Easy installation

Sensor installation manual

Edition 2026-01/A

BELIMO

Welcome

Introduction
Modern building technology systems place high demands on planning, installation, and operation. Sensors play a central role here, as they provide the basis for precise and energy-efficient control. This manual helps professionals to install these components correctly and ensure optimum integration into the overall system.

Your practical guide for technology and planning
This manual is aimed at technicians and installers, and it serves as a practical tool for the professional installation of sensors.

Careful planning and correct installation are crucial for the trouble-free, energy-efficient operation of building technology systems.

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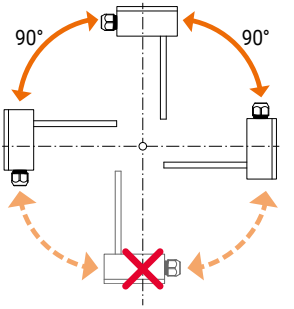
General information for all sensors

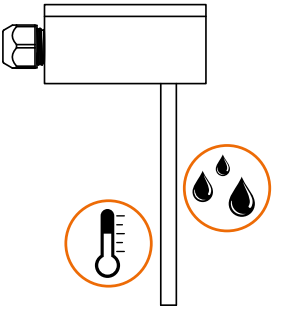
Installation and safety regulations, in addition to local laws, must be followed. The manufacturer's recommendations must also be observed.

Do not install sensors protruding or hanging down. Protect them against damage, risk of injury, and vandalism. Protect components from external influences (weather, animals, etc.).

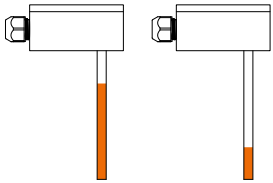
The installation orientation has an influence on the proper functioning of the sensor and must be observed.



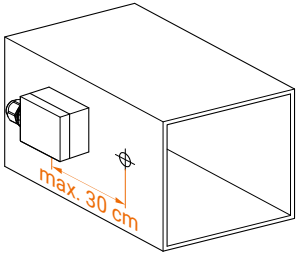
Clarify the following before each installation:
– Min./max. ambient temperature
– Ambient humidity, splash water
– Vibration
– Explosion safety
– External influences (weather, animals, etc.)



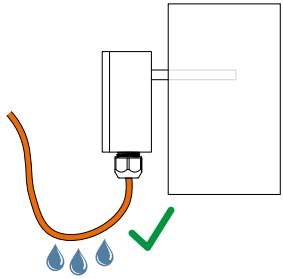
Take into account the active and inactive areas of rod sensors.

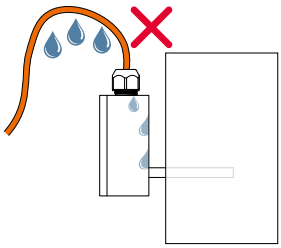


A check must be performed for each sensor regarding whether a tightly sealable measuring opening needs to be installed due to the system-specific conditions.

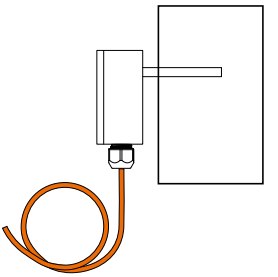


Cable connection from below so that no water can get into the sensor housing.

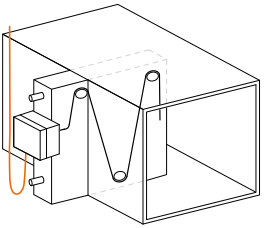




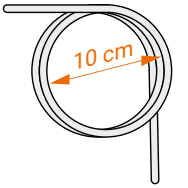
Provide the connecting cable with a reserve loop so that the sensor can be extended at any time without disconnecting the electrical connection.



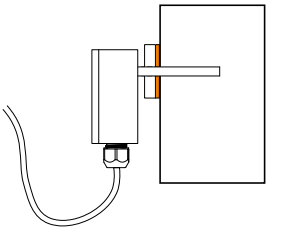
For installation on "drawers", the electrical supply cable must be of a sufficient length. This enables the drawer to be pulled out without disconnecting the electrical connection.



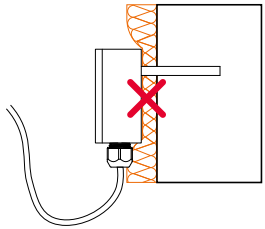
Roll up any unused capillary tube length in an orderly manner.



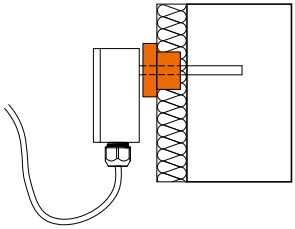
Openings in medium lines must be sealed to prevent leakage.



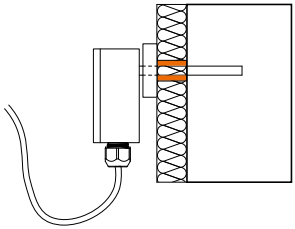
Do not compress the insulation when installing the sensor.



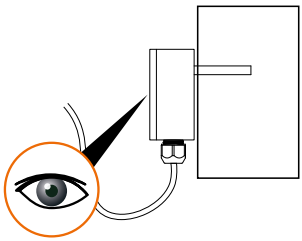
Use cover ring with gradations.



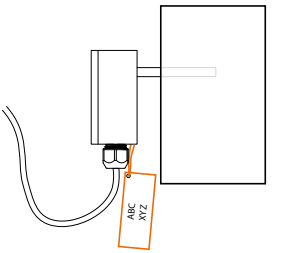
If the cover ring supplied does not have the corresponding gradations, then place spacer sleeves underneath it.



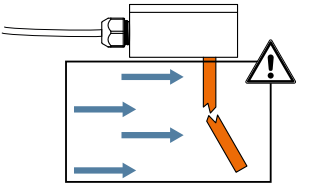
For concealed installations (e.g. suspended ceilings, shafts, etc.), clearly mark the locations and document them in the operating documents.



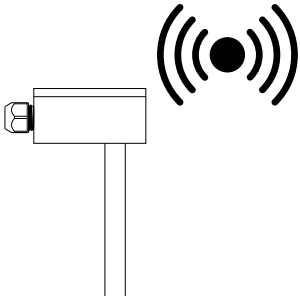
Label the sensors according to the system-specific concept.



