METRA Energie-Messtechnik
Member of Bopp & Reuther Messtechnik Group

ELECTRONIC FLOW COMPUTER ERW 700

1. IDENTIFICATION

Manufacturer: Bopp & Reuther Messtechnik GmbH
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Product type: Flow and energy computer for liquids, gases and water steam

Product name: ERW 700

2. APPLICATION

- Billing meters for the district and local heating sector
- System monitoring in energy plants
- in heat and cold production in the medium and upper output range
- For high demands on measurement accuracy and measurement stability

Arithmetic unit
ERW 700

3. SPECIAL FEATURES

- Suitable for the material flows gases, liquids, steam and water
- Can be combined with all common volume / mass transmitters (differential pressure, vortex, turbine, dynamic pressure, cross probe, ultrasonic, MID, Coriolis)
- Highly accurate process calculation for density, enthalpy and compressibility on the basis of equations or extensive substance database
- 2 independent 24 Bit AD converters for resistance (temperature) and current input, calculation speed 10 re-evaluations per second
- Compensation input for density or concentration
- Logger functions for set day, monthly values, period memory, error memory, parameter memory and min / max memory
- Parameterisation and operation via PC software and / or manually via keyboard
- Detachable LC display
- Extensive modular expandability of inputs and outputs
- Numerous special functions such as condensate connection, bidirectional measurement, tariff or disturbance counters, etc.
- Large illuminated graphic display, flexibly configurable
- Suitable for wall mounting, panel mounting, 1/3 19" slide-in panel mounting

4. DESCRIPTION

The electronic flow computer ERW 700 calculates the volume, standard volume, mass and energy of liquids, gases and vapours from the input variables flow (differential pressure), pressure, temperature and density / concentration.

Calculations	Counters
- Volume flow rate	- Operating volume
- Standard volume flow rate	- Standard volume
- Mass flow rate	- Mass
- Heat flow / cold flow	- Heat quantity / cold quantity
	- Tariff totalizer, disturbance totalizer, balance totalizer, energy difference

Inputs:

- Current 0/4-20 mA passive or active incl. transmitter supply
- Frequency
- Pulse
- Temperature PT100/500/1000 in 4-wire technology

Outputs:

- Current 0/4-20 mA active
- Pulse / Status passive
- Auxiliary energy

Communication:

- M-Bus
- Modbus
- Ethernet
- Profibus DP

Calculation methods

Liquids

- Density determination via algorithms and tables
- Heat capacity via algorithms and tables

Water / Steam

- Calculation standard IAP WS IF 97 (water steam table)

Gases

- ideal gas law
- Flow correction considering temperature, pressure and compressibility
- Redlich-Kwong
- GERG 88 (ERW 700A)

