

Technical Information

Proline Prosonic Flow E 100

Ultrasonic time-of-flight flowmeter



Cost-efficient ultrasonic time-of-flight flowmeter with integrated temperature measurement

Application

- The measuring principle is independent of pressure, density, temperature and conductivity
- Simultaneous measuring of dissolved gases (see also Ultrasonic) e.g. in boiler condensate return lines

Device properties

- Accuracy: up to $\pm 0.5\%$ (flow) according to EN 1434 C1, $\pm 0.5^\circ\text{C}$ ($\pm 1^\circ\text{F}$) (temperature)
- Process temperatures up to 150°C (302°F)
- Edge flowmeter made of stainless steel
- 4-20 mA HART, pulse frequency output
- Local display for reading and minimum evaluation
- Repeat transmitter housing

Other benefits

- Long-term stability + reliable output signal
- Extending further measuring range + multi-channel device
- Dependable flow measurements + high accuracy (0.05%)
- Total energy loss operation without additional software and hardware + integrated risk alarm
- Extensive calibration intervals + integrated device calibration due to Flowboost Technology
- Easy commissioning + local parameter configuration



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About this document

Symbols

Electrical symbols

Symbol	Meaning
	Direct current
	Alternating current
	Direct current and alternating current
	Ground connection A grounded terminal, wire, or line or its equivalent connection, is grounded to a grounding system.
	Protective Earth (PE) A terminal, which must be connected to ground prior to establishing any other connections. The ground terminal and bonded frame are shown via letters: • Above ground terminal: Denotes the primary safety connection type. • Over ground terminal: Denotes the letter of the power grounding system.

Symbols for various types of information

Symbol	Meaning
	Permitted Procedural processes or actions that are permitted.
	Preferred Procedural processes or actions that are preferred.
	Forbidden Procedural processes or actions that are forbidden.
	Tip Technical information to improve.
	Reference to documentation
	Reference to page
	Reference to graphic
	Visual inspection

Symbols for graphics

Symbol	Meaning
1, 2, 3, ...	Text numbers
a, b, c, ...	Series of steps
A, B, C, ...	Value
A-A, B-B, C-C, ...	Section
	Rectangular area
	Sole axis cross-section area
	Flow direction

Function and system design

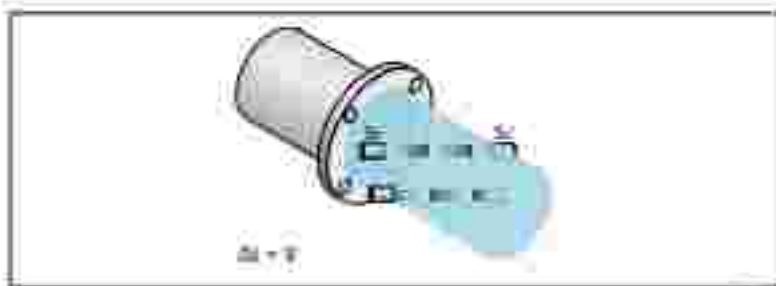
Measuring principle

The measuring device measures the flow velocity in the measuring tube based on an optical arrangement of ultrasonic sensors at an angle. The design does not count any pressure loss and does not have any moving parts.

The flow signal is established by determining an average signal between the sensor pairs and measuring the transit time of each transmission. Thus, adding the flow that would result faster with the flow area against the flow, the differential rate (Δt) can be used to determine the fluid velocity between the sensors.

The volume flow rate is established by combining all the flow velocities determined in the sensor pairs with the cross-sectional area of the meter body and assessing the design about fluid flow dynamics. The design of the sensors and their position ensures that only a short straight run of pipe upstream of the meter is required after typical flow obstructions such as bends or end of line plates.

Advanced digital signal processing and hardware ensure design features ensure flow measurement reliability and robust sensitivity to multi-phase flow conditions and process measurement reliability.



Measuring system

The device consists of a transmitter and a sensor.

The device is available as a complete system.

The transmitter and sensor form a mechanical unit.

Construction

Proline 100	Device materials and materials: • Compact stainless steel • Aluminum, 6061T6, coated • Compact stainless • Stainless steel 316L (304) Configuration: • The operating unit is e.g. Rotaflex Detachable • Also for long-term use with e.g. MA-MAT pipe replacement system • Via transmitter is e.g. Rotaflex Transmitter
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Details

Processor Flow E Single-path version (D: 40 to 400 mm)	• Designed around W, 10 machine • 110 mm • 400 mm • Range of control diameter: 20 to 90 to 100 (2 to 8) • Materials: • Working tool • Diameter steel: 1 000 (F700) • Chain • Diameter steel: 1 000 (F700) • Customized version • Diameter steel: 1 000 (F700) • Screen flange • Diameter steel: 1 400 (G100) • Alloy steel • Diameter steel: 1 400 (G100) • Leg joint flange • Steel: 1 000 (G100) • Stainless steel: 1 400 (G100), 1 400 (G100) • Leg joint flange • Steel: 1 400 (G100) • Stainless steel: 1 400 (G100) • Leg joint flange stamped plate • Steel: 1 000 (G100) • Diameter steel: 1 000 (F700)
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Safety

IT security

The machine is valid only if the device is installed and used as described in the Operating Instructions. The device is equipped with security mechanisms to protect it against any unwanted changes to the settings.

IT security measures, which provide additional protection for the device and associated data transfer, must be implemented by the operator themselves in line with their security standards.

Input

Measured variable

Direct measured variables

- Flow velocity
- Station temperature
- Sound intensity

Calculated measured variables

- Volume flow
- Mass flow

Measuring range

Typically: $Q = 0$ to Q_{max} / $G = 0$ to G_{max} with the specified accuracy

Flow characteristic values in SI units

Nominal diameter		Recommended flow	Flow accuracy		
			Reliable value current output	Flow value	Line flow cut off
DN65	DN4	(l/min)	(mA)	(m³/h)	(m³/h)
10	2	0 to 700	700	0	10.0
16	3.6	0 to 1200	1200	0	21.0
20	5	0 to 1400	1400	0	27.0

Nominal diameter		Recommended flow min./hr. full scale value	Factory settings		
			Full scale peak current output (mA/peak)	Peak value (mA/peak)	Low flow cut off (μ = 0.1 mA)
(mm)	(in)	(gall./min.)		(mA/peak)	(mA/min)
120	5	2 to 2400	2400	12	0.75
150	6	2 to 3150	3100	23	1.75

Flow characteristic values in US units

Nominal diameter		Recommended flow min./hr. full scale value	Factory settings		
			Full scale peak current output (gpm/min.)	Peak value (gpm/peak)	Low flow cut off (μ = 0.1 gpm)
(in)	(mm)	(gpm/min.)		(gpm/peak)	(gpm/min)
5	120	2 to 270	270	0.6	0.8
6	150	2 to 317	317	1.1	0.9
8	200	2 to 410	410	1.8	0.9
10	250	2 to 510	510	2.3	1.2
12	300	2 to 620	620	3.0	2.0

Flow characteristic values as per BS 434 Class 2

Flow characteristic values in SI units

Nominal diameter		Recommended flow			Factory settings	Low flow cut off (μ = 0.1 mA)
		Q^A (l/min.)	Q^B (l/min.)	Q^C (l/min.)		
(mm)	(in)				Peak value (mA/peak)	
80	3	0.15	15	60	5	0
80	3	0.15	15	60	5	0
80	3	0.15	15	60	5	0
100	4	0.30	30	120	10	0
150	6	0.90	90	360	30	0

- (1) Q^A Maximum flow rate • Minimum flow rate provides the maximum output within the limit of error in legal metrology.
 (2) Q^B Recommended flow rate • Highest flow rate at which the flowmeter operates within the limit of error in legal metrology.
 (3) Q^C Maximum flow rate • Highest flow rate

Flow characteristic values in SI units

Nominal diameter		Recommended flow			Factory settings	Low flow cut off (μ = 0.1 mA)
		Q^A (gpm/min.)	Q^B (gpm/min.)	Q^C (gpm/min.)		
(in)	(mm)				Peak value (mA/peak)	
3	80	0.04	40	120	0.5	0
4	100	0.12	120	240	1.0	0
6	150	0.36	360	720	3.0	0

Nominal deviation		Recommended flow			Factory setting	Low flow cutoff ($\leq 0.1 \text{ L/min}$)
Set	Unit	L (gal/min)	C ₁ (gal/min)	C ₂ (gal/min)	Pulse rate (1/gal pulse)	(gal/min)
1	100	2.5 L	15 L	625	2.5	0
2	100	0.05	500	1000	0.5	0

 To estimate the measuring range, use the Application along with [E 14](#).

Recommended measuring range:

 Flow (min) [E 21](#)

Output flow range:

Over 200 L

Output

Output signal

UART output signal

Current output	100 mA UART (min.)
Maximum output values	• 0.05 L/min flow • 20 L/min
Load	0 to 100 Ω
Resistance	100 Ω
Damping	Interference 0.07 to 0.9 s
Assignable measured variables	• Volume flow • Flow time • Start volume • Flow volume • Temperature • Start point time • Signal strength • Signal-to-noise ratio • Calibration • Signal bandwidth  The range of options includes all measuring devices and principles according to package.

