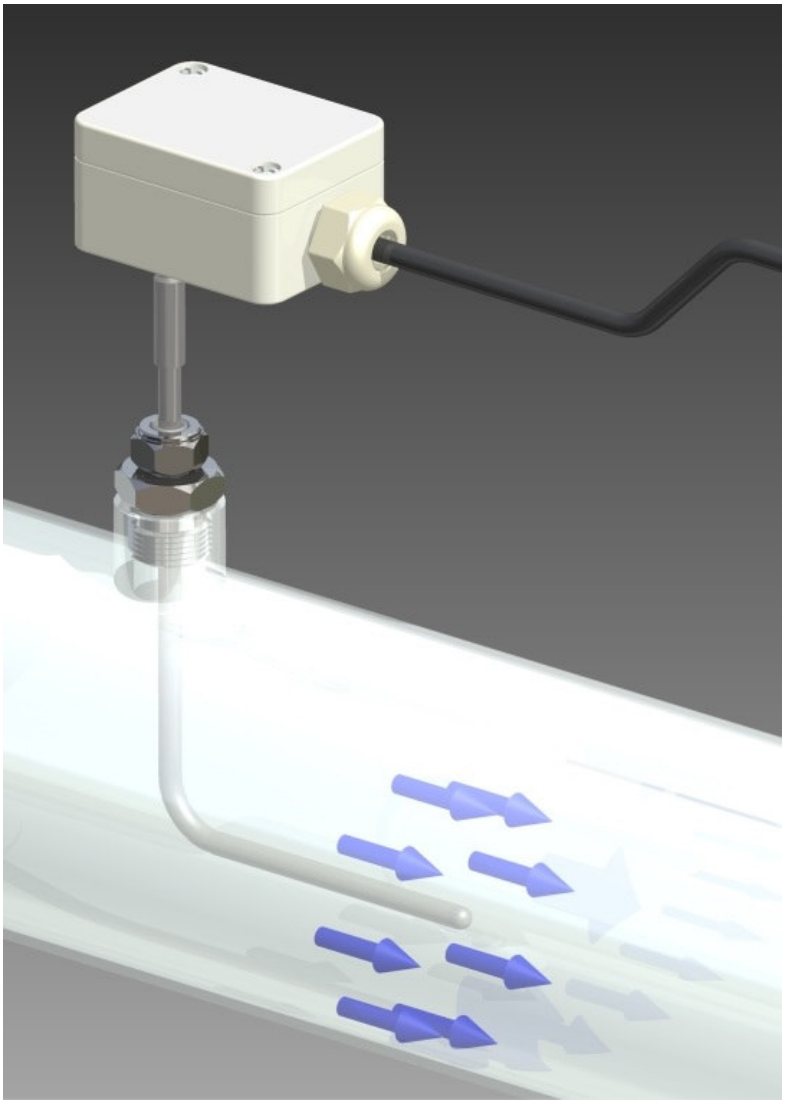
ICFLOW



Thermodynamic Flow Sensor

User Manual

Read and scrupulously follow the instructions given in this manual

1 General safety instructions

Before installing the device, read the following warnings:

¤ Read the installation instructions given in this manual before hooking up the device.
¤ The device must be cabled with wiring suited to the limit voltage and current specifications given in the technical data.
¤ The device is not equipped with an ON/OFF switch, and powers up immediately as soon as power is supplied to it
¤ The device must be powered with DC power of 18 to 30V; voltages higher than 30Vdc will cause the device to fail.
¤ Make sure that the working environment falls within the range specified in 6 'Technical Characteristics'.
¤ The device is not designed for operation in hazardous atmospheres (flammable or explosive): its use in such conditions is therefore **prohibited.**
¤ The device is intended for industrial use only and not for use in situations where compliance with strict safety precautions is required, such as applications directly or indirectly correlated with medical equipment.
¤ The device may not be dismantled or repaired by unauthorised staff. Contact your local dealer for any repairs.

1.1 Staff requirements

When performing their duties, staff must meet the following requirements:
¤ Qualified, skilled staff must hold qualifications for their roles and the specific task assigned
¤ They must be authorised by the plant's owner/operator
¤ They must be familiar with federal/national regulations
¤ Before starting work, skilled staff must have read and understood the instructions in the manual and the supplementary documentation (if available and depending on the application)
¤ They must comply with the instructions and basic conditions.

1.2 Intended use

Applications and fluids:
The measuring device described in these instructions is intended only for measuring air velocity and flowrate.
To guarantee that the measuring device remains in perfect condition during use:
¤ Only use the measuring device in full compliance with the data provided on the nameplate and the general conditions listed in this manual and, if applicable, in the additional documentation.

Improper use

Italcoppie Sensori s.r.l. is not liable in any way for damage or injury caused by tampering or incorrect or improper use of the device.

Attention:

Risk of injury if the process connection and sensor fitting are opened when pressurised.