5. WORKING METHOD AND SYSTEM STRUCTURE

Liquids

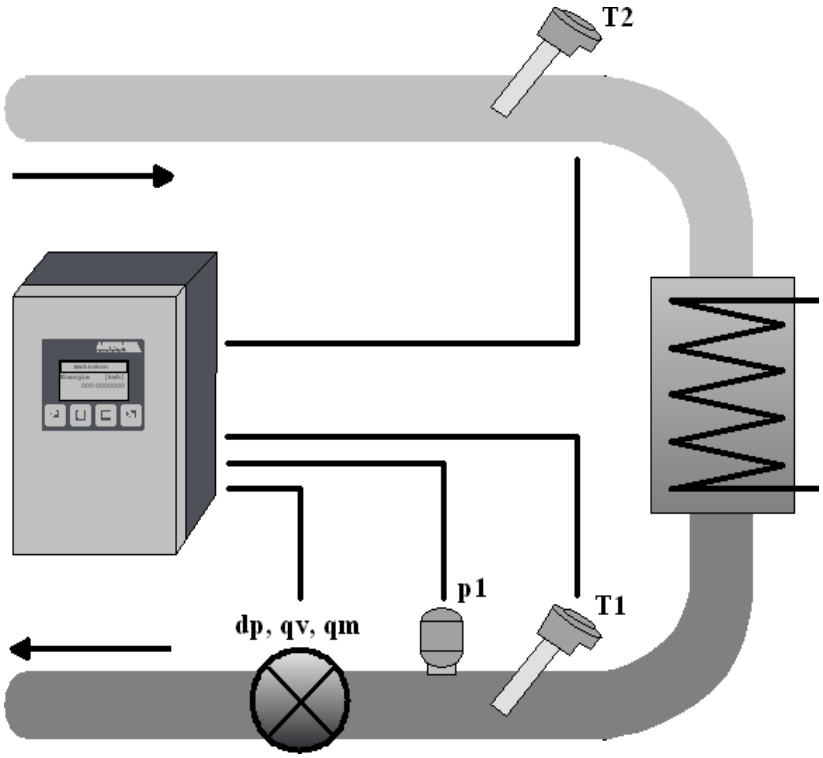
Energy, volume (mass), flow rate, power

Calculation of the energy delivered or absorbed by a liquid flow to a heating or cooling system. The energy is calculated from the volume or mass and the temperature difference between the flow and return.

Bidirectional measurements such as charging / discharging heat storage tanks, multi-tariff measurements are also possible.

Furthermore, an input is available for direct density / concentration measurement in case of changing mixing ratios, e.g. for water-glycol mixtures.

ELECTRONIC FLOW COMPUTER ERW 700



Calculation of the energy from the input variables flow rate and temperature difference. Volume transmitter assembled optionally in the flow or return.

Steam

Energy, mass (volume), flow rate, power

Calculation of energy, mass and volume as a function of the process variables steam flow, steam pressure and steam temperature.

For overheated steam, the calculation is pressure and temperature compensated. For saturated steam, the calculation is either pressure or temperature compensated.

Numerous special functions such as bidirectional measurements, steam condensate connection or multi-tariff measurements are possible.

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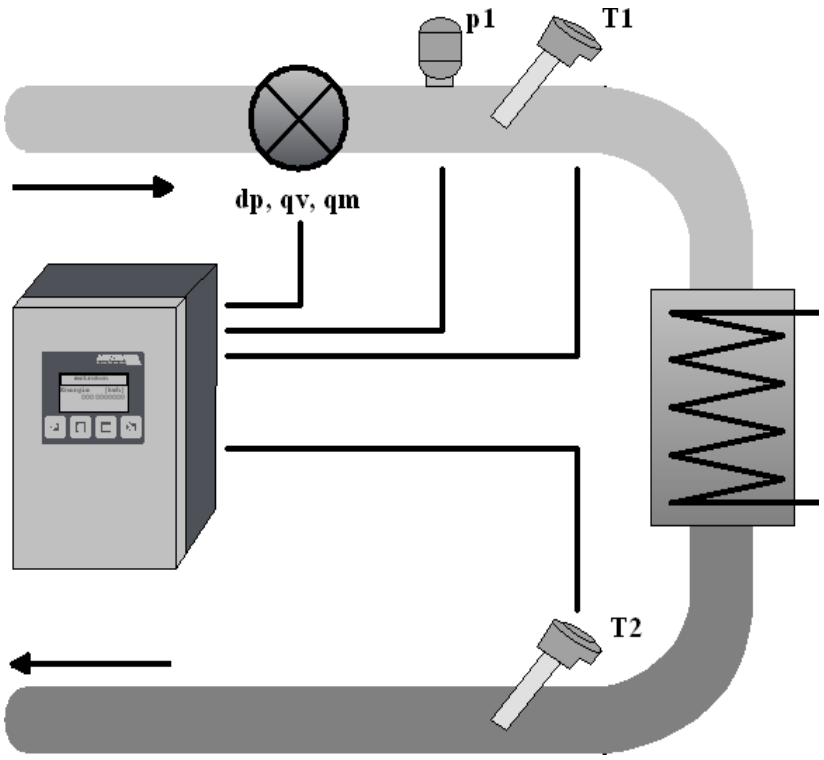


Calculation of the energy in a closed steam system from the input variables flow, pressure and temperature.