Observe maximum flow velocities, maximum operating pressures, sensor and probe lengths to avoid material breakage.



Wireless sensors



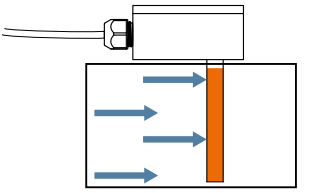
- Obstacles reduce the range of radio signals
- Metal (e.g. fire doors), thick concrete, and older buildings with solid masonry have a negative impact on the range of radio signals
- A clear line of sight is the best prerequisite for the range of radio signals
- Ambient conditions may change over time
- Other wireless technologies may cause interference
- Install wireless devices as high as possible
- Always allow for a certain buffer
- Low connection quality/signal strength has a negative impact on system stability and battery life. Check the use of amplifiers (repeaters)
- Observe system limits
- Manufacturers and suppliers offer corresponding tools for the planning, installation, testing, and troubleshooting of wireless systems
- Perform and confirm the site acceptance test after installation

Air

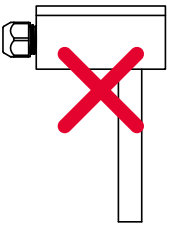
Temperature

Duct/immersion sensors

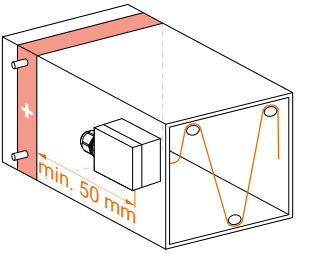
Duct/immersion sensors that do not measure at the tip must be surrounded by air along their entire length.



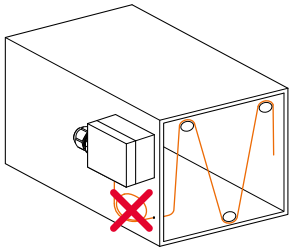
Where stratification is possible (e.g. downstream of mixing units, air heaters, coolers, or heat recovery systems), do not use rod sensors (check the use of average temperature sensors).



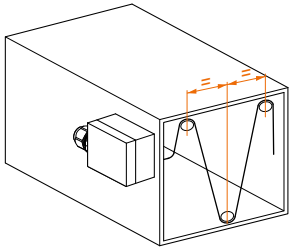
Distance between heat exchanger and sensor at least 50 mm.



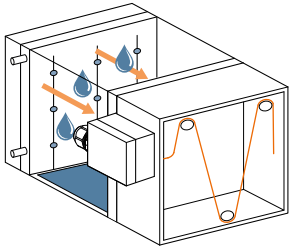
In the case of average temperature sensors, the sensor must be inserted into the air duct along its entire length.



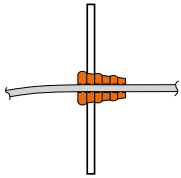
Spread the sensor element evenly over the entire cross-section.



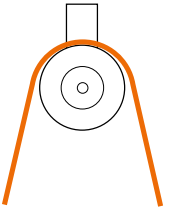
When using a scrubber system for humidification, install the sensor element in the direction of airflow downstream of the droplet separator.



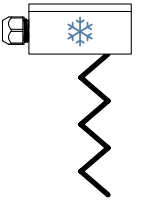
Use a rubber grommet with a seal for sheet metal feed-throughs (risk of chafing).



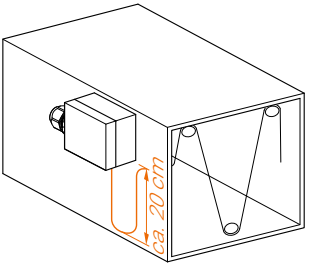
Install the sensor element with the fixing roller.



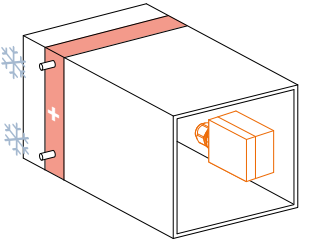
Frost protection thermostat



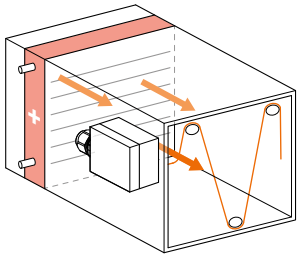
Provide a capillary tube loop of 20 cm outside the ventilation unit for operational checks.



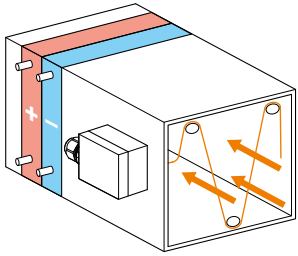
If the supply air unit is located outdoors or in unheated rooms, the probe and the test loop must be placed inside the supply air unit and downstream of the heat exchanger.



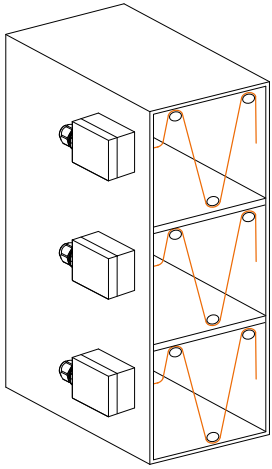
Install the capillary tube in the direction of airflow downstream of the first water-filled and frost-prone air heater. Lay the capillary tube at right angles to the heat exchanger tubes.



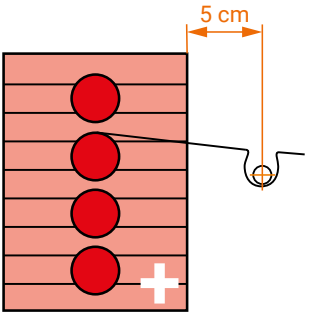
If a water-filled cooler is installed upstream of the first air heater, install the frost protection thermostat in the direction of airflow upstream of the cooler.



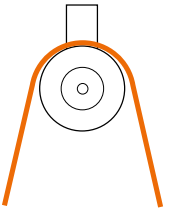
For large heat exchangers or for heat exchangers divided into multiple elements, install more than one frost protection thermostat (min. 1 frost protection thermostat per element).



Use a spacer clamp to ensure the necessary distance.