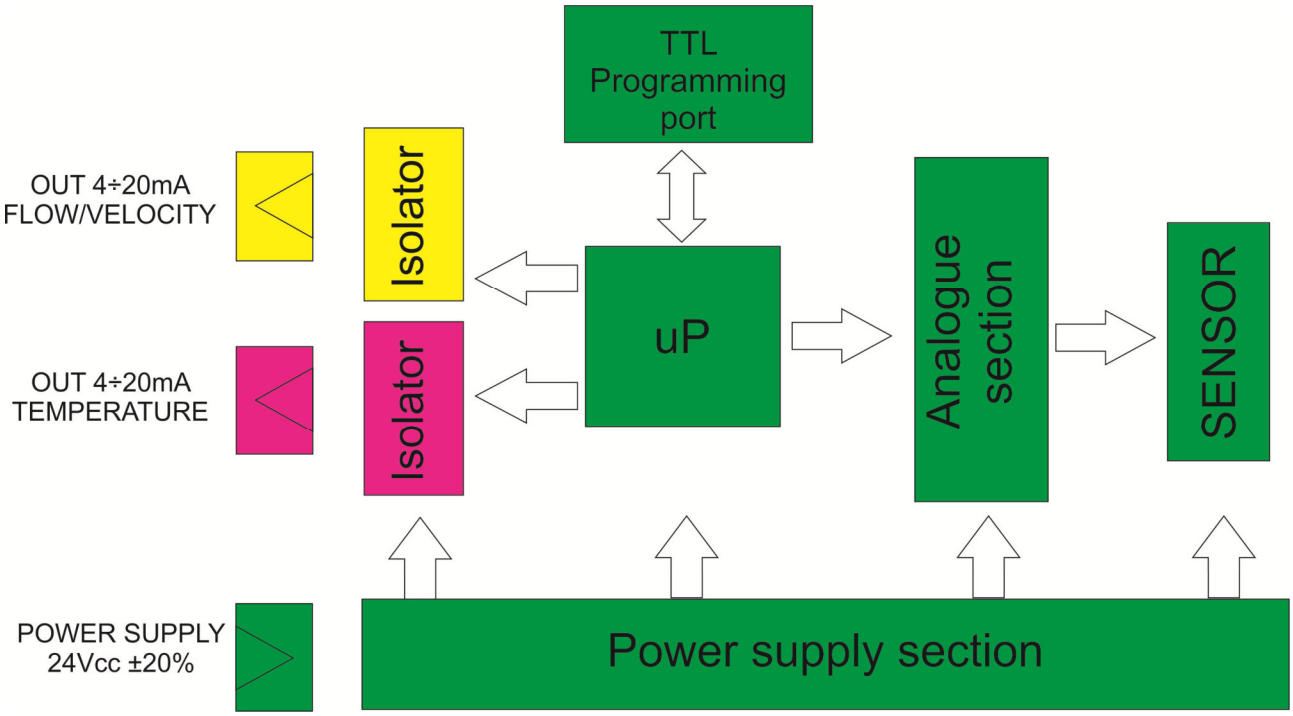
- The process connection and sensor fitting must only be opened when not pressurised.

1.3 Occupational health and safety

Refer to the relevant regulations.

2 Introduction

2.2 Block diagram of the device and isolation of parts



N.B.:
The different colours indicate the isolations of the various sections of the circuit (Flow/Velocity Out, Temperature Out, Power Supply + analogue part + programming serial port)

3 Installation

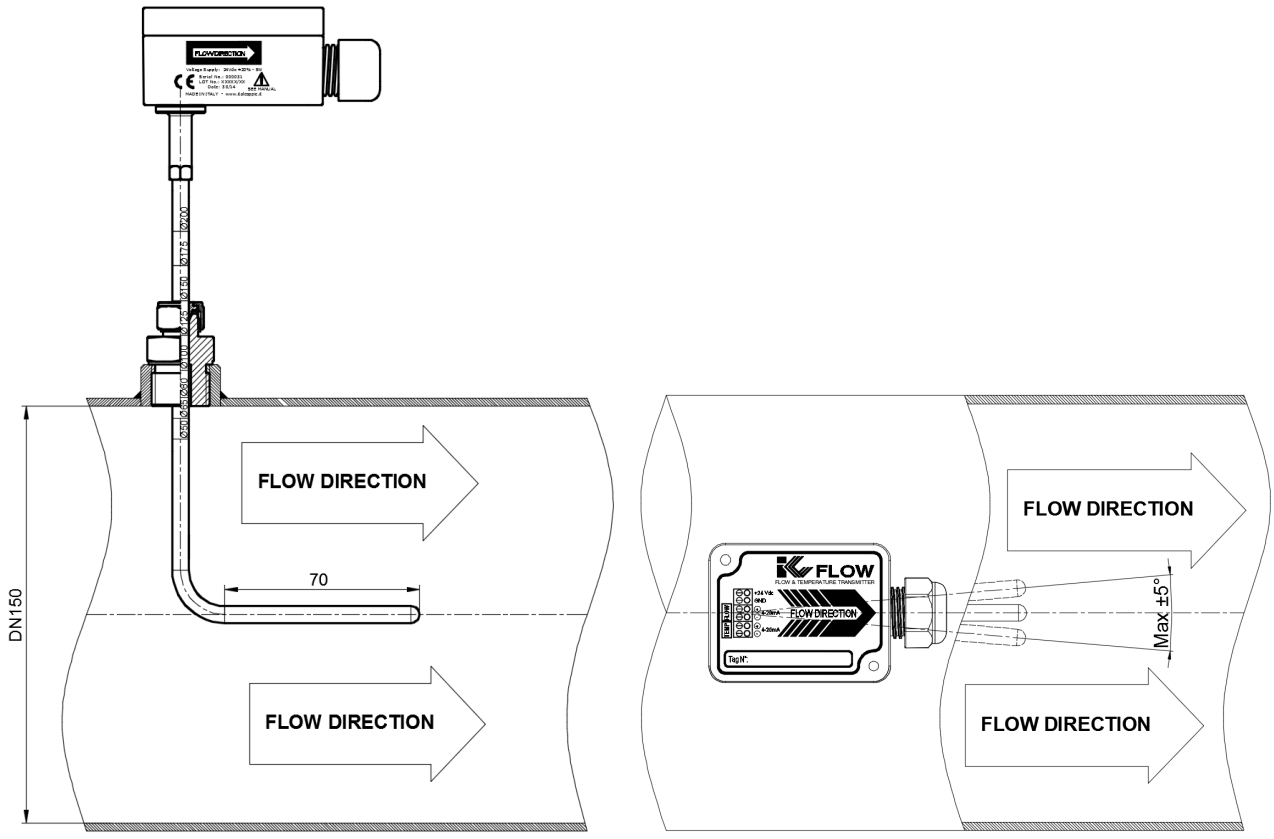
WARNING!
Systems must only be installed by qualified staff.

