## 1. Product overview

This data booklet is for the latest version of Grundfos Direct Sensors™. Customers already buying Grundfos Direct Sensors™ might be buying a sensor with another specification.

<table>
<thead>
<tr>
<th>Variant</th>
<th>Description</th>
<th>Technical data</th>
</tr>
</thead>
</table>
| VFI     | Vortex flow sensor, industry  
• all stainless steel  
• Grundfos flanges or fittings. | Flow range: 0.3 - 240 m3/h (1.3 - 1057 gpm)  
System pressure: Maximum 30 bar (435 psig)  
System temperature: -30 to +110 °C (-22 to +230 °F)  
Signal: 4-20 mA (2-wire)  
Power supply: 12.5 - 30 VDC  
Enclosure class: IP67 |
| VFI+T   | Vortex flow sensor, industry  
• combined flow and temperature measurement  
• Grundfos flanges or fittings. | Flow range: 0.3 - 240 m3/h (1.3 - 1057 gpm)  
Temperature range: 0-100 °C (32-212 °F)  
System pressure: Maximum 30 bar (435 psig)  
System temperature: -30 to +110 °C (-22 to +230 °F)  
Signal: 4-20 mA (2-wire)  
Power supply: 12.5 - 30 VDC  
Enclosure class: IP67 |
| VFS     | Vortex flow sensor, standard  
• combined flow and temperature measurement  
• composite flow pipe. | Flow range: 1.3 - 400 l/min (0.2 - 106 gpm)  
Temperature range: 0-120 °C (32-248 °F)  
System pressure: Maximum 24 bar (348 psig)  
System temperature: 0-100 °C (32-212 °F)  
Signal: 2 x 0.5 - 3.5 VDC (4-wire)  
Power supply: 5 VDC (PELV)  
Enclosure class: IP44 |
| VFS QT  | Vortex flow sensor, standard QT  
• combined flow and temperature measurement  
• stainless-steel pipe with composite insert. | Flow range: 1-200 l/min (0.2-53 gpm)  
Temperature range: 0-120 °C (32-248 °F)  
System pressure: Maximum 30 bar (435 psig)  
System temperature: 0-120 °C (32-248 °F)  
Signal: 2 x 0.5 - 3.5 VDC (4-wire)  
Power supply: 5 VDC (PELV)  
Enclosure class: IP44 |
| MFS     | Multiflow sensor, standard  
• combined flow, pressure and temperature measurement  
• output: two analog signals or proprietary digital bus for three signals (flow, temperature and pressure)  
• composite flow pipe. | Flow range: 2.6 - 400 l/min (0.5 - 106 gpm)  
Temperature range: 0-120 °C (32-248 °F)  
Pressure range: 0-10 bar (0-145 psig)  
System pressure: Maximum 24 bar (348 psig)  
System temperature: 0-100 °C (32-212 °F)  
Signal: Digital or analog communication, 2 x 0.5 - 3.5 VDC (4-wire)  
Power supply: 5 VDC (PELV)  
Enclosure class: IP44 |
| MFS QT  | Multiflow sensor, standard QT  
• combined flow, pressure and temperature measurement  
• output: two analog signals or proprietary digital bus for three signals (flow, temperature and pressure)  
• stainless-steel pipe with composite insert. | Flow range: 2-200 l/min (0.5 - 53 gpm)  
Temperature range: 0-120 °C (32-248 °F)  
Pressure range: 0-10 bar (0-145 psig)  
System pressure: Maximum 30 bar (435 psig)  
System temperature: 0-100 °C (32-212 °F)  
Signal: Digital or analog communication, 2 x 0.5 - 3.5 or 4.1 VDC (4-wire)  
Power supply: 5 VDC (PELV)  
Enclosure class: IP44 |
2. Product introduction

This data booklet gives an overview of the Grundfos vortex flow sensor range and related products.

Vortex principle

The flow measurement is based on the vortex principle. The system elements include a flow pipe with an integrated bluff body and a differential pressure sensor.

Flow ranges are determined by the pipe diameter and the signal processing parameters. The differential pressure sensor key elements are a bulk micromachined silicon chip and a microprocessor-based signal-conditioning circuit, both on the same PCB. The conditioning circuit converts the pressure reading to a signal proportional to the flow.

Construction

The bluff body is either integrated in the composite flow pipe, or supplied as a separate composite or stainless steel part to be inserted in the flow pipe. The square chip membrane warps due to the pressure difference. This is registered as a change of resistance in the strain gauges of a Wheatstone bridge. The pressure and temperature sensitive area, the membrane region, is coated on both sides by an extremely corrosion- and diffusion-resistant thin film (Silicofilm®). The coating makes the chip environmentally robust. The liquid-free zone is sealed by an O-ring.

Material

The Grundfos vortex flow sensors are available in three material variants, suitable for different liquids:
- EPDM O-rings: Suitable for water; drinking-water approved.
- FKM O-rings: Suitable for oily liquids and water in heating applications.
- EPDM sealing cap with FKM O-rings: Suitable for water in heating applications with a high volume of calcium and magnetite.

Definitions

Burst Pressure

The maximum allowable pressure (relative to ambient) in a system, which will not destroy the sensor or transmitter. Measured in [bar].

Maximum System Pressure

Maximum allowable static pressure (relative to ambient pressure) in a system, where the flow is zero.
3. Vortex Flow sensor, Industry (VFI and VFI+T2)

General data

![VFI sensor](image)

Fig. 4 VFI sensor

**Technical overview**

The VFI flow transmitter from Grundfos Direct Sensors™ is designed for industrial applications. The transmitter is based on the principle of vortex shedding behind a bluff body.

The VFI transmitter is fully compatible with wet, aggressive liquids. The transmitter is based on MEMS sensing technology in combination with the corrosion-resistant Silicoat® coating technology on the transmitter chip.

This makes the VFI transmitters very robust and ideal for pump integration and monitoring in harsh environments.

The transmitter is supplied with a stainless steel flow pipe, available with flanges or in a threaded version.

![Bluff body in a VFI transmitter](image)

Fig. 5 Bluff body in a VFI transmitter

**Applications**

- Pump control
- HVAC systems
- temperature control and chiller systems
- renewable energies such as heat pumps, solar thermals, fresh water and micro-CHP systems
- monitoring and control systems
- water treatment plants
- water utility and distribution systems
- HPC (High-Performance Computing) and IT cooling systems.