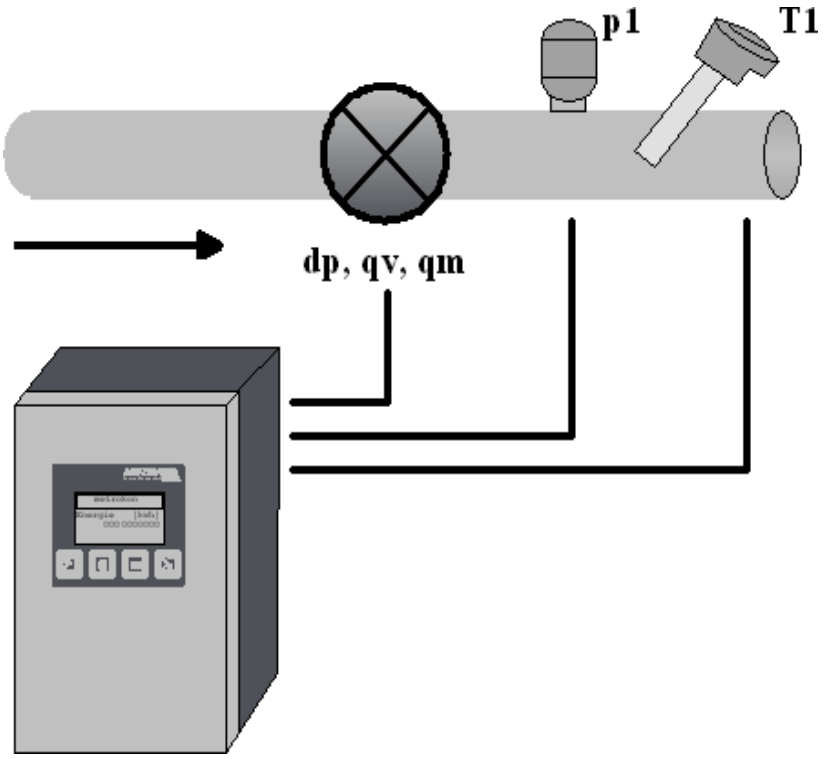
Gas / Air

Energy, standard volume (mass), flow meter, power

Calculation of the gas standard volume and the gas mass as a function of the process variables gas flow, gas pressure and gas temperature.

It is also possible to determine the energy.

Furthermore, an input is available for direct density / concentration measurement, e.g. with changing gas mixtures.



Calculation of energy, mass, volume and standard volume as a function of the input variables flow, pressure, temperature.

6. CONSTRUCTION OF THE MEASURING DEVICE

The electronic flow computer ERW 700 is a state-of-the-art heat quantity calculator. The ERW 700 has a graphic display for showing all relevant measured and calculated values. Menu-guided, the configuration and parameters can be changed via the keys. The functionality can be extended by optional input and output cards.

The flow computer ERW 700 consists of the following components:

- Calculation unit with integrated inputs and outputs (basic module)
- LC display unit with 4 keys
- additional input cards (optional)
- additional output cards (optional)

Maintainability

- no special maintenance necessary
- calibrated devices must be recalibrated after 5 years

IT security

The flow computer is password protected.

7. INPUTS

Measurand / Uncertainty

Electrical measured variables:	Current, pulse, frequency, resistance, contact (status)
Physical measurands:	Temperature, pressure, differential pressure, volume (current), mass (current)
Special feature:	2 independent 24-bit AD converters for resistance (temperature) and current

Measured variable	Input parameter
Resistance	Type: PT 100, PT500, PT1000 4-wire measurement overload protection: ± 24 V measuring uncertainty T: 0.1 % f.s. ± 0.1 K measuring uncertainty ΔT: 0.1 % f.s. ± 0.02 K Temperature influence T: 0.0025 % / K Temperature influence ΔT: 0.0010 % / K Resolution: 24 Bit Measuring rate: approx. 16 / s Sensor break monitoring
Power / Current	Measuring range: 0...22 mA Overload protection: ± 24 V Error detection 3.6 mA acc. to Namur NE43 Measuring uncertainty: 0.01 % f.s. ± 0.001 mA Temperature influence: 0.0025 % / K Resolution: 24 Bit Measuring rate: approx. 16 / s
Frequency **Pulse** **Status**	Frequency measurement: 0.1 Hz ...15 kHz Counting: 0 ... 15 kHz min. measuring time adjustable: (0.1 s to 10 s) Measuring uncertainty: 0.01 % f.s. Temperature influence: 0.0025 % / K Resolution: 0.001 % f.s. Switchable hardware filter: without, 50 Hz (for suppression of contact bounce) Signals active: voltage Lo (Us approx. 2 V), Hi (Us approx. 9 V) Signals passive: O.C, relay, Namur

Input variables (basic unit)

2 x Pt 100 / 500 / 1000
2 x 0/4 - 20 mA, 2 x transmitter supply
2 x pulse / frequency