3.1 Assembly Instructions

The sensor obtains a measurement in a single point. In order to obtain accurate readings of the mean flow and velocity value for the entire cross-section, the velocity profile must be fully developed and the sensor must be correctly positioned in relation to the flow direction.

Flow sensor position:

The sensing part of the sensor must be positioned so that the flow tends to disperse the heat generated by the heating element on the sensor tip. This means that the sensor can only be installed in one position, with the horizontal part pointing in the flow direction.



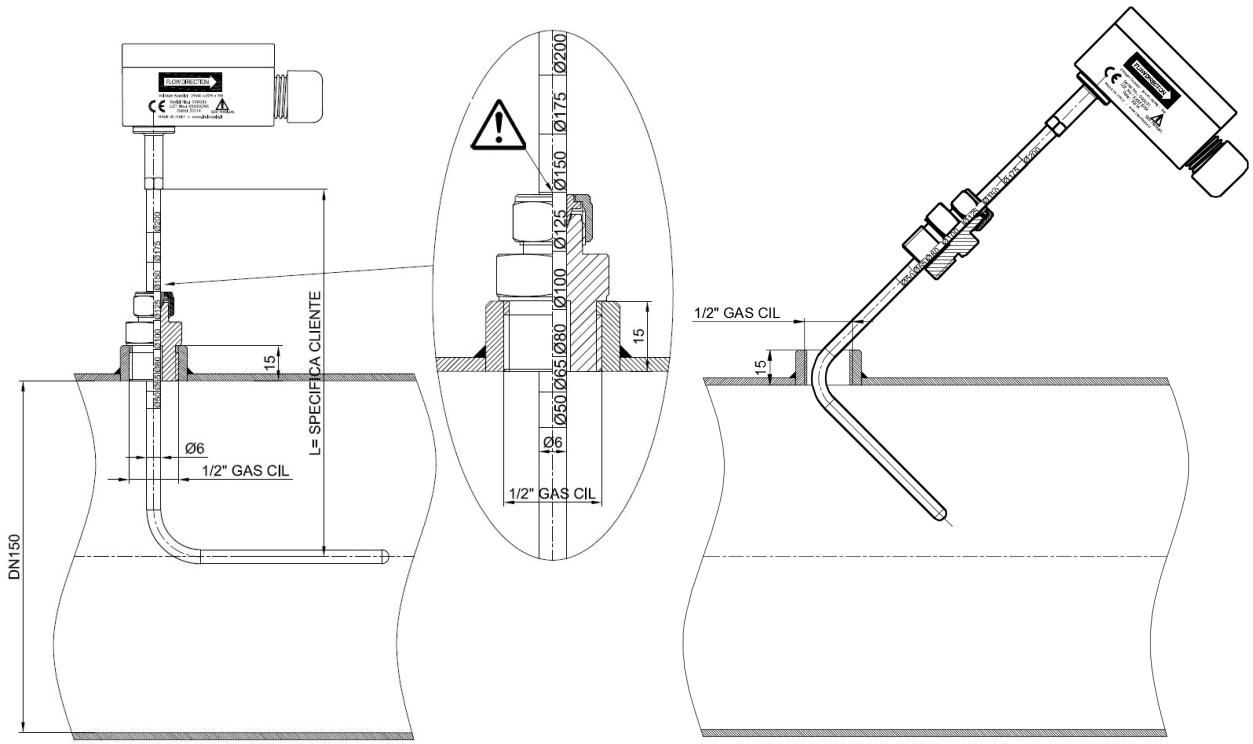
Align the arrow printed on the lid of the box so that the axis of the sensing part is parallel to the axis of the conduit.
An error of ±5° is permitted.

Immersing the flow sensor and making the connection to the process:

The sensor should be immersed in such a way that the axis of the horizontal sensing part is aligned with the axis of the conduit, in the centre of the cross-section, theoretically at the point of maximum velocity if the velocity profile is fully developed.
To allow this, the customer must select the correct length L when ordering in order to ensure that the sensor reaches the centre of the conduit with sufficient margin, also allowing for any insulation, spacers or fittings which may make an increase in length necessary.