**Features and benefits**

- Measurement principle with no movable parts, resulting in no wear and tear
- MEMS technology
- direct contact with the aqueous media resulting in a fast response time
- plug and play for quick setup
- smart system solution with Grundfos pump controls
- compact and robust design
- compatible with aqueous media
- suitable for a wide temperature range
- suitable for a wide range of application.

- For aqueous media below 2 µS/cm contact your local Grundfos sensor representative.

**Flow range**

<table>
<thead>
<tr>
<th>m³/h</th>
<th>gpm</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.3 - 6</td>
<td>1.32 - 26.42</td>
</tr>
<tr>
<td>0.6 - 12</td>
<td>2.64 - 52.83</td>
</tr>
<tr>
<td>1.3 - 25</td>
<td>5.72 - 110.07</td>
</tr>
<tr>
<td>2 - 40</td>
<td>8.81 - 176.11</td>
</tr>
<tr>
<td>3.2 - 64</td>
<td>14.09 - 281.78</td>
</tr>
<tr>
<td>5.2 - 104</td>
<td>22.89 - 457.89</td>
</tr>
<tr>
<td>8 - 160</td>
<td>35.22 - 704.46</td>
</tr>
<tr>
<td>12 - 240</td>
<td>52.83 - 1056.69</td>
</tr>
</tbody>
</table>

**Approvals (w/EPDM O-rings)**

- WRAS
- KTW
- AS4020
- ACS.

**Certificates**

- CE C, CSA, US
- EAC
**Electrical connections**

![Electrical connections](image)

**VFI Signal condition: 2-wire, loop-powered.**

<table>
<thead>
<tr>
<th>Pin</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wire colour</td>
<td>Brown</td>
<td>White</td>
<td>Blue</td>
<td>Black</td>
</tr>
<tr>
<td>I/O</td>
<td>Power supply</td>
<td>Not used</td>
<td>Flow signal 4-20 mA</td>
<td>Not used</td>
</tr>
</tbody>
</table>

Power supply: 12.5 - 30 V, screened cable.

**VFI+T Signal condition: 4-wire**

<table>
<thead>
<tr>
<th>Pin</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wire colour</td>
<td>Brown</td>
<td>White</td>
<td>Blue</td>
<td>Black</td>
</tr>
<tr>
<td>I/O</td>
<td>Power supply</td>
<td>Flow signal 0-10 V</td>
<td>GND*</td>
<td>Temperature signal 0-10 V</td>
</tr>
</tbody>
</table>

* Common ground for pressure and temperature signals.
  Power supply, screened cable: SELV or PELV.

**Directives**

The Grundfos Direct Sensors™ are in conformity with these council directives on the approximation of the laws of the EC member states:

- **Low Voltage Directive (2014/35/EU)**
  - Standards used: EN 61010-1:2010

- **EMC Directive (2014/30/EU).**
  - Standards used: EN 61326-1:2013 and EN 61326-2-3:2013

The Grundfos Direct Sensors™ are exempted from the Pressure Equipment Directive (PED) according to Article 4, paragraph 3 in the PED 2014/68/EU.
Vortex Flow sensor, Industry (VFI and VFI+T2)

**Flow sensors**

VFI and VFI+T2, 0.3 - 6 m³/h (1.3 - 26.4 gpm)

![VFI sensor with flanges and thread](image)

**Fig. 7** VFI sensor with flanges and thread

**Dimensions**

![Dimensions, VFI with flanges](image)

For flanges according to ANSI and JIS standards or for other pressure ranges, contact Grundfos Direct Sensors™.

**Fig. 8** Dimensions, VFI with flanges

**Sensor output signals**

![Flow response](image)

**Fig. 10** Flow response

**Specifications**

<table>
<thead>
<tr>
<th><strong>Flow</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Measuring range</strong></td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
</tr>
<tr>
<td><strong>Response time</strong></td>
</tr>
<tr>
<td><strong>Resolution</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Temperature, VFI+T with temperature output</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Measuring range</strong></td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
</tr>
<tr>
<td><strong>Response time</strong></td>
</tr>
<tr>
<td><strong>Resolution</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>System conditions and environment</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Liquid types</strong></td>
</tr>
<tr>
<td><strong>Maximum system pressure</strong></td>
</tr>
<tr>
<td><strong>Melt pressure</strong></td>
</tr>
<tr>
<td><strong>Liquid temperature, operation</strong></td>
</tr>
<tr>
<td><strong>Liquid temperature, peak</strong></td>
</tr>
<tr>
<td><strong>Ambient temperature, operation</strong></td>
</tr>
<tr>
<td><strong>Ambient temperature, peak</strong></td>
</tr>
<tr>
<td><strong>Humidity, relative</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Electrical data, VFI without temperature output</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power supply</strong></td>
</tr>
<tr>
<td><strong>Output signals</strong></td>
</tr>
<tr>
<td><strong>Maximum power consumption</strong></td>
</tr>
<tr>
<td><strong>Maximum load impedance</strong></td>
</tr>
<tr>
<td>100 Ω at 13.3 VDC</td>
</tr>
<tr>
<td>900 Ω at 30 VDC</td>
</tr>
<tr>
<td><strong>Maximum cable length</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Electrical data, VFI+T with temperature output</strong></th>
</tr>
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<tbody>
<tr>
<td><strong>Power supply</strong></td>
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<tr>
<td><strong>Output signals</strong></td>
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<td><strong>Maximum power consumption</strong></td>
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</tr>
<tr>
<td><strong>Maximum cable length</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Materials</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sensing element</strong></td>
</tr>
<tr>
<td><strong>O-ring</strong></td>
</tr>
<tr>
<td><strong>Housing</strong></td>
</tr>
<tr>
<td><strong>Flow pipe</strong></td>
</tr>
<tr>
<td><strong>Flange, no liquid contact</strong></td>
</tr>
<tr>
<td><strong>Bluff body</strong></td>
</tr>
<tr>
<td><strong>Corrosion-resistant coating</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Environmental standards</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Enclosure class</strong></td>
</tr>
<tr>
<td><strong>Temperature cycling</strong></td>
</tr>
<tr>
<td><strong>Vibration, non-destructive</strong></td>
</tr>
<tr>
<td><strong>Electromagnetic compatibility</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Complete weight</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>with cast iron flanges, cable etc</strong></td>
</tr>
<tr>
<td><strong>with stainless steel flanges, cable etc</strong></td>
</tr>
<tr>
<td><strong>with thread, unions, fittings, cable etc</strong></td>
</tr>
</tbody>
</table>

Install the VFI sensor with threaded ends by means of union nuts with threaded ends by means of union nuts.
Vortex Flow sensor, Industry (VFI and VFI+T2)

**Flow sensors**

VFI and VFI+T2, 0.6 - 12 m³/h (2.6 - 52.8 gpm)

**Dimensions**

For flanges according to ANSI and JIS standards or for other pressure ranges, contact Grundfos Direct Sensors™.

