Flow Computer System
ERZ 2000

RMG Meßtechnik GmbH

P.O. Box 280 · 35502 Butzbach (Germany)
Tel.: +49 (0)6033 897-0 · Fax: +49 (0)6033 897-130
E-mail: messtechnik@rmg.de · Internet: http://www.rmg.de

Publication No. 3.433-E

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 measuring 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. 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.

The ERZ 2000 gas volume corrector performs this conversion 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.

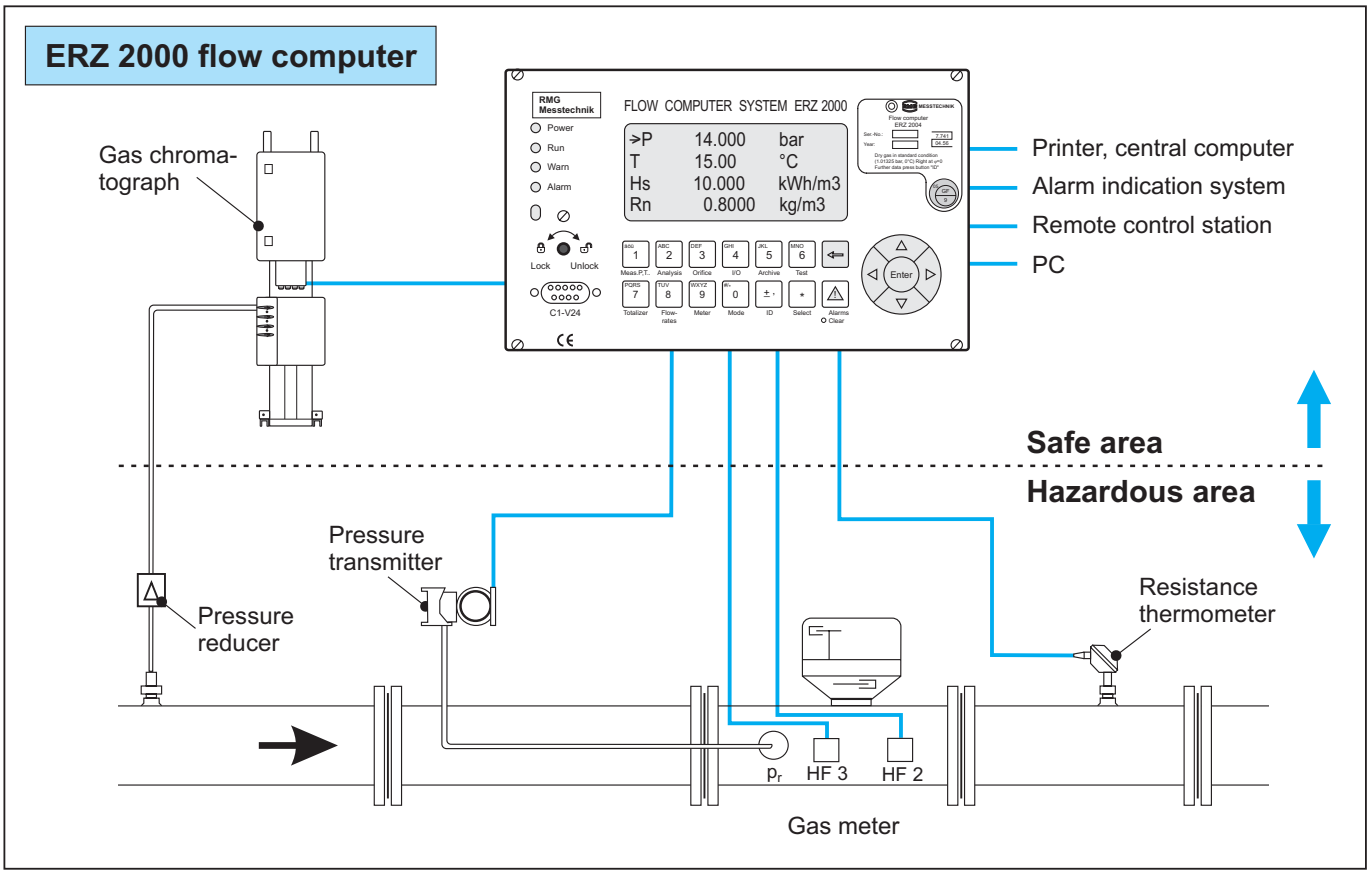
RMG's ERZ 2000 gas volume corrector can be used for both custody transfer and secondary metering applications in conjunction with all gas meters, such as
- turbine meters
- vortex meters
- ultrasonic gas flowmeters
- rotary displacement meters

The ERZ 2000 flow computer is a PC-based computer. Thus, the functions of volume correction and measured-value recording are provided within the scope of performance of a PC. This system also enables the computer to be fitted with a more powerful processor or a larger memory card as technological development proceeds.