Minimum recommended lengths "L":

Conduit Diameter (mm)	**Minimum Sensor Length**
Ø50 ÷ Ø150	130 mm
Ø150 ÷ Ø300	200 mm
> Ø300	> 300 mm

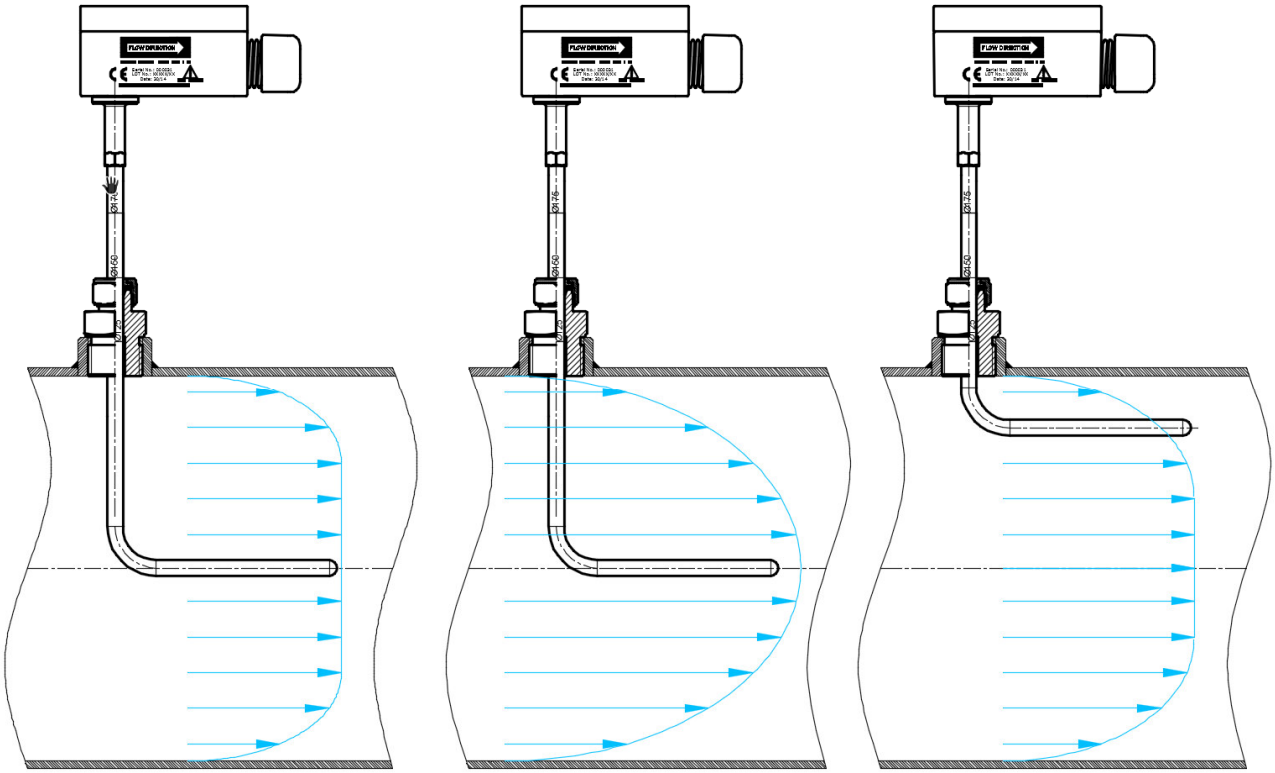


The flow sensor is supplied complete with a **compression fitting with ½" Gas Cyl thread** designed to allow the instrument to be installed correctly positioned, adjusting it so that it is immersed in the most effective point.
Position the sensor in the centre of the conduit with the aid of the **graduated scale** marked on the sheath. Align the corresponding diameter (or the depth in the case of rectangular conduits) with the end of the fitting as shown.
For easier installation the **female socket,** normally welded to the process pipe, should be no thicker than the recommended 15 mm (including the thickness of the conduit itself).
Any variations to the specific installation mode must be discussed with Italcoppie Sensori.

Immersing the sensor in positions not in line with the axis of the conduit:

The sensor may also be immersed in a position other than the "maximum velocity" position, i.e. not in the centre of the measurement cross-section, if the velocity profile is fully developed.
The instrument measures the velocity of the flow of fluid in contact with the horizontal sensing part. Therefore, in all cases it inevitably provides a local velocity reading, useful for mapping the velocity profile of the flow or for specific monitoring purposes.
In cases a) and b) illustrated, the instrument is in the centre of the conduit and detects the maximum velocity in case of both laminar and turbulent flows. The standard flow rate calculation model used by the sensor software uses the maximum velocity value for the measurement cross-section as input. In these conditions, the instrument will provide an accurate flow reading.

Sensor position for different velocity profiles:



a) Turbulent flow with velocity profile fully developed.
Sensor installed in the point of maximum velocity.

b) Laminar flow with velocity profile fully developed.
Sensor installed in the point of maximum velocity.

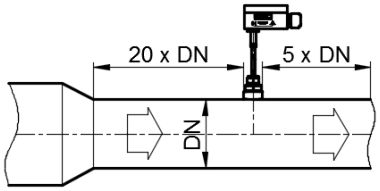
c) Turbulent flow with velocity profile fully developed.
Sensor installed in a point chosen by the user.