**Sensor output signals**

Install the VFI sensor with threaded ends by means of union nuts.

**Specifications**

- **Flow**
  - Measuring range: 0.6 - 12 m³/h (2.64 to 52.83 gpm)
  - Accuracy (± 1σ) in water, 0-100 °C (32-212 °F): ± 1.5 % FS
  - Response time (63.2 %): Less than 1 s
  - Resolution: 0.015 m³/h (0.07 gpm)

- **Temperature, VF+T with temperature output**
  - Measuring range: -10 - 120 °C (14-248 °F)
  - Accuracy (± 1σ): ± 0.5 K
  - Accuracy (± 1σ), -10 - 120 °C (14-248 °F): ± 1 K
  - Response time (63.2 % at 50 % FS flow): 250 ms
  - Resolution: 0.1 K

- **System conditions and environment**
  - Liquid types: Aqueous media compatible with wetted materials. Kinematic viscosity less than or equal to 6 mm²/s (cSt). See appendix Pressure drop curves
  - Max. system pressure: 30 bar (435 psig)
  - Burst pressure: 40 bar (580 psig)
  - Liquid temperature, operation: -30 to +110 °C (-22 to +230 °F), non-freezing
  - Liquid temperature, peak: -55 to +70 °C (-67 to +158 °F)
  - Ambient temperature, operation: -25 to +60 °C (-13 to +140 °F)
  - Ambient temperature, peak: -55 to +70 °C (-67 to +158 °F)
  - Humidity, relative: 0-95 %, non-condensing

- **Electrical data, VFI without temperature output**
  - Power supply: 12.5 - 30 VDC (± 5 %)
  - Output signals: 4-20 mA
    - Signal cut off: 21 mA
  - Maximum power consumption: 660 mW
  - Maximum load impedance:
    - 60 Ω at 12.5 VDC
    - 100 Ω at 13.3 VDC
    - 600 Ω at 24 VDC
    - 900 Ω at 30 VDC
  - Maximum cable length: 30 m (98 ft)

- **Electrical data, VFI+T with temperature output**
  - Power supply, VFI: 16.6 - 30 VDC
  - Output signals:
    - Signal cut off: -10 °C at 0 V, 120 °C at 10 V
    - 11 VDC
  - Maximum power consumption: 270 mW
  - Maximum load impedance: 10 kΩ
  - Maximum cable length: 30 m (98 ft)

- **Materials**
  - Sensing element: Silicon-based MEMS
  - O-ring: EPDM or FKM
  - Housing: Stainless steel 1.4404 (AISI 316 L)
  - Flow pipe: Stainless steel 1.4408 (AISI 316)
  - Flange, no liquid contact: Cast iron or stainless steel
  - Bluff body: Stainless steel 1.4401 (AISI 316 L)
  - Wetted materials: Corrosion-resistant coating, EPDM or FKM, Stainless steel 1.4401/04/08 (AISI 316 L)

- **Environmental standards**
  - Enclosure class: IP67, cable connected
  - Temperature cycling: IEC 68-2-14
  - Vibration, non-destructive: 20-2000 Hz, 10G, 4 h
  - Electromagnetic compatibility: EN 61326-1

- **Complete weight**
  - with cast iron flanges, cable etc: 6.5 kg (14.3 lbs)
  - with stainless steel flanges, cable etc: 5.6 kg (12.3 lbs)
  - with thread, unions, fittings, cable etc: 3.6 kg (7.9 lbs)
Vortex Flow sensor, Industry (VFI and VFI+T2)

Flow sensors

VFI and VFI+T2, 1.3 - 25 m³/h (5.7 - 110 gpm)

Dimensions

For flanges according to ANSI and JIS standards or for other pressure ranges, contact Grundfos Direct Sensors™.

Sensor output signals

Specifications

Flow

<table>
<thead>
<tr>
<th>Measuring range</th>
<th>1.3 - 25 m³/h (5.72 to 110.07 gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy (± 1 σ) in water</td>
<td>± 1.5 % FS</td>
</tr>
<tr>
<td>Response time</td>
<td>Less than 1 s</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.031 m³/h (0.14 gpm)</td>
</tr>
</tbody>
</table>

Temperature, VFI+T with temperature output

<table>
<thead>
<tr>
<th>Measuring range</th>
<th>-10 - 120 °C (14-248 °F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy (± 1 σ)</td>
<td>± 0.5 K</td>
</tr>
<tr>
<td>Accuracy (± 1 σ)</td>
<td>± 1 K</td>
</tr>
<tr>
<td>Response time</td>
<td>(63.2 % at 50 % FS flow) 250 ms</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.1 K</td>
</tr>
</tbody>
</table>

System conditions and environment

Liquid types

Aqueous media compatible with wetted materials. Kinematic viscosity less than or equal to 6 mm²/s (cSt).
See appendix for pressure drop curves.

Max. system pressure 30 bar (435 psig)

Burst pressure 40 bar (580 psig)

Liquid temperature, operation -30 to +110 °C (-22 to +230 °F), non-freezing.

Liquid temperature, peak -30 to +110 °C (-22 to +230 °F), non-freezing.

