

Simply a question of
better measurement



Flow Sensor EM 20651

Maintenance free flow sensor for air and gases with high temperature, highly responsive from 0.2 m/s.

Burner control

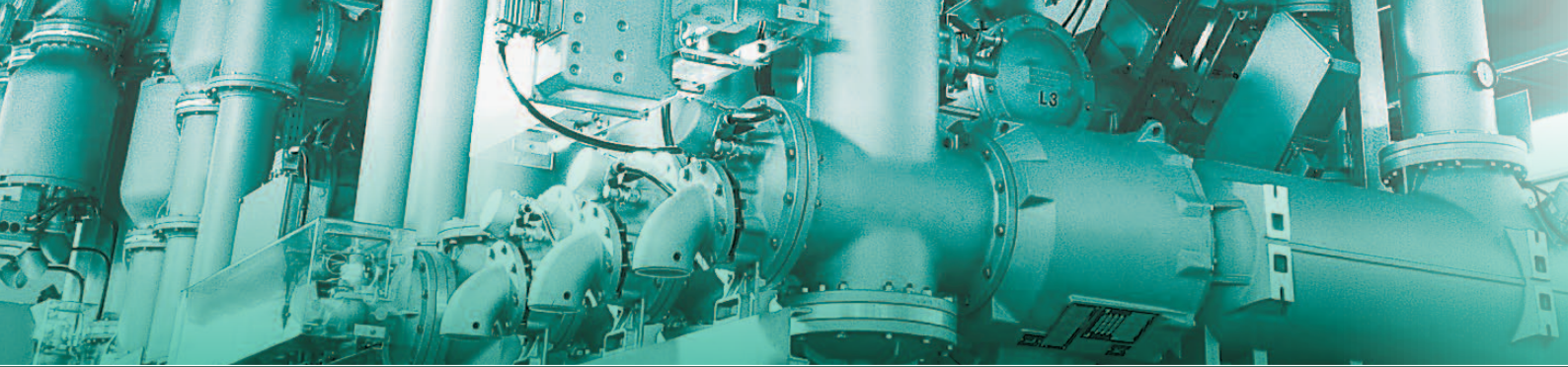
Drying processes

Sterile tunnel

Process technology

+350 °C

HOT



Flow Sensor EM 20651

Flow measurement at high temperature and under pressure

Measurement of flow velocity and / or volume flow at higher temperatures up to +350 °C is very important in many applications with regard to energy efficiency, quantity detection and system control. Accordingly the requirements for a stationary flow sensor are very high.

Temperature output

In addition the temperature of the medium will be measured. This represents an important process parameter which can be used for monitoring or controlling. In combination with the measured mass flow this allows to calculate heat flow or heat flow volume.

Mechanically robust

The sensor is exposed to high temperatures and forces caused by gas flow. A long operation time without any maintenance is very important because in some cases access to installation sites is difficult. For that reason sensors without wearing parts are particularly economic.

Exact and long-term stable measuring values

Precise measurements are essential, even after years in operation all readings have to be as reliable as on the first day. The "Drifting" of sensoric characteristics e.g. of the zero point or measuring values is unacceptable. Changes of process parameters like temperature or pressure may not affect measurement accuracy.