- 1) [Only with Hardware Monitoring](#)
 2) [Only with Hardware Monitoring](#) and data port (serial)

Pulse frequency/analog signal

Function	Can be set to pulse frequency and analog
Version	From 0.1 gal/min pulse
Maximum input values	• 0.05 L/min • 20 L/min
Voltage drop	For 25 min < 0.05 V
Pulse output	
Pulse width	Interference 0.05 to 0.005 sec

Maximum pulse rate	10000 pulses/s
Pulse rate	40000/s
Assignable measured variables	• Volume flow • Mass flow
Processing output	
Output frequency	Configurable 0 to 10000 Hz
Sampling	Configurable 0 to 600 s
Scale (pulse ratio)	1:1
Assignable measured variables	• Volume flow • Mass flow • Sound pressure • Flow velocity • Temperature • Amplitude rate¹⁾ • Signal strength²⁾ • Signal to noise ratio²⁾ • Turbulence²⁾ • Signal consistency²⁾
Switch output	
Switching behavior	Binary, continuous or pulse-modulated
Switching delay	Configurable 0 to 100 s
Number of switching output	Unlimited
Assignable functions	• On • Off • Diagnostic feedback • Limit value • On • Volume flow • Mass flow • Sound pressure³⁾ • Flow velocity • Temperature • Turbulence • Signal strength²⁾ • Signal to noise ratio²⁾ • Turbulence²⁾ • Signal consistency²⁾ • Amplitude rate³⁾ • Flow direction monitoring • Status • On • Fault not off A The range of inputs exceeds if the measuring device has one of the applicable packages.

1) Only with Hardware Monitoring

2) Only with Hardware Monitoring and dual pulse output

3) Only with Hardware Monitoring and dual pulse output

Signal as pulse

Depending on the location, pulse information is explained as follows:

Current output 4 to 20 mA

0 to 20 mA

Failure mode	Choose from: • 1 to 20 mA (transmission error: 0.1% of measurement range) • 1 to 20 mA (transmission error: 0.2) • 10% value: 0.05 mA • High value: 20 mA • PWM: pulse-modulated between 0.05 to 20 mA • Active value • Ignored value
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Radar/Range-finder/vehicle output

Radar output	
Failure mode	Detect from: • Active mode • In-pulse
Range-finder output	
Failure mode	Detect from: • Active mode • ID-Id • Detect range 2 to 21000m
Vehicle output	
Failure mode	Detect from: • Continuous • Scan • ID-Id

Local display

Front-vent display	With information on speed and selected, measured
Settings	Set for operating distance & detection

i Detect signal as per [SAS/SAFE recommendations \(IE 10\)](#)

Interface/protocol

- Via digital communication:
HART protocol
- Via analog interface:
IIO-RTD sensor interface

Front-vent display	With information on speed and selected, measured
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i Additional information on remote operation & [IE 10](#)

Web browser

Front-vent display	With information on speed and selected, measured
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Low flow not off: This is not possible for the front-vent off and on, respectively.

Protocol-specific data

HART

Manufacturer ID	011
Device type ID	1100
HART protocol version	7.5
Device description file (RTM_ID)	Information and file under www.sasgroup.com
HART user	Ver. 1100

Dynamic variables	Read by the dynamic simulator: IASRT command 2 The measured variables can be directly integrated in the dynamic simulator Measured variables for PV (primary dynamic variables) • Volume flow • Mass flow • Sound velocity • Sound density • Temperature • Acceptance rate⁽¹⁾ • Signal strength⁽²⁾ • Signal to noise ratio⁽²⁾ • Turbulence⁽²⁾ • Signal spectrum⁽²⁾ Measured variables for DC, TV, QV (secondary, tertiary and quaternary dynamic variables) • Volume flow • Mass flow • Sound velocity • Sound density • Temperature • Acceptance rate⁽¹⁾ • Signal strength⁽²⁾ • Signal to noise ratio⁽²⁾ • Turbulence⁽²⁾ • Signal spectrum⁽²⁾ • Position 1 • Position 2 • Position 3  The type of dynamic variable if the measuring device has other more applications possible
Device variables	Read by the dynamic simulator: IASRT command 3 These device variables are permanently accepted A maximum of 8 device variables can be measured • 1 • volume flow • 2 • mass flow • 3 • sound velocity • 4 • sound density • 5 • temperature • 6 • position 1 • 7 • position 2 • 8 • position 3 • 9 • acceptance rate • 10 • turbulence • 11 • signal spectrum • 12 • signal strength

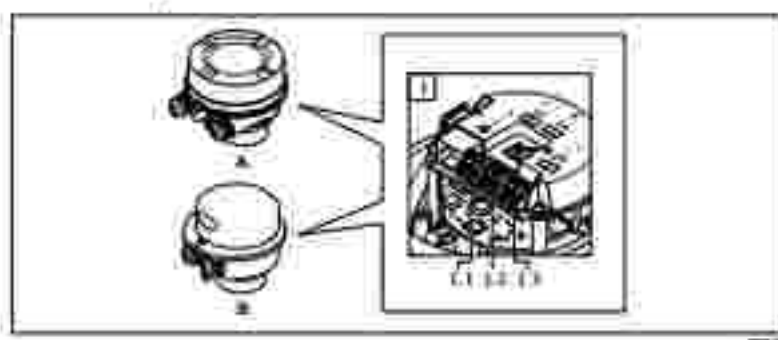
(1) Only with hardware monitoring

(2) Only with hardware monitoring, and dual port version

Power supply

Terminal assignments

Common: housing position and connection: variants



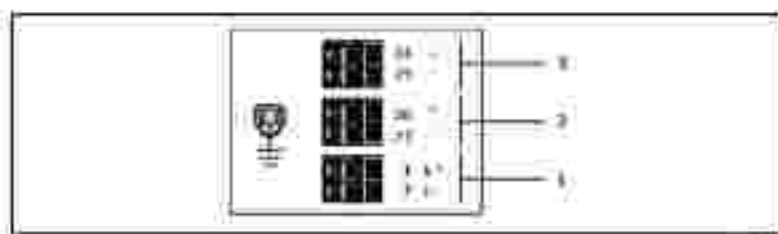
- 1 Housing position: compact, standard output
- 2 Housing position: compact, standard
- 3 Connection variant: 4-20 mA, 0/5V, pulse (frequency) output
- 1.1 Signal: temperature, pulse (frequency) output
- 1.2 Signal: temperature, 4-20 mA, 0/5V
- 1.3 Supply voltage

Temperature

Connection variant: 4-20 mA, 0/5V, pulse (frequency) output

Order code for "Output": option B

Order code "Output"	Connection methods and wiring		Possible options for order code "Signal/temperature"
	Example	Form factor	
Output A-B	Temperature	Temperature	• Option A: output 0/5V • Option B: output 0/5V • Option C: output 0/5V • Option D: output 0/5V
Order code for "Output": • Option A: compact, sealed aluminum • Option B: compact, standard			



- 1 Connection variant: 4-20 mA, 0/5V, pulse (frequency) output
- 2 Power supply: DC 24 V
- 3 Output 1: 4-20 mA, 0/5V, pulse
- 4 Output 2: pulse (frequency) output (pulse)

Order code "Output"	Terminal number			
	Power supply		Output 1	Output 2
	23 (V)	24 (A)	27 (V)	28 (A)
Option B	DC 12 V		4-20 mA HART (active)	Pulse frequency output (active)
Order code for Output 2: Option B 4-20 mA HART with pulse frequency output (active)				

Supply voltage: The power line must be tested to ensure it meets safety requirements (e.g. SELV, SILV).

Transmitter

For device version with HART transmitter module type DC 12.2 to DC 2.7

Power consumption: Transmitter

Order code for "Output"	Maximum Power consumption
Option B 4-20 mA HART with pulse frequency output (active)	3.0 W

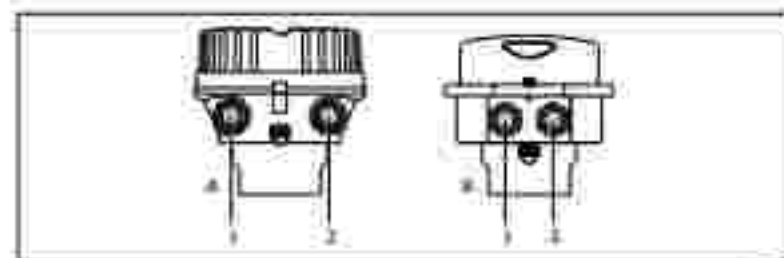
Current consumption: Transmitter

Order code for "Output"	Maximum Current consumption	Maximum output for HART
Option B 4-20 mA HART pul. freq. output (active)	200 mA	22.5 mA (2.375 bar)

Power supply failure:

- Total time may go to full value measured.
- Depending on the device version, the configuration is retained in the device memory or the plug-in data memory (SmartCOM DAT).
- Error messages (and, when activated, beeps) are stored.

