



## THERMAL FLOW SENSOR TFS-35

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## USED SYMBOLS

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To ensure maximum safety of control processes, we have defined the following safety instructions and information. Each instruction is labelled with the appropriate pictogram.



### **Alert, warning, danger**

This symbol informs you about particularly important instructions for installation and operation of equipment or dangerous situations that may occur during the installation and operation. Not observing these instructions may cause disturbance, damage or destruction of equipment or may cause injury.



### **Information**

This symbol indicates particularly important characteristics of the device.



### **Note**

This symbol indicates helpful additional information.

## SAFETY

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**All operations described in this instruction manual have to be carried out by trained personnel or by an accredited person only. Warranty and post warranty service must be exclusively carried out by the manufacturer.**

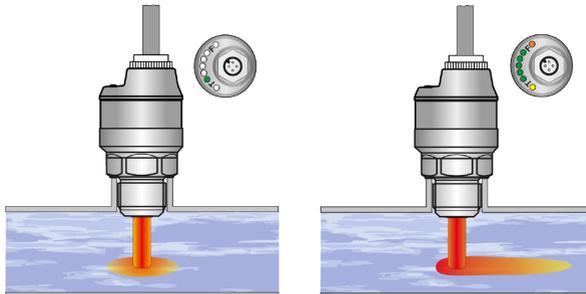
**Improper use, installation or set-up of the sensor can lead to crashes in the application.**

**The manufacturer is not responsible for improper use, loss of work caused by either direct or indirect damage, and for expenses incurred at the time of installation or during the period of use of the level sensors.**

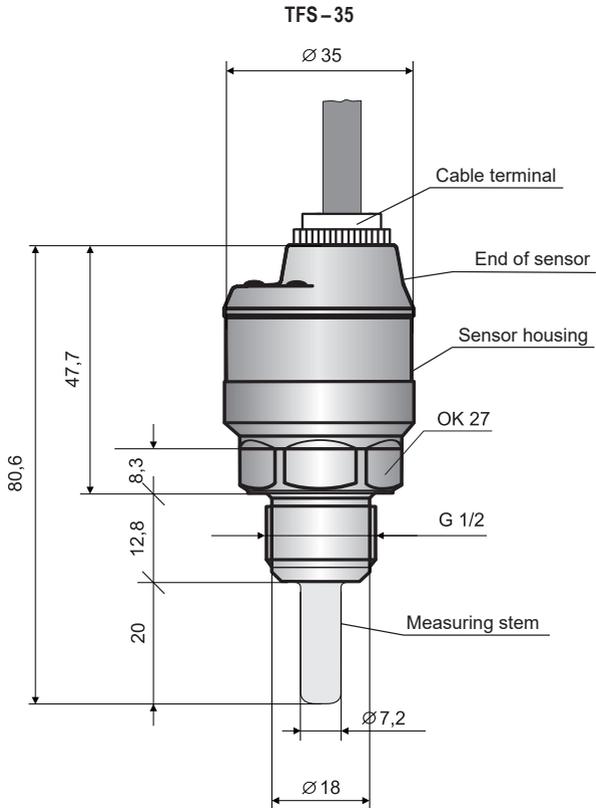
## 1. BASIC DESCRIPTION

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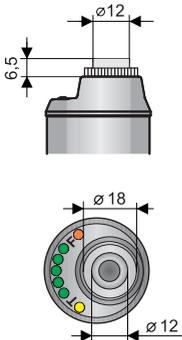
**Thermal flow sensor - TFS-35** is a compact measuring device intended for industrial use for flow monitoring of liquids media and for monitoring of their temperature when installed in a pipe. The sensor may be installed in plastic or metal pipes. Suitable for monitoring filling, cooling or lubricating media and their temperatures. Flow rate is indicated by means of a bar graph (5 green LEDs). Output (flow rate and temperature) switching indicator by means of LED (orange and yellow). Simple configuration using a magnetic pen. Sensor is made in a stainless steel design. Quick and simple installation thanks to simple construction.