Different installation sites

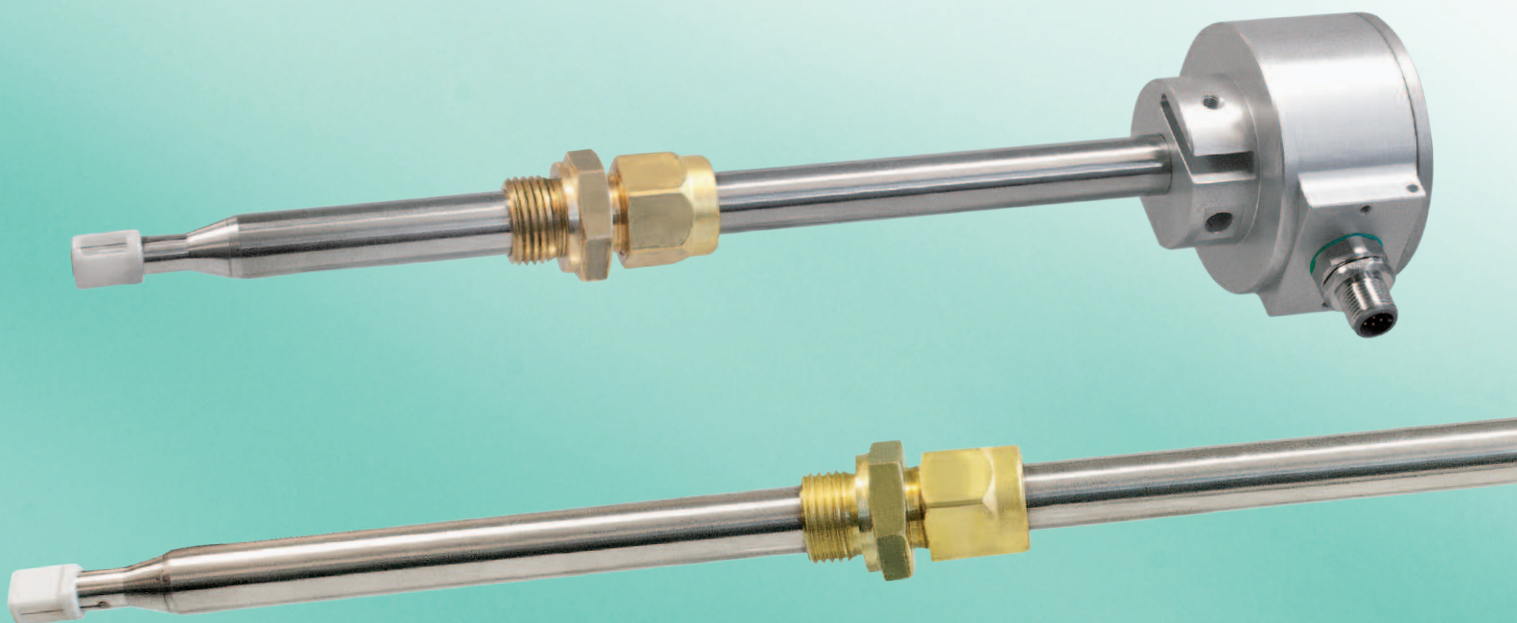
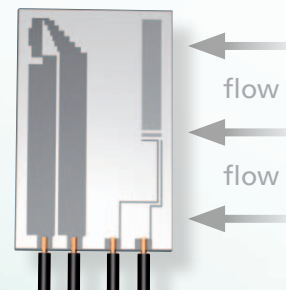
Each installation site has its own requirements and sometimes they are very restrictive. Therefore a sensor has to offer flexible installation possibilities like various probe lengths or the ability to tolerate suboptimal mounting conditions. Size also plays a role – a bigger device suffers more cutbacks considering limitations of mounting space.

Wide flow measuring range

Due to different operating conditions or load periods the sensor must be able to measure both minimal and maximal volume flows precisely – with verifiable accuracy.

The sensor element

... is protected inside an aerodynamically designed "chamber head". A chip-shaped element substrate, made of temperature-resistant ceramics, carries the actual sensoric structure which is coated by a thin glass layer.



Burner control on process ovens

Innovative ceramic products are increasingly used in medical, environmental and automotive engineering. Demands on those products are manifold and the required burning process is very complex and meets strong requirements. Manufacturers of burners must meet the challenge to develop future-oriented technologies that guarantee highest temperature accuracy, atmospheric regulation and efficient use of energy by heat recovery. Here the measuring equipment is of particular importance. The **Flow Sensor EM 20651** has been developed for precise measurement of combustion air which is preheated up to 350 °C. The inherent recording of mass flow allows for an optimal stoichiometric combustion without needing additional sensorics for temperature or pressure.

Additional measurements like differential pressure with orifice gauge, absolute pressure or temperature can be omitted using the EM 20651.

Monitoring of drying processes

In processes using coating technologies the drying phase plays an important role for high product quality and avoiding wastage. Using the **Flow Sensor EM 20651** the volume flow of drying air can be regulated accurately. Simultaneous temperature measurement allows monitoring or control of other important process parameters.

Another advantage lies in its wearless and nearly maintenance free conception thus avoiding short maintenance cycles especially in sites difficult to access.

Safe monitoring and precise control in sterile tunnel applications

The **Flow Sensor EM 20651** can be applied in sterile tunnels which demand continuous operation in hot air. Its range of applications comprises pharma and cosmetics as well as food and nonfood industries. The demands of hot air sterilization meets the **EM 20651** by using appropriate materials in combination with easy cleanability.

Cross contamination caused by moving parts (e.g. by bearings of a measurement turbine) is impossible due to sensor design.