Ambient temperature, operation -25 to +60 °C (-13 to +140 °F)

Ambient temperature, peak -55 to +70 °C (-67 to +158 °F)

Storage temperature -55 to +70 °C (-67 to +158 °F)

Humidity, relative 0-95 %, non-condensing

Electrical data, VFI without temperature output

Power supply, VFI 12.5 - 30 VDC

Output signals

- Signal cut off 4-20 mA 21 mA

Maximum power consumption 660 mW

Maximum load impedance 60 Ω at 12.5 VDC 100 Ω at 13.3 VDC 600 Ω at 24 VDC 900 Ω at 30 VDC

Maximum cable length 30 m (98 ft)

Electrical data, VFI+T with temperature output

Power supply, VFI 16.6 - 30 VDC

Output signals

- Signal cut off 0-10 VDC

(-10 °C at 0 V, 120 °C at 10 V)

Maximum power consumption 270 mW

Maximum load impedance 10 kΩ

Maximum cable length 30 m (98 ft)

Materials

Sensing element Silicon-based MEMS

O-ring EPDM or FKM

Housing Stainless steel 1.4404 (AISI 316 L)

Flow pipe Stainless steel 1.4408 (AISI 316)

Flange, no liquid contact Cast iron or stainless steel

Bluff body Stainless steel 1.4401 (AISI 316 L)

Wetted materials Corrosion-resistant coating, EPDM or FKM, Stainless steel 1.4401/04/08 (AISI 316 L)

Environmental standards

Enclosure class IP67, cable connected

Temperature cycling IEC 68-2-14

Vibration, non-destructive 20-2000 Hz, 10G, 4 h

Electromagnetic compatibility EN 61326-1

Complete weight

with cast iron flanges, cable etc 6.5 kg (14.3 lbs)

with stainless steel flanges, cable etc 5.6 kg (12.3 lbs)

with thread, unions, fittings, cable etc 3.9 kg (8.6 lbs)

Install the VFI sensor with threaded ends by means of union nuts.
VFI and VFI+T2, 2-40 m³/h (8.8 - 176 gpm)

Flow sensors

Fig. 17 VFI 2-40 sensor

Dimensions

Fig. 18 Dimensions, VFI with flanges

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>ISO/DIN flange</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>200</td>
<td>18</td>
<td>131</td>
<td>150</td>
</tr>
<tr>
<td>in</td>
<td>7.87</td>
<td>0.71</td>
<td>5.16</td>
<td>5.91</td>
</tr>
</tbody>
</table>

For flanges according to ANSI and JIS standards or for other pressure ranges, contact Grundfos Direct Sensors™.

Sensor output signals

Fig. 19 Flow response

Specifications

<table>
<thead>
<tr>
<th>Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
</tr>
<tr>
<td>Accuracy (± 1 σ) in water, 0-100 °C (32-212 °F)</td>
</tr>
<tr>
<td>Response time</td>
</tr>
<tr>
<td>Resolution</td>
</tr>
</tbody>
</table>

Temperature, VFI+T with temperature output

| Measuring range | -10 - 120 °C (14-248 °F) |
| Accuracy (± 1 σ), 15-90 °C (59-194 °F) | ± 0.5 K |
| Accuracy (± 1 σ), -10 - 120 °C (14-248 °F) | ± 1 K |
| Response time (63.2 % at 50 % FS flow) | 250 ms |
| Resolution | 0.1 K |

System conditions and environment

<table>
<thead>
<tr>
<th>Liquid types</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aqueous media compatible with wetted materials. Kinematic viscosity less than or equal to 6 mm²/s (cSt). See appendix Pressure drop curves</td>
</tr>
</tbody>
</table>

Maximum system pressure | 30 bar (435 psig) |
Burst pressure | 40 bar (580 psig) |
Liquid temperature, operation | -30 to +110 °C (-22 to +230 °F), non-freezing |
Liquid temperature, peak | -30 to +110 °C (-22 to +230 °F), non-freezing |
Ambient temperature, operation | -25 to +60 °C (-13 to +140 °F) |
Ambient temperature, peak | -55 to +70 °C (-67 to +158 °F) |
Storage temperature | -55 to +70 °C (-67 to +158 °F) |
Humidity, relative | 0-95 %, non-condensing |

Electrical data, VFI without temperature output

| Power supply | 12.5 - 30 VDC (± 5 %) |
| Output signals | 4-20 mA |
| Signal cut off | 21 mA |
| Maximum power consumption | 860 mW |
| Maximum load impedance | 60 Ω at 12.5 VDC |
| | 100 Ω at 13.3 VDC |
| | 600 Ω at 24 VDC |
| | 900 Ω at 30 VDC |
| Maximum cable length | 30 m (98 ft) |

Electrical data, VFI+T with temperature output

| Power supply, VFI | 16.6 - 30 VDC |
| Output signals | 0-10 VDC |
| (-10 °C at 0 V, 120 °C at 10 V) | 11 VDC |
| Maximum power consumption | 270 mW |
| Maximum load impedance | 10 KΩ |
| Maximum cable length | 30 m (98 ft) |

Materials

| Sensing element | Silicon-based MEMS |
| O-ring | EPDM or FKM |
| Housing | Stainless steel 1.4404 (AISI 316 L) |
| Flow pipe | Stainless steel 1.4408 (AISI 316) |
| Flange, no liquid contact | Cast iron or stainless steel |
| Bluff body | Stainless steel 1.4401 (AISI 316 L) |
| Wetted materials | Corrosion-resistant coating, EPDM or FKM, Stainless steel 1.4401/04/08 (AISI 316 L) |

Environmental standards

| Enclosure class | IP67, cable connected |
| Temperature cycling | IEC 68-2-14 |
| Vibration, non-destructive | 20-2000 Hz, 10G, 4 h |
| Electromagnetic compatibility | EN 61326-1 |

Complete weight

| With cast iron flanges, cable etc | 7.4 kg (16.3 lbs) |
| With stainless steel flanges, cable etc | 6.5 kg (14.3 lbs) |
VFI and VFI+T2, 3.2 - 64 m³/h (14-282 gpm)

For flanges according to ANSI and JIS standards or for other pressure ranges, contact Grundfos Direct Sensors™.

Sensor output signals

Specifications

Flow
- Measuring range: 3.2 - 64 m³/h (14.09 to 281.78 gpm)
- Accuracy: ±1.5 % FS
- Response time: Less than 1 s
- Resolution: 0.08 m³/h (0.35 gpm)

Temperature, VFI+T with temperature output
- Measuring range: -10 to -120 °C (14-248 °F)
- Accuracy: ±0.5 K
- Response time: Less than 1 s

System conditions and environment
- Liquid types: Aqueous media compatible with wetted materials. Kinematic viscosity less than or equal to 6 mm²/s (cSt).
- Maximum system pressure: 30 bar (435 psig)
- Burst pressure: 40 bar (580 psig)
- Liquid temperature, operation: -25 to +60 °C (-13 to +140 °F)
- Liquid temperature, peak: -55 to +70 °C (-67 to +158 °F)
- Storage temperature: -55 to +70 °C (-67 to +158 °F)
- Humidity, relative: 0-95 %, non-condensing