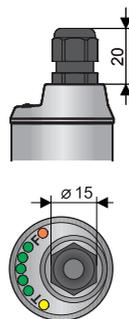
## 2. DIMENSIONAL DRAWINGS



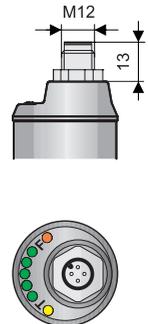
**Design „A“ with short stainless steel terminal**



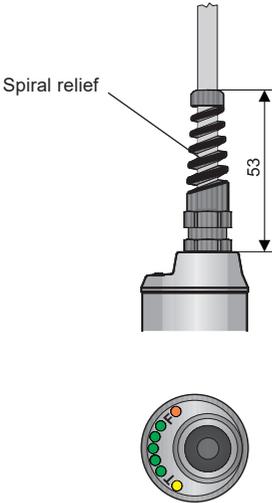
**Design „B“ with plastic threaded terminal**



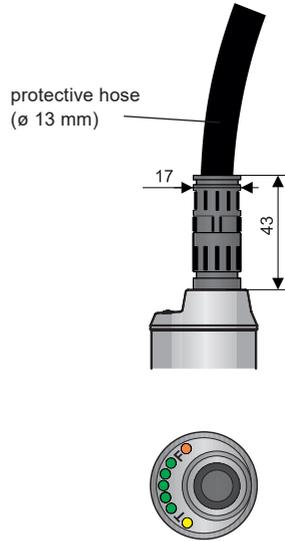
**Design „C“ with connector M12**



**Design „V“ with plastic terminal with spiral relief** – in case of increased mechanical strain on the cable

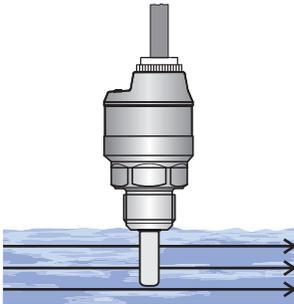


**Variant „H“ with terminal for protected hoses** - for use in outdoor environments or in areas with increased moisture.

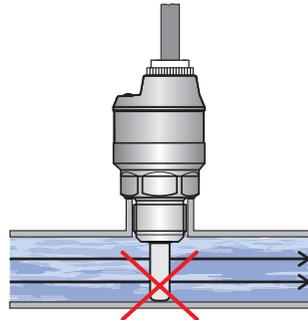


### 3. INSTALLATION INSTRUCTIONS

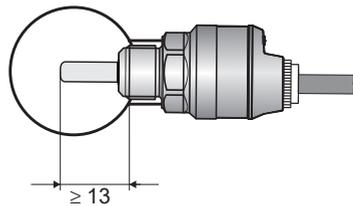
The sensor must be installed with the sensor stem completely flooded.



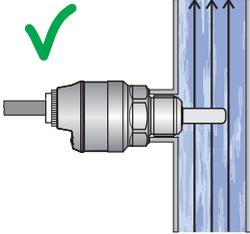
The tip of the sensor stem must not be touching the pipe wall.



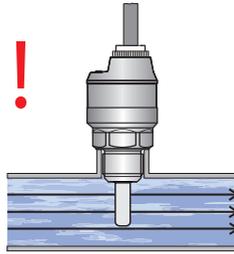
The sensor must be located in such a way that the tip of the sensor stem is at least 13 mm away from the pipe wall.



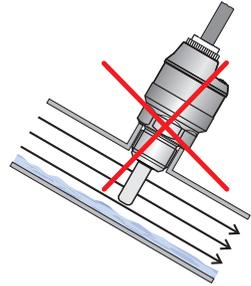
The recommended installation location is in the rising parts of the pipe system.



The sensor is installed on a horizontal pipe from above when the pipe is completely flooded.



Installation is not recommended in parts of the pipe system that may become aerated (highest parts of the pipe system, horizontal areas with open ends).



When measuring very low flow rates in water pipe systems, where there is a risk of dirt accumulating on the stem of the sensor, it is recommended to install it from the side of the pipe.

Disruptive elements cause the media to swirl, which reduces measuring accuracy. For this reason, the sensor installation location is selected so that there are calming direct pipe segments before and after the sensor. A direct segment of length 5...10 DN is recommended before the sensor and a direct segment of length 3...5 DN behind it. Disruptive elements are understood to mean bends, elbows, valves, reductions, other sensors, etc.

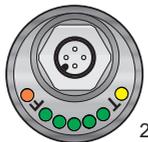
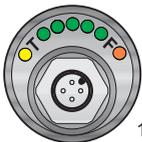
The sensor is screwed into a threaded sleeve in the pipe. For tightening, a 27 mm open end wrench must be used. The tightening torque must be selected respecting the used seal and the working overpressure in the pipe system.

The sensitivity of the sensor depends on its position relative to the flow direction.

The four basic position and their characteristics are listed below.