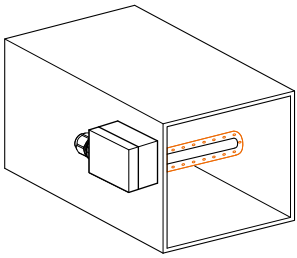


Install the sensor element with the fixing roller.

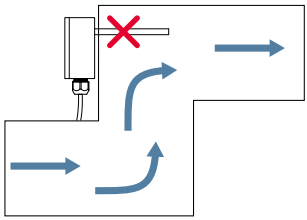


Humidity

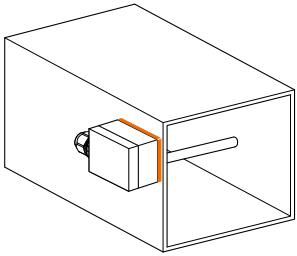
Humidity sensors are influenced by air velocity. The maximum value specified by the manufacturers and suppliers on the sensor must not be exceeded.
Measures: Fit a cover upstream of the sensor (e.g. perforated plate). This must be replaced or cleaned periodically.



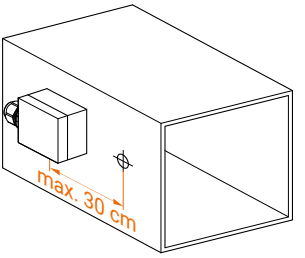
Do not place the sensor in zones where there is no flow. (Supersaturation occurs in these zones.)



Caution: When installing in ducts with negative pressure, false air can be sucked in through the device and the installation opening due to leaks. Seal these to avoid incorrect measurements.

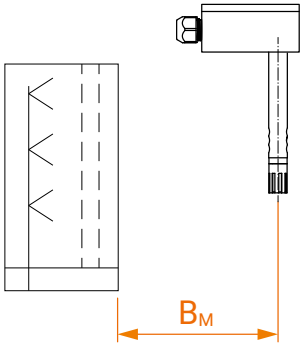


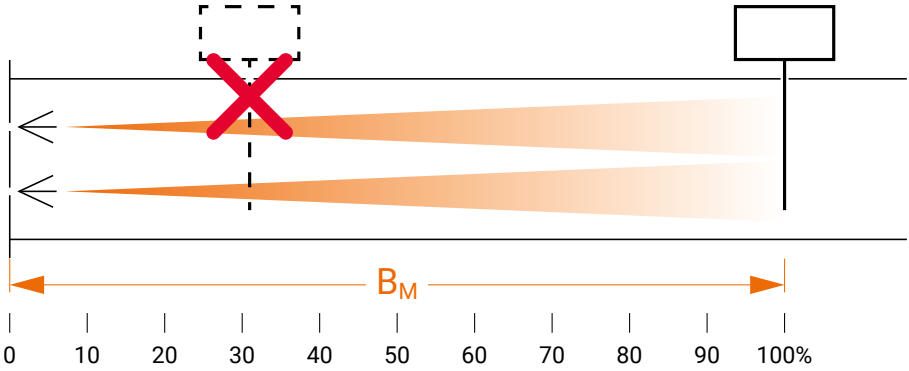
Each humidity sensor has a control measurement opening.
Recommendation: ø 40 mm.



Humidifier measuring section (B_M)

The humidifier measuring section (B_M) is the distance between the humidifier and the humidity sensor at which the water added to the air is 100% dissolved in gaseous form. It depends on the water volume supplied, air velocity, and humidifier system.
If this distance is not maintained, then the humidity sensor will measure an incorrect value. The manufacturer's B_M specifications must be observed.





Example: A sensor that is installed too close will only detect the gaseous fraction, e.g. 30% of the supplied water/steam. The sensor element gets wet, measures incorrectly, and may become damaged.

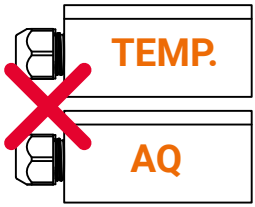
Sensor placement for humidifiers (simplified)

		Distance to sensor or maximum humidistat		
			Steam distribution pipe	Multiple steam distribution system
Isothermal	Steam humidifier		3...5 m*	1...2 m*
Adiabatic	High pressure atomiser	3 m*		
	Evaporator	3 m*		
	Hybrid humidifier	3 m*		

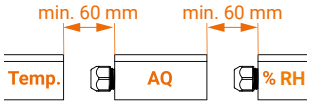
* Depending on the required humidification capacity. More detailed information can be found in the manufacturer's documentation.

Air quality (AQ)

Only one gas (e.g. CO_2) is measured from the ambient air (selective).
Do not install the temperature and humidity sensor above or below the AQ sensor.



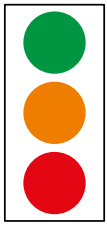
The heated measuring element can cause the device to heat up considerably. Depending on the type of device, this must be taken into account during installation.
Observe lateral clearances (min. 60 mm).



These devices require servicing at regular intervals. The intervals and servicing work vary depending on the gas and measuring method used.

Observe the manufacturer's specifications.
(Observe accessibility)

Set the air quality traffic light to the following values:



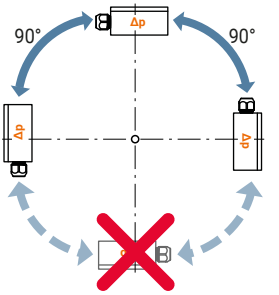
≤800 ppm

800...1200 ppm

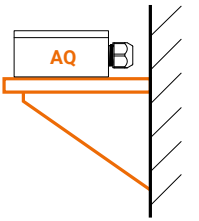
≥1200 ppm

Pressure

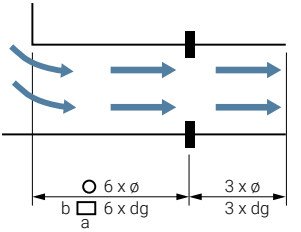
The installation orientation has an influence on the proper functioning of pressure sensors.
(See manufacturer's installation instructions)



Install the sensor on a vibration-free surface.