Electrical data, VFI without temperature output
- Power supply: 12.5 - 30 VDC
- Output signals: 4-20 mA
- Maximum power consumption: 660 mW
- Maximum load impedance: 60 Ω at 12.5 VDC
- Maximum cable length: 30 m (98 ft)

Electrical data, VFI+T with temperature output
- Power supply: 16.6 - 30 VDC
- Output signals: 0-10 VDC
- Maximum power consumption: 270 mW
- Maximum load impedance: 10 kΩ
- Maximum cable length: 30 m (98 ft)

Materials
- Sensing element: Silicon-based MEMS
- O-ring: EPDM or FKM
- Housing: Stainless steel 1.4404 (AISI 316 L)
- Flow pipe: Stainless steel 1.4404 (AISI 316 L)
- Flange, no liquid contact: Cast iron or stainless steel
- Bluff body: Stainless steel 1.4401 (AISI 316 L)
- Wetted materials: Corrosion-resistant coating, EPDM or FKM, Stainless steel 1.4401/04/08 (AISI 316 L)

Environmental standards
- Enclosure class: IP67, cable connected
- Temperature cycling: IEC 68-2-14
- Vibration, non-destructive: 20-2000 Hz, 10G, 4 h
- Electromagnetic compatibility: EN 61326-1

Complete weight
- With cast iron flanges, cable etc: 9.4 kg (20.7 lbs)
- With stainless steel flanges, cable etc: 8.2 kg (18.0 lbs)
VFI and VFI+T2, 5.2 - 104 m³/h (23-458 gpm)

**Dimensions**

![Diagram of sensor](image1)

For flanges according to ANSI and JIS standards or for other pressure ranges, contact Grundfos Direct Sensors™.

**Sensor output signals**

![Diagram of sensor output signals](image2)

**Specifications**

<table>
<thead>
<tr>
<th>Flow</th>
<th>Measuring range</th>
<th>5.2 - 104 m³/h (22.89 - 457.89 gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy (± 1 σ) in water, 0-100 °C (32-212 °F)</td>
<td>± 1.5 % FS</td>
<td></td>
</tr>
<tr>
<td>Response time</td>
<td>Less than 1 s</td>
<td></td>
</tr>
<tr>
<td>Resolution</td>
<td>0.13 m³/h (0.57 gpm)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Temperature, VFI+T with temperature output</th>
<th>Measuring range</th>
<th>-10 - 120 °C (14-248 °F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy (± 1 σ), -10 - 120 °C (14-248 °F)</td>
<td>± 0.5 K</td>
<td></td>
</tr>
<tr>
<td>Response time</td>
<td>250 ms</td>
<td></td>
</tr>
<tr>
<td>Resolution</td>
<td>0.1 K</td>
<td></td>
</tr>
</tbody>
</table>

**System conditions and environment**

- **Aqueous media** compatible with wetted materials. Kinematic viscosity less than or equal to 6 mm²/s (cSt). See appendix Pressure drop curves
- **Maximum system pressure**: 30 bar (435 psig)
- **Burst pressure**: 40 bar (580 psig)
- **Liquid temperature, operation** -30 to +110 °C (22 to +230 °F), non-freezing
- **Liquid temperature, peak** -30 to +110 °C (22 to +230 °F), non-freezing
- **Ambient temperature, operation** -25 to +60 °C (-13 to +140 °F)
- **Ambient temperature, peak** -55 to +70 °C (-67 to +158 °F)
- **Storage temperature** -55 to +70 °C (-67 to +158 °F)
- **Humidity, relative** 0-95 %, non-condensing

**Electrical data, VFI without temperature output**

<table>
<thead>
<tr>
<th>Power supply, VFI</th>
<th>12.5 - 30 VDC (± 5 %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output signals</td>
<td>4-20 mA</td>
</tr>
<tr>
<td>– Signal cut off</td>
<td>21 mA</td>
</tr>
<tr>
<td>Maximum power consumption</td>
<td>660 mW</td>
</tr>
<tr>
<td>Maximum load impedance</td>
<td>60 Ω at 12.5 VDC</td>
</tr>
<tr>
<td></td>
<td>100 Ω at 13.3 VDC</td>
</tr>
<tr>
<td></td>
<td>600 Ω at 24 VDC</td>
</tr>
<tr>
<td></td>
<td>900 Ω at 30 VDC</td>
</tr>
<tr>
<td>Maximum cable length</td>
<td>30 m (98 ft)</td>
</tr>
</tbody>
</table>

**Electrical data, VFI+T with temperature output**

<table>
<thead>
<tr>
<th>Power supply, VFI</th>
<th>16.6 - 30 VDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output signals</td>
<td>0-10 VDC</td>
</tr>
<tr>
<td>– Signal cut off</td>
<td>11 VDC</td>
</tr>
<tr>
<td>Maximum power consumption</td>
<td>270 mW</td>
</tr>
<tr>
<td>Maximum load impedance</td>
<td>10 kΩ</td>
</tr>
<tr>
<td>Maximum cable length</td>
<td>30 m (98 ft)</td>
</tr>
</tbody>
</table>

**Materials**

- **Sensing element**: Silicon-based MEMS
- **O-ring**: EPDM or FKM
- **Housing**: Stainless steel 1.4404 (AISI 316 L)
- **Flow pipe**: Stainless steel 1.4408 (AISI 316)
- **Flange, no liquid contact**: Cast iron or stainless steel
- **Bluff body**: Stainless steel 1.4401 (AISI 316 L)
- **Wetted materials**: Corrosion-resistant coating, PDM or FKM, stainless steel 1.4401/04/08 (AISI 316 L)

**Environmental standards**

- **Enclosure class**: IP67, cable connected
- **Temperature cycling**: IEC 68-2-14
- **Vibration, non-destructive**: 20-2000 Hz, 10G, 4 h
- **Electromagnetic compatibility**: EN 51326-1

**Complete weight**

- With cast iron flanges, cable etc: 11.5 kg (25.3 lbs)
- With stainless steel flanges, cable etc: 11.9 kg (26.2 lbs)
Vortex Flow sensor, Industry (VFI and VFI+T2)

Fig. 26 VFI sensor

Fig. 27 Dimensions, VFI with flanges

Fig. 28 Flow response

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>ISO/DIN flange</th>
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</thead>
<tbody>
<tr>
<td>mm</td>
<td>200</td>
<td>25</td>
<td>152</td>
<td>200</td>
</tr>
<tr>
<td>m</td>
<td>7.87</td>
<td>0.96</td>
<td>5.98</td>
<td>7.87</td>
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</table>

For flanges according to ANSI and JIS standards or for other pressure ranges, contact Grundfos Direct Sensors™.