Electrical connection: Connecting the transmitter

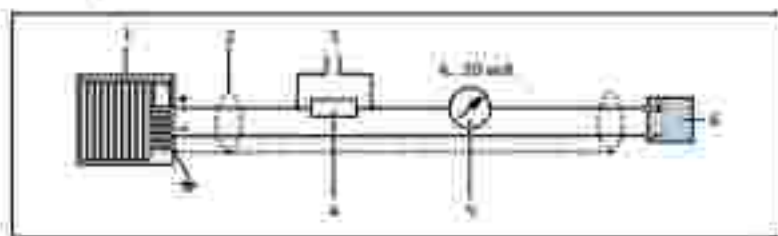


- 1. Housing version: connection terminal
- 2. Housing version: connection terminal
- 3. 20 A entry for signal transmission
- 4. 20 A entry for power supply

Terminal assignments B 11

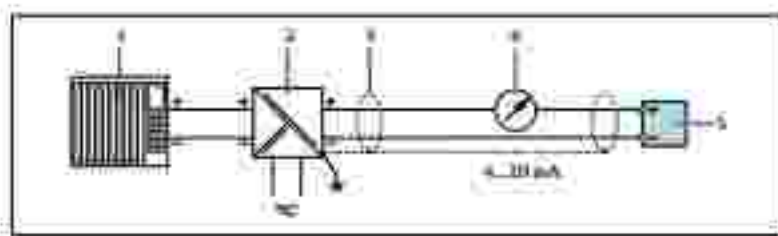
Connection example

Current supply 4 to 20 mA BART



1. Connection example 4 for 4 to 20 mA BART current output (basic)

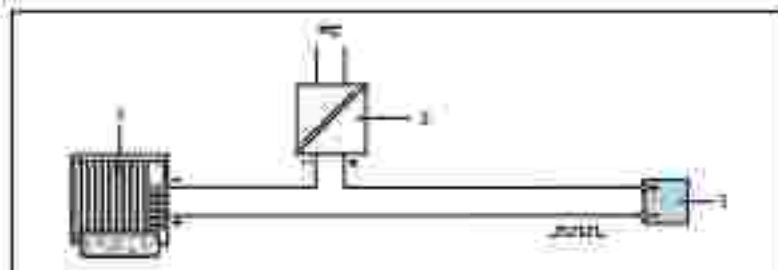
1. Automation system with current input (e.g. PLC)
2. Data point provided at one end. The data point must be provided at both ends to comply with 2000 data transfer rate and specifications + 2000
3. Connection for BART operating to 20 mA + 2000
4. Resistor for BART connection (e.g. 100 Ohm) + 2000 maximum and
5. Analog signal with 2000 maximum and
6. Transmitter



1. Connection example 4 for 4 to 20 mA BART current output (basic)

1. Automation system with current input (e.g. PLC)
2. Power supply
3. Data point provided at one end. The data point must be provided at both ends to comply with 2000 data transfer rate and specifications + 2000
4. Analog signal with 2000 maximum and
5. Transmitter

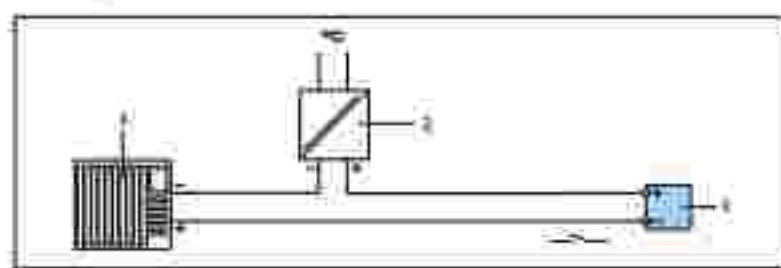
Pulse frequency output



1. Connection example 4 for pulse (frequency) output (basic)

1. Automation system with pulse/frequency input (e.g. PLC)
2. Power supply
3. Transmitter. Data transfer rate must be + 2000

Select output



■ 2. Conditions example (for electric output positive)

1. Automation system with control room (e.g. PLC)
2. Pump output
3. Descriptive Objective (condition)

Special qualification	Requirements No special measures for potential equalisation are required.
Terminals	Termination Spring terminals for most cases positioned 0.5 to 2.5 mm ² (12 to 14 AWG)
Cable codes	- Cable gland: M20 x 1.5 with cable Ø 6 to 12 mm (0.24 to 0.47 in.) - Design for cable entry: - M20 - G 1/2" 10T 3d
Cable specification	Permitted temperature range: - The installation guidelines that apply in the country of installation must be observed. - The cables must be suitable for the minimum and maximum temperatures to be expected. Power supply cable (incl. conductors for the frame ground terminal) Standard installation cable is sufficient. Signal cable Current range 4 to 20 mA HART A shielded cable is recommended. Observe grounding concept of the plant. Pulse frequency/switch margin: Standard installation cable is sufficient.

Performance characteristics

reference operating conditions	- Exon tests following DIN EN 18104, in Annex B3.3.3.3 - Worst case: +13 to +45 °C (+55 to +113 °F), a2 to 6 bar (28 to 87 psi) - Data as indicated in the installation manual - Security based on certified installation rigs according to ISO 17025
Maximum measured error	Same limits under reference operating conditions I - Fluctuations in the supply voltage do not have any effect within the specified range - Temperature accuracy: 0.5 °C (±0.9 °F)

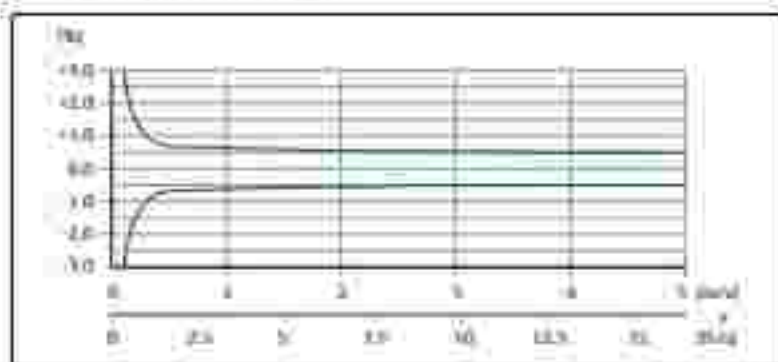
Volume Flow (Standard)

Check tests for Calibration flow?

- Option A 0.5%
- Option D 0.5%, 2-point, transmittance to ISO/IEC 17025
- Option H 0.5%, 2-point

Measured error:

- ± 0.5 mV (1.54 Pa) ± 0.5 % ± 0.02 % a.f.s.
- ± 0.5 mV (1.54 Pa) ± 0.02 % a.f.s.
- of full scale value: 5 mV (15.4 Pa)
- $\pm$ = of reading, $\pm$ = of full scale value

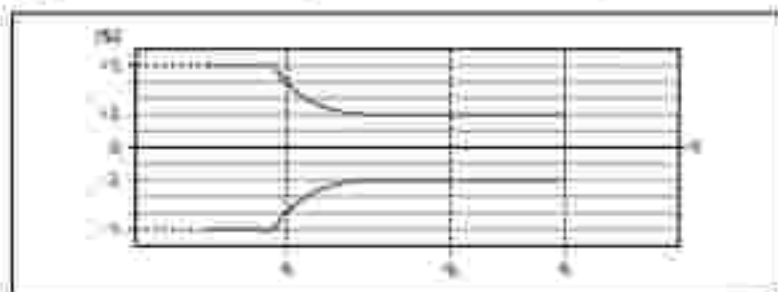

Fig. 2 Maximum measured error: % a.f.s.

Volume Flow (EN 1434)

Check tests for Calibration flow?

Option G 2.0% as per EN 1434

Measured error as per EN 1434 Class 2 (%)
 $\pm 2 \pm 2.02 \cdot \sqrt{q_v}$ limited to ± 5 %

 q_v = specified volumetric flow rate dependent on nominal diameter • EN 1434 q_v variable flow rate

Fig. 3 Error due to q_v per EN 1434

1. Maximum flow rate
2. Permanent flow rate
3. Minimum flow rate

Accuracy of outputs

The output accuracy must be derived into the measured error. Loading outputs are used.

The outputs have the following load capacity specification:

Current output

Accuracy	max. ±5 %
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Pulse frequency output

max. of loading

Accuracy	max. ±10 % (for 100 Hz) or max. ±15 % (for 1000 Hz)
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Repeatability

max. of loading

Voltage Sens
0.01 %/sInfluence of ambient
temperature

Current output

max. of loading

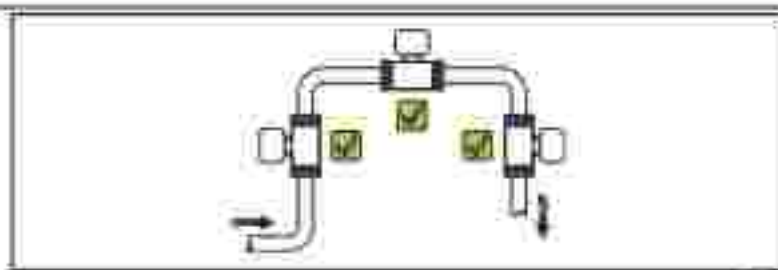
Temperature coefficient	max. ±0.005 %/°C
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Pulse frequency output

Temperature coefficient	no systematic effect (depends on accuracy)
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Installation

Mounting location



Orientation

The direction of the arrow on the nameplate helps you to install the sensor according to the flow direction (direction of medium flow through the piping).