Monitoring of air compressors

When monitoring power consumption of modern air compressors by measuring their volume flow it is possible that temperatures of up to 200 °C and pressure levels up to 16 bar may occur. The **Flow Sensor EM 20651** is not only suitable to endure such circumstances but also features precise measurements in the range of 0.2 to 60 m/s. Therefore it allows both an accurate calculation of consumption of compressed air as well as the indication and control of leakages.



Four Duo-LEDs are signalling the operational state of the sensor and a simple representation of flow velocity. In case of a problem they are useful for a quick error analysis onsite. With an optional fieldbus version its communication status is displayed via additional LEDs.





Innovative flow measurement technology

The **Flow Sensor EM 20651** is based on the wear free thermal measuring principle that does not use moving parts. A particular advantage of this principle is the measurement of the so-called "standard flow velocity" which is referred to standard conditions. Therefore it is not necessary to measure additional parameters like pressure or temperature. When used in pipes the user can easily calculate the standard volume flow based on pipe diameter.

The basic sensor version is designed for atmospheric pressure conditions and offers three measuring ranges (0 ... 2.5 / 10 / 20 m/s) with a maximum temperature of 200 °C. There are also optional versions with enhanced features like temperatures up to +350 °C and pressure tightness up to 16 bar.

It is also possible to record brief temperature overshooting exceeding the nominal temperature up to 10 %. The **Flow Sensor EM 20651** is equipped with an integrated temperature measurement which is displayed by a second analog output.

Robust sensor element

The sensor element developed by **EM** uses a high-temperature resistant ceramic substrate as carrier. This sensor element is positioned inside the aerodynamically designed chamber head, which is also made of heat-resisting ceramic material.

The deposits and dust can be eliminated by cleaning the sensor elements with compressed air.

Parylene coating – "Allrounder" augmentation for EM 20651

Due to its optional protection coating "Parylene" (only for versions with maximum temperature of 200 °C) it exhibits enhanced media resistances and hydrophobic behaviour. Thus it can be used under rougher environmental conditions. This coating is robust to a lot of organic and anorganic compounds that can be found in atmosphere.

Flexible mounting lengths and small dimensions for simple installation

Standard probe lengths are 250, 400, 600 and 1,000 mm. The measured air flow is not influenced by the probe thanks to the small structure of the sensor element and the small diameter of the sensor tube.

A compression fitting is included in delivery – the pressure-tight version (up to 16 bar) also contains a pressure protection kit. Installation is very simple: Screw compression fitting in welded sleeve, insert probe and adjust its tip in the middle of the pipe, finally tighten spigot nut. Now start flow analysis!

Which output signals are needed?

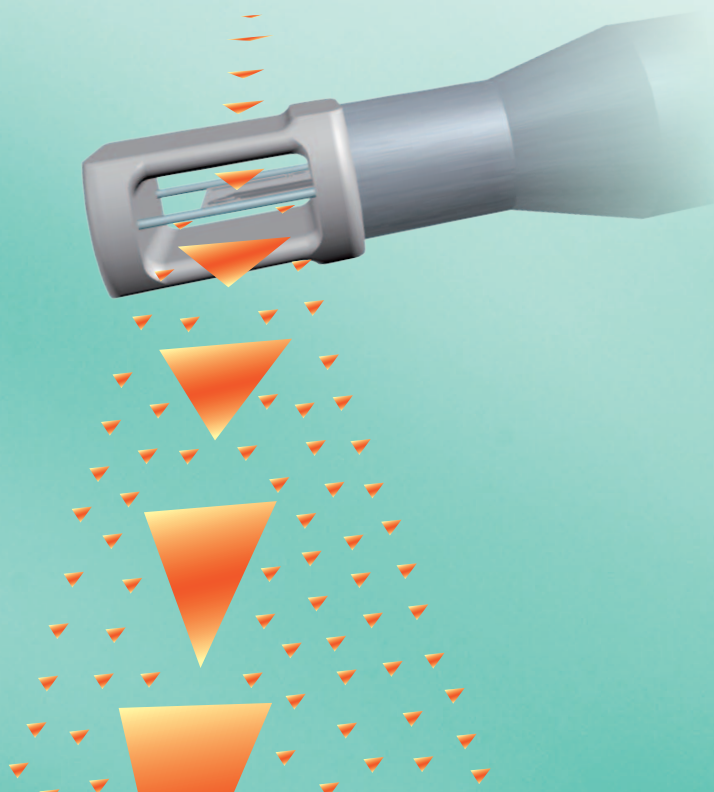
The **Flow Sensor EM 20651** features two linear outputs with 0 ... 10 V / 4 ... 20 mA characteristics – by default completed with two additional digital outputs for reporting direct consumption rate. Connection to fieldbus systems can be established with optional versions using Profibus DP or DeviceNet.