Sensor output signals

Specifications

**Flow**
- Measuring range: 8-160 m³/h (35.22 to 704.46 gpm)
- Accuracy (± 1σ) in water, 0-100 °C (32-212 °F): ± 1.5 % FS
- Response time: Less than 1 s
- Resolution: 0.2 m³/h (0.88 gpm)

**Temperature, VFI+T with temperature output**
- Measuring range: -10 - 120 °C (14-248 °F)
- Accuracy (± 1σ): ± 0.5 K
- Response time (63.2 % at 50 % FS flow): 250 ms
- Resolution: 0.1 K

**System conditions and environment**
- Liquid types: Aquous media compatible with wetted materials. Kinematic viscosity less than or equal to 6 mm²/s (cSt). See appendix Pressure drop curves

**Electrical data, VFI without temperature output**
- Power supply: 12.5 - 30 VDC (± 5 %)
- Output signals:
  - Signal cut off: 4-20 mA
  - Maximum power consumption: 660 mW
- Maximum load impedance:
  - 60 Ω at 12.5 VDC
  - 100 Ω at 13.3 VDC
  - 600 Ω at 24 VDC
  - 900 Ω at 30 VDC
- Maximum cable length: 30 m (98 ft)

**Electrical data, VFI+T with temperature output**
- Power supply: 16.6 - 30 VDC
- Output signals:
  - Signal cut off: 0-10 VDC
  - Maximum power consumption: 270 mW
- Maximum load impedance: 10 kΩ
- Maximum cable length: 30 m (98 ft)

**Materials**
- Sensing element: Silicon-based MEMS
- O-ring: EPDM or FKM
- Housing: Stainless steel 1.4404 (AISI 316 L)
- Flow pipe: Stainless steel 1.4408 (AISI 316)
- Flange, no liquid contact: Cast iron or stainless steel
- Bluff body: Stainless steel 1.4401 (AISI 316 L)
- Wetted materials: Corrosion-resistant coating, EPDM or FKM, Stainless steel 1.4401/04/08 (AISI 316 L)

**Environmental standards**
- Enclosure class: IP67, cable connected
- Temperature cycling: IEC 68-2-14
- Vibration, non-destructive: 20-2000 Hz, 10G, 4 h
- Electromagnetic compatibility: EN 61326-1

**Complete weight**
- With cast iron flanges, cable etc: 13.2 kg (29.0 lbs)
- With stainless steel flanges, cable etc: 13.7 kg (30.1 lbs)
Vortex Flow sensor, Industry (VFI and VFI+T2)

**Specifications**

**Flow**
- Measuring range: 12-240 m$^3$/h (52.83 to 1056.69 gpm)
- Accuracy (± 1 o) in water, 0-100 °C (32-212 °F): ± 1.5 % FS
- Response time: Less than 1 s
- Resolution: 0.30 m$^3$/h (1.32 gpm)

**Temperature, VFI+T with temperature output**
- Measuring range: -10 - 120 °C (14-248 °F)
- Accuracy (± 1 o), 15-90 °C (59-194 °F): ± 0.5 K
- Accuracy (± 1 o), -10 - 120 °C (14-248 °F): ± 1 K
- Response time (63.2 % at 50 % FS flow): 250 ms
- Resolution: 0.1 K

**System conditions and environment**
- Aqueous media compatible with wetted materials. Kinematic viscosity less than or equal to 6 mm$^2$/s (cSt).
- See appendix Pressure drop curves
- Maximum system pressure: 30 bar (435 psig)
- Burst pressure: 40 bar (580 psig)
- Liquid temperature, operation: -30 to +110 °C (-22 to +230 °F), non-freezing
- Liquid temperature, peak: -55 to +70 °C (-67 to +158 °F)
- Storage temperature: -55 to +110 °C (-67 to +230 °F)
- Humidity, relative: 0-95 %, non-condensing

**Electrical data**
- Power supply: 12.5 - 30 VDC (± 5 %)
- Output signals
  - Signal cut off: 4-20 mA
  - 21 mA
- Maximum power consumption: 660 mW
- Maximum load impedance
  - 60 Ω at 12.5 VDC
  - 100 Ω at 13.3 VDC
  - 600 Ω at 24 VDC
  - 900 Ω at 30 VDC
- Maximum cable length: 30 m (98 ft)

**Electrical data, VFI+T with temperature output**
- Power supply: 16.6 - 30 VDC
- Output signals
  - 0-10 VDC
  - (-10 °C at 0 V, 120 °C at 10 V)
- Maximum power consumption: 270 mW
- Maximum load impedance: 10 kΩ
- Maximum cable length: 30 m (98 ft)

**Materials**
- Sensing element: Silicon-based MEMS
- O-ring: EPDM or FKM
- Housing: Stainless steel 1.4404 (AISI 316 L)
- Flow pipe: Stainless steel 1.4408 (AISI 316)
- Flange, no liquid contact: Cast iron or stainless steel
- Bluff body: Stainless steel 1.4401 (AISI 316 L)
- Wetted materials
  - Corrosion-resistant coating, EPDM or FKM, Stainless steel 1.4401/04/08 (AISI 316 L)

**Environmental standards**
- Enclosure class: IP67, cable connected
- Temperature cycling: IEC 68-2-14
- Vibration, non-destructive: 20-2000 Hz, 10G, 4 h
- Electromagnetic compatibility: EN 61326-1

**Complete weight**
- With cast iron flanges, cable etc: 18.1 kg (39.8 lbs)
- With stainless steel flanges, cable etc: 18.1 kg (39.8 lbs)
4. Vortex Flow sensor, Standard (VFS and VFS QT)

General data

Technical overview

The VFS is a combined flow and temperature sensor (two-in-one) from Grundfos Direct Sensors™. The sensor is based on the principle of vortex shedding behind a bluff body.

The VFS sensor is fully compatible with wet, aggressive liquids. The sensor is based on MEMS sensing technology in combination with the corrosion-resistant Silicoat® coating technology on the sensor chip.

The sensor is supplied with a flow pipe.

Applications

- Pump control
- HVAC systems
- temperature control and chiller systems
- renewable energies such as heat pumps, solar thermals, fresh water and micro-CHP systems
- monitoring and control systems
- water treatment plants
- water utility and distribution systems
- HPC (High-Performance Computing) and IT cooling systems.

