Gas Volume Corrector

EC 21 / EC 24

EC 21

Volume Correction
via Temperature

7.745
04.12

EC 24

Volume Correction
via Pressure and
Temperature

7.741
03.53

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Serving the Gas Industry
- WORLDWIDE

Method of operation

Irrespective of pressure and temperature, a gas meter measures only the gas volume flowing through it, i.e. what is called volume at measurement conditions. Since gas can be compressed, the quantity of gas which has actually flowed through the meter has still to be calculated from the measured volume at measurement conditions (correction). As a measure for this quantity of gas, what is called volume at base conditions (related to the temperature at base conditions of 0°C and the pressure at base conditions of 1.01325 bar) is used.

This conversion is made by the EC 21 or EC 24 volume corrector on the basis of the equation of state for ideal gases. Since this equation alone does not meet all the requirements for high-precision gas metering, it is also necessary to take account of the characteristics of the real gas by using a correction factor, i.e. the K coefficient.

The EC 21 and EC 24 volume correctors can be used for custody transfer and secondary metering in conjunction with turbine meters or rotary displacement meters.
In the case of the EC 24, correction is based on the state variables of pressure, temperature and compressibility. For the EC 21, programmable fixed values are used for pressure and compressibility.

Approvals

The EC 21 has been approved as a temperature corrector for custody transfer metering of natural gases and the EC 24 as a volume corrector.

PTB approval marks:

EC 21: 7.745 / 04.12 EC 24: 7.741 / 03.53

During operation, the specified limit values for custody transfer metering are monitored. If these are exceeded, separate totalizers are used for metering the gas volume under disturbed conditions.

Options for combination

The two volume correctors EC 21 and EC 24 can be combined with other gas meters in a multitude of variants. There are two basic combinations:

1. Installation on mechanical meters

The classic way to install a compact gas volume corrector is directly on the mechanical head of a turbine or rotary displacement meter (see description on page 6). Connection is to be made to the reed contact in the meter head.

2. Electronic meters with a corrector feature

If the rotations of the turbine wheel are picked up by Wiegand sensors, no mechanical meter head is installed on the meter case, but an electronic meter head without a corrector feature or a volume corrector of the type EC 21 or EC 24. Possible combinations are listed in the table below together with type designations.

Gas meters without a corrector feature are described in separate publications.

Gas meter	Electronic meter head	Temperature corrector	Volume corrector
Volumeter	TERZ 94 *Publication No. 3.174*	TEC 21 *Page 7*	TEC 24 *Page 7*
TRZ (standard)	TRZ 03-TE *Publication No. 3.163*	TRZ 03-TE / EC 21 *Page 5*	TRZ 03-TE / EC 24 *Page 5*
TRZ (without inlet pipe)	TRZ 03-TEL *Publication No. 3.164*	TRZ 03-TEL / EC 21 *Page 5*	TRZ 03-TEL / EC 24 *Page 5*

Custody transfer metering

Features

- **Ease of installation and start-up**
  If the EC 21 or EC 24 is ordered together with an RMG turbine meter, it can be delivered ready-installed.
- **Battery-powered or mains-powered operation**
  The standard design of the EC 21 is powered by one and the EC 24 by two lithium cells. In normal operation (input frequency below 1 Hz with reed contact), the batteries have a service life of a minimum of six years and can be changed without opening the case.
- **Explosion protection**
  The EC 21 / EC 24 is intrinsically safe and can be used in zone 1.
- **Calculation of the K coefficient**
  The EC 24 volume corrector calculates the K coefficient in conformity with GERG 88S. With the temperature corrector, the K coefficient can be specified as a constant.
- **4-20 mA current output (transmitter)**
  For designs with a current output board (an external power supply unit is required for devices located in areas subject to explosion hazards).
- **Data logger**
  The monthly values and meter readings for the volume at measurement and base conditions, pressure and temperature are stored for a period of 14 months. A data logger for custody transfer metering is in preparation.
- **Digital interface**
  A serial RS 485 interface with Modbus protocol is available for exchanging data.
- **Read-out and parameterization program**
  Using an easy-to-operate program, measured values and totalizer readings, for example, can be read or the device can be parameterized.
- **Flow display**
  In the case of electronic turbine meters with Wiegand sensors (and HF input pulses), the current flow rate value and the maximum value are displayed.
- **Two pulse outputs**
  With reed contact: LF (Vm) and LF (Vb)
  With Wiegand sensors: HF (Vm) and LF (Vm or Vb)
- **Alarm output**