In case c), the sensor measures a local velocity different from the maximum velocity, and thus the mass or volume flowrate calculated by the instrument will not be correct, and it must be suitably compensated if necessary.

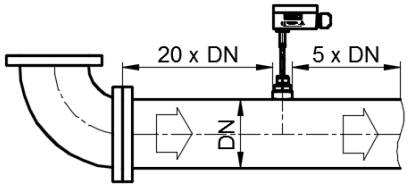
The **ICFlow-SET configuration kit** (code ICFLOWSET) can be used to modify the calculation parameters at the user's discretion, by correcting the flow and velocity values to meet specific requirements. Refer to the relative guide for instructions for use of the software supplied with the kit.

Conduit requirements, straight flow normalisation sections:

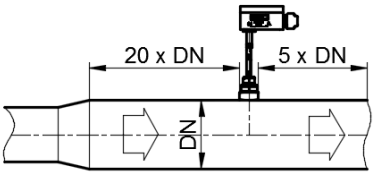
For accurate measurements, the velocity profile inside the conduit must be fully developed. To allow this, during installation consideration must be given to any features which may interfere with the flow.
For more detailed information, refer to the following standards:
UNI 10727 / ISO 7145: *"Determination of flowrate of fluids in closed conduits of circular cross-section - Method of velocity measurement at one point of the cross-section"*
ISO 3966: *"Measurement of fluid flow in closed conduits -- Velocity area method using Pitot static tubes"*
ISO 14511: *"Measurement of fluid flow in closed conduits — Thermal mass flowmeters"*



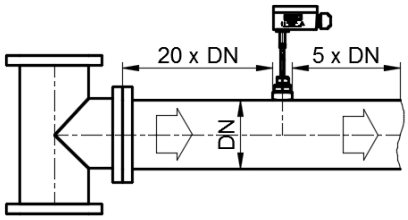
a) Reduction



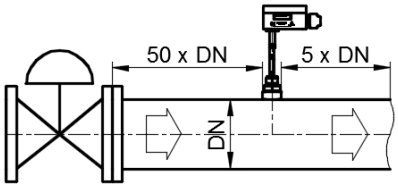
e) Elbow



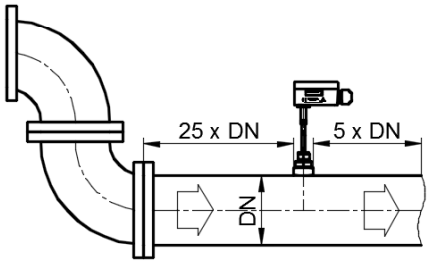
b) Expansion



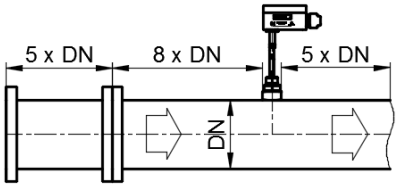
f) "T" fitting



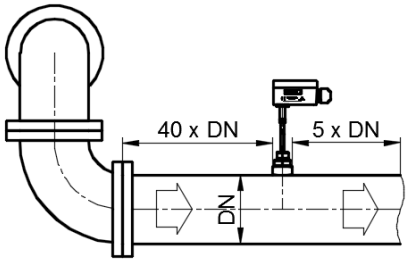
c) Regulator valve



g) 90° double elbow



d) Flow conditioner



h) Double elbow with direction

When choosing the insertion point, the minimum distances recommended in the drawings should be complied with. These restrictions may be overcome by fitting a **perforated plate flow conditioner** (case d).

WARNING! ***Minimum conduit diameter DN50.***

3.2 Operating conditions

Installation ambient temperature: –35 ÷ +80 °C [1]
(1) avoid direct sunlight
avoid installations particularly exposed to the weather
Storage temperature: –40 ÷ +80 °C
Standard tightness degree: IP 66
Electromagnetic compatibility (EMC): In accordance with the IEC/EN 61326 standards.
Fluid temperature: 0 ÷ +200 °C
Fluid nominal pressure: 0.5 ÷ 10 bar [2]
(2) with specific ferrule
Fluid velocity: 0 [3] ÷ 33m/s
(3) between 0 ÷ 1m/s the output is set on 1m/s
Fluid type: Air

3.3 Electrical connection

3.3.1 Electrical connection conditions - Tools required

- For wiring, use a blade-type screwdriver <= 3mm (0,12 in.)
- Use a multicore cable with twisted, shielded wires having outside diameter Ø5÷Ø10mm; the diameter of the single wires must be AWG20÷26
- Peel the outside sheathing off the multicore cable for a length of about 45mm.

3.3.2 Power supply adapter requirements

- Device power supply voltage: 24Vdc (18÷30Vdc)
- Use a power supply adapter with 24Vdc output compliant with the ELV requirements
- Maximum power consumption: 5W.

