	Every 3 months 2 strokes
DN 200	PN 25 to 100 ANSI 300 to 600	Small oil pump (pushbutton- operated)	Every 3 months 6 strokes
DN 250	PN 10 to 16 ANSI 150		
DN 250	PN 25 to 100 ANSI 300 to 600	Large oil pump (lever-operated)	Every 3 months 2 strokes
from DN 300	all pressure classes		

Please observe also the instruction plate on the case.

In the case of unfavourable operating conditions, such as the formation of water or hydrocarbon condensate or the use of dust-laden gas, we would recommend performing lubrication at shorter intervals, even daily under extreme conditions (permanent formation of condensate).

Recommendations for lubricating oils:

Aero Shell Fluid 12 or another oil with 2 to 4°E at 25°C as per MIL-L-6085 A specification.

Changing the battery

Use only lithium batteries of the type **SL 770/P Size C, 3.6 V** produced by Sonnenschein or type **LS 33600** produced by Saft.

These batteries have a service life of a minimum of 6 years and can be ordered ready for installation from RMG under the following order number:

For Non-Ex (not explosion-protected) devices: 86.90.613.00
For Ex (explosion-protected) devices: 86.90.614.00



- If you use other batteries than the replacement batteries from RMG, you run the risk of the TERZ 94 not being approved for areas subject to explosion hazards any more.
- In areas subject to explosion hazards, you must never insert or remove the battery. Remove the display board from the case and change the battery in an area without explosion hazards.

To change the battery, you must proceed as follows:

- Remove the cover of the meter head – on the rear side, there is the battery fixed with cable ties.
- If the meter is located in an area subject to explosion hazards, disconnect the sensor wires from terminal X5 (see chapter “Electrical connections” – Remember the terminals and colours!) and take the display board to an area without explosion hazards.
- Remove the connecting wires of the battery from the contacts on the bottom of the terminal board.
- Screw off the four screws with which the battery board is fixed.
- Remove the cable ties with which the battery is fixed and take out the battery.
- Insert the new battery and fix it with cable ties.
- Plug the connecting wires of the battery on the contacts of the terminal board. Make sure that the polarity is correct.
- Reinsert the battery-board into the case and screw it on. In case you have previously disconnected the wires of the sensor and the control button, you must connect them again (make sure that the polarity of the sensor wires is correct!).
- Close the case.

Specifications

Measuring range

Under atmospheric pressure: 1:16

If the pressure increases, the measuring range of the meter extends.
Measuring ranges of up to 1:50 can be reached.

Measuring error

For Q_{\min} to $0.2 \cdot Q_{\max}$: $\leq \pm 2\%$

For $0.2 \cdot Q_{\max}$ to Q_{\max} : $\leq \pm 1\%$

(DN 25: $\leq \pm 2\%$ for Q_{\min} to Q_{\max})

Reproducibility: $\leq \pm 0.5\%$

Temperature ranges

Fluid temperature range: -10°C to +50°C

Ambient temperature range:

TERZ 94 II2 G EEx ib IIC T4 -20°C to +40°C

II2 G EEx ib IIC T3 -20°C to +60°C

TERZ 94-S II2 G EEx ib IIC T4 -20°C to +60°C

In the case of special designs, even higher or lower fluid temperatures are possible in non-Ex versions.

Inputs and outputs

Sensor input S1 (Measuring input)

(For Ex connected loads, see approval certificate)

Terminals: X5,1 (+)
X5,2 (-)

Sensor type:
Wiegand sensor, direct Line length < 50 cm
Jumpers X_S1 / 3-5 and 4-6

Wiegand sensor, remote totalizer Line length < 30 m

Specifications

Reed contact

Jumpers: X_S1 / 3-5 and 4-6

Jumpers: X_TERZ90 / 1-2

Jumpers X_S1 / 1-3 and 2-4

Sensor input S2

(Comparative input or start/stop/reset)

(For Ex connected loads, see approval certificate)

Terminals:	X5,3 (+) X5,4 (-)
Sensor type: Wiegand sensor, direct	Line length < 50 cm Jumpers X_S2 / 3-5 and 4-6
Wiegand sensor, remote totalizer	Line length < 50 m Jumpers: X_S2 / 3-5 and 4-6 Jumpers: X_TERZ90 / 3-4
Reed contact	Jumpers X_S2 / 1-3 and 2-4

HF output

In the case of the explosion-protected (Ex) design, the device can only be connected to a certified intrinsically safe circuit.