Approvals

The ERZ 2000 has been approved as a gas volume, superior calorific value and density corrector for the custody transfer metering of natural gases, just like the integrated ET 2000 as a data logger. Density correction has also been approved for other technically pure gases, while gas volume correction has also been approved for hydrogen, nitrogen and oxygen.

During normal operation, the limits specified for custody transfer metering are monitored. An alarm is tripped if these limits are exceeded and separate disturbance totalizers are used for metering. All alarm messages are stored in a log, just like all changes of parameters.



Features

- **Original totalizer readings**
  In the case of gas meters with electronic totalizers, it is possible to digitally transmit their readings to the ERZ 2000 and so their original readings are then available in the corrector.

- **Digital inputs for measured values**
  Alternatively to the analog transmission of measured values from pressure transmitters and resistance thermometers, the values can also be transmitted digitally in conformity with the HART protocol.

- **Error curve linearization**
  During high-pressure testing of a gas meter, its error curve, which depends on the flow rate, is determined. This error curve can be simulated in the ERZ 2000 gas volume corrector as interpolation points or as a polynomial applied over the flow rate or the Reynolds number and thus the error of measurement can be corrected.

- **Calculation of the K coefficient**
  The ERZ 2000 gas volume corrector calculates the K coefficient of natural gases in accordance with all currently used calculation methods at the same time.

- **Test functions**
  Functions like "On-the-fly calibration", "Freeze" or "Functional test" enable manual or automatic test totalizers to be started or stopped, means to be calculated or measured values to be frozen.

- **Data-logging feature**
  The ERZ 2000 includes:
  - a data logger which provides conventional data logging and
  - the DSfG archive, i.e. a data memory recording the data which are generated in the corrector and transmitted via the DSfG interface (recording entity).

- **Bus interface**
  The device has interfaces for the DSfG bus, MODBUS (RTU/ASCII) and RMG bus as standard, optionally for the Profibus as well.

- **Connection option for two gas meters**
  There is a variant available for two gas meters with separate totalizers and archives which can add up the two quantities.

- **Remote parameterization is possible**
  The parameters of the ERZ 2000 can be changed via the DSfG bus and remote data transmission by a PC in the control centre provided that there are data element identifiers for these parameters. With operating data, first the code has to be sent, while with custody transfer data, the calibration switch of the device has to be opened first.

- **High-contrast display**
  A big 4-line display enables data to be read even at a distance of a few steps.

- **Language selection**
  The software is bilingual, so either German or English can be chosen.

Device types

The computer has been designed as a universal device which can be used for all metrological tasks in a gas metering station. There are the following standard designs:

ERZ 2004 gas volume corrector
Calculation of the volume at base conditions via pressure, temperature and K coefficient.

ERZ 2104 calorific value corrector
Calculation of the volume at base conditions and the energy content via pressure, temperature and K coefficient.

ERZ 2002 density corrector
Calculation of the volume at base conditions via density, standard density and velocity of sound.

In addition, there is a series of other designs for special applications:

ERZ 2114 differential pressure computer
Evaluation computer and gas volume corrector for orifice plate metering.

GC 2000 analytical computer
Control and evaluation computer for the PGC 9000 VC process gas chromatograph.

EMC 2000 analytical computer
Control and evaluation computer for the EMC 500 gas quality measuring device.

The powerful computer also enables individual functions to be combined, e.g. the EMC 2000 with volume correction.

Operation

All configuration data and measured and calculated values are stored in an easy-to-survey table with columns and lines just like a spreadsheet. All the cells of this table can be displayed by pressing arrow keys. The major variables, such as pressure, temperature or totalizers, can be directly accessed by pressing a single key.