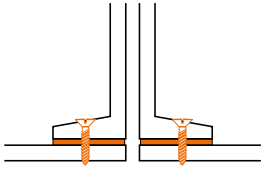
The pressure tapping point must be in a location where there is no flow. There must be sufficiently long flow calming sections upstream and downstream of the pressure tapping point. The flow calming section consists of a straight, obstacle-free pipe or duct section.



$$\text{Formula dg} = \frac{2a \times b}{a \times b}$$

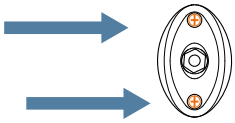
dg = equivalent diameter

The measuring nipple is screwed or glued to duct walls.
Seal prevents false air from entering.
Remove any protrusions on the inside of the duct.

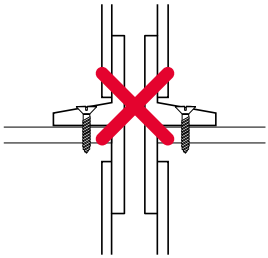


Attention: Protruding fastening screws influence the measurement.

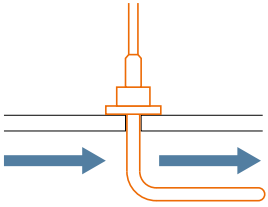
Correct installation.

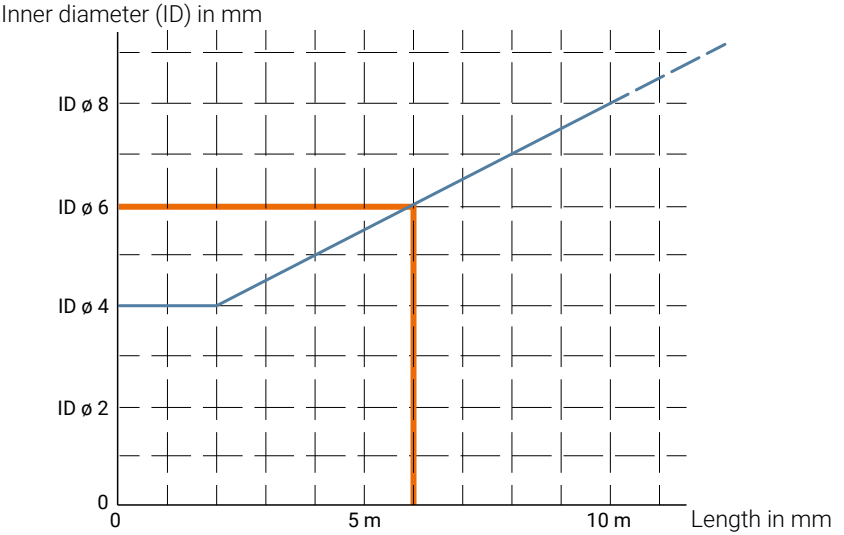


Do not measure static pressure with this nipple.
(Use only for cable feedthroughs.)



The pressure probe measures the static pressure in the duct. Position the probe parallel to the flow. The probe can be installed both with and against the flow.

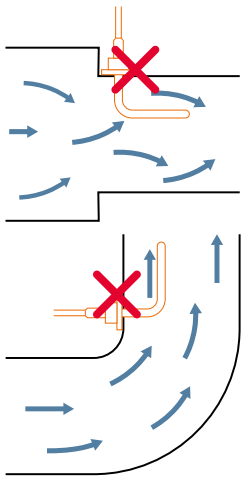




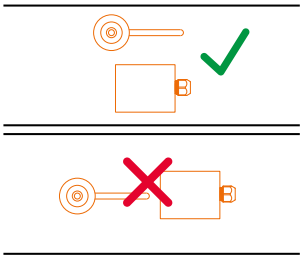
Dimensioning of the pressure line (called the measuring line)
for air and gases

The line length should be as short as possible. An inner diameter of 4 mm is sufficient for measuring lines of up to two metres in length. For longer measuring lines, the inner diameter must be determined according to the diagram.
(Example: 6 m measuring line = 6 mm inner diameter)

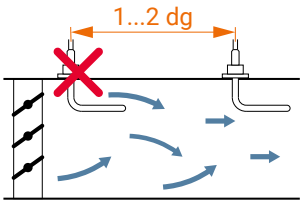
The pressure tapping point must not be influenced by flow-related obstacles.



Do not install several sensors in a row, but side by side.

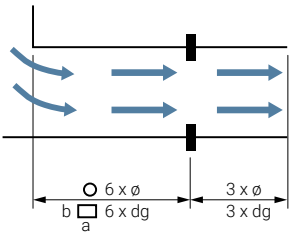


Observe the distance after the obstacle.



Velocity/flow

The pressure tapping point must be in a location where there is no flow. There must be sufficiently long flow calming sections upstream and downstream of the pressure tapping point. The flow calming section consists of a straight, obstacle-free pipe or duct section.

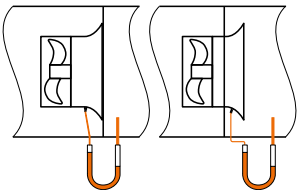


$$\text{Formula dg} = \frac{2a \times b}{a \times b}$$

dg = equivalent diameter

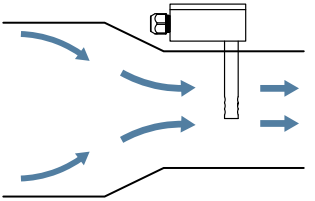
V-belt monitoring

- A differential pressure switch is used to monitor the correct fan function
- Connection "–" in the impeller with copper pipe
- Connection "+" in the pressure nozzle with pressure probe



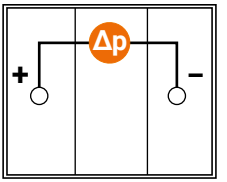
Flow monitoring

- Flow monitor (electrothermal)
- Always install electrothermal flow monitors in a location with a high flow velocity, e.g. in constrictions



Differential pressure

Do not monitor the flow or the differential pressure at variable resistance points such as filters, coolers, fans, etc. Suitable elements: air heaters, sound attenuators, baffle sheets.