Positions relative to the flow direction:



Optimal positions are no. 1 and no. 2. In these positions, the signal from the sensor is not dependent on the flow direction and sensitivity corresponds to factory settings. The lighting up of individual LED diodes on the bar graph is practically linear relative to the flow rate.

In position 3, the sensor is more sensitive to small flow rates, the ability to differentiate large flow rates is limited.

In position no. 4, the sensor is able to detect larger flow rates well, the sensitivity to small flow rates is limited.

## 4. ELECTRICAL CONNECTION



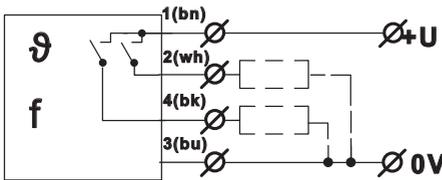
**Electrical connection can only be made in a voltage-free state!**

A sensor with PNP type of outputs can be loaded only by resistive or inductive loads. The positive pole of the supply voltage (+U) is connected to the brown wire *BN* or *pin connector no. 1*, the negative pole (0V) is connected to the blue wire *BU* or *pin connector no.3*. Flow rate load on the black wire *BK* or *pin connector no.4* and temperature load on the white wire *WH* or *pin connector no.2*. The capacitive loads and low resistance loads (e.g.bulb) are evaluated by the sensor as a short circuit.

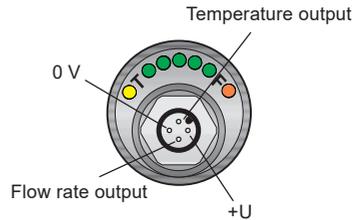
Wiring diagrams are provided in the figures below.

Flowmeter TFS-35 with a type A, B, V or H cable terminal, is connected to the assessment units permanently by a connection cable, see. Dimensional drawings.

The TFS-35 flow meter with connection method type C (see Dimensional drawings) is connected to the assessment units by means of a connector socket with a pressed-in cable, or by means of a detachable connector socket without a cable (e.g. ELWIKA), see accessories. In this case the cable is connected to the inside pins of the socket according to the figure below. The recommended diameter of this cable when using ELWIKA connectors is 4 to 6 mm (the recommended wire cross-sectional area is 0.5 to 0.75 mm<sup>2</sup>).

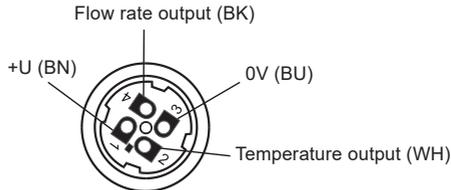


Connection of flow meter TFS-35



### Cable wire colours:

- BN** – brown
- WH** – white
- BK** – black
- BU** – blue



Inside view of the connector socket (variant „C“)



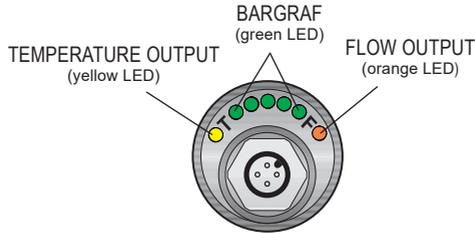
The source of the power voltage must comprise of a stabilised safe low power source with galvanic separation. In the event that a switch-mode power supply is used, it is essential that its construction effectively suppresses common mode interference on the secondary side. In the event that the switch-mode power supply is equipped with a PE safety terminal, it must be unconditionally grounded! In the event that the water level meter (sensor) is installed in an outdoor environment at a distance greater than 20 m from the outdoor switchboard, or from an enclosed building, it is necessary to supplement the electrical cable leading to the water level meter (sensor) with suitable overvoltage protection.

In the event of strong ambient electromagnetic interference, paralleling of conductors with power distribution, or for distribution to distances over 30 m, we recommend using a shielded cable and grounding the shielding on the side of the power source.

## 5. SETTINGS

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Settings are performed by placing the magnetic pen on to the sensitive spot marked „T“ or „F“ located between the LEDs. In this way, the minimum and maximum flow rate, flow rate switching point, temperature switching point, switching modes (O, C) are set or the factory setting are restored. An incorrect setting is indicated by the green LEDs gradually turning on and off, going from the centre to the edges. Information on settings of the sensor is provided in the user's manual.



### **Procedure for setting the flow sensor TFS-35**

Connect the sensor to the power supply and wait for the sensor temperature to stabilise (during this time the sensor flashes with all its green LED diodes, then the sensor automatically transitions to the measuring state).