Expansion stage input variables (basic unit plus additional input card)

2 x Pt 100 / 500 / 1000
4 x 0/4 - 20 mA, 4 x transmitter supply
2 x pulse / frequency

8. OUTPUTS

Measurand / Uncertainty

Current, pulse, switching output / status

Output variable	Output parameter
Power / current	Range: 0...22 mA, active max. load: > 500 Ω (U0 approx. 12V) galvanic isolation from each other and from the basic unit Error signals: 3.5 mA and 22 mA according to NAMUR NE43 Accuracy: 0.02 % f.s. ± 0.002 mA Temperature influence: 0.005 % / K Resolution: 16 bit
Pulse / Status	Type: Open collector, passive, galvanically isolated Frequency range: 0 ... 100 Hz min. pulse width: 5 ms ... 500 ms Overload protection: ± 24 V Internal resistance 70 Ω Residual voltage < 1.2 V I_{max} : 20 mA U_{max} : 24 V

Quantity: (basic unit)

2 x 0/4 - 20 mA
3 x pulse / status
1 x M-Bus
1 x RS 232 Modbus
1 x auxiliary power

Expansion stage 1: (basic unit plus 1 additional output card)

4 x 0/4 - 20 mA
5 x pulse / status
1 x M-Bus
1 x RS 232 Modbus
1 x auxiliary power

Expansion stage 2: (basic unit plus 2 additional output cards)

6 x 0/4 - 20 mA
7 x pulse / status
1 x M-Bus
1 x RS 232 Modbus
1 x auxiliary power

Expansion stages with special outputs: (basic unit plus additional output card)

Outputs up to expansion stage 2
one of the following communication modules

- 2. M-Bus interface
- Ethernet TCP/IP interface
- RS-485 interface

In addition, a Profibus DP module can be installed.

9. OPERATING BEHAVIOUR

Reference conditions

Power supply:	230 VAC ±10 %, 50 Hz ±0.5 Hz
Warm-up time:	10 min
Ambient temperature:	25°C ±5°C
Humidity:	39 % ±10 % r. h.

- Accuracy class as heat meter according to EN 1434-1
- otherwise depending on the medium and the operating mode typically 0.1 %

Failure signal

- Error signal 3.5 mA and 22 mA according to Namur NE43
- Error contact

10. OPERATING CONDITIONS

Application limits

Medium	Size	Area
Liquids Gases Steam	Temperature	Pt 100: -100°C to 600°C Pt 500: -100°C to 500°C Pt 1000: -100°C to 300°C
	Pressure	0 to 150 bar

Ambient conditions

Ambient temperature: -10°C to 55°C
Storage temperature: -30°C to 70°C
Climate class: according to EN 1434 class C
Protection class: IP65 IEC 529/EN 60529

Cable length

- for calibrated devices ≤ 100 m
- for uncalibrated devices > 100 m (depending on the installation and ambient conditions)

Electromagnetic compatibility

Interference emission: EN 61326 Class A

Interference immunity:

- Power failure: 20 ms, no influence
- Electromagnetic fields: 10 V/m (80 ... 2700 MHz) according to EN 61000-4-3
- Electromagnetic fields: 30 V/m (800 .. 2000 MHz) according to EN 61000-4-3
- Conducted HF: 0.15 to 80 MHz, 10 V according to EN 61000-4-6
- Electrostatic discharge: 4 kV contact / 8 kV indirect according to EN 61000-4-2
- Burst (AC and DC supply): 4 kV according to EN 61000-4-4
- Burst (signal): 1 kV / 2 kV according to EN 61000-4-4
- Surge (supply AC and DC): 1 kV / 2 kV according to EN 61000-4-5
- Surge (signal): 500 V / 1 kV according to EN 61000-4-5
- EN1434-4 Class C

Fluid temperature range

Measuring ranges: -100°C to 600°C
PT100: -100°C to 600°C
PT500: -100°C to 500°C
PT1000: -100°C to 300°C

Fluid pressure range

0 - 150 bar

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State of aggregation

Liquids, steam, gases

Power supply
180 - 264 VAC
18 - 36 VDC

Power consumption

from 5 to 30 W depending on configuration

Protection class

Flow computer ERW 700	IP 65 IEC 529/EN 60529
Control panel with remote displayIP	20 IEC 529/EN 60529