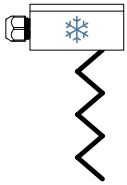


Liquid media

Temperature

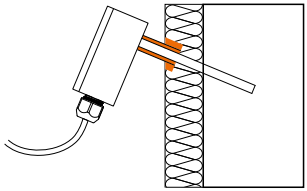
Rod sensor

Frost protection thermostat for water

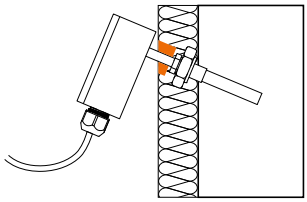


Chilled water and cooling pipes

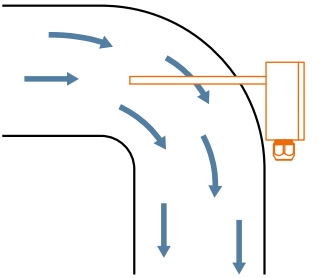
To prevent condensation, extend the thermowells inside the thermal insulation with a plastic nipple.



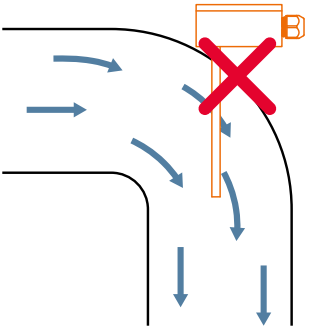
To prevent humidity from penetrating through the thermal insulation, seal the feedthrough (water vapour barrier).



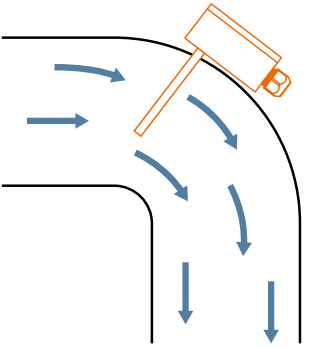
Install against the direction of flow.



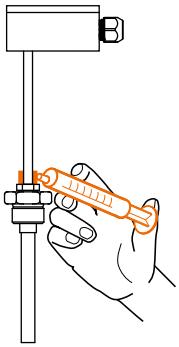
Incorrect installation.



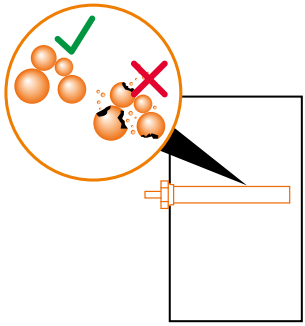
Observe the inclination.



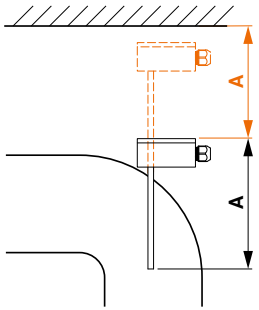
Always apply thermal contact fluid to the tip of thermowells.



Observe the choice of material. Galvanic corrosion can cause damage to the system (sacrificial anode).

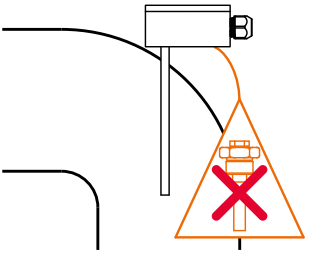


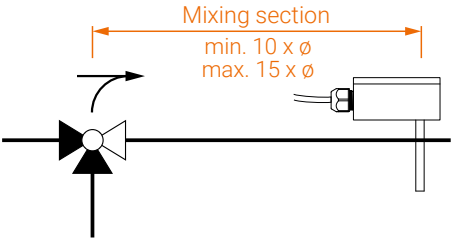
Keep the distance A to the next obstacle free so that the sensor can be extended from the thermowell.



Sensors installed without thermowells or sensors with slotted or perforated thermowells must be specially labelled.

Attach a sticker: No thermowell present.

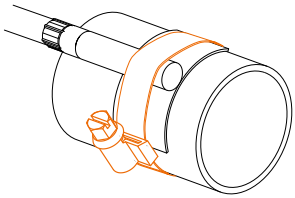




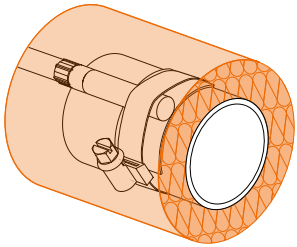
After mixing two water streams of different temperatures, a sufficiently large distance must be maintained between the mixing valve and the sensor due to stratification.

Contact sensors

Attach the contact sensor, either bent or with a probe, tightly to the pipe under the insulation.

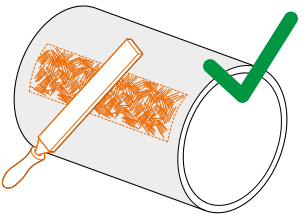


Cover the contact sensor completely with insulation so that external conditions cannot influence the measurement.

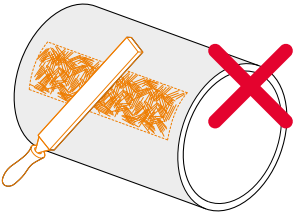


Surface contact sensor

File the surface of heating pipes bare that have paint for corrosion protection.

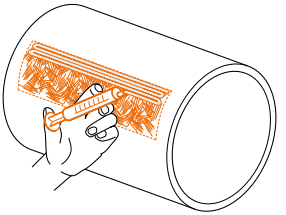


Do not file the surface of pipes made of copper, stainless steel, or other pipes without paint as corrosion protection.

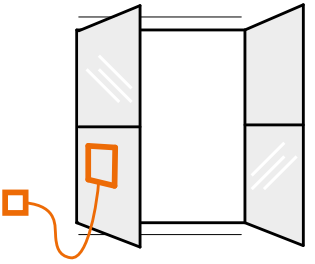


The sensor must be firmly in contact with the surface. Use thermal contact fluid.

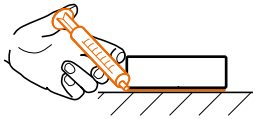
Caution: Avoid external heat influences.

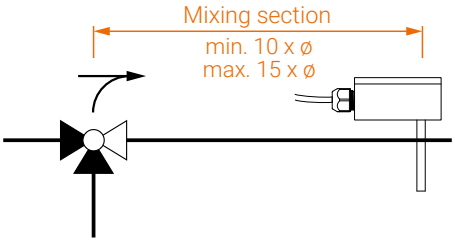


If windows can be opened: Pay attention to the cable length. The sensor must be in direct contact with the window surface.



The sensor must be in direct contact with the surface. Use thermal contact fluid.