Pressure transmitter and resistance thermometer

The pressure transmitter is installed in the case of the EC 24 as standard. Special designs with an external pressure transmitter are possible.

The standard version is fitted with a resistance thermometer of the type PT 1000. In the case of mains-powered devices, it is also possible to use resistance thermometers of the types PT 500 or PT 100 (on request).

Operation

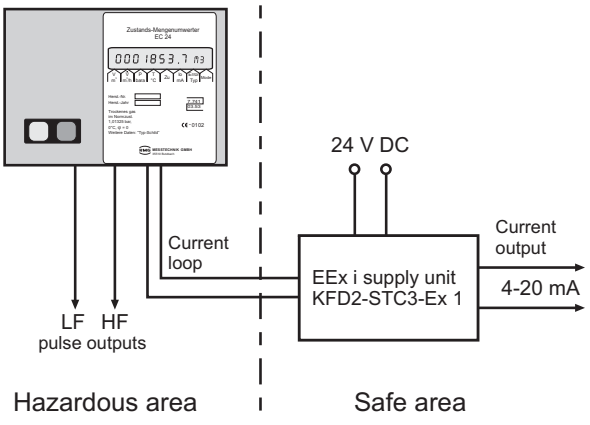
All configuration data as well as measured and calculated values are stored in an easy-to-survey table. All cells of this table can be reached and displayed by pressing two keys. Each value is shown with its corresponding unit.

The parameters can be changed using internal keys, a programming module or the supplied parameterization program. Parameters for custody transfer metering are protected by a sealable plug-in jumper, whereas all the other parameters are locked via a code number.

Current output (option)

If the device is operated with HF pulses (Wiegand sensors), a current of 4-20 mA can be outputted with an additional current output board. For this purpose, the volume corrector has to be externally supplied by a power supply unit.The EC 24 is fitted with a back-up battery as standby power supply as standard, whereas this is an option with the EC 21.

Via the current output, the flow rate at measurement or base conditions, or the pressure or temperature can optionally be outputted.



Data logger

The EC 21 / EC 24 stores the monthly meter readings and mean values for pressure and temperature over a period of 14 months. These values can be read from the device.

In addition, a data logger for custody transfer metering is optionally available which can be read out using a PC. The following values are recorded:

– Hourly mean values for pressure and temperature and hourly quantities and meter readings for 45 days.
– Daily mean values for pressure and temperature and daily quantities and meter readings for 200 days.
– Monthly mean values for pressure and temperature and monthly quantities and meter readings for 36 months.
– 240 events (e.g. fault messages).

It is possible to retrofit the data logger for custody transfer metering on site.