Accuracy in black and white

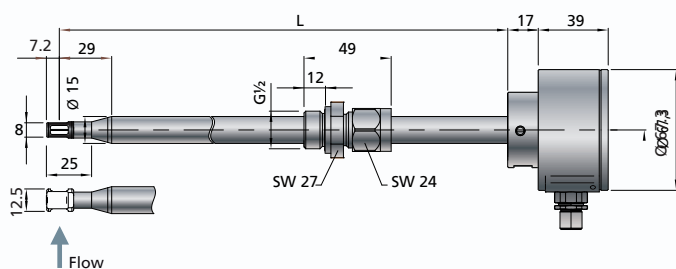
Upon request, the sensor can be supplied with a high precision calibration. The according measurements are carried out using high end wind tunnels. This calibration is re-newable at any time upon user request.

All advantages at a glance:

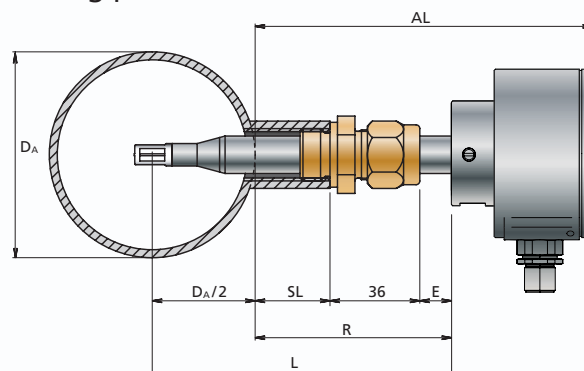
- direct measurement of standard volume flow up to +350 °C and up to 16 bar
- high turndown ratio of up to 1:300
- integrated temperature measurement
- high precision calibration with ISO calibration certificate (optional)
- analog (2 x Auto U/I) and digital (2 x) outputs
- fieldbus output (optional)
- robust and compact housing
- two-color LEDs status display
- flexible probe lengths up to 1,000 mm and remote version (option)