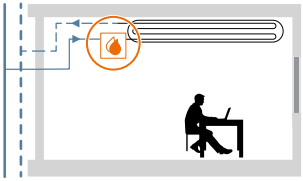




After mixing two water streams of different temperatures, a sufficiently large distance must be maintained between the mixing valve and the sensor due to stratification.

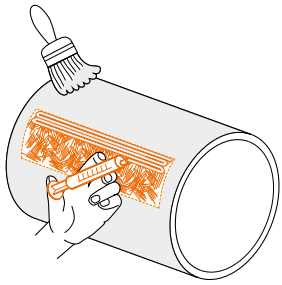
Condensation switch

For chilled ceilings, attach to the supply directly at the beginning of the uninsulated pipes.



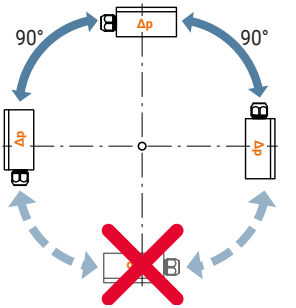
The sensor must be firmly in contact with the surface. Use thermal contact fluid.

Caution: Avoid external heat influences.

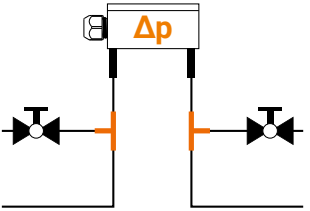


Pressure

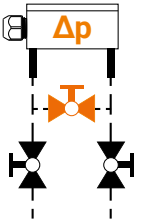
The installation orientation has an influence on the proper functioning of pressure sensors.
(See manufacturer's installation instructions)



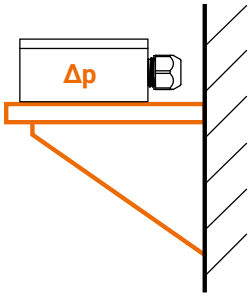
For inspection purposes, equip the measuring lines at the media connections with a lockable T-piece.



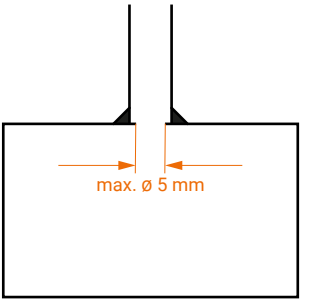
To prevent one-sided overloading of the sensor during manipulation, the connection must always be provided with a lockable bypass.



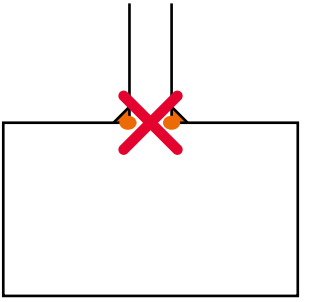
Install the sensor on a vibration-free surface.



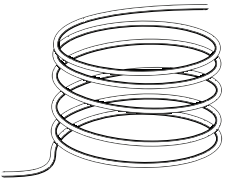
Pressure tapping point
Drilled and deburred ø 5 mm measuring hole.



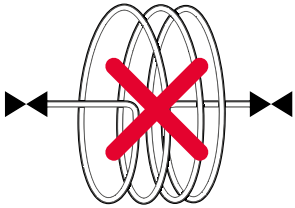
Smooth interior (deburred).



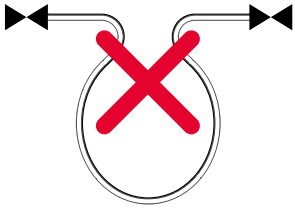
Use a damping loop to prevent vibrations from being transmitted.
Shape a copper pipe that is 4 mm to 6 mm in diameter and 1 m long into a spiral with a loop diameter of 15 cm.



Incorrect: Air bubbles and condensate cannot be drained.

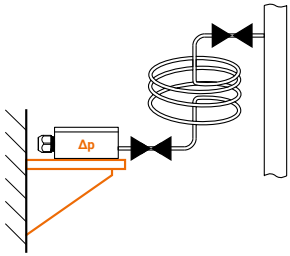


Incorrect: Condensate cannot be drained.



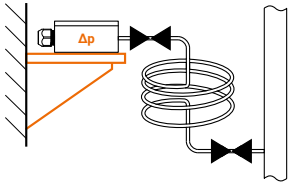
Installation for liquid media

Always install the pressure sensor lower than the pressure detection element (venting).



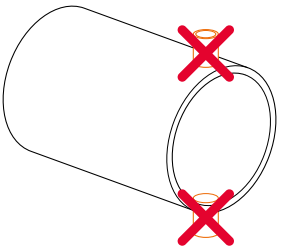
Installation for steam/gases

Always install the pressure sensor higher than the pressure detection element (venting).

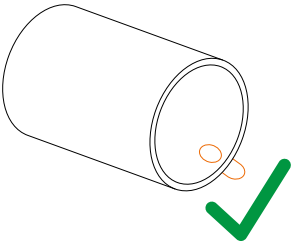


Pressure detection for liquid media

Do not attach the pressure detection element at the top (air pockets, bubbles) or at the bottom (dirt).

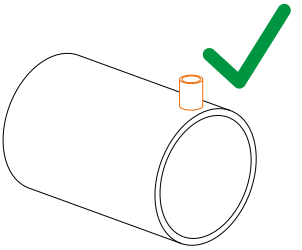


Attach the pressure detection on the bottom lateral side.

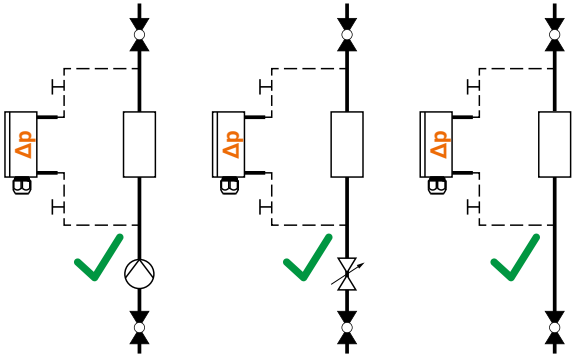


Condensing gases

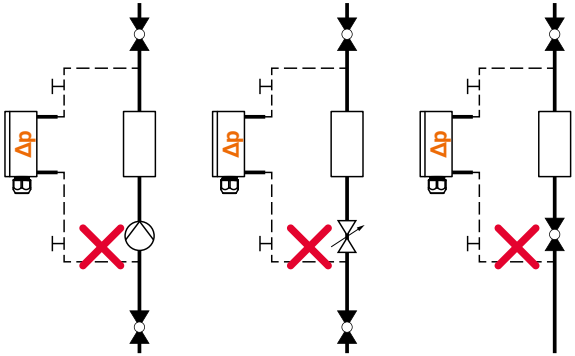
Extraction at the top so that no condensate can get into the measuring line.