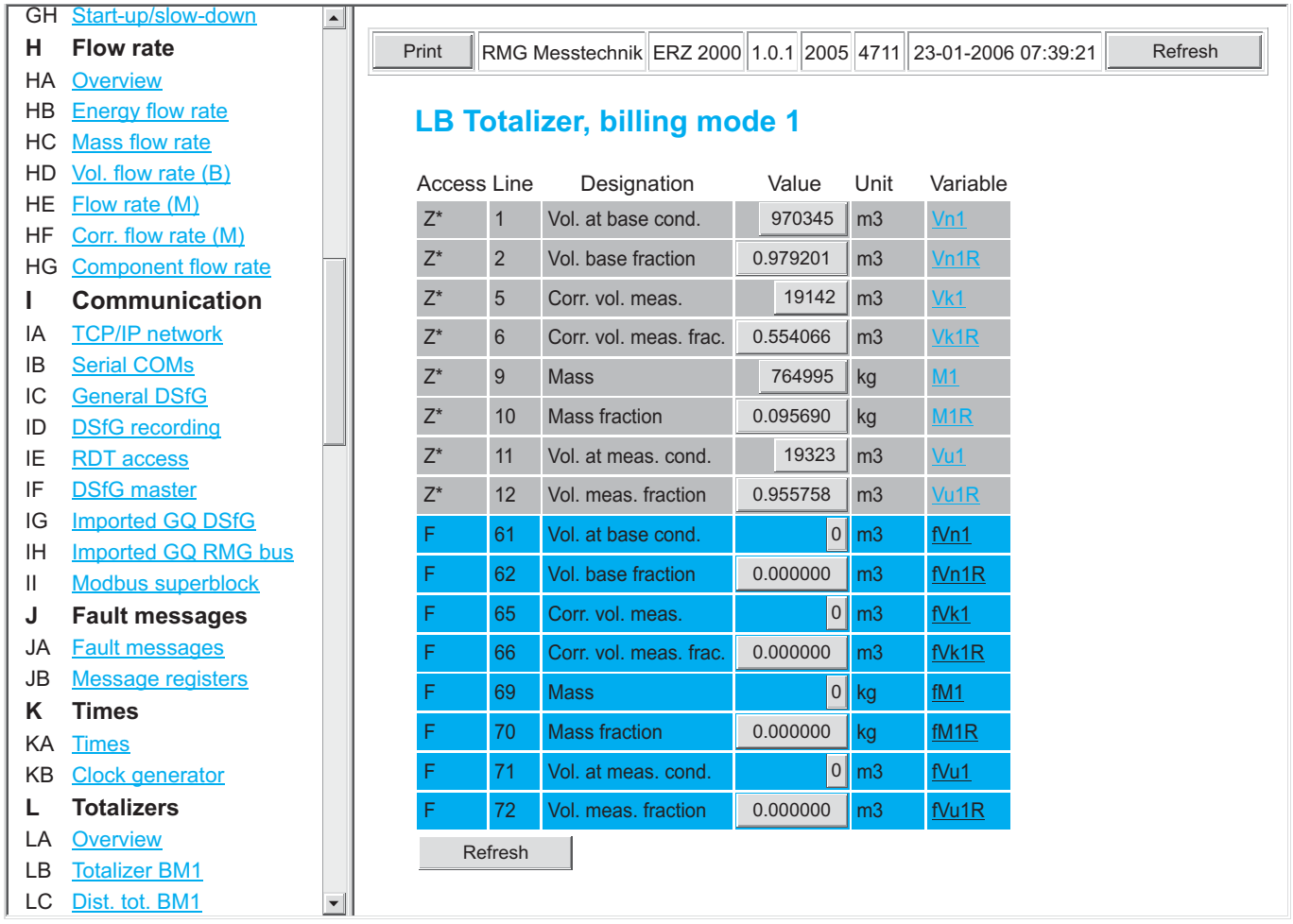
Programming can be done either via the keyboard of the device or a local network or by the control centre via the DSfG bus (if the appropriate data element identifiers are available). Parameters for custody transfer metering are protected by a sealable switch, while all the other parameters are protected by a code.

The ERZ 2000 has a network connection through which data can be read out or changed. To do this, no read-out program is required on the PC but an internet browser software such as Internet Explorer or Netscape is sufficient. The program is quasi inside the ERZ 2000 and you can surf in the flow computer as you surf on the internet. Thus, the read-out program is always appropriate and up-to-date independently of the software version of the flow computer and the operating system of the PC connected.

Operation is to be performed in line with the standards on the internet so that you can do it without reading a manual. Data are displayed in the form of easy-to-survey tables and the meaning of the parameters is shown in plain text. To increase clarity, it is possible to limit the display to the major variables. As far as parameters are modifiable, they can simply be clicked and then edited and transmitted to the flow computer.