Data transmission

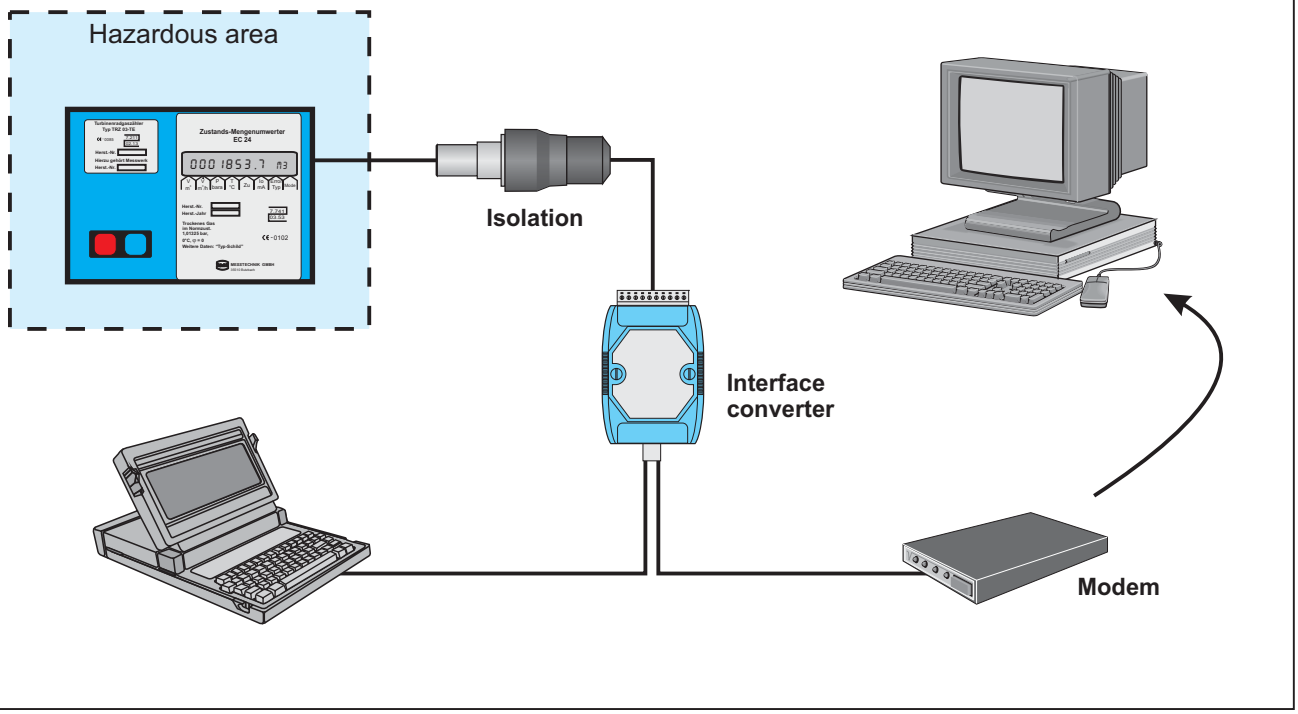
Using the RS 485 interface, data can be transmitted from the EC 21 / EC 24 to a PC on site or in the central station. For this purpose, only an interface converter to RS 232 (power pack required) or USB is required and an isolating module if the EC 21 / EC 24 is located in a hazardous area. Data are read out or parameterization is performed using a program which is supplied together with the device.

It is also possible to establish a connection to the central computer via modem. Remote programming of the EC 21 / EC 24 is then feasible and the K coefficient or gas quality data, for example, can be changed by the central station.

Accessories

- **EEx i isolating module** for connecting a PC to the RS 485 interface of devices located in areas subject to explosion hazards.
- **EEx i supply unit** for analog output, required for using the analog output of mains-powered devices.
- **Isolating amplifier** for isolating the pulse outputs.
- **Interface converter** for connecting a PC to the EC 21 / EC 24.
- **Bracket** for fastening the device to an RMG turbine meter.
- **Thermowells** for resistance thermometers, G¼" or G¾" threaded connections.
- **Three-way check valve** for pressure transmitters.

Data transmission EC 21 / EC 24 ↔ PC



Electronic turbine meters with a corrector feature

With electronic turbine meters with a corrector feature, the EC 21 or EC 24 volume corrector with its Vm display is simultaneously used as electronic totalizer of the meter. In each case, the volume corrector is installed on a measuring element of the electronic turbine meter of the type TRZ 03-TE.

A permanent magnet is rigidly connected to the turbine wheel and its rotation is picked up by two Wiegand sensors (2-channel measurement). In this way, the electronic totalizing system receives HF volume pulses which are suitable for calculating the flow rate. If the difference between the two measuring channels is too big, an alarm is released.