Velocity/flow



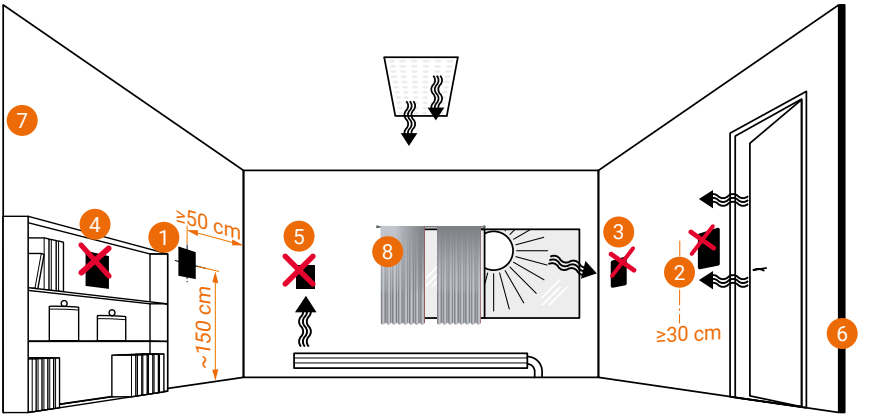
If the differential pressure is used for flow monitoring, there must be no shut-off or balancing devices between the pressure tapping points.



Incorrect installation.

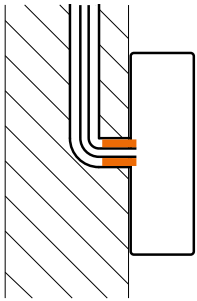
Room units

Installation locations



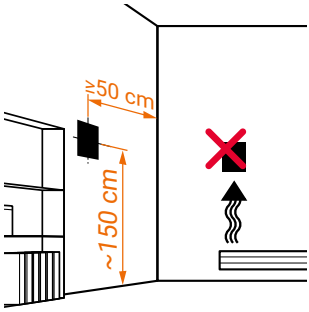
1. Install the sensor at a height of approx. 150 cm in the living area and at least 50 cm from the nearest wall
2. Install the sensor at least 30 cm from the nearest door
3. Not where sunlight can hit the sensor
4. Not in niches or on shelving units
5. Not near lamps or above radiators
6. For solid walls (steel, concrete, etc.), a heat-insulating underlay is mandatory
7. Not on an external wall
8. Not behind curtains
9. Not on walls behind which there is a chimney
10. Not on walls behind which there are hot water pipes

Seal between the cable or plastic tube and the installation pipe. Otherwise, incorrect air circulation will result in a faulty measurement.



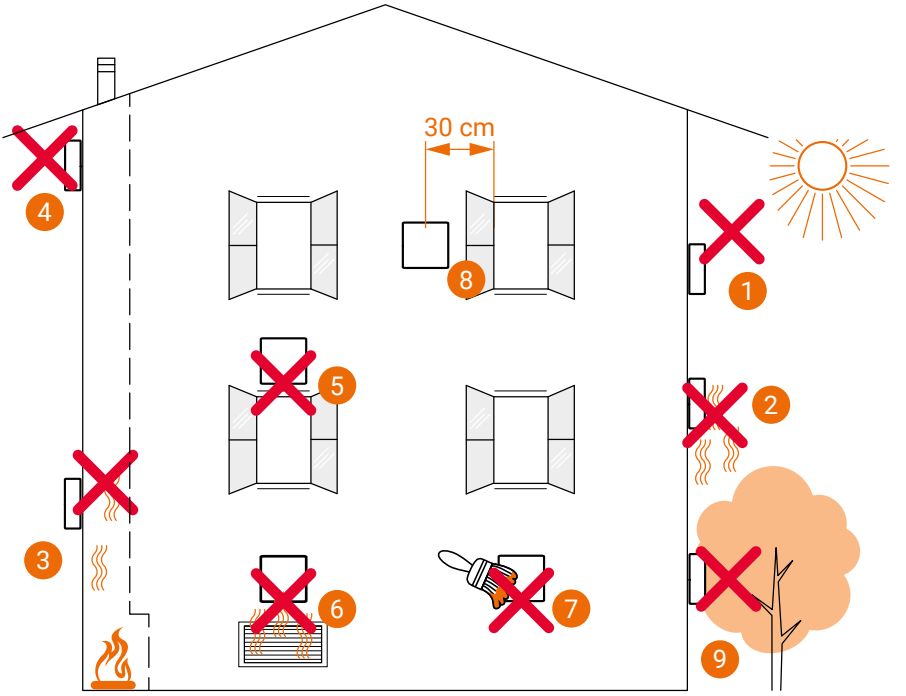
Radiant heat

Select a position on a wall of the monitored room that is representative of the prevailing room conditions.



Outdoor sensors

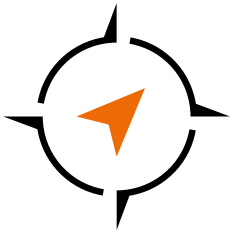
Installation locations



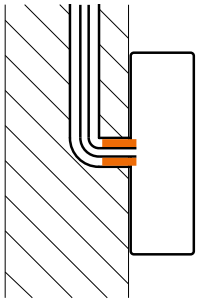
1. Do not expose to direct sunlight
2. Do not install on facades with high uplift heat. Not on facades that are heated by solar radiation
3. Not on walls behind which there is a chimney

4. Not under the eaves of a building
5. Not above windows
6. Not above ventilation outlet shafts
7. Do not paint over the sensor
8. Observe accessibility (for inspection purposes)
9. Avoid shading (trees, neighbouring houses, etc.)