Terminals:	X4,4 (+) X4,3 (-)
Output:	Open-drain transistor
T_{pulse}	1 ms \pm 10%
F_{max}	300 Hz

	Ex	Non-Ex
U_{min} :	4.0 V	4.0 V
U_{max} :	28 V	30 V
I_{max} :	60 mA* (total current)	400 mA
External inductance	1 H	
External capacitance	25 μ F	

* maximum total current of the 3 pulse outputs (LF + HF + Alarm)

LF output

In the case of the explosion-protected (Ex) design, the device can only be connected to a certified intrinsically safe circuit. (For Ex connected loads, see approval certificate.)

Terminals: X4,2 (+)
X4,1 (-)

Output: Open-drain transistor
T_{pulse} 125 ms ± 10% (F_{max}: 4 Hz)
250 ms ± 10% (F_{max}: 2 Hz)

	Ex	Non-Ex
U _{min} :	4.0 V	4.0 V
U _{max} :	28 V	30 V
I _{max} :	60 mA* (total current)	400 mA
External inductance	1 H	
External capacitance	25 µF	

* maximum total current of the 3 pulse outputs (LF + HF + Alarm)

Alarm output

In the case of the explosion-protected (Ex) design, the device can only be connected to a certified intrinsically safe circuit. (For Ex connected loads, see approval certificate.)

Terminals: X4,6 (+)
X4,5 (-)

Output: Open-drain transistor

	Ex	Non-Ex
U _{min} :	4.0 V	4.0 V
U _{max} :	28 V	30 V
I _{max} :	60 mA* (total current)	400 mA
External inductance	1 H	
External capacitance	25 µF	

* maximum total current of the 3 pulse outputs (LF + HF + Alarm)

Vo or RS-485 data interface

In the case of the explosion-protected (Ex) design, the device can only be connected to a certified intrinsically safe circuit. (For Ex connected loads, see approval certificate.)

Vo data interface:	<i>Internal</i>	<i>Connector (Binder)</i>
Terminals:	X15,4 (+)	4
	X15,3 (-)	1
	X15,1 and X15,2 open	
U_{\min} :	7.0 V	
U_i :	13.5 V	
I_i :	15 mA	
P_i :	210 mW	
External capacitance:	2,5 μ F	
External inductance:	1 H	
Ex separating unit:	KFD2-ST2-Ex1.LB (Pepperl+Fuchs)	

RS-485 data interface:

Terminals:	X15,4 (+ supply)
	X15,3 (- supply)
	X15,2 (line A)
	X15,1 (line B)
U_{\min} :	7.0 V
U_i :	10.5 V
I_i :	428 mA
P_i :	900 mW
Internal capacitance:	1,32 μ F
Internal inductance:	600 μ H
External capacitance:	23,7 μ F
External inductance:	1 H
Ex separating unit:	17-21S1-S111 / EExi (Bartec)

NOTE: If the EZD protocol or the RS485 bus is used, the device is supplied via the data interface.

Temperature input (hardware and software options)

For Ex connected loads, see approval certificate.

Terminals:	X9,2 (+) X9,1 (-)
Sensor type:	PT 1000
Measuring range:	-20°C to 60°C
Resolution:	± 0.2°C

Current-loop connection (TERZ 94-S only!)

Terminals:	X22.1 (+) X22.2 (-)
U _{ext} (min):	12 V
U _{ext} (max):	28 V
I _{min} :	3.5 mA
I _{max} :	23 mA
External load (max.):	$R_{Lmax} = (U_{ext} - 10 V) / I_{max}$ (in Ω) e.g. U _{ext} = 16 V $\Rightarrow R_{Lmax} = (16 V - 10 V) / 23 mA = 260 \Omega$
Current output with	
- minimum flow rate:	4 mA
- maximum flow rate:	20 mA
- Warning:	3.5 mA
- Alarm:	23 mA
Accuracy, current output:	Better than 1% of the final value

Data for the use in hazardous areas:

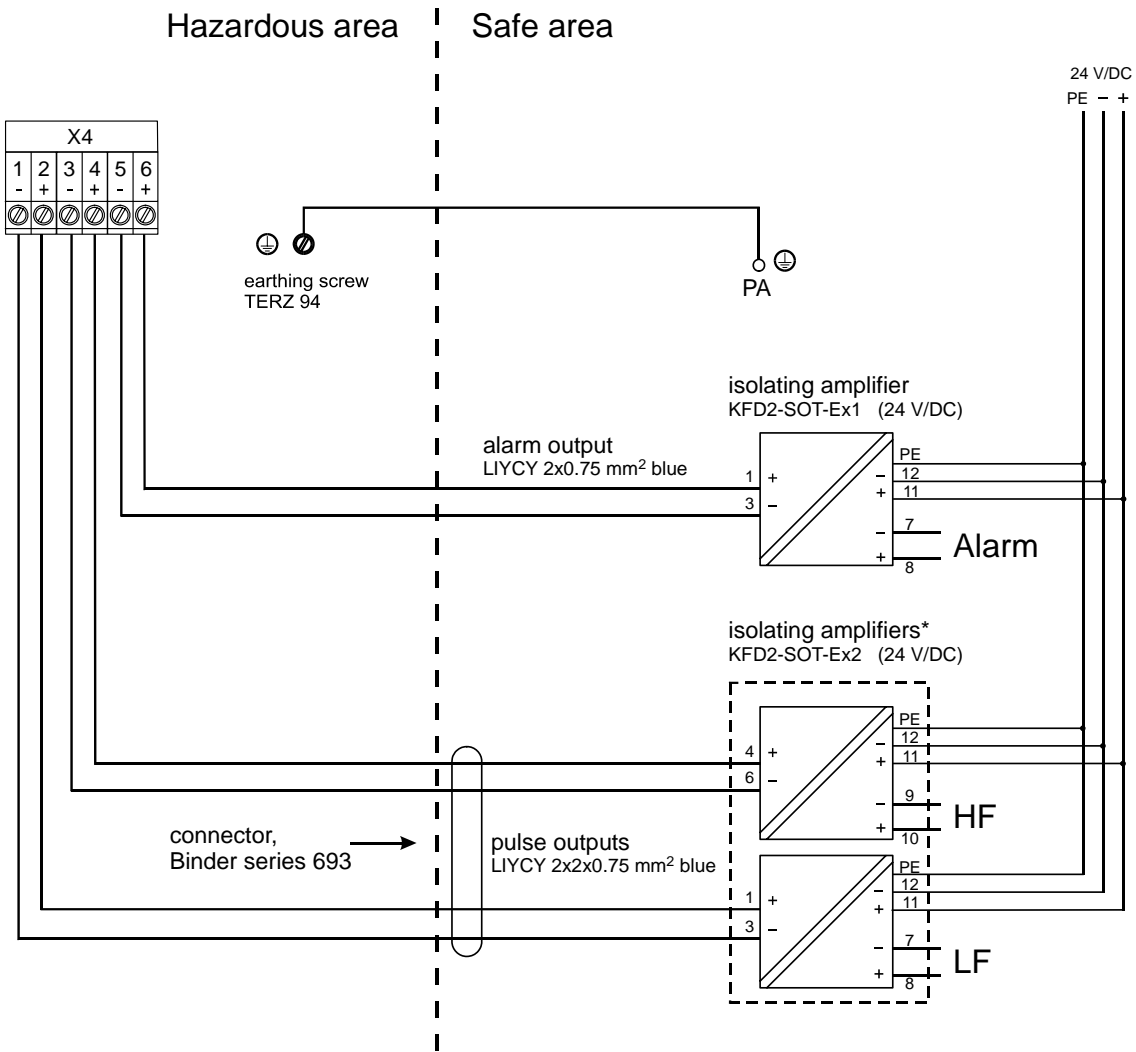
U _i	=	28 V
I _i	=	110 mA
P _i	=	770 mW
C _i	=	2,2 nF
L _i	=	110 μ F

Materials used for the meter case

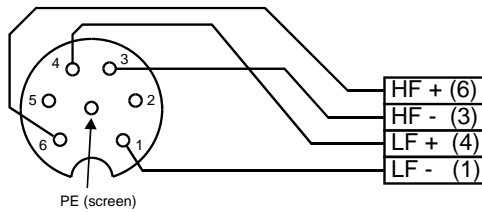
Spheroidal cast iron or steel, depending on the pressure class and the nominal diameter. Aluminium is used for the threaded-end design.