The measuring element has only few mechanically actuated parts and thus it is very low-wearing.

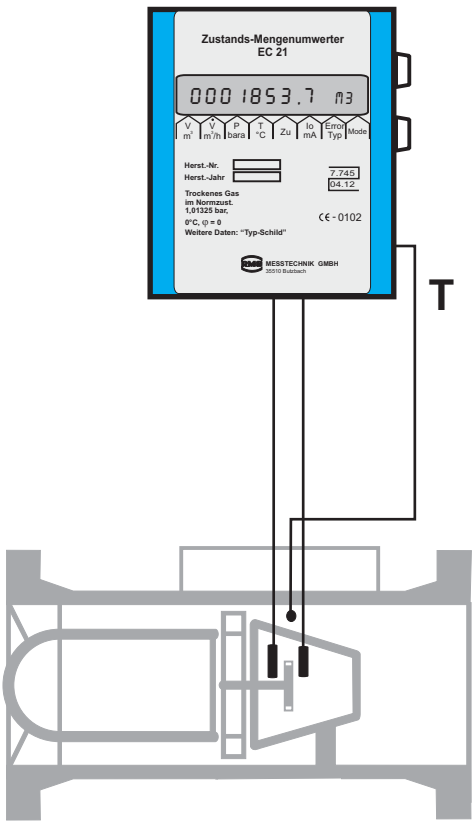
The resistance thermometer is located together with the two sensors in a sensor sleeve which sticks out into the measuring element up to the permanent magnet.

Since the TRZ 03-TE turbine meter has been approved by PTB for custody transfer metering, the combinations of TRZ 03-TE / EC 21 and TRZ 03-TE / EC 24 can also be used for custody transfer applications. In each case, installation in the gas pipe is to be made with an inlet pipe of a length of 2 DN.

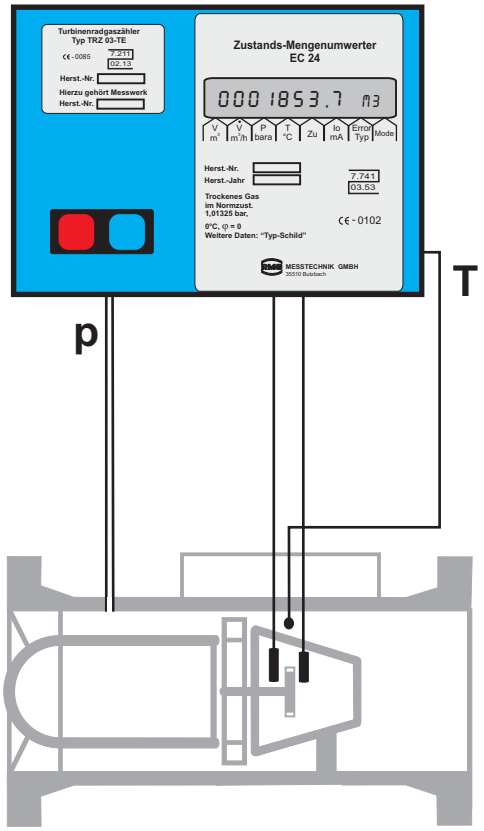
The measuring element of the electronic turbine meter TRZ 03-TEL can also be used for custody transfer metering. This gas meter has a perforated plate at its inlet and can be operated without an inlet pipe. Together with the volume corrector, the type designations are as follows: TRZ 03-TEL / EC 21 and TRZ 03-TEL / EC 24.