- Install the retaining device in a parallel plane line of electrical installation points
- The internal diameter of the pipe must be inside the nominal diameter of the sensor



Orientation		Diagram	Minimum clearance
A	Vertical orientation		1/2"
B	Horizontal orientation, unobstructed head up		1/2"
C	Horizontal orientation, unobstructed head down		1/2"
D	Horizontal orientation, unobstructed head side		1/2"

Inlet and outlet runs

If possible, the pipes should be installed downstream from valves, T-joints, gauges etc. To obtain the specified level of accuracy of the measuring device, the inlet and outlet runs must be maintained at minimum. If there are several flow disturbances present, the longest specified pipe run must be maintained.

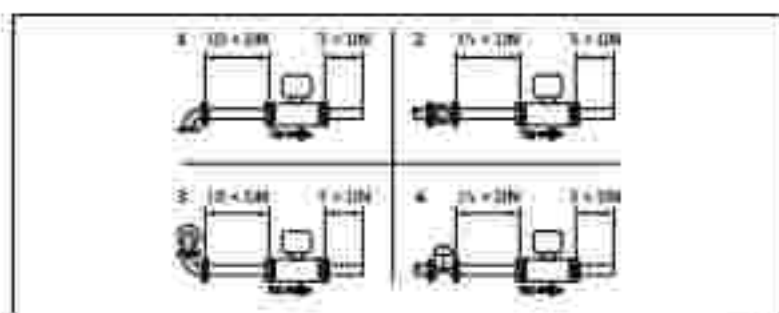


Figure 2: Inlet and outlet runs with various flow disturbances

1. 1/2" pipe or T-joint
2. Tee
3. 1/2" above 1/2" diameter
4. Check valve

Outlet runs when installing control devices

When using an external device, observe the specified distance:

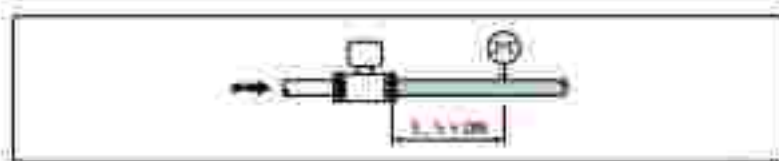


Figure 3: Measure measuring device

Environment

Ambient temperature range	Temperature	+23 to +40 °C (+33 to +104 °F)
	Peak display	+20 to +60 °C (-4 to +140 °F), the resolution of the display that is required at temperatures outside the temperature range
	Enter	+22 to +40 °C (+32 to +104 °F)

- If operating outdoors:
 Avoid direct sunlight, particularly in warm climates regions.

Storage temperature	All components apart from display module -25 to +80 °C (-13 to +176 °F), periodically at +25 °C (+68 °F)	
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Degree of protection	Translucent and sealed • As standard IP66-67 type 4X enclosure • When housing is open, IP20, type 1 enclosure	
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Shock resistance	Shock test as rough handling following IEC 60068-2-21	
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Vibration resistance	• Oscillation, sinusoidal, following IEC 60068-2-6 • 1 to 8 & 80, 5.0 mm/sec • 8 to 500 Hz, 1 g peak • Oscillation, broadband noise following IEC 60068-2-64 • 12 to 200 Hz, 0.005 g ² /Hz • 200 to 2000 Hz, 0.001 g ² /Hz • Total: 1.56 g rms	
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Electromagnetic compatibility (EMC)	• As per IEC EN 61326-1, IEC EN 61326-2-2 and HARMONIZED EN 61326-2-1 (CE Mark) • Complies with emission limits for industrial as per EN 55011 (Class A)	
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Details are provided in the Declaration of Conformity

Process

Medium temperature range	Enter -10 to +120 °C (+14 to +248 °F)	
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Sound velocity range	1200 to 2000 m/s (3307 to 5682 ft/s)	
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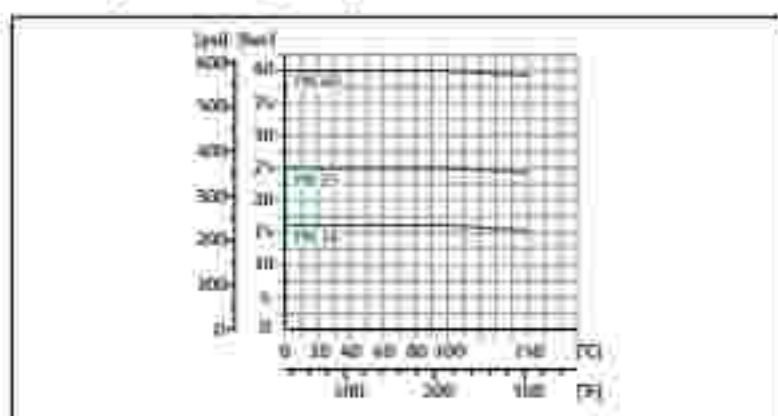
Process temperature ratings	The following process temperature ratings apply to all process sealing parts of the device and are just the generic information. The diagrams show the maximum permissible medium pressure depending on the specific medium temperature.	
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Devices conforming with section 4 and 5 are subject to the following maximum process temperatures:

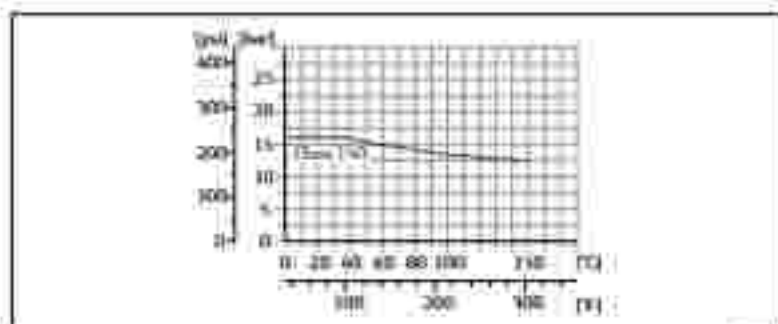
- As per EN 1062: -10 °C (+14 °F)
- As per ASME: -10 °C (+32 °F)

Smooth Range DHE EN 1022-12 type 000 shape S1, P0 35/35/40



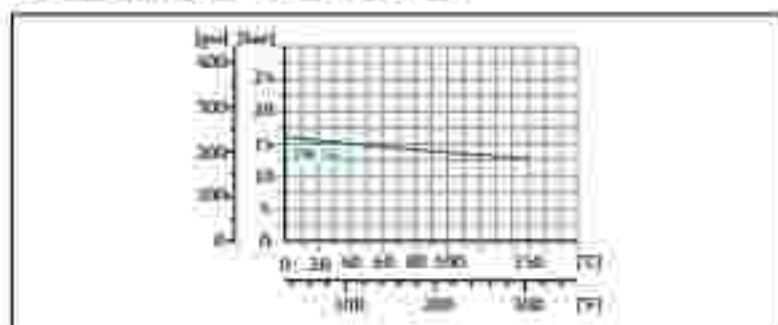
20 - with large amount of ferrite (24%)

High-strength Range following ASTM E58.8, class 350



20 - with large amount of ferrite (24%)

Low yield strength DHE EN 1022-12 type 025 shape A, P0 18



20 - with large amount of ferrite (24%) minimum plastic temperature = 20

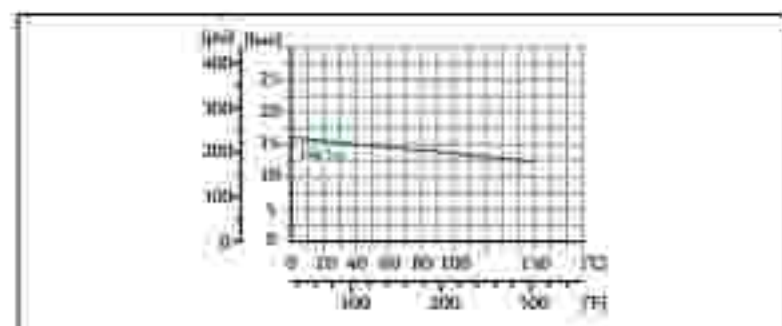


Fig. 12 6061-T6 aluminum (A 429 (F304) and A 429 (F304))

Lap Joint Design Following ASME B16.3, class 150

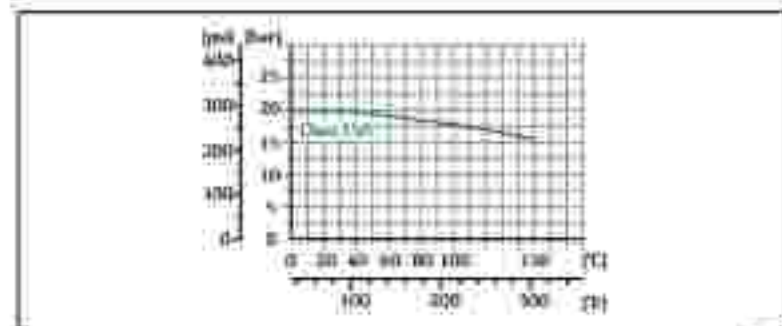


Fig. 12 6061-T6 aluminum (A 429 (F304) and A 429 (F304))