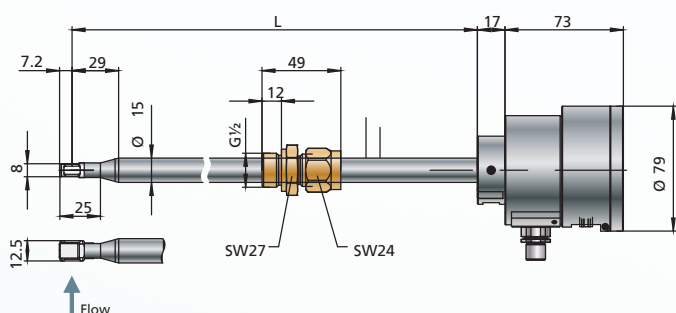
Standard sensor dimensions



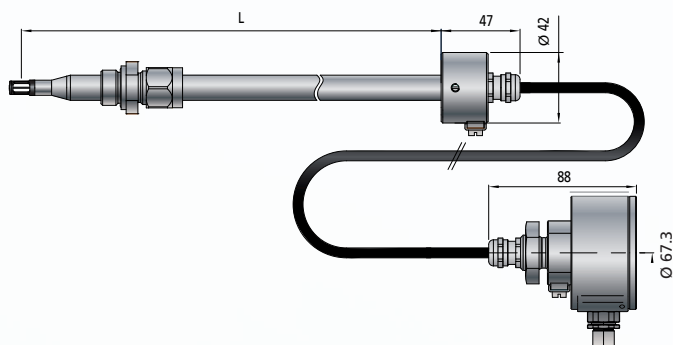
Mounting parameters



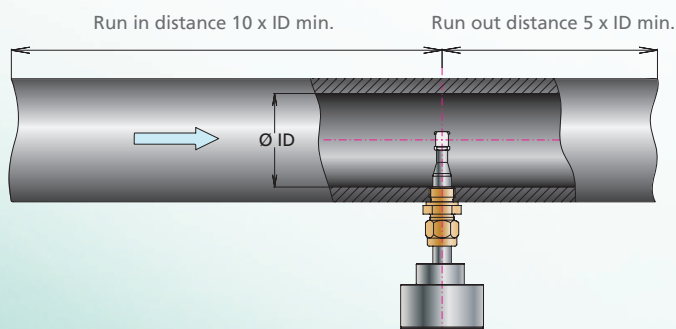
Fieldbus version dimensions



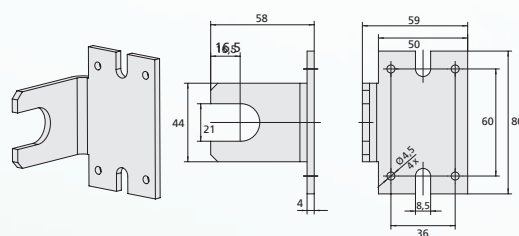
Remote sensor dimensions



Mounting instructions



Wall mounting bracket



included in delivery



In order to avoid overheating of the sensor electronics, the probe tube must reach out of the pipe in a length of $E > 50$ mm (without insulation).

D_A = Tube outside diameter
 SL = Length of welding sleeve
 E = Probe tube setting length
 AL = Compact sensor projecting length
 R = Reference length
 L = Probe length



Technical data

Measuring data	
Measuring quantities	Standard velocity w_N based on standard conditions of $T_N = 20\text{ °C}$ and $p_N = 1,103.25\text{ hPa}$ Media temperature T_M
Media to be measured	Clean air, nitrogen, other gases upon request
Measuring range w_N	0 ... 2.5 / 10 / 20 / 40 / 60 m/s
Lower detection limit w_N	0.2 m/s @ 20 °C
Measuring range T_M	0 ... +200 / +350 °C
Measurement accuracy w_N	Standard: $\pm(3\text{ \% of measured value} + [0.4\text{ \% of fmr; min. } 0.08\text{ m/s}])$ ¹⁾ High precision: $\pm(1\text{ \% of measured value} + [0.4\text{ \% of fmr; min. } 0.08\text{ m/s}])$ ¹⁾
Response time (t_{90}) w_N	3 s (jump from 0 to 5 m/s in air)
Temperature gradient w_N	< 8 K/min @ $w_N = 5\text{ m/s}$
Recovery time	< 10 s after temperature change of $\Delta\vartheta = 40\text{ K}$ @ $w_N = 5\text{ m/s}$
Measurement accuracy T_M ($w_N > 2\text{ m/s}$)	$\pm 2\text{ K}$ ($T_M = 10\text{ ... }30\text{ °C}$) $\pm 4\text{ K}$ (remaining measuring range)
Operating conditions	
Sensor tip	0 ... +200 / +350 °C
Electronics	-20 ... +70 °C
Storage temperature	-20 ... +85 °C
Humidity	Measuring mode: Non-condensing (< 95 % RH), high relative air humidity in combination with high temperature can cause measurement deviations
Operating pressure	Atmospheric / 16 bar (over pressure)
Electronic data	
Supply voltage	24 V DC $\pm 20\text{ \%}$
Current consumption	Typ. 50 mA (max. 250 mA)
Display	4 x Duo LEDs (green / red / orange)
Start up time	Approx. 10 s after switch-on
Type / class of protection	IP65 (housing), IP54 (probe) / III (SELV or PELV)
Analogue outputs for temperature and flow rate Auto-U/I	0 ... 10 V / 4 ... 20 mA (protected against short circuits) Voltage output: $\geq 550\text{ }\Omega$ Current output: $\leq 500\text{ }\Omega$ Hysteresis: 50 Ω Load capacity: $\leq 10\text{ nF}$
Impulse outputs	1. Highside driver to supply voltage (not galvanically isolated) High level: > supply voltage - 3 V Short circuit current limitation: 100 mA 2. Semiconductor relay (galvanically isolated); max. 30 V / 50 mA
Frequency of digital outputs	0 ... 100 Hz or 1 impulse/m ³ or free selectable frequency (10 ... 100 Hz)
Feldbus (optional)	Profibus DP/DeviceNet
Electrical connection	Plug-in connector M 12, 8-pole, male, screwed
Maximum cable length ²⁾	100 m