#### **5.1. Setting the flow rate range**

##### **Setting the minimum flow rate**

1. Flood the pipe system containing the sensor and stop the flow
2. Wait at least 15 seconds (maximum response time)
3. Place the magnetic pen on to „T“ for a period longer than 5 seconds (the yellow LED and all the green LEDs are lit, which then gradually turn off one by one; finally the yellow LED will flash three times). This saves the setting for the minimum flow rate.

##### **Setting the maximum flow rate**

1. Flood the pipe system containing the sensor and set the flow to maximum
2. Wait at least 15 seconds (maximum response time)
3. Place the magnetic pen on to „F“ for a period longer than 5 seconds (the orange LED is lit, the green LEDs light up one by one; finally the orange LED flashes three times). This saves the setting for the maximum flow rate.

## 5.2. Setting the switching points

### Setting the flow rate switching point

- By shortly placing the magnetic pen on the (sensitive) spot „F“ to move the flow rate switching point
- This switching point is indicated by one of the five green LEDs
- When the last LED is reached, the point moves back to the first LED when the is again.

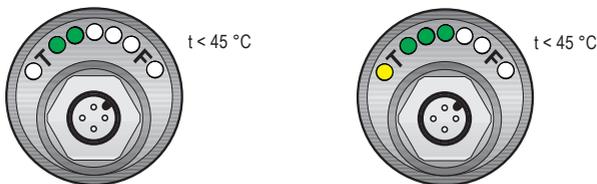


*Example: if the flow rate switching point is set to the 3rd LED, then the flow rate output switches (in the case of setting O) when at least such a flow rate is achieved, which lights the 3rd LED on the bar graph.*

### Setting the temperature switching point

- The magnetic pen „T“ to move the temperature switching point.
- This switching point is indicated by one of the five green LEDs.
- When the last LED is reached, the point moves back to the first LED when the is again.
- The temperatures at which the output temperature is switched are:

15 °C	first green LED
30 °C	second green LED
45 °C	third green LED
60 °C	fourth green LED
75 °C	fifth green LED



*Example: if the temperature switching point is set to the 3rd LED, then the temperature output switches (in the case of setting O) when a temperature of 45 °C is reached.*



The sensor has by principle of function a reaction time in the order of a few seconds.

If the sensor is set to switch at the 1st LED on the bar graph, then the sensor reacts faster to flow being started and reacts slower to flow being stopped.

If the sensor is set to switch at the 5th LED on the bar graph, then the sensor reacts slower to flow being started and reacts faster to flow being stopped.

If the sensor is set for switching at the 3rd LED on the bar graph, then the reaction time for the starting and stopping of flow is approximately the same.

### 5.3. Setting the switching modes O / C

Both outputs (flow rate and temperature) are either switching (O) or both outputs are unswitching (C). This means that in the case of a switching setting (O) the flow rate output will switch when the flow rate increases above the set limit and unswitch when it falls below this limit. In the case of the unswitching setting (C), the output behaves in the opposite way (unswitches when the flow rate increases). In the case of the temperature output, it switches when the temperature goes above a set limit, in the case of (O). In the case of setting (C), the output behaves in the opposite way (unswitches when the temperature increases).

The sensor is factory set to switching mode (O); If this setting is desired, skip the following steps.

#### **Setting the sensor to mode (C)**

1. Disconnect the sensor from the power source (e.g. by disconnecting the connector).
2. Place the magnetic pen the „T“ in the voltage-free state and hold the magnetic pen pressed against the pad when connecting the power supply. This is signalled by the yellow LED being lit.
3. Now it is possible to take the magnetic pen away, which is confirmed by the yellow LED flashing three times. All the other settings of the sensor remain unchanged. When the magnetic pen is taken away, the sensor goes into the temperature stabilisation mode and then to the measurement mode.
4. Repeating this procedure will set the switching mode (O) again.

### 5.4. Reset to factory default

If necessary, it is possible to restore factory default.