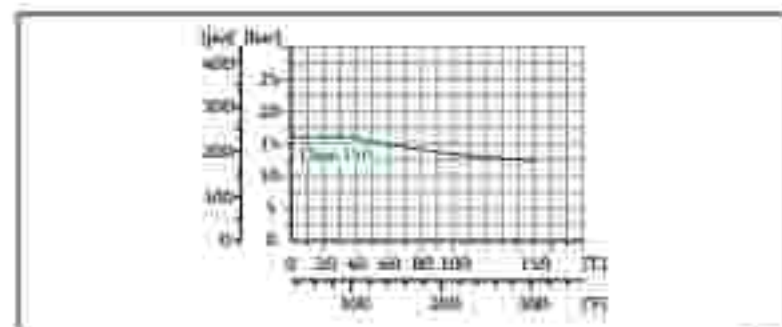


Fig. 12 6061-T6 aluminum (A 429 (F304) and A 429 (F304))

Key joint design, straight joint following EN 1090-1 (DIN 1901), 999.10

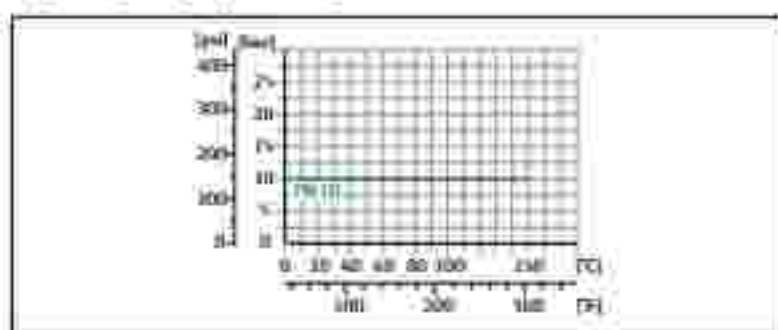


Fig. 10 With large diameters: 10000 (10000) and 10000 (10000) minimum process temperature = 10

Flow limit

Limit the nominal diameter by optimizing between the required flow range and permissible pressure loss

For an overview of the full scale select for the measuring range, not the measuring range:

- The maximum recommended full scale value is approx. 1.00 of the maximum full scale value
- In most applications, 50 or 80 % of the maximum full scale value can be considered ideal

Pressure loss

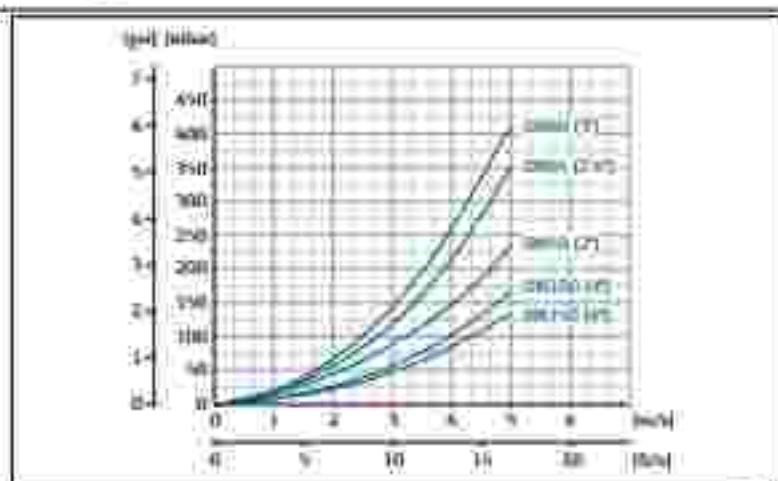


Fig. 10 Pressure loss 10 (10) to 100 (100)

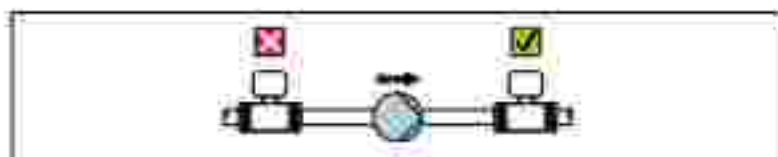
To reduce the pressure loss, use the Agilometer using tool = 10

System pressure

It is important that cavitation does not occur, or that gases entrained in the liquid do not escape. This is prevented by means of a sufficiently high system pressure

For this reason, the following measuring locations are recommended

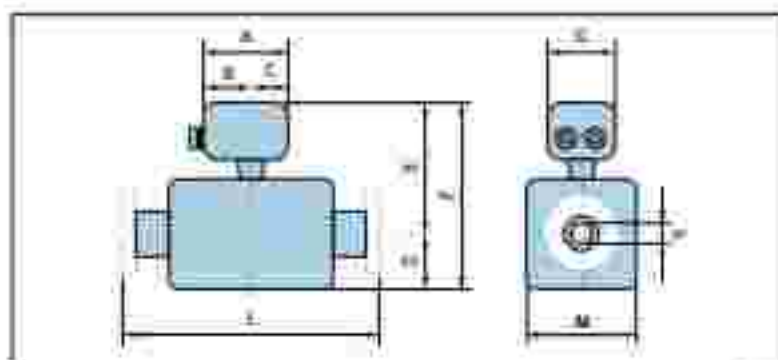
- At the lowest point in a vertical pipe
- Downstream from pumps (no danger of cavitation)

**Thermal insulation:**

In the case of steam fluids it is important to keep the heat radiated from the sensor as low as possible up to low levels. A wide range of materials can be used for the required insulation.



- a: Maximum insulation thickness 2 are 30 mm
- b: Minimum distance from heating to insulation

Mechanical construction**Dimensions in SI units****Compact version:**

Order code for fitting: option A: Compact aluminium model

Ø1	A	B	C	D	Ø2	Ø3	E	Ø4	F	G	H
50	100	80	90	82.0	223.0	110	120	10	°	21.0	
55	100	80	90	82.0	228	100.5	120	12.0	°	21.0	
60	100	80	90	82.0	233	110	120	14.0	°	21.0	
65	100	80	90	82.0	238	110.5	120	16.0	°	21.0	
70	100	80	90	82.0	243	120.5	120	18.0	°	21.0	

- (1) : When using a display (order code for display: option B: Display 40 mm)
- (2) : Distance 40 mm
- (3) : Depending on required process connection

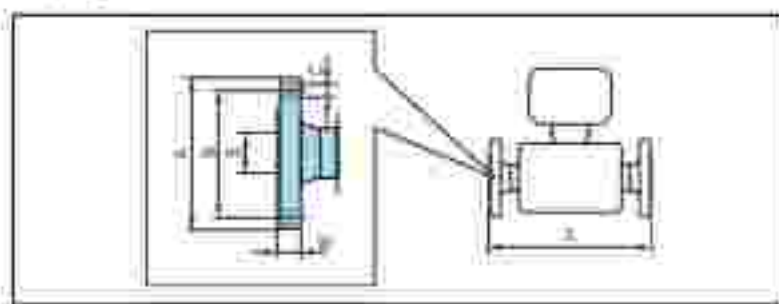
Dimension for Housing, Spindle Z (Design standard)

DN (mm)	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F ¹⁾ (mm)	G (mm)	G ²⁾ (mm)	L (mm)	H (mm)
50	127	77	62	82.5	122.5	71.1	130.5	75	7	81.8
65	127	77	62	82.5	123	71.5	130.5	75.5	7	71
80	127	77	62	100	124	72.6	130.5	76.5	7	79.5
100	127	77	62	127.5	125.5	87.1	130.5	78	7	128
150	127	77	62	150	171.5	111.5	130.5	102.5	7	158

- 1) When using a tapered roller cone for design standard, option B, Flange - 15.5 mm
 2) Tolerance all mm
 3) Depends on the project conditions in general

Flange connections

Flange flange


 Second flange ISO 95 (ISO's Type G) Item B, H, H¹⁾ and H²⁾

(ISO's G16), see also for Design connection, option B1, B2, B3

DN (mm)	Pressure rating (b)	A (mm)	B (mm)	C (mm)	D (mm)	E ¹⁾ (mm)	L (mm)
50	10	125	123	4 + 15	75	54.5	200 ²⁾
65	16/18	125	123	5 + 15	75/72	71.1	200 ²⁾
80	16/18	130	123	6 + 15	80/75	81.5	210 ²⁾
100	16/18	150/149	180/190	8 + 15/11	100/98	120.5	280 ²⁾
150	16/18	180/180	215/232	8 + 15/11	140/135	181.5	350 ²⁾

- 1) Tolerance all mm
 2) Tolerance 0-2 mm
 3) Tolerance 0-3 mm

Spares Range following ISO 95 G16 Item B1

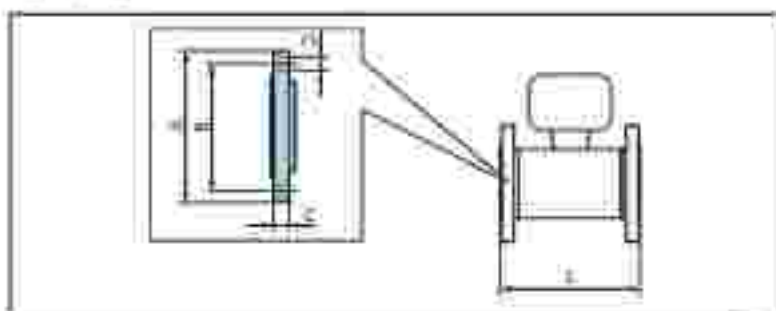
(ISO's G16), see also for Design connection, option G1