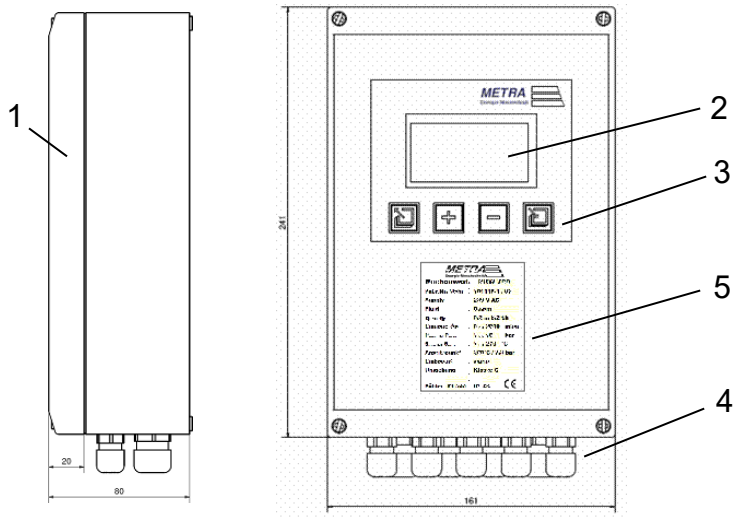
Installation instructions

Operating Manual A-DE-34001-00 ERW 700

11. CONSTRUCTION

Device structure

Wall mounted in plastic housing



1 Housing cover with display
2 Display
3 Push buttons
4 Cable glands
5 Label

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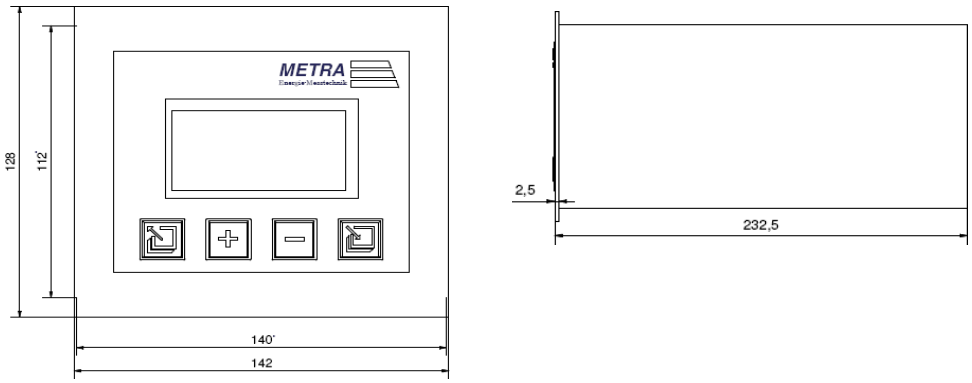
Cassette 19"



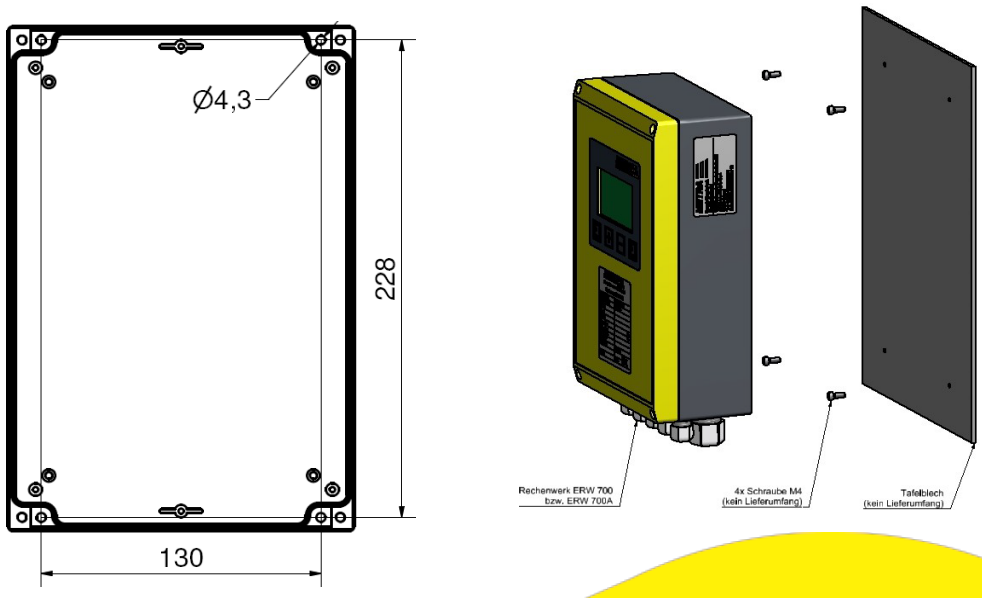
Assembly

There are different installation variants:

- Housing with LCD for wall mounting
- Housing without LCD for wall mounting and remote LCD housing
- Housing for control cabinet mounting and remote installation of the LCD
- Displays in the cabinet door
- Housing as 19“ cassette

Mounting variants:

ERW 700 Front panel installation



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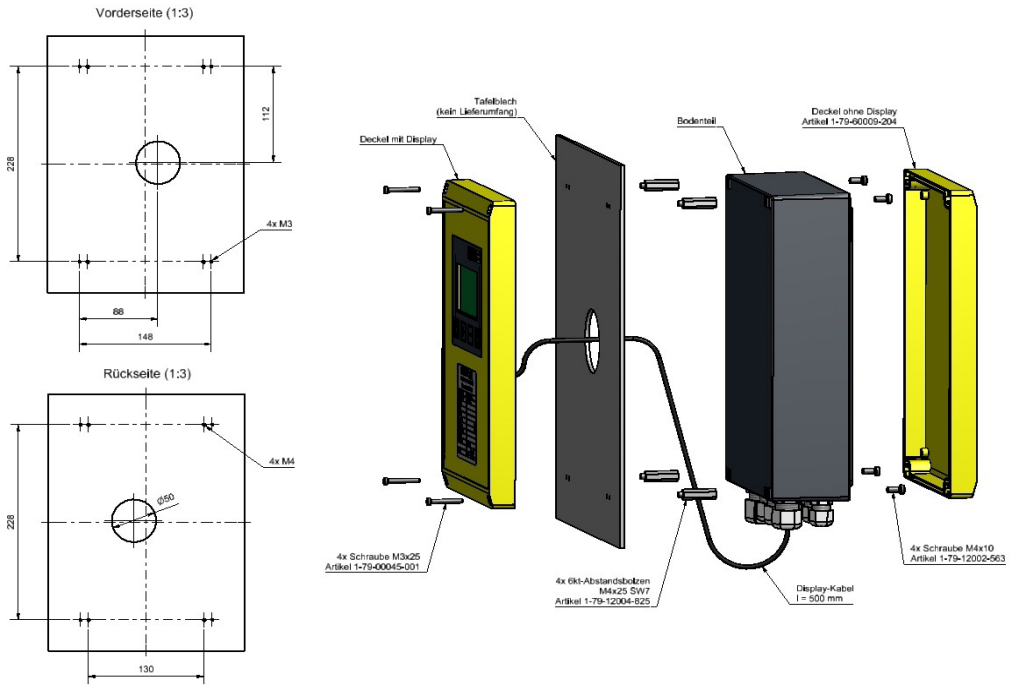
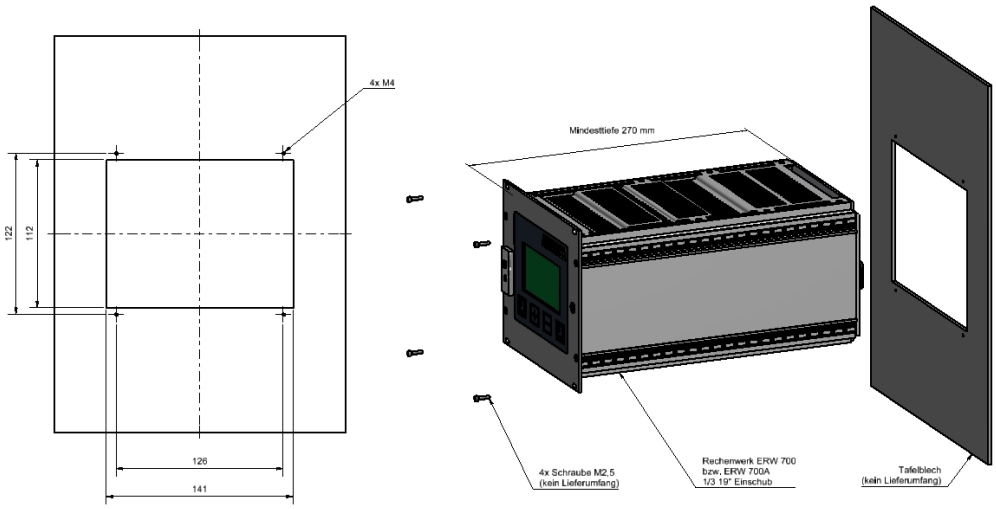
Panel mounting