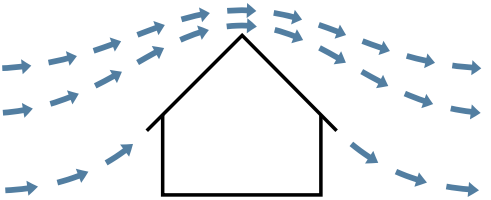
The installation location, in relation to the compass direction, is determined by the system concept.



Seal between the cable or plastic tube and the installation pipe. Otherwise, incorrect air circulation will result in a faulty measurement.

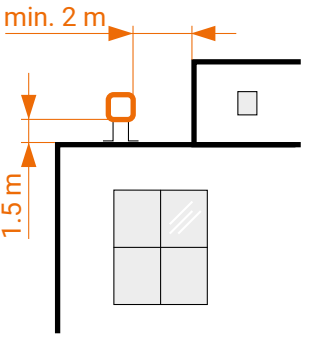


Pressure



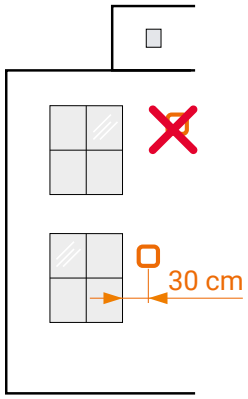
Measure the pressure at a location that is sheltered from the wind. Individual facades are not suitable as measuring locations, as the pressure changes depending on the wind direction. The correct measuring location is a place where the air can circulate freely, e.g. on a flat roof. However, the pressure tapping point must be fitted with a wind deflector.

Possibilities: Averaging of pressure measurements on multiple facades. Pressure measurement in an open field (min. 1.5 m above the ground). Multiple measuring points on a flat roof.

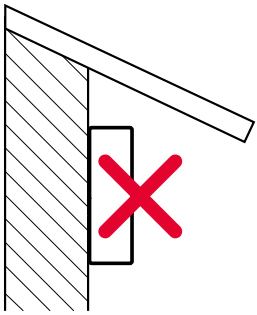


Wind

Install wind sensors on the facade that is in the prevailing wind direction. Install the sensor in an easily accessible location (for inspection purposes).

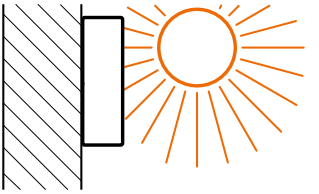


Not under eaves. Not in niches.

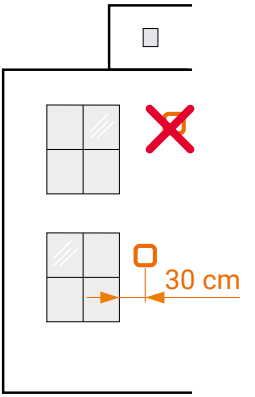


Sun

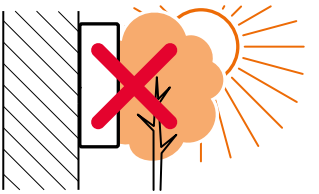
Install sun sensors on the facade behind which the affected control system operates.



Install the sensor in an easily accessible location (for inspection purposes).



Avoid shading (trees, neighbouring houses, etc.).



Servicing

Checking

Checking sensors

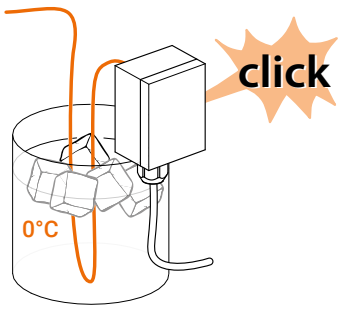
A check is always a comparison. A high-quality measuring device must be used to check sensors. The check is only meaningful if the measured variable is constant during the checking process.

Caution: Avoid external influences (your own body heat, etc.).

The check must be performed at the sensor. The sensors in connection with the installation (electrical) may be checked only by trained specialist personnel (see regulations).

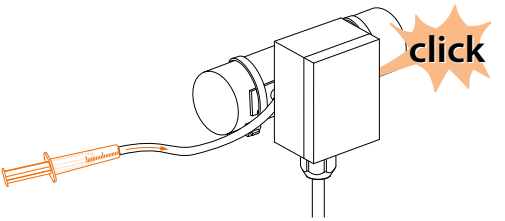
Checking the frost protection thermostat

The capillary tube loop (20 cm) is immersed in a container filled with water and ice cubes. This "ice water" is measured with a thermometer. Set the frost protection thermostat to the measured temperature. It must switch at this temperature (recalibrate if necessary). Then set the frost protection thermostat to a setpoint of +2°C.



Filter monitor check

Check the filter monitor with a medical syringe.



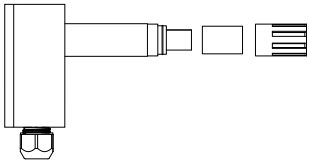
Procedure:

– Switch off the system
– Disconnect the measuring lines (+ and –) at the measuring points
– Connect the medical syringe and the display pressure gauge (U-pipe) to the + terminal
– Switch on the system
– Slowly increase the pressure with the medical syringe until the switching point on the display pressure gauge is reached. The alarm system must be triggered; otherwise, it must be recalibrated
– Switch off the system
– Reconnect the measuring lines to the measuring points
– Switch on the system again

Periodic servicing

The sensor cover (e.g. perforated plate) must be replaced or cleaned periodically.

Interval: Every 24 months



All inclusive.

Belimo is the global market leader in the development, production, and sales of field devices for the energy-efficient control of heating, ventilation and air-conditioning systems. The focus of our core business is on damper actuators, control valves, and sensors and meters.

Always focusing on customer value, we deliver more than only products. We offer you the complete product range for the regulation and control of HVAC systems from a single source. At the same time, we rely on tested Swiss quality with a five-year warranty. Our worldwide representatives in over 80 countries guarantee short delivery times and comprehensive support through the entire product life. Belimo does indeed include everything.

The "small" Belimo devices have a big impact on comfort, energy efficiency, safety, installation and maintenance.

In short: Small devices, big impact.

- 5-year warranty
- On site around the globe
- Complete product range
- Tested quality
- Short delivery times
- Comprehensive support

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