Features and benefits

- Measurement principle with no movable parts, resulting in no wear and tear
- flow and temperature measurement in one sensor (two-in-one solution) for easy and cost-efficient installation
- MEMS technology
- direct contact with the aqueous media resulting in a fast response time
- plug and play for quick setup
- smart system solution with Grundfos pump controls
- compact and robust design
- compatible with aqueous media
- suitable for a wide temperature range
- suitable for a wide range of applications.
- For aqueous media below 2 µS/cm contact your local Grundfos sensor representative.

Flow range

<table>
<thead>
<tr>
<th>Flow range</th>
<th>l/min</th>
<th>gpm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-18</td>
<td></td>
<td>0.26 - 4.76</td>
</tr>
<tr>
<td>1.3 - 20</td>
<td></td>
<td>0.34 - 5.28</td>
</tr>
<tr>
<td>2-40</td>
<td></td>
<td>0.53 - 10.57</td>
</tr>
<tr>
<td>5-100</td>
<td></td>
<td>1.32 - 26.42</td>
</tr>
<tr>
<td>10-200</td>
<td></td>
<td>2.64 - 52.83</td>
</tr>
<tr>
<td>20-400</td>
<td></td>
<td>5.28 - 105.67</td>
</tr>
</tbody>
</table>

Approvals (w/EPDM O-rings)

- WRAS
- KTW
- AS4020
- ACS.

Certificates

Electrical connections

Power supply requirements

- 5 VDC ± 5 %, PELV
- Ratiometric
- Max. 10 mV ripple: 50 Hz
- Min. output current: 25 mA
- Separated from hazardous live circuitry by double or reinforced insulation.
- Grounding of the sensor supply is required.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description Analogue signal</th>
<th>Description Digital signal</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Temperature signal Rx</td>
<td></td>
<td>Yellow</td>
</tr>
<tr>
<td>2</td>
<td>Pressure signal Tx</td>
<td></td>
<td>White</td>
</tr>
<tr>
<td>3</td>
<td>GND, 0 V PELV</td>
<td>GND, 0 V PELV</td>
<td>Green</td>
</tr>
<tr>
<td>4</td>
<td>Voltage supply, +5 VDC</td>
<td>Power supply, +5 VDC</td>
<td>Brown</td>
</tr>
</tbody>
</table>
Directives

The Grundfos Direct Sensors™ are in conformity with these council directives on the approximation of the laws of the EC member states:

- Low Voltage Directive (2014/35/EU)
  – Standards used: EN 61010-1:2010

The Grundfos Direct Sensors™ are exempted from the Pressure Equipment Directive (PED) according to Article 4, paragraph 3 in the PED 2014/68/EU.

VFS sensors

The VFS flow sensor consists of a composite flow pipe and a sensor fitted with cable.

The VFS flow sensor is available in 1-20, 2-40, 5-100, 10-200, 20-400 l/min versions.

VFS QT sensors

The VFS QT flow sensor consists of a composite insert, a stainless steel flow pipe and a sensor fitted with cable.

The VFS QT flow sensor is available in 1-18, 2-40, 5-100, 10-200 l/min versions.

Snap-on sensor

Differential Temperature

The differential temperature is between two standard Direct Sensors™ from Grundfos.
Vortex Flow sensor, Standard (VFS and VFS QT)

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Flow sensors

VFS, 1-20 l/min (0.2 - 5.3 gpm)

Fig. 37  VFS, 1-20 l/min

Dimensions

Fig. 38  Dimensions, VFS, 1-20 l/min, without adapter

Fig. 39  Dimensions, VFS, 1-20 l/min, with adapters

Sensor output signals

Specifications

Flow

| Measuring range | 1.3-20 l/min (0.34 to 5.3 gpm) |
| Accuracy (± 1σ) in water, 0-120 °C (32-248 °F) | ± 1 % FS |
| Response time (63.2 %) | Less than 1 s |
| Resolution | max flow/16384 l/min or gpm |

Temperature

| Measuring range | 0-120 °C (32-248 °F) |
| Accuracy (± 1σ), 15-90 °C (59-194 °F) | ± 0.5 K |
| Accuracy (± 1σ), 0-120 °C (32-248 °F) | ± 1 K |
| Response time (63.2 % at 50 % FS flow) | 250 ms |
| Resolution | 0.006 K |

Differential Temperature

| Accuracy 15-90 °C (59-194 °F) | 0.3 K |
| Accuracy 0-120 °C (32-248 °F) | 0.5 K |

System conditions and environment

- Liquid types: Aqueous media compatible with wetted materials. Kinematic viscosity less than 2 mm²/s (cSt)
- Liquid temperature, operation: Water: 0-100 °C (32-212 °F)
- Liquid temperature, peak: -25 °C (-13 °F), non-freezing 120 °C (248 °F) for 5 minutes, up to 3 weeks in sensor lifetime
- Ambient temperature, operation: -25 to +60 °C (-13 to 140 °F)
- Ambient temperature, peak: -55 to +180 °C (-67 to 356 °F)
- Humidity, relative: 0-95 %, non-condensing
- Maximum System Pressure: 24 bar (348 psig)
- Burst Pressure: 30 bar (435 psig)
- Maximum system pressure examples: Max 10 bar (145 psig) at 100 °C (212 °F)

Electrical data

- Power supply: 5 VDC (± 5 %), PELV
- Grounding of sensor supply required
- Output signals: Ratiometric
- Digital output signals: Grundfos open data protocol
- Analog output signals: 0.5 - 3.5 V for flow (zero at 0.35 V), 0.5 - 4.1 V for temperature (zero at 0.5 V and 100 °C at 3.5 V)
- Power consumption: Appr. 75 mW
- Load impedance: > 47 kΩ
- Maximum cable length: 3 m (9.10 ft)

Materials

- Sensing element: Silicon-based MEMS
- Sealing: EPDM O-rings, FKM O-rings or EPDM sealing cap with FKM O-rings
- Housing: Composite (PPS, PA66)
- Flow pipe: PPA 40-GF
- Wetted materials: Corrosion-resistant coating, EPDM or FKM, PPS, PPA 40-GF

Environmental standards

- Enclosure class: IP44, cable connected
- Temperature cycling: IEC 68-2-14
- Vibration, non-destructive: 20-2000 Hz, 10G, 4 h
- Electromagnetic compatibility: EN 61326-1