Examples of connection

Battery-operated device



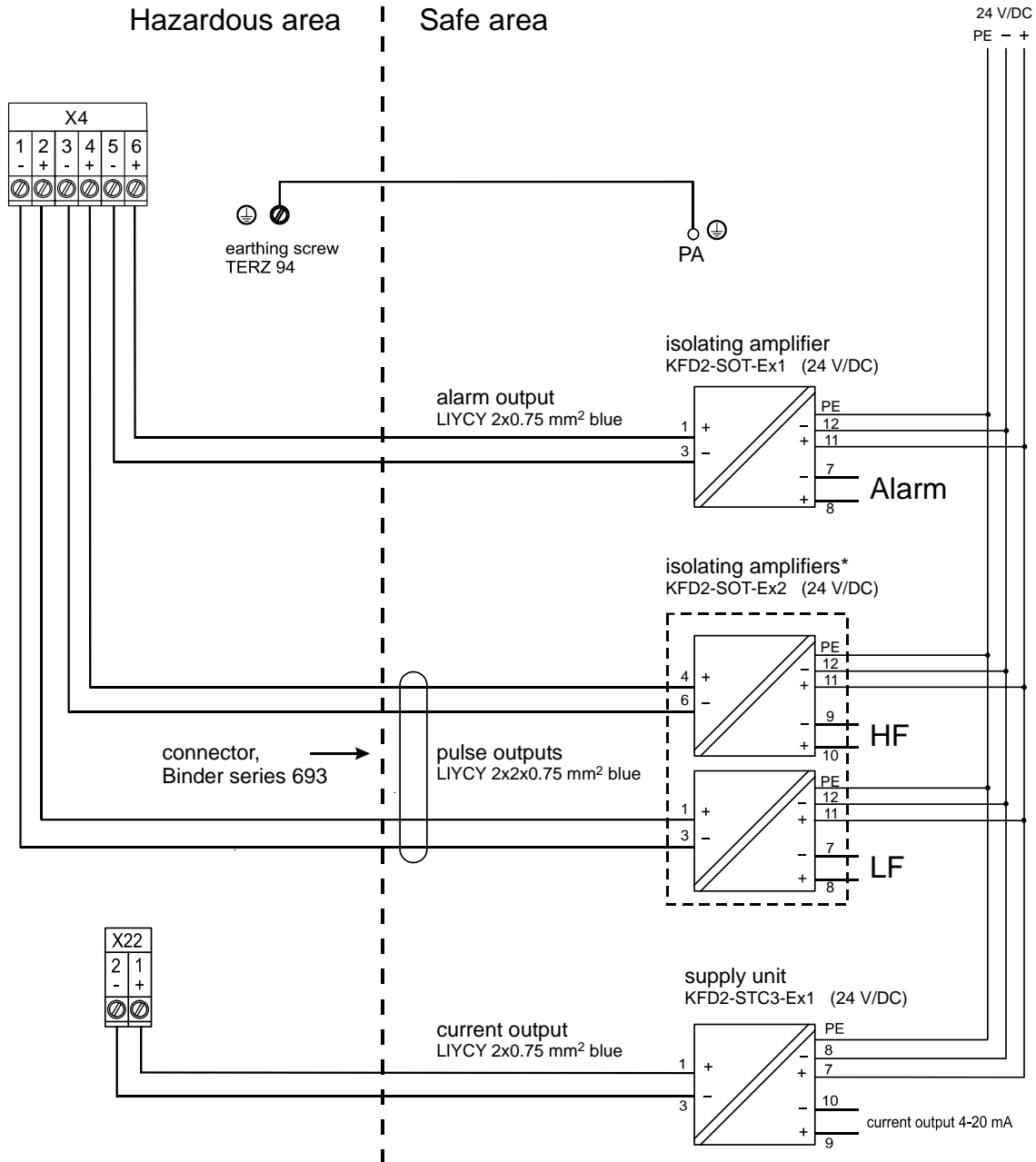
connector pin assignment:



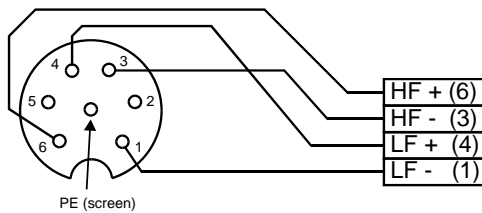
* If 2-channel isolating amplifiers are used, the two inputs must be separated!