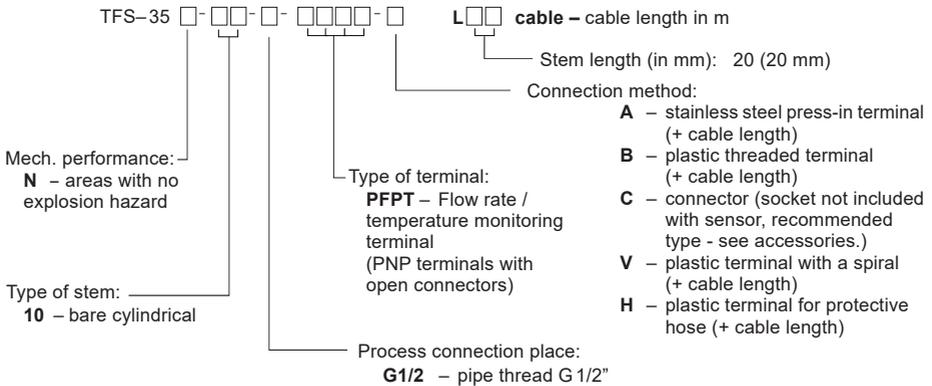
1. Disconnect the sensor from the power source (e.g. by disconnecting the connector).
2. Place the magnetic pen the „F“ in the voltage-free state and hold the magnetic pen pressed on the when connecting the power supply. This is signalled by the orange LED being lit.
3. Now it is possible to take the magnetic pen away, which is confirmed by the orange LED flashing three times.
4. When the magnetic pen is taken away, the sensor is restored to the factory setting, see table on page 16.

## 6. FUNCTION AND STATUS INDICATION

signal	colour	function
<p>"FLOW OUTPUT"</p> 	orange	<p><u>Sensing mode:</u>  <b>permanently shine</b> - output is switched  <b>dark</b> - output is unswitched</p> <p><u>Setting mode:</u>  <b>light with gradual lighting of green LEDs</b> - after holding down on the F pad, the maximum flow rate setting is saved  <b>3 flashes</b> - confirmation of maximum flow rate setting being saved or confirmation of restoring to factory settings  <b>light while powering up</b> - when the pen is placed against pad F before it powers up, signals the restore factory settings mode</p>
<p>"BARGRAF" (5 LED)</p> 	green	<p><u>Start up mode:</u>  <b>parallel flashing of all LEDs</b> - indication the the sensor temperature is stabilising after powering up</p> <p><u>Sensing mode:</u>  <b>gradual lighting up of LEDs from left to right</b> - indication of flow rate based on the flow rate range setting  <b>gradual lighting up / turning off from the centre to the edges</b> - incorrect settings *</p> <p><u>Setting mode:</u>  <b>one LED is permanently shine</b> - after tapping the pen on the pad F/T indication and movement of the switching point for flow rate / temperature  <b>gradual turning off of all LEDs</b> - when the pen is held down on pad T, the minimum flow rate setting is saved  <b>gradual lighting up of all LEDs</b> - when the pen is held down</p>
<p>"TEMPERATURE OUTPUT"</p> 	yellow	<p><u>Sensing mode:</u>  <b>permanently shine</b> - output is switched  <b>dark</b> - output is unswitched</p> <p><u>Setting mode:</u>  <b>light with gradual lighting of green LEDs</b> - after holding down on the T pad, the minimum flow rate setting is saved  <b>3 flashes</b> - confirmation of minimum flow rate setting being saved or confirmation change to the switching mode  <b>light while powering up</b> - confirmation of minimum flow rate setting being saved or confirmation change to the switching mode</p>

\*) It is indicated, when during the setting of the maximum flow rate a lower or equal flow rate is detected than during the setting of the minimum flow rate.

## 7. ORDER CODE



## 8. CORRECT SPECIFICATION EXAMPLES

TFS-35N-10-G1/2-PFPT-A-L20 cable 2m

(**N**) configuration for normal areas; (**10**) bare cylindrical, (**G1/2**) process connection with thread G1/2", (**PFPT**) PNP type flow rate and temperature sensing terminals, (**A**) stainless steel cable terminal, (**L20**) length of stem 20mm. cable 2 m)

TFS-35N-10-G1/2-PFPT-C-L20

(**N**) configuration for normal areas; (**10**) bare cylindrical, (**G1/2**) process connection with thread G1/2", (**PFPT**) PNP type flow rate and temperature sensing terminals, (**C**) M12 connector, (**L20**) délka stonku 20mm.

TFS-35N-10-G1/2-PFPT-B-L20 cable 12m

(**N**) configuration for normal areas; (**10**) bare cylindrical, (**G1/2**) process connection with thread G1/2", (**PFPT**) PNP type flow rate and temperature sensing terminals, (**B**) plastic cable terminal, (**L20**) length of stem 20mm. cable 12 m)

## 9. ACCESSORIES

optional – for a surcharge (see catalogue sheet of accessories)

- cable (over the standard 2m length)
- connector socket (type ELWIKa or ELKA)
- standard steel or stainless steel welding flange
- protective hose (for type of cable terminal H)
- stainless steel fixing nut
- various types of seals (PTFE, AI, etc.)