The gas meters are available in the following designs:
- Nominal diameters: DN 50 to DN 600
- Pressure rating: up to PN 100 / ANSI 600
- Measuring ranges: 10 to 25,000 m^3/h

TRZ 03-TE / EC 21



TRZ 03-TE / EC 24



Mechanical gas meters in conjunction with the EC 21 / EC 24

The EC 21 and EC 24 volume correctors can naturally also be connected conventionally to mechanical gas meters:

- turbine meters for custody transfer metering, such as the TRZ 03 or TRZ 03-L;
- mechanical volumeters, such as the TRZ 03-K;
- rotary displacement meters, such as the RMG 130 or RMG 132a;
- any other gas meters with LF pulse transmitters.

In the case of RMG gas meters, the easiest way to install the volume corrector is directly on the meter head using a bracket. Installation is even possible farther away from the meter up to a distance of 50 m and with the pipe from the pressure transmitter of the EC 24 sloping towards the meter.

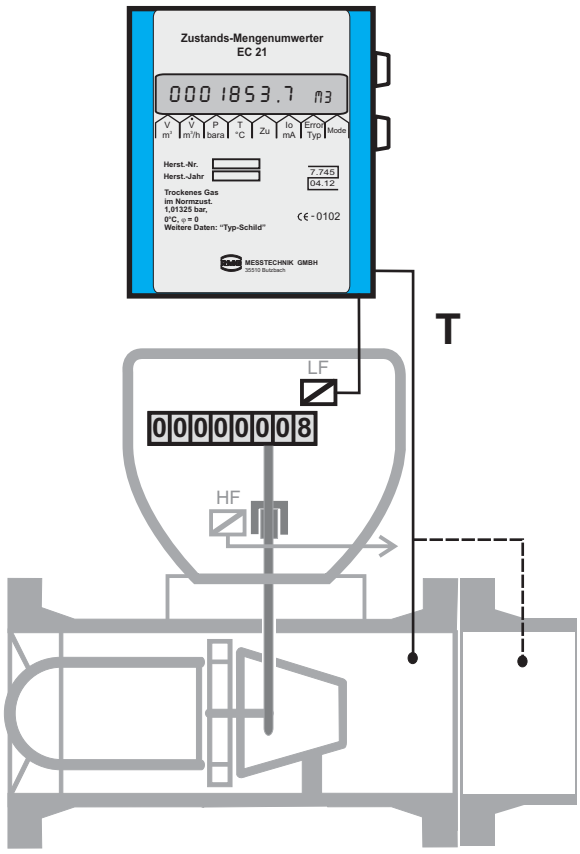
If the volume corrector is installed on mechanical meters, an external temperature pick-up is used which is located in a thermowell on the meter or in the outlet pipe.

The reed contact in the mechanical head of the meter serves as a pulse transmitter. Operation is performed in the low-frequency range up to 1 Hz, and in this mode, the flow rate is not measured. Also the service life of the battery depends on the input frequency; it is longer if low frequencies are used.

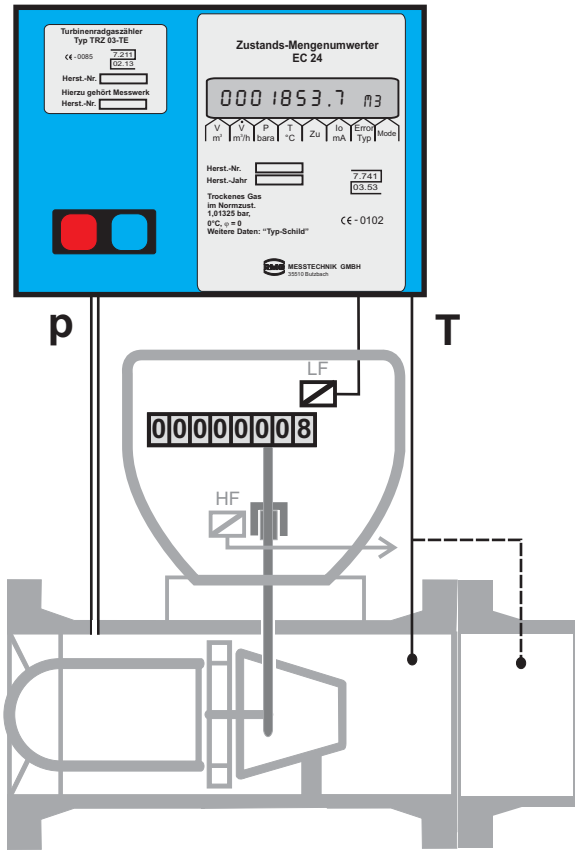
1-channel measurement is usually sufficient - even for custody transfer metering - since there is a mechanical totalizer which can be simultaneously used as a "second measuring channel". However, 2-channel measurement is possible here too.