DN (mm)	A (mm)	B (mm)	C (mm)	D (mm)	E ¹⁾ (mm)	L (mm)
50	122.5	122.5	4 + 15.5	75.1	54.1	200 ²⁾
65	123	121.5	4 + 15.1	75.5	54.1	210 ²⁾

Seat Range Rimming ARM 8045 - Class 100 1.440x 712mm, max load for Proactive construction, option A12						
200 [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E ¹⁾ [mm]	L [mm]
120	126.8	192.8	8 + 27.1	22.8	107.5	800 ²⁾
180	179.1	244.8	8 + 27.1	29.8	160.5	800 ²⁾

- 1) Thickness 40 mm
2) Thickness 50 mm
3) Thickness 60 mm

Seat joint design



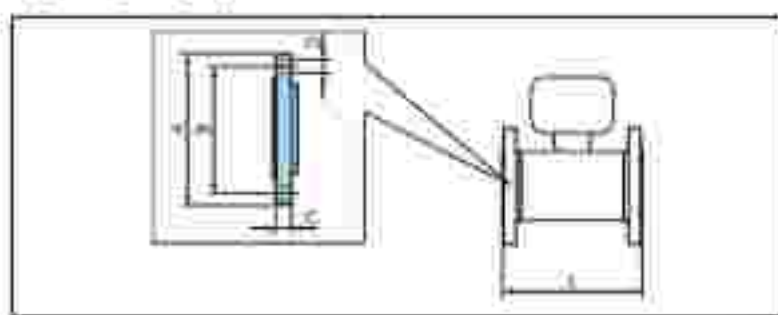
Seat joint design 200x120x180 - 1.70x30 Form in 80x30 1.700x 1.210mm, max load for Proactive construction, option C22 1.440x 712mm, 1.440x 712mm, max load for Proactive construction, option C24						
200 [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
50	138	179	20	8 + 18	100 ²⁾	
70	160	198	20	8 + 18	120 ²⁾	
90	180	218	20	8 + 18	140 ²⁾	
120	220	260	12	8 + 18	180 ²⁾	
180	288	320	19	8 + 21	800 ²⁾	

- 1) Thickness 20 mm
2) Thickness 30 mm

Seat joint design Rimming ARM 8018 - Class 100 1.178 Interpose for Proactive construction, option A12 1.440x 712mm, max load for Proactive construction, option A14						
200 [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
50	132.1	123.7	19.1	4 + 26.1	100 ²⁾	
60	143.3	134.4	20.2	4 + 26.1	110 ²⁾	
120	228.9	223.5	20.2	8 + 26.1	200 ²⁾	
180	276.1	271.2	29.9	8 + 26.1	800 ²⁾	

- 1) Thickness 20 mm
2) Thickness 30 mm

Lat. 30° 11' N. Long. 122° 04' W. Depth 1000 fathoms.



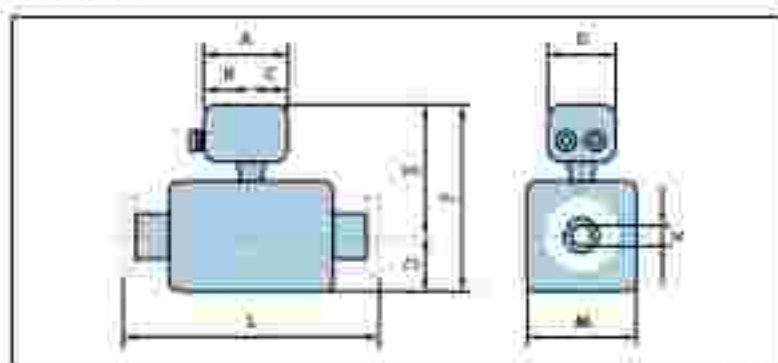
1. **Get your things done** (4 pages) **Planning** (100) - 1. (100/1000) **Per** 10
 1. **100/1000** - **100/1000** **100/1000** **100/1000** **100/1000**
 1. **100/1000** - **100/1000** **100/1000** **100/1000** **100/1000**

$\frac{a}{b}$	$\frac{c}{d}$	$\frac{e}{f}$	$\frac{g}{h}$	$\frac{i}{j}$	$\frac{k}{l}$
00	111	111	111	1 = 11.1	100
11	111	111	111	1 = 11.1	100
00	100	111	111	1 = 11.1	100
100	100	111	111	1 = 11.1	100
100	100	100	100	1 = 11.1	100

- 2) Coarseness 2-2 mm
 3) Thickness 7-8 mm

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Canoeing training



$\frac{1}{\text{[H]}}$	$\frac{1}{\text{[H]}}$	$\frac{1}{\text{[H]}}$	$\frac{1}{\text{[H]}}$	$\frac{1}{\text{[H]}}$	$\frac{1}{\text{[H]}}$	$\frac{1}{\text{[H]}}$	$\frac{1}{\text{[H]}}$	$\frac{1}{\text{[H]}}$	$\frac{1}{\text{[H]}}$	$\frac{1}{\text{[H]}}$
0	0.12	0.21	0.17	0.11	0.10	0.14	0.11	0.10	0	0.12
0.1	0.12	0.21	0.17	0.11	0.10	0.14	0.11	0.10	0	0.12
0	0.12	0.21	0.17	0.11	0.10	0.14	0.11	0.10	0	0.12

SP Inch	A Inch	B Inch	C Inch	D Inch	E ¹ Inch	E ² Inch	F Inch	E ³ Inch	G Inch	H Inch
1	8.13	1.12	2.13	4.13	10.1	11.3	9.13	2.13	7	1.13
2	8.13	1.12	2.13	3.92	10.9	11.8	9.13	1.92	7	1.12

- 1) When using a display, enter code for Display operation, option B/Values <1.1 in.
- 2) Tolerance ± 0.05 in.
- 3) Depends on the process controlled in question.

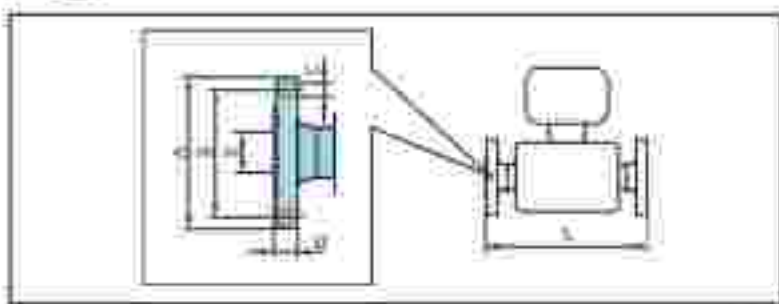
Order code for Missing: Option 2: Complete omitted

SP Inch	A Inch	B Inch	C Inch	D Inch	E Inch	E ¹ Inch	F Inch	E ² Inch	G Inch	H Inch
1	8.1	1.05	2.15	4.15	9.88	11.15	9.14	1.18	7	1.15
2-10	8.1	1.04	2.15	3.94	9.17	11.35	9.14	1.17	7	1.05
3	8.1	1.05	2.15	3.94	9.15	11.15	9.14	1.14	7	1.15
4	8.1	1.04	2.15	4.15	9.18	11.15	9.14	1.13	7	1.13
5	8.1	1.05	2.15	3.94	10.17	11.17	9.14	1.14	7	1.15

- 1) When using a display, enter code for Display operation, option B/Values <5.43 in.
- 2) Tolerance ± 0.05 in.
- 3) Depends on the process controlled in question.

Profile dimensions

Plan/Top



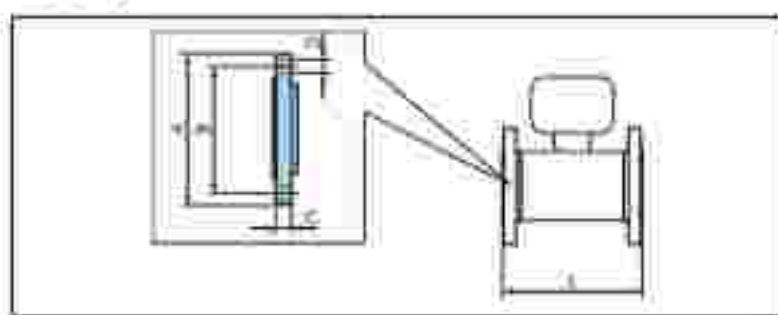
Order change following serial stock of Class 100

2.4476 (1234) - enter code for process correction, serial stock

SP Inch	A Inch	B Inch	C Inch	D Inch	E ¹ Inch	G Inch
1	8.00	4.75	4 ± 0.75	1.00	1.13	11.9
2	7.83	5.00	4 ± 0.75	1.17	1.13	11.8
4	8.00	7.50	8 ± 0.75	1.13	4.14	11.87
5	11.0	9.10	8 ± 0.84	1.16	6.17	11.7

- 1) Tolerance ± 0.05 in.
- 2) Tolerance 0 ± 0.05 in.
- 3) Tolerance 0 ± 0.12 in.