In addition, the flow computer provides concise documentation about the data and messages. Thus, the DSfG data element identifiers and the Modbus registers can be displayed and printed for example. It is even easy to create a data book.

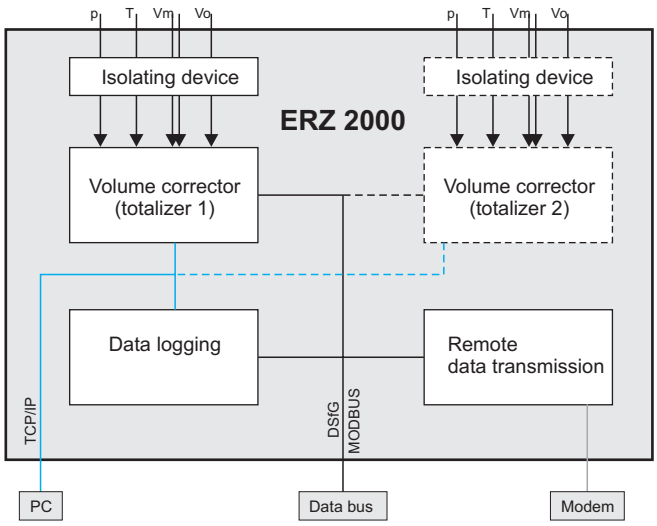
The contents of the archives can be viewed with the internet browser and saved with a file format which can be read by spreadsheet programs such as Excel.



Separation of software

The operating software of the ERZ 2000 is divided into two modules which have their own checksum in each case: the official kernel and the functions for showing and evaluating the measured values and totalizer readings. The official kernel comprises all functions for acquiring measured values. Here, among other data, the calibration factors are stored which have been determined and programmed in our testing laboratory.

The great advantage of this separation is that a software change has to be approved only if the checksum of the official kernel changes. Since most of the changes are made outside the official kernel, ongoing development becomes not only easier but can also be implemented faster. Thus, it will be easier to respond to customer requirements.



Recording function

There is more than one data memory included in the ERZ 2000 flow computer as standard:

- In the data memory according to the DSfG standard (recording entity), the totalizer readings and the mean and instantaneous values for pressure, temperature and density are stored. The standard memory depth is 85 days.
- Another memory records maximum values, e.g. maximum hourly values per day, month and year and maximum daily values per month and year.
- A log records all events such as the coming and going of alarm messages.
- A log which can be written by the user provides an option for inputting user-specific entries.
- There is an option for storing additional analog values (e.g. room temperature, dew point, etc.).

Calculation of the K coefficient

The K coefficient is calculated in accordance with all currently used calculation methods:
- GERG 88S
- AGA 8-92DC
- AGA-NX-19 and AGA-NX-19 mod
- Beattie-Bridgeman (for industrial gases)
- van der Waals equation.

Calculation is performed simultaneously. The powerful computer requires no more than 9 ms even for complex calculation methods like AGA 8-92DC. The results are displayed and can thus be compared with each other. Then you can select one of these methods as mode for volume correction.

Remote data transmission (RDT)

The ERZ 2000 includes a RDT module as standard so that it is possible to directly connect the device to a modem. Just like an external RDT unit, the ERZ 2000 not only transmits data but can also fulfil the function of the DSfG master with all related tasks, e.g. calling PTB time and synchronizing the bus.

Explosion protection

A card inserted into the device comprises isolating amplifiers which allow intrinsically safe circuits to be connected for volume pulse inputs (for pulse generators of gas meters), the Vo input (for connection of an encoder totalizer) and two inputs for measured values (4-20 mA or HART). Setting the switching threshold and hysteresis of the pulse inputs is performed automatically but can also be done manually via the keyboard.