¹⁾ under reference conditions, related to adjustment reference

²⁾ signal output in voltage mode: use AGND and $R_L \geq 10\text{ k}\Omega$ (mass offset)*

fmr = final measuring range

General data	
Mounting position	Arbitrary (atmospheric; under higher pressure preferred horizontally)
Installation tolerance	$\pm 3^\circ$ to flow direction
Minimum tube diameter	DN20 (depending on media temperature)
Weight	750 g max. (fieldbus version)
Probe length (L)	250 / 400 / 600 / 1,000 mm (both versions)
Cable length (remote version)	Selectable: 1 ... 10 m (in steps of 1 m)
Material	
Enclosure	Aluminium, anodized
Sensor tube	Stainless steel 1.4571
Compression fitting	Stainless steel 1.4571 or brass (depending on sensor option)
Sensor head	Platinum resistor element (glass-passivated), ceramics

Accessories



LED measured value display

For visualization purposes directly on location, an LED unit is available to display measuring values.

Advantages:

- Free selection of measurement unit (e.g. m/s or m³/h)
- Programmable analogue output signal
- Two programmable relay outputs
- Power supply: 85 – 250 V AC or 24 V DC
- Power supply of connected sensor
- Enhanced version with second measurement input and "sum" function



Connection cable available in various lengths



Coupler socket with screw type terminals



Welding steel sleeves or stainless steel

Order information for Flow Sensor EM 20651

	Description	Article number										
Basic sensor	Flow Sensor EM 20651	546650 -	A	B	C	D	E	F	G	H	DD	
	Options											
	Standard		1									
Output signals	Basic (2 x analogue auto-U/I plus 2 x impulse)		1									
	Profibus DP-V0		2									
	DeviceNet		3									
Mechanical version	Basic (compact version with fixed probe)				1							
	Remote version with cable length: ____ m (1 ... 10 m, in steps of 1 m)				2							
	Probe length 250 mm				1							
	Probe length 400 mm				2							
	Probe length 600 mm				3							
	Probe length 1000 mm				4							
Measuring range and adjustment	Measuring range 0 ... 2.5 m/s					1						
	Measuring range 0 ... 10 m/s					2						
	Measuring range 0 ... 20 m/s					3						
	Measuring range 0 ... 40 m/s (only at H = 3 or 4)					4						
	Measuring range 0 ... 60 m/s (only at H = 3 or 4)					5						
	Standard adjustment						1					
	Standard adjustment with factory calibration certificate						3					
	High precision adjustment with factory calibration certificate						2					
Impulse output	Standard: $w_N \sim f = 0 \dots 100 \text{ Hz}$ ($w_{N,max} = f_{max}$)								1			
	1 impulse/m³ for pipe diameter (round): ____ mm (min. 20 mm)								2			
	Selectable f_{max} : ____ Hz (10 ... 100 Hz)								9			
Temperature and pressure	200 °C atmospheric									1		
	200 °C atmospheric (coated)									2		
	200 °C pressure-tight									3		
	200 °C pressure-tight (coated)									4		
	350 °C atmospheric									5		
	350 °C pressure-tight									6		
	350 °C atmospheric (coated)									7		
	350 °C pressure-tight (coated)									8		
	Pressure DD: ____ (00 ... 16 bar; 00 = atmospheric; > 1 bar overpressure)										00...16	
	Description	Article number										
Accessories	Connecting cable 8-pin, length 5 m, with coupler socket and open cable ends	524 921										
	Coupler socket 8-pin, cable length selectable, (2 ... 100 m; one-meter-steps), free of halogen, with cable end sleeves	524 942										
	Coupler socket 8-pin, with screw connections, for cable diameter ø 6 ... 8 mm	524 929										
	Welding sleeve G ½, steel, according EN 10241, 5 pcs.	524 916										
	Welding sleeve G ½, stainless steel, according EN 10241, 2 pcs.	524 882										
	Power supply: out 24 V DC / 1 A; in 115 / 230 V AC (strip terminal)	535 282										
	Assembly kit for pipe assembly suitable for MD 10.010 / MD 10.015, including pipe clamps and collar for adjustment to pipe diameter	531 394										
	LED display EMD 10.010 in wall housing to show volume flow and flow velocity, 85 ... 250 V AC and sensor power supply	527 320										
	LED display EMD 10.010, similar to 527 320 but with 24 V DC voltage supply	528 240										
	LED display EMD 10.015, similar to 527 320 but with additional sum function and second measuring input	527 330										
	LED display EMD 10.015, similar to 527 330 but with 24 V DC voltage supply	528 250										