Cassette: ERW 700 Rack-mounting panel mounting (19")



Weight

Standard: approx. 1 kg
19” cassette: approx. 1.5 kg

Materials

Standard: ABS -40°C to 80°C halogen-free
19” cassette: Aluminium

12. DISPLAY AND USER INTERFACE

- Illuminated graphic display, flexibly configurable
- can be set down max 5 m (control cabinet door installation)
- Parameterisation and operation via PC software and / or via keyboard (4 keys)

13. AUXILIARY POWER

Transmitter supply and auxiliary power

Output data	Output parameter
Transmitter power supply (MUS)	Voltage: 24 V DC Current: max. 30 mA, short-circuit proof
Auxiliary voltage	Voltage: 24 V DC Current: max. 250 mA, short-circuit proof

14. CERTIFICATES AND APPROVALS

EU Declaration of Conformity
MID approval no. DE-08-MI004-PTB004 (heat meter calculator) valid until: 30.01.2028
PTB approval no. DE-18-M-PTB-0010 (cold meter calculator) valid until: 30.01.2028

15. DOCUMENTATION

Operating Manual A-DE-34001-00 ERW 700

16. ORDER INFORMATION / TENDER TEXT

Universal energy and flow computer

Energy and flow computer "autarkon" ERW 700
Housing made of impact-resistant plastic for wall or panel mounting

Medium: _____
Operating mode: (energy/flow) _____
Operating temperature: _____
Operating pressure: _____
Installation place: (hot/cold) _____
Volume / mass input: _____
Model: _____
Remote display: _____

LCD multifunctional display, large illuminated graphic display, flexibly configurable for all relevant values
Logger functions for set day, monthly values, period memory, error memory, Parameter memory and min/max. memory
No applications set

Inputs:
2 x 0/4-20mA freely programmable
2 x temperature inputs for PT 100/500/1000 4-wire technology
2 x pulse / frequency input, freely programmable

Outputs:
2 x 0/4-20mA galvanically isolated, freely programmable
3 x optocoupler outputs, galvanically isolated, freely programmable
1 x M-Bus
1 x RS 232 (Modbus)
1 x auxiliary power 24 VDC
1 x transmitter power supply 24 V DC

Protection class: IP 65 according to EN 60529
Ambient temperature: -10°C - 55°C
Auxiliary power: 230V 50/60 Hz, 24 V DC

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Additional equipment:

with an additional output module:

- 4 x analogue current output 0/4-20mA, freely assignable to each instantaneous value, galvanically isolated
- 5 x pulse/status output (optocoupler) for e.g. volume/normal volume/ground/error

with two additional output modules:

- 6 x analogue current output 0/4-20mA, freely assignable to each instantaneous value, galvanically isolated
- 7 x pulse/status output (optocoupler) for e.g. volume/normal volume/ground/error

with communication module:

- 2. M-Bus or Ethernet TCP/IP or RS-485
- alternatively or additionally Profibus DP interface

with an additional input module:

- 4 x analogue current input 0/4-20mA
- 4 x transmitter supply 24 V DC
- Remote display for wall/panel mounting including connecting cable 5 m
- Configuration software with PC interface cable for setting and documentation
- Configuration of the calculator according to customer specifications
- Conformity assessment as heat or cold meter according to MID/MessEG
- 19" aluminium installation cassette (on request)
- Density input (in conjunction with density transmitter for changing mixing ratio)

Software variants

- Bidirectional measurement with 2 additional counters
- Flow rate and heat quantity determination with condensate connection and additional counters
- Heat / cold changeover with 2 additional counters
- Limit value-dependent tariff switching with additional counters
- Special calibration for water-glycol mixtures, thermal oils and other liquid mixtures with constant mixing ratio
- Input of C-value including linearization