Accessories

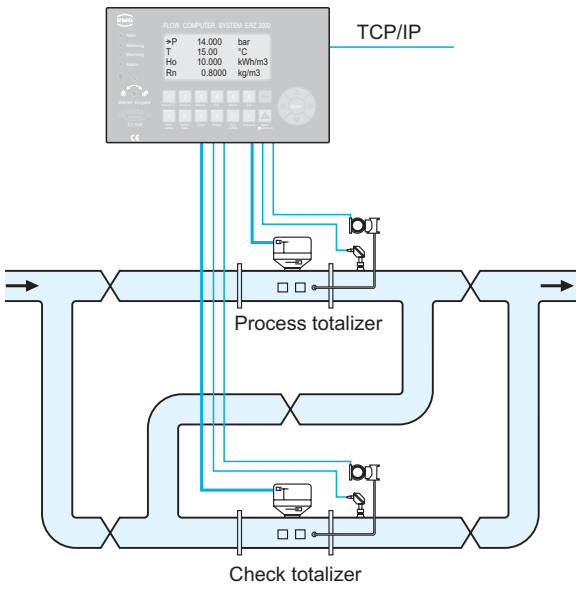
- **19" subrack** for a maximum of two ERZ 2000 rack-mounting units
- **DSfG interface expander** for installation in 19" subracks for linking the DSfG interfaces of a maximum of five users.
- **Thermowells** for resistance thermometers
- **Thermal insulation** for resistance thermometers
- **Three-way check valve** for pressure transmitters
- **Stand** for accommodating the pressure transmitter and the three-way check valve.

Examples of application

Four examples out of a variety of possible configurations.