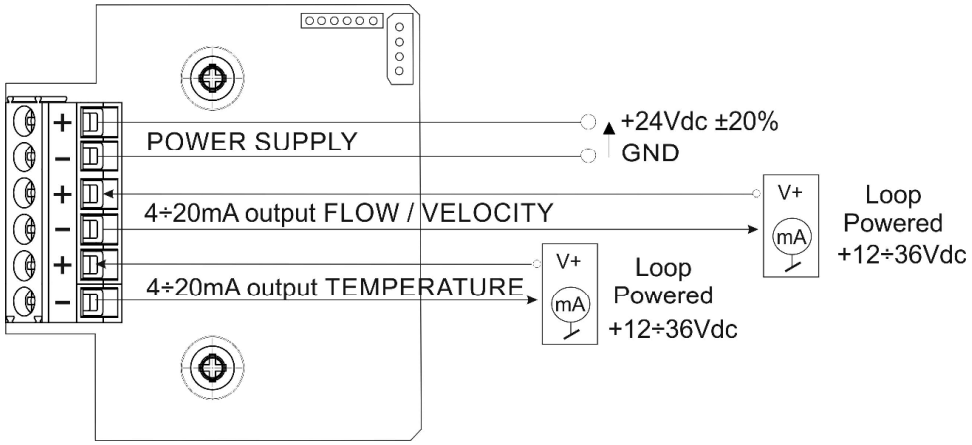
WARNING! ***Comply with the power supply polarity (the device is protected against inverted polarity)***

Provide a circuit breaker and a suitably rated fuse on the power supply line.

3.3.3 Ensure the tightness degree

The product complies with the requirements of IP66 tightness. Once the electrical connection is complete, make sure that the 4 screws of the lid have been firmly screwed down to ensure tightness and tighten the cable gland securely.

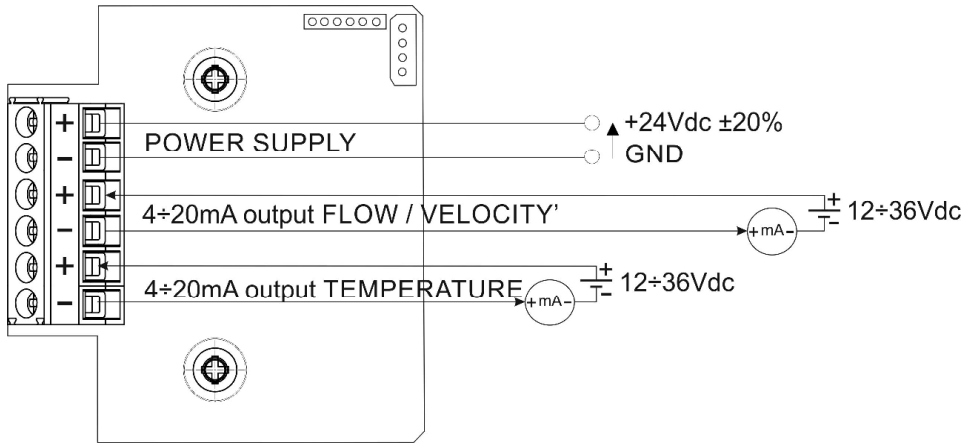
3.3.4 Loop powered mode output connection



This connection mode is recommended since it provides complete isolation between the three stages:
¤ 4÷20mA output for Flow/Velocity
¤4÷20mA output for temperature
¤Power supply stage

Devices with 4÷20mA loop-powered input must be used (as well as reading the 4÷20mA signal, the input also supplies the power supply voltage for the output stage).

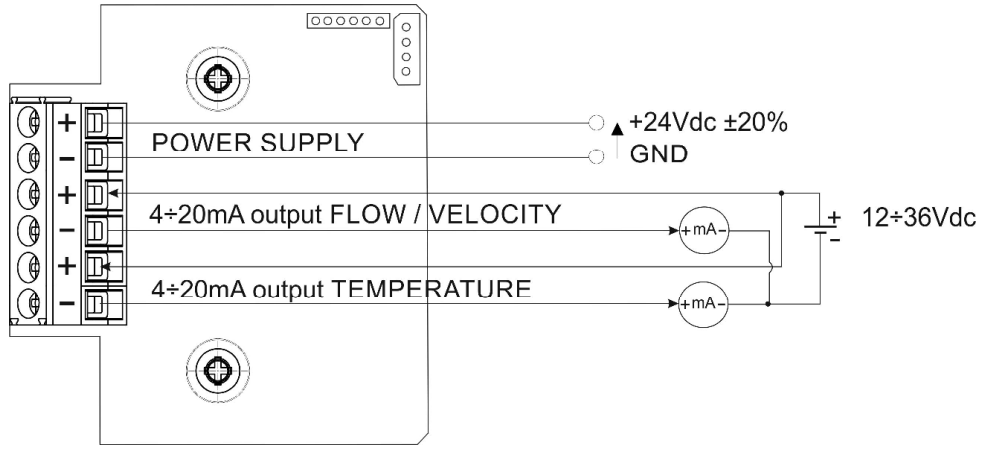
3.3.5 Output connection by means of two separate external power supply adapters



This connection mode is also recommended since it provides complete isolation between the three stages:
¤4÷20mA output for Flow/Velocity
¤4÷20mA output for temperature
¤Power supply stage.

It must be used with devices which do not allow 2-wire loop-powered connection: in this case, 2 external power supply adapters must be used as shown in the diagram above.