There are two LF pulse outputs available; one of them outputs the unchanged input frequency (Vm) and the other one can be programmed for Vm or Vb.

EC 21 on TRZ



EC 24 on TRZ



Electronic volumeters with a corrector feature

With electronic volumeters with a corrector feature, the EC 21 or EC 24 volume corrector with its Vm display is simultaneously used as electronic totalizer of the meter. In each case, the volume corrector is installed on a measuring element of the electronic volumeter of the type TERZ 94.

A permanent magnet is rigidly connected to the turbine wheel and its rotation is picked up by one (optionally two) Wiegand sensor(s). In this way, the electronic totalizing system receives HF volume pulses which are suitable for calculating the flow rate.

The measuring element has only a few mechanically actuated parts and thus it is very low-wearing.

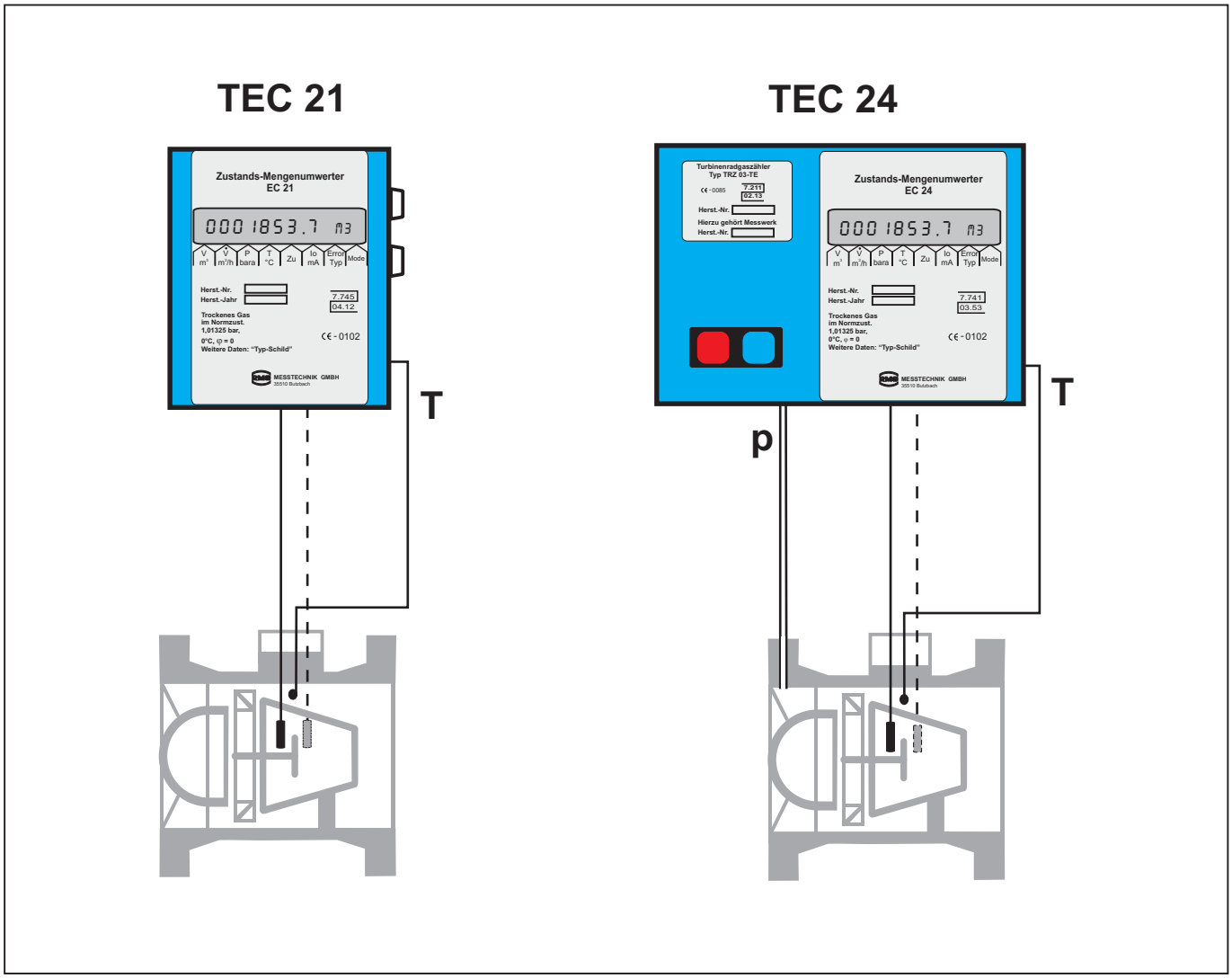
The resistance thermometer is located together with the sensor in a sensor sleeve which sticks out into the measuring element up to the permanent magnet.