Main-powered device (Ex design)

(Connection only via the current module with built in backup battery)



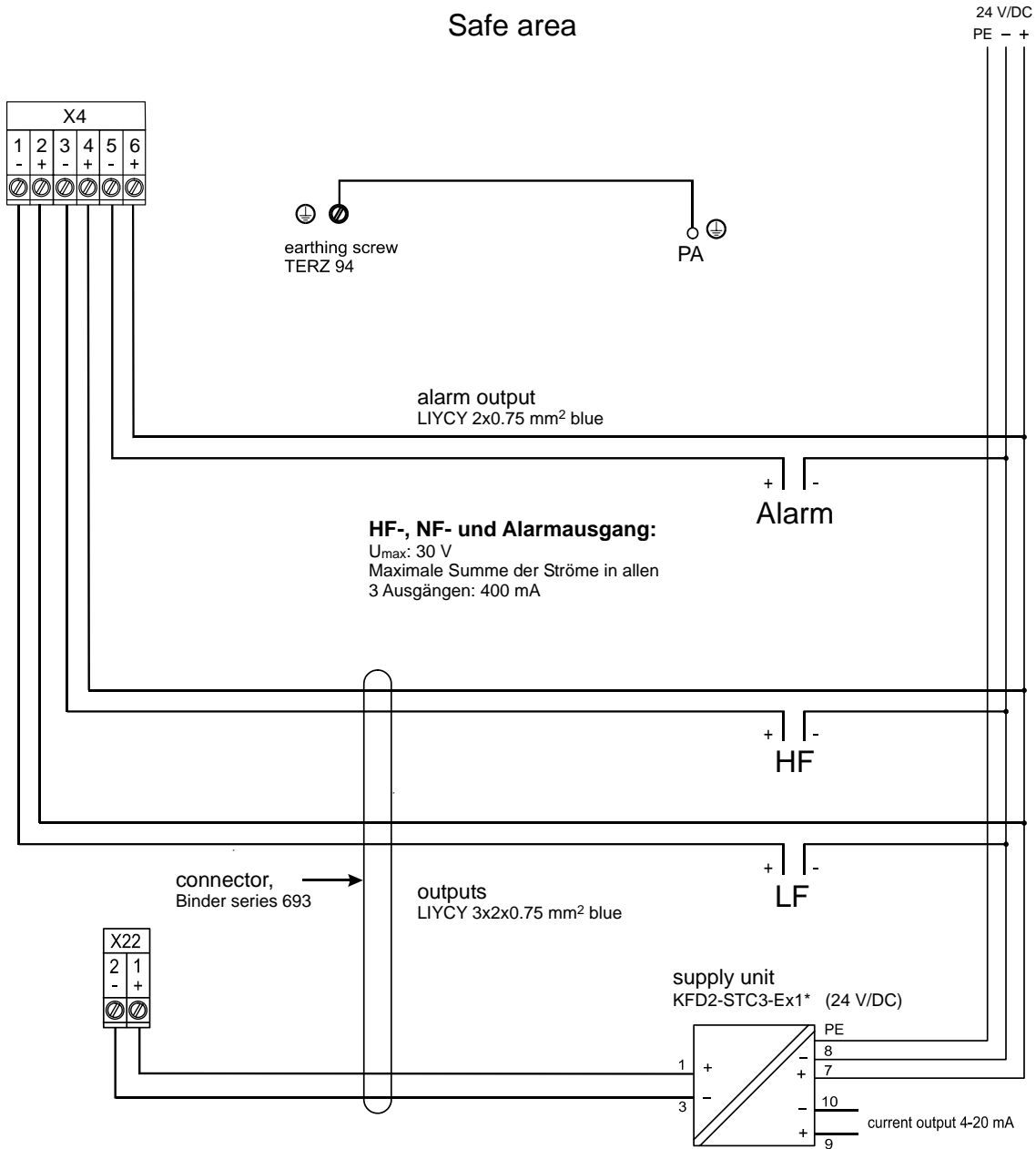
connector pin assignment:



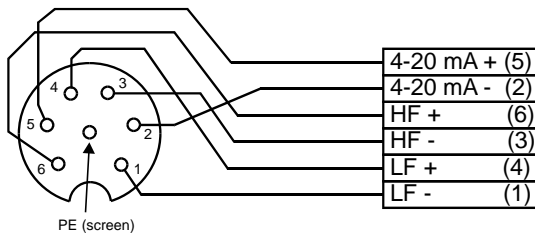
* If 2-channel isolating amplifiers are used, the two inputs must be separated!