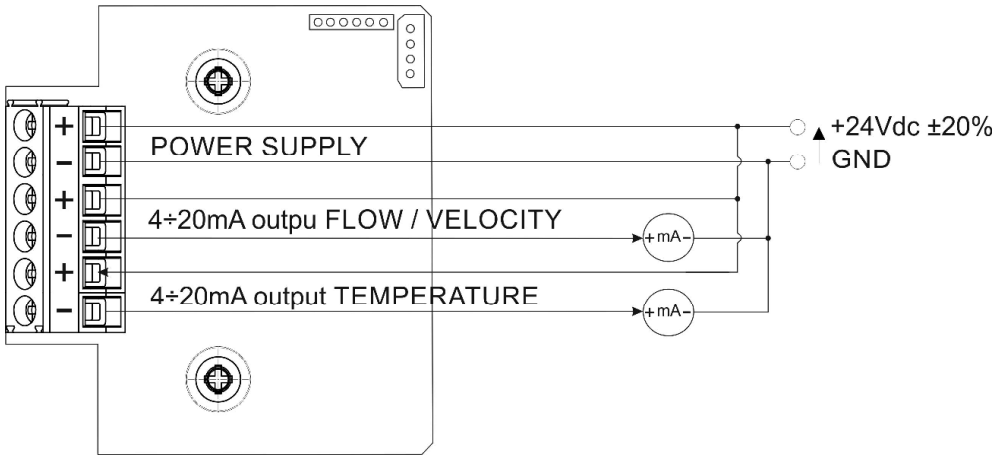
3.3.6 Output connection by means of an external power supply adapter



This connection provides isolation between:
¤The two 4÷20mA outputs (Flow/Velocity and Temperature)
¤Power supply stage

The two outputs are not isolated from each other.
1 external power supply adapter must be used as shown in the diagram above.

3.3.7 Output connection by means of the device's power supply



This connection mode is not recommended since it does not provide any isolation between the power supply stage and the two outputs.
The device's power supply is also used to power the two 4÷20mA outputs.

4 Programming the device

Default values
The ICFlow is set in the factory with the following default settings:

Output type: Point-velocity of flow [m/s]
Output range 4÷20mA: 1÷33m/s
Temperature 4÷20mA: 0÷200°C

The ICFlow can be programmed to the user's requirement with the aid of the configuration kit (code ICFLOWSET).
This setting capability allows the device to be used in different types of applications; the programming parameter functions are described below.

Main output type selection
The ICFlow can be configured to transmit the following parameters as a 4÷20mA signal:
- Point-velocity of flow [m/s]
- Mass flow [Kg/h]
- Volumetric flow [m^3/h]
- Normalised volumetric flow [Nm^3/h]

Temperature output
The fixed ranged set for 4÷20mA transmission of the process temperature is 0÷200°C.

Conduit characteristics
If the type of output selected is a flow parameter (mass or volumetric), the conduit characteristics have to be set.
The conduct parameters to be set are as follows:
"Square": height and inside base
"Cylindrical": inside diameter
In both cases, the roughness can also be set.

Operating pressure
The point-velocity (and thus the flow) is affected by the operating pressure. Its value can be set to enable the device to compensate for the error due to this parameter.
If no value is specified, the default value of 1 bar abs. is assigned to the operating pressure.

Correction factor
In some cases it may be useful to calibrate the device to align it with a benchmark device available at the plant itself.
The correction factor is a multiplying coefficient which provides a directly proportional adjustment of the device's output, allowing it to be recalibrated to the user's specific application.
If no value is specified, the default value of 1 is assigned to the correction factor.

Profile factor
The device calculates the average velocity in the conduit, and thus the flow, by means of the profile factor (Fp).

Average V = point V x Fp

Theoretical profile factor:
If no value is specified for the user profile factor, the sensor automatically uses the theoretical profile factor.

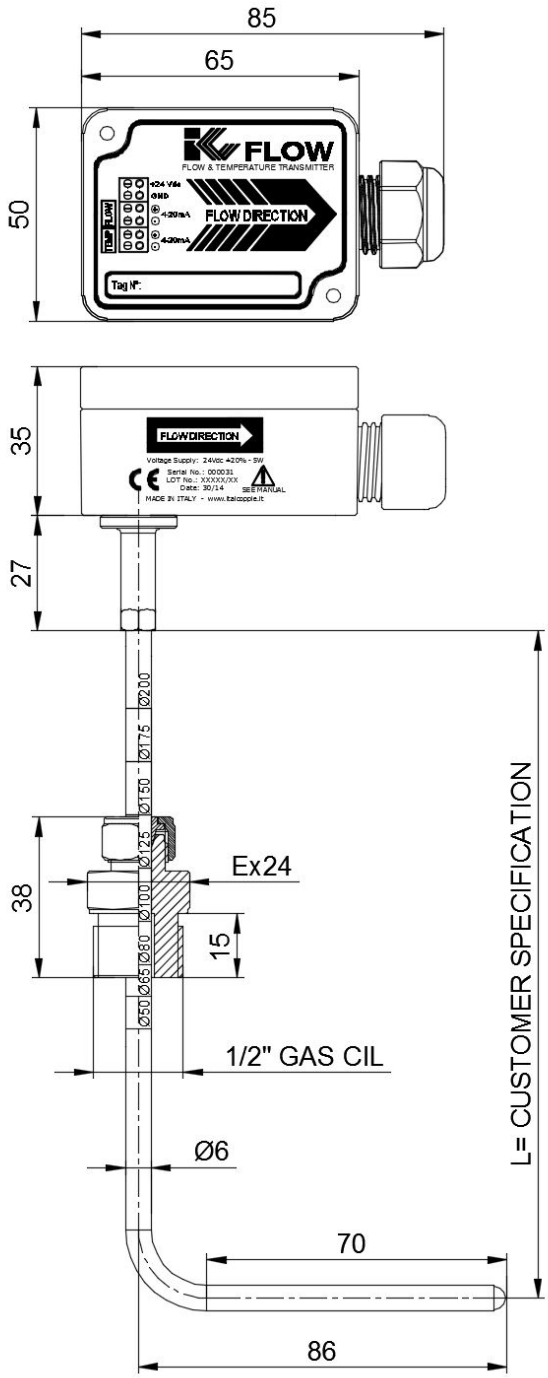
Attention:
To avoid calculation errors, the sensor must be placed in the centre of the conduit.