Lap joint flange


 Lap joint flange (existing) A4038212 to Table 100
 A4038212 (new) for Ergoline correction, option 012
 A4038212 (new) for Ergoline correction, option 014

DP (in)	A (in)	B (in)	C (in)	D (in)	L (in)
1	6.00	4.75	0.00	4 + 0.75	12.8 ¹⁾
2	7.00	6.00	1.25	4 + 0.75	12.8 ¹⁾
4	8.00	7.00	1.50	4 + 0.75	12.8 ¹⁾
8	11.0	9.00	1.00	4 + 0.00	12.7 ²⁾

- 1) Tolerance D+C 0.00 in
 2) Tolerance D+C 0.12 in

Weight

Weight in 31 series

Comparison

Comparison for flange, option A Comparison of aluminum, steel

Nominal diameter (mm)	Weight	Flange flange		Lap joint flange		Lap joint flange, standard weight
		Aluminum (mm 2000) (kg)	Aluminum 6061 (kg)	Aluminum (mm 2000) (kg)	Aluminum 6061 (kg)	Aluminum 6061 (mm 2000) (kg)
50	Aluminum	0.50	0.50	0.50	0.50	0.50
60	Aluminum	1.10	-	1.10	-	0.50
80	Aluminum	1.20	1.20	1.20	1.20	0.50
100	Aluminum	1.80	1.80	1.80	1.80	1.00
120	Aluminum	2.40	2.40	2.40	2.40	1.00

- 1) Flange flange for 40 (mm 2000) for 10 (mm 2000) to 120
 2) Flange flange 120
 3) Flange flange for 10 (mm 2000)
 4) Flange flange for 10

Order code for 'Measuring': Option D Compact unit/kit

Nominal diameter (mm)	Version	Fixed flange		Lag joint flange		Lag joint flange, extended (mm)
		DN ISO 5201 (mm) ¹	ASME B16.5 (in)	DN ISO 5201 (mm) ¹	ASME B16.5 (in)	DN ISO 5201 (mm) ¹
25	Single-part	9.14	0.36	9.14	0.36	9.14
32	Single-part	12.07	-	12.07	-	12.07
40	Single-part	12.07	12.07	12.07	12.07	12.07
100	Single-part	18.14	18.14	18.14	18.14	18.14
150	Single-part	25.40	25.40	25.40	25.40	25.40

- 1) Pressure rating PN 10 (DN 100), PN 16 (DN 40 to 150)
 2) Pressure rating: class 150
 3) Pressure rating: PN 10/16
 4) Pressure rating: PN 10

Weight in kg/unit

Compensation

Order code for 'Measuring': option A Compact aluminium, coated

Nominal diameter (in)	Version	Fixed flange ASME B16.5 ¹ (in)	Lag joint flange ASME B16.5 ¹ (in)
2	Single-part	07.87	07.87
3	Single-part	08.66	08.66
4	Single-part	08.66	08.66
6	Single-part	07.87	07.87

- 1) Pressure rating: class 150

Order code for 'Measuring': Option D Compact unit/kit

Nominal diameter (in)	Version	Fixed flange ASME B16.5 ¹ (in)	Lag joint flange ASME B16.5 ¹ (in)
2	Single-part	07.87	07.87
3	Single-part	08.66	08.66
4	Single-part	08.66	08.66
6	Single-part	07.87	07.87

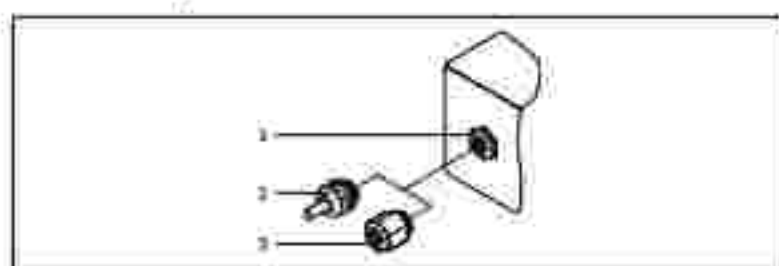
- 1) Pressure rating: class 150

Materials

Transition flanging

- Order code for 'Measuring': option A Compact aluminium coated/
Aluminium: AISI 5053g; coated
- Order code for 'Measuring': option D Compact aluminium/
Stainless steel: 1.4305 (304)
- Welding material for optional final display (+/- 30°C)
Order code for 'Display-Operation': option B; glass

Cable entry/cable glands



► 2.1 Cable entry/cable glands

- 1 Cable gland M20 = 1.1
- 2 Cable gland M20 = 1.2
- 3 Adapter for cable entry with female thread G 1/2 or G 1/4 (1.1 or 1.2)

Cable entry for Housing, option A Compact aluminium stand

Cable entry/cable glands	Material
Cable gland M20 = 1.1	Housing gland type
Adapter for cable entry with female thread G 1/2	
Adapter for cable entry with female thread M20 w/	

Cable entry for Housing, option B Compact stainless steel

Cable entry/cable glands	Material
Cable gland M20 = 1.1	Stainless steel, 1.4571 (316L)
Adapter for cable entry with female thread G 1/2	
Adapter for cable entry with female thread M20 w/	

Spindle Housing

Spindle steel (solid material)

- 1.4301 (304)
- 1.4302 (304)

Process connections

- Gaskets steel:
 - 1.4301 (304)
 - 1.4306 (304L)
 - 1.4404 (316L)
 - 1.4571 (316L)
- Seal 2215/R (1.0039)
- Coarse steel A305

 [Download process connections](#) ► **B 17**

Process connections

Flange

- EBF 100L-1 (DIN 2851)
- ASH E 316.5

 For information on the different materials used in the process connections ► **B 16**

Human interface

Operating concept

Operator-adjusted menu structure for using specific tools

- Communication
- Operation
- Diagnosis
- Expansion

Quick and safe commissioning

- Indication menu for applications
- Menu guidance with brief explanations of the individual parameter functions

Reflexible operation:

- Operation in the following languages:
 - Via FieldCare, DeviceCare operating tool: English, German, French, Spanish, Italian, Chinese, Japanese
 - Via integrated Web browser: English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Bahasa (Indonesian), Vietnamese, Celtic, Swedish, Korean
- Uniform operating philosophy applied to operating tools and Web browser
- If replacing the component module, transfer the device configuration via the plug-in memory (HART-IO-DAT) which contains the previous and changing device data and the device logbook. No need to reconfigure.

Efficient diagnostics increase measurement availability

- Troubleshooting measures can be called up via the operating tools
- Oversee maintenance systems
- Status indicated by colour light emitting diodes (LEDs) on the component module in the existing measuring system

Local display

The local display is only available with the following device order tools:

Order code for Display operation/ option B: Active illumination via communication

Display classes

- White liquid crystal display with 18 characters per line
- White background lighting, switches to red in case of alarm state
- Format for displaying measured variables and alarm variables can be individually configured
- Permitted ambient temperature for the display: -20 to $+60$ °C (-4 to $+140$ °F). The maximum of the display may be impaired at temperatures outside the temperature range.

Remote operation

Via HART protocol

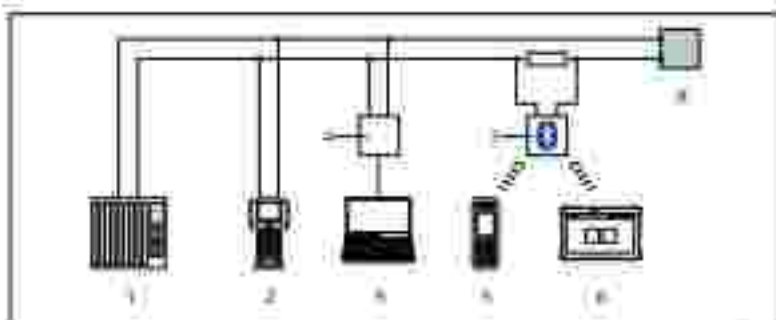


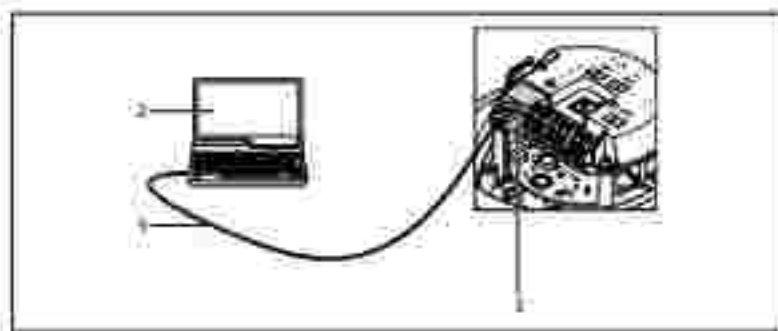
Fig. 10: Typical HART remote operation via HART protocol

1. Device system (e.g. PLC)
2. Field Communicator #72
3. Computer with operating tool (e.g. FieldCare, AVE Device Manager, SIMATIC Manager)
4. Controller (PLC or DDC)
5. Field Oper. STAG 20 or STAG 16
6. Field Oper. 20000
7. HART-IO-DAT module with connecting cable
8. Transmitter

Service interface

Via service interface (CSI-F145)

HART



- Fig. 15** Connection for the order code for device version E 645 with HART pulse frequency module output
- 1 Device keypad (CSI-F145) at the measuring point with access to the integrated unit server
 - 2 Computer with cable modem (e.g. Internet Explorer) for accessing the integrated device Web browser with WinCC supporting tool with COM2000 CSI Communication (HART)
 - 3 Device Driver connecting tablet with HART plug

Certificates and approvals

i Currently available certificates and approvals can be called up via the product configuration.