Main-powered device (Non-Ex design)

(Connection only via the current module with built in backup battery)



connector pin assignment:



* Alternatively also the supply unit type KFD2-CR-1.300 is applicable. **If the current output is not used, a direct connection to 24 V/DC is possible.**

Annex

Overview of Parameters for the TERZ 94/94-S

	Parameter	Setting	Example (display)
A01	Main totalizer (Vm)	0 to 99999999	12345678 m ³
A02	Flow rate (Qm)		12.3 m ³ /h
A03	Disturbing quantity totalizer	0 to 99999999	123 m ³
A04	Start-stop totalizer	0 to 99999999	12345678 m ³
A05	Resettable totalizer	0 to 99999999	12345678 m ³
A06	Meter factor	in all: six digits	12.3456 P/m ³
A07	Pulse scaler	0.01; 0.1;1;10;100	L 1 --
A08	Configuration	TERZ operating mode	00011021 MOD
A09	Error	Rolling display	0 ERR
B01	Serial number	0 to 99999999	12345678 MOD
C01	Current output	TERZ 94-S	12.345 mA
C02	Flow rate at 4 mA	0 to 999999.99	20.00 --
C03	Flow rate at 20 mA	0 to 999999.99	650.00 --
C04	Calibration current	4.000 to 20.000	4.000 mA
C05	Current output mode	0 – Default value 1 – Flow rate Qm	3 MOD
C06	Correction factor - Offset	0 to 99999999	1234.5678 --
C07	Correction factor - Rise	0 to 99999999	1234.5678 --
C08	Damping display / current output	0 to 0.9	0.4 --
Z06	Frequency display		651 Hz

Standard Parameters (values set in the factory) up to DN 150

Internal	Menu for standard operation		Pulse width LF output:		Units:		Cubic meter (m ³)		
Cut-off time of	5 minutes		Interface protocol:		Off				
Settings									
Parameter	DN25	DN40	DN50	DN80	DN80	DN80	DN100	DN150	DN150
Nominal diameter									
Qm max (m³)	25	65	100	160	250	400	650	1000	1000
Meter factor	13000	7750	7700	2380	2380	1060	580	330	
Pulse scaler (pulses/m ³)	10	1	1	1	1	1	1	1	1
Configuration									
1 channel	00110102	00110102	00110102	00110102	00110102	00110102	00110202	00110202	00110202
2 channels, X:Y	00110109	00110109	00110109	00110109	00110109	00110109	00110209	00110209	00110209
1 channel with 4 - 20 mA without faults	00110112	00110112	00110112	00110112	00110112	00110112	00110212	00110212	00110212
2 channels, X:Y deactivated	00110119	00110119	00110119	00110119	00110119	00110119	00110219	00110219	00110219
Output current									
Flow rate at 4 mA	0	0	0	0	0	0	0	0	0
Flow rate at 20 mA	25	65	100	160	250	400	650	1000	1000
Calibration current	←	←	←	←	←	←	←	←	←
Current output mode 0=default value / 1=flow	1	1	1	1	1	1	1	1	1
Correction factor (offset)	←	←	←	←	←	←	←	←	←
Correction factor (rise)	←	←	←	←	←	←	←	←	←
Damping	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7

Standard Parameters (values set in the factory) from DN 200

Internal	Menu for standard operation		Pulse width LF		250 ms	Units:		Cubic meter (m ³)
Cut-off time of	5 minutes		Interface protocol::		Off			
Settings								
Parameter	DN200	DN200	DN250	DN250	DN300	DN400	DN500	DN600
Nominal diameter	1600	2500	4000	4000	4000	6500	10000	16000
Meter factor	135	80	75	44	48	24	12	6
Pulse scaler (pulses/m ³)	1	1	1	1	1	1	0.1	0.1
Configuration								
1 channel	00110202	00110202	00110202	00110202	00110202	00110202	00110302	00110302
2 channels, X:Y	00110209	00110209	00110209	00110209	00110209	00110209	00110309	00110309
1 channel with 4 - 20 mA without faults	00110212	00110212	00110212	00110212	00110212	00110212	00110312	00110312
2 channels, X:Y deactivated	00110219	00110219	00110219	00110219	00110219	00110219	00110319	00110319
Output current								
Flow rate at 4 mA	0	0	0	0	0	0	0	0
Flow rate at 20 mA	1600	2500	2500	4000	4000	6500	10000	16000
Calibration current	←	←	←	←	←	←	←	←
Current output mode 0=default value / 1=flow	1	1	1	1	1	1	1	1
Correction factor (offset)	←	←	←	←	←	←	←	←
Correction factor (rise)	←	←	←	←	←	←	←	←
Damping	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7

Fault and Event Display (coordinate A09)

In the TERZ 94/94-S there are 16 error messages.