User profile factor:
The profile factor can be set directly by the user, in relation to the point-velocity read by the sensor by means of the logarithmic curve:

User Fp = m Ln(point V) + q

m= logarithmic curve gain
q= curve offset

5 Mechanical Dimensions



Minimum recommended lengths "L":

Conduit Diameter (mm)	**Minimum Sensor Length**
Ø50 ÷ Ø150	130 mm
Ø150 ÷ Ø300	200 mm
> Ø300	> 300 mm

6 Technical Characteristics:

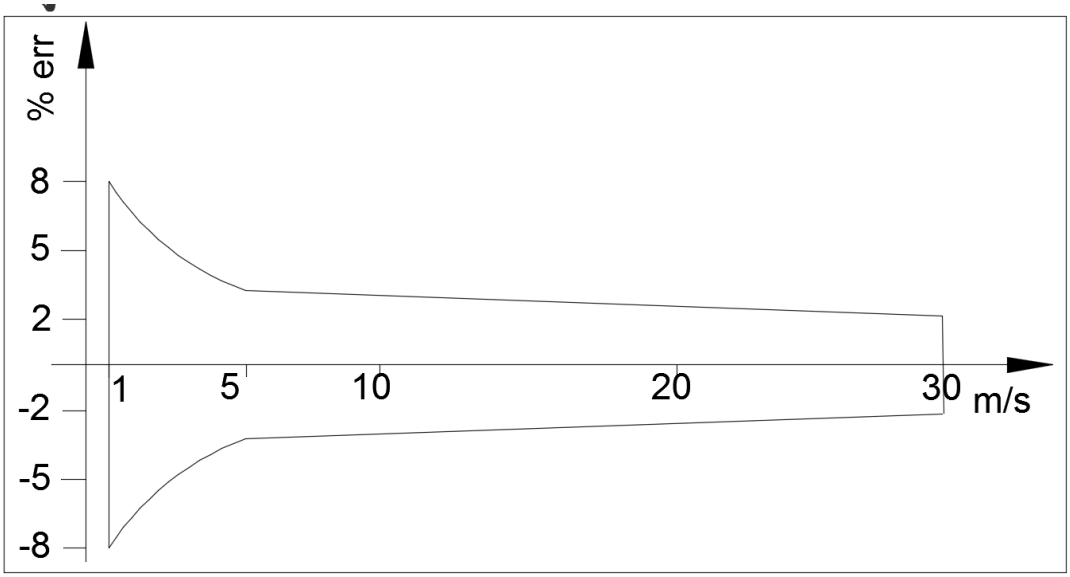
Sensor element:

Flow: Thermodynamic sensor
Process temperature: Pt1000 Class B (IEC 751)

Accuracy:

Temperature: ±0.3°C
Flow (see graph)

Error percentage in relation to flow velocity:



Type of Gas:

Air

Power supply:

24Vdc ±20%

Consumption:

Max 5W

Output signal:

Flow: 4÷20mA isolated (2.5KV)
Temperature: 4÷20mA isolated (2.5KV)
Permitted load: ~550Ω at 24Vdc [RLΩ=(Valim.-12) / 0.020]

Output type (configurable):

Point-velocity (m/s)
Volumetric Flow (m^3/h)
Normalised Volumetric Flow [Nm^3/h]
Mass flow (kg/h)

Connection:

6-pin terminal, AWG20÷26

Configuration connection:

4-pin connector for interfacing with the configuration kit (code ICFLOWSET)

Case:

Material: Glass fibre reinforced polycarbonate
Dimensions: 65 x 50 x 35mm
Tightness degree: IP 66
Colour: grey
Integral cable gland: for cables Ø5÷Ø10mm

Process connection:

Sliding compression fitting with metal ferrule
Male thread ½" GAS CYL under UNI ISO 228/1
Material: AISI316 stainless steel

Sensor sheath:

Type: Hollow with Mgo mineral oxide insulation
Material: AISI316 stainless steel
Diameter: Ø6mm

Laser marking on metal sheath:

Level marking for installation in central point of all normalised conduits

CONTENTS

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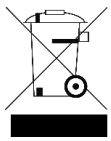
http:www.italcoppie.com

Warranty Conditions: Devices are guaranteed against manufacturing defects for 1 year after installation. The warranty does not cover defects caused by uses other than those described in this user manual.

Returns: devices may not be returned without the prior authorisation of Italcoppie Sensori.

This product must be disposed of in accordance with the European WEEE [Waste Electrical and Electronic Equipment] regulations.



Engineered and manufactured in Italy
Made in Italy
Pensato, progettato e prodotto in Italia