With the type TEC 21, an EC 21 temperature corrector is installed on the measuring element, and with the type TEC 24 an EC 24 volume corrector.

The electronic volumeters TERZ 94, TEC 21 and TEC 24 can be used for secondary metering and their measuring uncertainty is less than 1%.

The following designs of volumeters are available:
- Nominal diameters: DN 25 to DN 600
- Pressure rating: up to PN 100 / ANSI 600
- Measuring ranges: 2.5 to 25,000 m^3/h
- Flanged-end or sandwich designs.

For a detailed description of the measuring element with dimensions, measuring ranges, etc., please refer to RMG Publication No. 3.174 (TERZ 94).



Gas Volume Corrector
EC 21 / EC 24

Specifications

Explosion protection	II2 G EEx ib[ia] IIC T3/T4	
Case	Cast aluminium case	
Dimensions (L x W x D)	EC 21: 160 x 100 x 60 mm	EC 24: 250 x 120 x 105 mm
Weight	EC 21: approx. 0.6 kg	EC 24: approx. 1.5 kg
Degree of protection	IP 65	
Ambient temperature range	-20°C to +60°C	
Measuring temperature range	-20°C to +60°C	
Resistance thermometer	PT 1000, 2-wire connection	
Pressure ranges	0.7 - 2 bar(a) 0.8 - 5 bar(a) 2 - 10 bar(a) 4 - 20 bar(a) 8 - 40 bar(a) 14 - 70 bar(a)	
Pressure transmitter connection	M12 x 1.5 coupling for ERMETO 6L (6 mm pipe); an adapter is required for other cross sections.	
Distance of remote totalizer	Max. 50 m	
Power supply voltage	EC 21: 1 lithium battery 3.6 V (service life > 8 years) EC 24: 2 lithium batteries of 3.6 V each (service life > 6 years) or (for both devices) external 24 V/DC power supply unit	
Inputs	1 channel or 2 channels Input pulses via reed contact with f_{max} = 2 Hz or input pulses from Wiegand sensor with f_{max} = 400 Hz	
Outputs	• 3 transistor outputs: - HF (with reed contact: LF) for Vm - LF (programmable) for Vm or Vb - Alarm (fault) U_{max} = 28 V, I_{max} = 60 mA, P_{max}= 420 mW Connection via 7-pin circular connector • 4 - 20 mA analog output (only with external power supply), electrically isolated, load resistance max. 260 Ω	
Interfaces	RS 485 (Modbus protocol) / external power supply	

All outputs are protected against overvoltage.

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