The error numbers are indicated in a roll mode, if more than one error is active, the display changes each second to the next active error (1... 5... 1... 5...).

Number "0" means faultless operation.

Fault No.	Fault description	Remedy
0	No fault	-----
1	wrong EEPROM version, invalid constant	TERZ 94 PCB board must be exchanged
2	Pulse fault: (sensor loss / 10:10000 (X:Y))	Check the electrical connection of the sensor. Possibly the sensor must be exchanged.
3	EEProm Hardware fault	TERZ 94 PCB board must be exchanged
4	-----	
5	Current output min/max fault: (wrong range values)	Entered range values (C02 and C03) are wrong or the value of the counter factor is wrong. Check the values and change them if necessary.
6	-----	
7	-----	
8	Pulse output LF: (more than 500 NF pulses accumulated in the memory)	Value of the LF output pulse factor (A07) is too high and must be adapted.
9	-----	
10	Configuration ist wrong	Selected mode of operation is wrong. Change the operation mode in coordinate A8.8 to 2.
11	-----	
12	-----	
13	-----	
14	-----	
15	-----	
16	-----	

Matrix of the TERZ 94 / 94-S

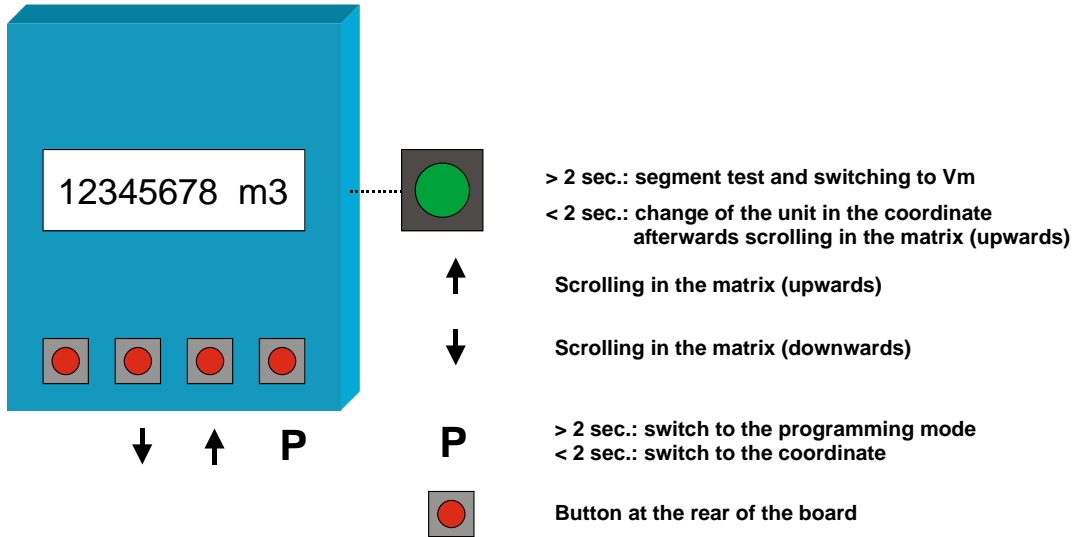
Coordinate	Specification	Terz94 1 Channel	Terz94 2 Channel	Terz94-S 1 Channel	Terz94-S 2 Channel
A01	Main Totalizer Vm	X	X	X	X
A02	Flow rate (Qm)	X	X	X	X
A03	Disturbing quantity totalizer	NO	X	NO	X
A04	Start / Stop totalizer	X	NO	X	NO
A05	Resettable totalizer	X	NO	X	NO
A06	Meter factor	X	X	X	X
A07	Pulse scaler	X	X	X	X
A08	Configuration	X	X	X	X
A09	Error	X	X	X	X
A10	Operating mode Pulse X from X:Y	NO	X	NO	X
A11	Operating mode Pulse Y from X:Y	NO	X	NO	X
B01	Serial number	X	X	X	X
C01	Current output	NO	NO	X	X
C02	Flow rate at 4 mA	NO	NO	X	X
C03	Flow rate at 20 mA	NO	NO	X	X
C04	Calibration current	NO	NO	X	X
C05	Current output mode	NO	NO	X	X
C06	Correction factor – offset	NO	NO	X	X
C07	Correction factor – Rise	NO	NO	X	X
C08	Damping display / current output	NO	NO	X	X
Z01	Number of digit positions following a Decimal point	NO	NO	NO	NO
Z02	Factor	NO	NO	NO	NO
Z03	Divisor	NO	NO	NO	NO
Z04	Direction of rotation for ENCO	NO	NO	NO	NO
Z05	Totalizer	NO	NO	NO	NO
Z06	Frequency	X	X	X	X
Z07	Maximum flow value	0	0	0	0
Z08	Frequency-mode	0	0	0	0
Z09	Error state	0	0	0	0
Z10	Number of pulses	X	X	X	X
Z11	Version number	X	X	X	X
	Not available	NO			
	Available	X			
	Available in service mode	0			