## 10. PROTECTION, SAFETY AND COMPATIBILITY

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The flow meter TFS-35 is equipped with protection against voltage polarity reversal, protection against current overload and protection against short term overvoltage.

Protection against dangerous contact is provided by low safety voltage according to 33 2000-4-41.

Electromagnetic compatibility is provided by conformity with standards EN 55011/B, EN 61326-1, EN 61000-4-2 (8 kV), -4-3 (10 V/m), -4-4 (2 kV), -4-5 (1 kV) and -4-6 (10 V).

## 11. USE, MANIPULATION AND MAINTENANCE

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Maintenance of the device consists of regularly checking the integrity of the power cord or the connector and removing dirty material from the rear side of the sensor. If the sensor is set correctly, it does not need to be attended to during operation. In the event of a power outage, all settings are retained. In the event that deposits adhere to the stem of the sensor, it is necessary to remove them regularly.

It is forbidden to make any changes or interventions to the device without the consent of the producer. Any repairs of the sensor must only be carried out by the producer or authorised service organisations.

Assembly, installation, commissioning, operation and maintenance of the device must be performed in accordance with these technical conditions and with the manual. Likewise, provisions of valid norms for the installation of electrical equipment must be adhered to. The operator of the device must be demonstrably acquainted with the operation and maintenance of the device.

## 12. GENERAL CONDITIONS AND WARRANTY

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Dinel, s.r.o. guarantees for the period of three (3) years that the product has the characteristics as mentioned in the technical specification.

Dinel, s.r.o. is liable for defects ascertained within the warranty period and were claimed in writing.

This guarantee does not cover the damages resulting from misuse, improper installation or incorrect maintenance.

This guarantee ceases when the user or the other person makes any changes on the product or the product is mechanically or chemically damaged, or the serial number is not readable.

The warranty certificate must be presented to exercise a claim.

In the case of a rightful complaint, we will replace the product or its defective part. In both cases, the warranty period is extended by the period of repair.



BASIC TECHNICAL DATA	
Cable	PVC 4x0.5 mm <sup>2</sup>
Heat up time after start	10s
Response time	2 to 15s <sup>*1)</sup>
Pressure strength	10 MPa ( 100 bar ) over full temperature range
Weight of sensor (without cable)	150g

\*1) Depending on the flow rate and setting of the sensor.

USED MATERIALS		
part of the sensor	type	standard material
Housing	all	stainless steel W.Nr. 1.4404 (AISI 316L)
End of sensor	all	stainless steel W.Nr. 1.4301 (AISI 304)
Cable terminal	TFS-35 _ _ _ _ -A-L_ _	stainless steel W.Nr. 1.4571 / NBR
	TFS-35 _ _ _ _ -B-L_ _	plastic PA / NBR
	TFS-35 _ _ _ _ -V-L_ _	plastic PA / NBR
	TFS-35 _ _ _ _ -H-L_ _	plastic PA / NBR
Connector M12	TFS-35 _ _ _ _ -C-L_ _	nickel-plated brass /

PROCESS CONNECTION		
name	dimensions	marking
pipe thread	G 1/2"	G 1/2

DEFAULT SETTINGS TABLE (FACTORY DEFAULT)	
Output mode	<b>switching (O)</b>
Flow rate sensing range	<b>0 .. 100 cm/s <sup>*2)</sup></b>
Flow rate switching point	<b>3. LED</b>
Temperature switching point	<b>3. LED</b>

\*2) The medium for the default flow rate sensing settings was water.

## 15. PACKAGING, SHIPPING AND STORAGE

The device TFS-35 is packaged in a polyethylene bag, and the entire consignment is placed into a cardboard box. A suitable filler material is used in the cardboard box to prevent mechanical damage during transport. Remove the device from the packaging only just before using, thereby protecting it from potential damage.

A forwarding company will be used to ship goods to the customer. Upon prior agreement, ordered goods can be picked up in person at company headquarters. When receiving, please check to see that the consignment is complete and matches the order, or to see if any damage has occurred to the packaging and device during transport. Do not use a device clearly damaged during transport, but rather contact the manufacturer in order to resolve the situation.

If the device is to be further shipped, it must be wrapped in its original packaging and protected against impact and weather conditions.

Store the device in its original packaging in dry areas covered from weather conditions, with humidity of up to 85 % without effects of chemically active substances. The storage temperature range is -10 °C to +50 °C.







# Dinel<sup>®</sup>

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