CE mark

The device meets the legal requirements of the applicable EU Directives. These are listed in the corresponding EU Declaration of Conformity along with the standards applied.

Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.

RCM tick symbol

The measuring system meets the EMC requirements of the Australian Communications and Media Authority (ACMA).

HART certification

HART interface

The measuring device is certified and registered by the FieldComm Group. The measuring system meets all the requirements of the following specifications:

- Certified according to HART 7.5
- The device has also been approved with certified versions of other standard plug-in components (if applicable)

Pressure Equipment Directive

The device can be ordered with or without a PED approval. If a device with a PED approval is required, this must be explicitly stated in the order.

- With the mark **Pressure PED** (CE) a (1st category) as the main category, Endress+Hauser conforms conformantly with the European Safety Requirements specified in Appendix I of the Pressure Equipment Directive 2014/68/EU.
- Devices bearing the marking (PED) are suitable for the following types of medium:
 - Media in Group 1 and 2 with higher pressure greater than, or equal to and equal to 0.5 bar (7.5 psi)
- Devices not bearing this marking (PED) are designed and manufactured according to good engineering practice. They meet the requirements of article 4 paragraph 3 of the Pressure Equipment Directive 2014/68/EU. The range of application is indicated in tables 4 to 6 in Annex 2 of the Pressure Equipment Directive 2014/68/EU.

Other standards and guidelines

- EN 60619
Degree of protection provided by enclosures (IP code)
- EN 61326-2
Safety requirements for electrical equipment for measurement, control and laboratory use – general requirements
- EN 61326-3
Extension in accordance with Class A requirements: Electromagnetic compatibility (EMC) requirements
- IEC 61010-1
Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment
- IEC 61010-2
Take attention to the order of a given failure in field and control equipment with microprocessors
- IEC 61010-3
Standardization of the signal level for the breakdown information of digital measuring instruments with analog output signal
- IEC 61010-4
Software of field devices and signal processing systems with digital components
- IEC 61010-5
The application of the protection equipment function to process control devices
- IEC 61010-6
Specifications for measuring fieldbus devices at engineering tools for field devices
- IEC 61010-7
Self-monitoring and diagnosis of field devices
- IEC 61010-8
Requirements for field devices for standard applications

Ordering information

Detailed ordering information is provided as follows:

- In the Product Configurator on the Endress+Hauser website: [www.endress.com](#) → Click "Configure" → Select your country → Click "Product" → Select the product using the filter and search field → Open product page → The "Configure" button to the right of the product image opens the Product Configurator
- From your Endress+Hauser Sales Center: [www.endress.com/contact](#)

Product Configurator – the tool for individual product configuration

- User-friendly configuration data:
 - Depending on the device: Direct input of necessary product-specific information such as measuring range or operating language
 - Automatic modification of selection criteria
 - Automatic creation of the order code and its breakdown in PDF or Excel output format
 - Ability to order directly in the Endress+Hauser Online Shop

Application packages

Many different application packages are available to enhance the functionality of the device. Such packages might be needed to address safety aspects or specific application requirements.

The application packages can be ordered with the device or subsequently from Endress+Hauser. Detailed information on the order code in question is available from your local Endress+Hauser sales center or on the product page of the Endress+Hauser website: [www.endress.com](#)

Detailed information on the application packages

Accessories	Package	Description
Endress+Hauser Accessories	Heartbeat Verification Alignment	Heartbeat Verification Meets the requirement for possible alignment to DIN EN ISO 9000:2008 Chapter 7.3.4: "Control of measuring and measuring equipment" • Customized setting to the transfer from without interrupting the process • Transfer a verification result on request creating a report • Simple setting process in idle operation or under operating conditions • Clear measuring point identification (position) with optical marking points the requirements of manufacturing applications • Execution of verification without blocking of operation (no adjustment) Heartbeat Monitoring Continuously signals data, which are documented in the measuring principle in programs, indicate monitoring system for the purpose of preventive maintenance or process analysis. These data enable the operator to: • Draw conclusions using these data and other information about the setup of the measuring application and its measuring performance over time • Generate recording of data • Monitor the process or process points, e.g. gas pressure

Accessories

Various accessories, which can be ordered with the device or added jointly from Endress+Hauser, are available for the device. Detailed information on the order code in question is available from your local Endress+Hauser sales office or on the product page of the Endress+Hauser website.

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Communication specific accessories	Accessories	Description
Communication specific accessories	Converter EXA495-ART	For permanently safe HART communication only (TrueData) to the IAS interface.  Technical Information 10000047
	Converter EXA492	Converter Endress+Hauser to a device with a G24 interface (Endress+Hauser Custom Data Interface) and the USB port of a computer is required.  Technical Information 10000049
	HART Long Converter M4970	Is used to exchange and convert digital HART process variables to analog current signals or their value.  • Technical Information 10000099 • Operating Instructions 84000710
	Universal HART Adapter Box 470	Is used for the wireless connection of field devices. The Universal HART adapter can be easily integrated into field devices and a secure information transfer over long distances and transmission safety can be guaranteed by means of other endress+hauser communication using technology.  Technical Information 84000513
	Adapter RT442	Is used to transmit the measured value of converted 4-20 mA analog measuring signals, provided digital measuring device.  • Technical Information 10000770 • Operating Instructions 84000710 • Product page www.endress.com/rt442

Real-Time 30000	The Real-Time 30000 series PC for device configuration enables remote plant-wide management to improve the plant's efficiency. It is suitable for commissioning and maintenance staff to manage their instruments with a digital communication interface and to access programs. This series PC is designed to work together with a personal computer (PC) and a keyboard, mouse, touchpad or trackball. An external hard disk (which can be used to manage field instrument configuration data and the data) • Device Information: D000000 • Operating Instructions: S000000 • Product page: www.abaco.com/realtime30000
Real-Time 30000T	The Real-Time 30000T series PC for device configuration enables remote plant-wide management to access the plant at all times. • Device Information: D000000 • Operating Instructions: S000000 • Product page: www.abaco.com/realtime30000t

Software & accessories

Accessories	Description
Applinet	Software for reporting and using Endress+Hauser measuring services: • Choice of measuring services and measuring instruments • Calculation of all the parameters used for measuring the process (for example, e.g. internal diameter, pressure loss, flow velocity and density) • Detailed characterisation of the measuring device • Determination of the partial error code, identification, compensation and access to all project-related data and parameters over the whole life cycle of a plant Applinet includes: • The user manual www.abaco.com/applinet • CD-ROM (available DVD for 100% PC connection)
Vigil	Vigil Life Cycle Management Improved productivity, cost effectiveness, error-free plants. This software is a plant and its components is generated from the drawings of planning and during the test & commissioning phase. Vigil Life Cycle Management is an open and flexible information platform with online and offline tools. Connect data for yourself to current, or legacy, data and create your plant's engineering data, systems, production processes and maintenance programs. Connect with the right services. Vigil Life Cycle (data) can connect production in every phase. For more information, visit www.abaco.com/life-cycle-management
RakData	PC-based plant data management for Endress+Hauser. It can configure all plant data which is your system and help you manage them. By using the data information, it is also a simple and effective way of checking your system condition. • Operating Instructions: S000000 and S000000
DeviceCare	Can be used to install and configure Endress+Hauser field devices • Installation Instructions: D000000

System management

Accessories	Description
Management 10 program (see install)	The Management 10 program data manager provides information on all the relevant measured variables. Measured values are filtered and sorted. The data are normalised and measured points are used. The data are stored in the 104 (10) format, memory and also on a CD-ROM or USB stick • Device Information: D000000 • Operating Instructions: S000000

Supplementary documentation

- E** For an overview of the scope of the associated Technical Documentation, refer to the following:
- **High-Dose Master** [Technical Documentation](#): Enter the serial number from the **masterplate**.
 - **Exposure-Master Operations App**: Enter the serial number from the **masterplate** or from the ID matrix code (ID matrix) on the **masterplate**.

Standard documentation

Basic Operating Instructions

Basic Operating Instructions for the sensor

Measuring device	Documentation code
Exposure Process File E	04000000

Basic Operating Instructions for the monitor

Measuring device	Documentation code
	04000000
Exposure ID	04000000

Operating Instructions

Measuring device	Documentation code
	04000000
Exposure File E ID	04000000

Description of Device Parameters

Measuring device	Documentation code
	04000000
Exposure File ID	04000000

Supplementary device-dependent documentation

Special Documentation

Contents	Documentation code
Information on the Pressure Equipment Directive	00000000
EMC Test	00000000

Contents	Documentation code
	04000000
Harmonized Technical	00000000

Installation Instructions

Contents	Documentation code
Installation instructions for open gas and air circulation	Documentation code applied to each individual customer

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