In case only a part of the matrix is displayed. It any depends on the operating mode, which fields are displayed. Fields, which have no function in the selected operating

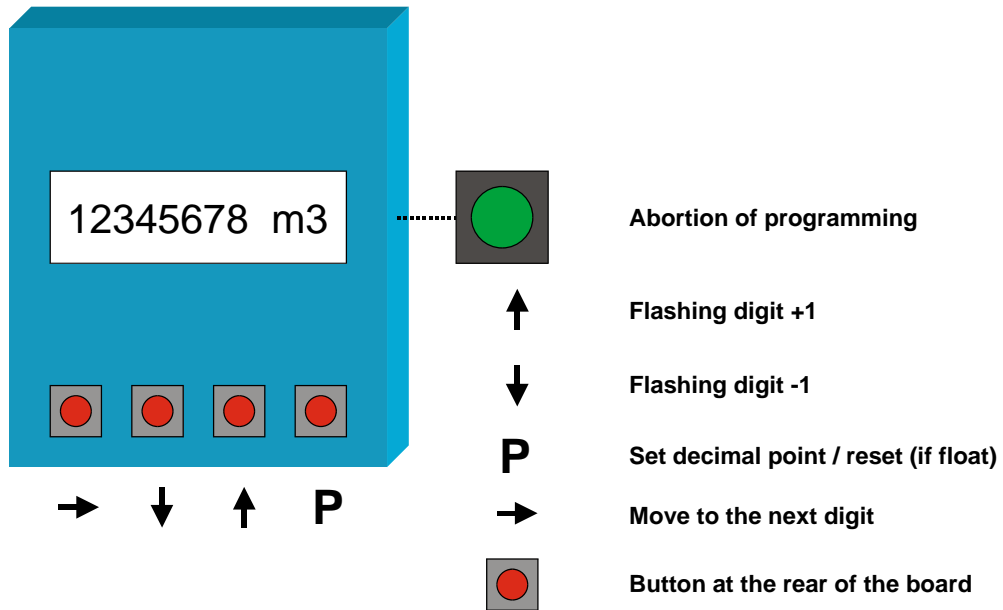
mode are blanked out.

TERZ 94 Button Assignments

Terz 94 Display Mode



Terz 94 Programming Mode



Converting the TERZ 94 into the TERZ 94-S

The TERZ 94 can be converted into a TERZ 94-S by installing another board.

- Remove the battery (see chapter “Changing the battery”).
- Remove the jumper for battery-powered mode (1-2) on the socket X2_0 of the board.
- Screw the 4 short stay bolts onto the present stay bolts on the board.
- Plug the current module TERZ94trm with a 12-pin connector (X2_1) into the socket X2_0.
- Apply the supply voltage (24V) to terminal X22 (1 +, 2 -).
- Switch on the power supply (24 V).
- Check the current output:
 - Set the current output in channel A09 to I-Out (mode 1 or 2).
 - Channel C02: enter flow rate at 4 mA.
 - Channel C03: enter flow rate at 20 mA.
 - Set channel C04 (default value) to 10.0 mA.
 - Set channel C05 (output mode) to 1 (current output is proportional to the flow rate).
 - Channel C06: enter correction value for the current offset (see value on the board)
 - Channel C07: enter correction value for the current rise (see value on the board)
 - In the event that a recalibration should be necessary, there is a PC-based program available which will define the new offset and rise values.
- Now the TERZ94-S is operational.

Cable Type Abbreviations

Basic type: Control cable (twisted cable)

Example