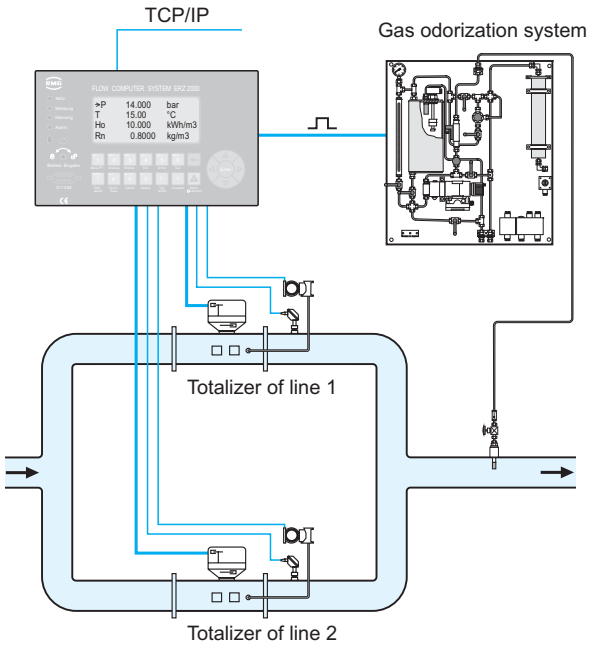
Meter test arrangement

ERZ 2000 - 2-channel version



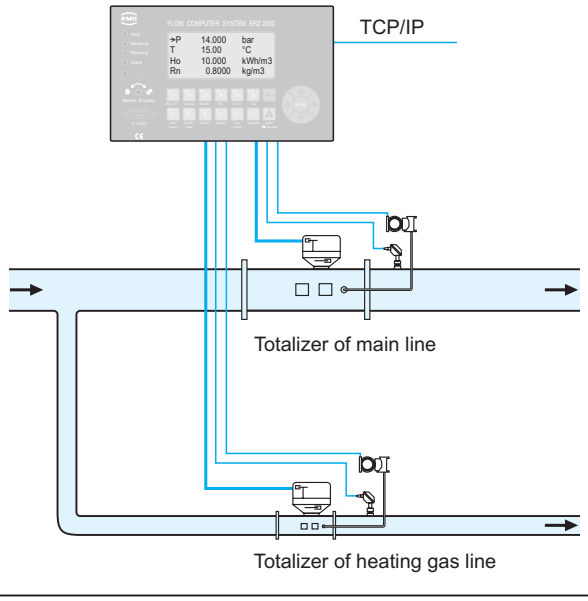
Totalizing for odorization control

ERZ 2000 - 2-channel version



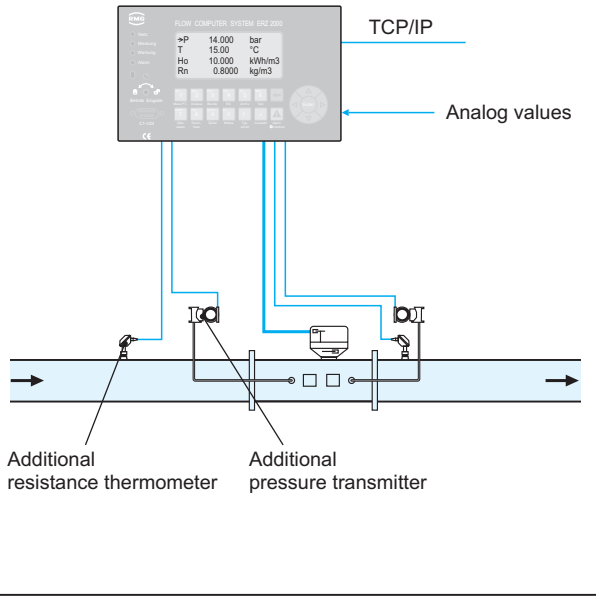
Measuring and heating lines

ERZ 2000 - 2-channel version



Recording additional measured values

ERZ 2000 1-channel version



Resistance thermometer

Type	Rosemount PT 100 / W-GYI Resistance thermometer as per DIN 43760
Explosion protection	EEx-d IIC T6 (explosion-proof enclosure)
Gas temperature range	-20°C to +60°C (for custody transfer metering*)
Measuring error	< ±0.1% of the measured value
Face-to-face dimensions	160 mm (standard) 250 mm (option) 400 mm (option)
Process connection	G¾" integral thread
Maximum pressure	100 bar
Electrical connection	4-wire connection, M20 x 1.5 wire feed-through, 6.1 to 11.6 mm cable diameter
Degree of protection	IP 65

PT 100 Ex (d)
resistance thermometer

* Temperature range for secondary metering: -50°C to +550°C

The PT 100 resistance thermometer has been approved for custody transfer metering. It can be used either directly in the fluid or in a sensor pocket. The PT 100 resistance thermometer can also be used in conjunction with other RMG gas volume correctors.

Pressure transmitters

Type	Rosemount 2088 A	Rosemount 3051 CA
Measuring ranges (bar absolute)	0.9 – 4.5 2 – 10 3 – 15 4 – 20 6 – 30 10 – 50	0.9 – 4.5 2 – 10 3 – 15 4 – 20 6 – 30 10 – 50 14 – 70 20 – 100
Measuring error	≤ 0.3% of the measured value	≤ 0.25% of the measured value
Weight	approx. 0.9 kg	approx. 2.5 kg
Explosion protection	EEx-d IIC T6 (pressure-proof enclosure)	
Ambient temperature	-10°C to +40°C (for custody transfer metering)	
Process connection	Ermeto coupling (6 mm)	
Electrical connection	2-wire connection, ½" NPT wire feed-through, 6 to 8 mm cable diameter	
Degree of protection	IP 65	

Rosemount 2088 A
pressure transmitter

Rosemount 3051 CA
pressure transmitter

The 2088 A and 3051 CA pressure transmitters have been approved for custody transfer metering and can also be used in conjunction with other RMG gas volume correctors.

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Specifications

Operating conditions	
Power supply voltage	24 V/DC -10%/+15% or 90 V/AC to 230 V/AC
Power input	max. 24 W
Ambient temperature	-20°C to +55°C
Dimensions	W x H x D = 213 x 128.4 x 310 mm (42 depth units / 3 height units)

Inputs / outputs			
2-channel volume input	f_{max} = 7 kHz		
6 current inputs	0/4-20 mA (2-wire connection) for pressure transmitters and resistance thermometers		
2 resistance inputs	for resistance thermometers (4-wire connection)		
4 frequency inputs	for density and velocity-of-sound measurement frequency range: 0.05 Hz to 20 kHz		
5 digital inputs	for status signals load: U_{max} = 5 V; I_{max} = 13 mA		
4 current outputs	0/4-20 mA, user-programmable load resistance: max 700 Ω,		U_{max} = 10 V
4 pulse outputs	U_{max} = 24 V	I_{max} = 100 mA	P_{max} = 150 mW
8 contact outputs	U_{max} = 24 V	I_{max} = 100 mA	P_{max} = 150 mW
Alarm / warning contact	U_{max} = 24 V	I_{max} = 100 mA	P_{max} = 100 mW

Interfaces		
Front panel	RS 232	for program updates
Rear panel	RS 232 / RS 485	MODBUS ASCII / RTU
	RS 232	for an ultrasonic gas flowmeter
	RS 232 / RS 485	DSfG interface, entities
	RS 232 / RS 485	DSfG interface, master
	RS 232	for a modem (RDT)
	Ethernet (TCP/IP)	network, operation via internet browser

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Publication No. 3.433-E

Issue 02/2006
Subject to technical modification
without prior notice.