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Flow</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>1.3-20 l/min (0.34 to 5.3 gpm)</td>
<td>0-120 °C (32-248 °F)</td>
</tr>
<tr>
<td>Accuracy (± 1σ) in water, 0-120 °C (32-248 °F)</td>
<td>± 1 % FS</td>
<td>± 0.5 K</td>
</tr>
<tr>
<td>Accuracy (± 1σ), 0-120 °C (32-248 °F)</td>
<td>± 1 K</td>
<td>± 1 K</td>
</tr>
<tr>
<td>Response time (63.2 % at 50 % FS flow)</td>
<td>250 ms</td>
<td>250 ms</td>
</tr>
<tr>
<td>Resolution</td>
<td>max flow/16384 l/min or gpm</td>
<td>0.006 K</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Flow</th>
<th>Temperature</th>
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<td>Accuracy (± 1σ), 0-120 °C (32-248 °F)</td>
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<tr>
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<tr>
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<td>Resolution</td>
<td>max flow/16384 l/min or gpm</td>
<td>0.006 K</td>
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<td>0-120 °C (32-248 °F)</td>
</tr>
<tr>
<td>Accuracy (± 1σ) in water, 0-120 °C (32-248 °F)</td>
<td>± 1 % FS</td>
<td>± 0.5 K</td>
</tr>
<tr>
<td>Accuracy (± 1σ), 0-120 °C (32-248 °F)</td>
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<td>± 1 K</td>
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<tbody>
<tr>
<td>Measuring range</td>
<td>1.3-20 l/min (0.34 to 5.3 gpm)</td>
<td>0-120 °C (32-248 °F)</td>
</tr>
<tr>
<td>Accuracy (± 1σ) in water, 0-120 °C (32-248 °F)</td>
<td>± 1 % FS</td>
<td>± 0.5 K</td>
</tr>
<tr>
<td>Accuracy (± 1σ), 0-120 °C (32-248 °F)</td>
<td>± 1 K</td>
<td>± 1 K</td>
</tr>
<tr>
<td>Response time (63.2 % at 50 % FS flow)</td>
<td>250 ms</td>
<td>250 ms</td>
</tr>
<tr>
<td>Resolution</td>
<td>max flow/16384 l/min or gpm</td>
<td>0.006 K</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Flow</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
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<td>Measuring range</td>
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<td>0-120 °C (32-248 °F)</td>
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</tr>
<tr>
<td>Resolution</td>
<td>max flow/16384 l/min or gpm</td>
<td>0.006 K</td>
</tr>
</tbody>
</table>
Vortex Flow sensor, Standard (VFS and VFS QT)

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Flow sensors

VFS, 2-40 l/min (0.5 - 10.6 gpm)

Fig. 42 VFS, 2-40 l/min

Dimensions

Fig. 43 Dimensions, VFS, 2-40 l/min, without adapter

Fig. 44 Dimensions, VFS, 2-40 l/min, with adapters

Sensor output signals

Fig. 45 Flow response in Analogue mode

Fig. 46 Temperature response in Analogue mode

Specifications

<table>
<thead>
<tr>
<th>Flow</th>
<th>Measuring range 2-40 l/min (0.5 - 10.6 gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy (± 1 o) in water, 0-100 °C (32-212 °F)</td>
<td>± 1 % FS</td>
</tr>
<tr>
<td>Response time (63.2 %)</td>
<td>Less than 1 s</td>
</tr>
<tr>
<td>Resolution</td>
<td>max flow/16384 l/min or gpm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Measuring range 0-120 °C (32-248 °F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy (± 1 o), 15-90 °C (59-194 °F)</td>
<td>± 0.5 K</td>
</tr>
<tr>
<td>Accuracy (± 1 o), 0-120 °C (32-248 °F)</td>
<td>± 1 K</td>
</tr>
<tr>
<td>Response time (63.2 % at 50 % FS flow)</td>
<td>250 ms</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.006 K</td>
</tr>
</tbody>
</table>

Differential Temperature

Accuracy 15-90 °C (59-194 °F) 0.3 K
Accuracy 0-120 °C (32-248 °F) 0.5 K

System conditions and environment

Liquid types
Aqueous media compatible with wetted materials. Kinematic viscosity less than or equal to 2 mm²/s (cSt)

Liquid temperature, operation
Water: 0-100 °C (32-212 °F)

Liquid temperature, peak
120 °C (248 °F) for 5 minutes, up to 3 weeks in sensor lifetime

Ambient temperature, operation
-25 to +60 °C (-13 to +140 °F)

Ambient temperature, peak
-5 to +90 °C (-47 to 194 °F)

Humidity, relative
0-95 %, non-condensing

Maximum System Pressure
24 bar (348 psig)

Burst Pressure
30 bar (435 psig)

Maximum system pressure examples
Max 10 bar (145 psig) at 100 °C (212 °F)

Electrical data

Power supply
5 VDC (± 5 %), PELV

Grounding of sensor supply required

Output signals
Ratiometric

Digital output signals
Grundfos open data protocol

Analog output signals
0.5 - 3.5 V for flow (zero at 0.35 V)
0.5 - 4.1 V for temperature (zero at 0.5 V and 100 °C at 3.5 V)

Power consumption
Appr. 75 mW

Load impedance
> 47 kΩ

Maximum cable length
3 m (9.10 ft)

Materials

Sensing element
Silicon-based MEMS

Sealing
EPDM-O-rings or FKM O-rings or EPDM sealing cap with FKM O-rings

Housing
Composite (PPS, PA66)

Flow pipe
PPA 40-GF

Wetted materials
Corrosion-resistant coating, EPDM or FKM, PPS, PPA 40-GF

Environmental standards

Enclosure class
IP44, cable connected

Temperature cycling
IEC 68-2-14

Vibration, non-destructive
20-2000 Hz, 10g, 4 h

Electromagnetic compatibility
EN 51328-1

Specifications

<table>
<thead>
<tr>
<th>Flow</th>
<th>Measuring range 2-40 l/min (0.5 - 10.6 gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy (± 1 o) in water, 0-100 °C (32-212 °F)</td>
<td>± 1 % FS</td>
</tr>
<tr>
<td>Response time (63.2 %)</td>
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</tr>
<tr>
<td>Resolution</td>
<td>max flow/16384 l/min or gpm</td>
</tr>
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</table>

<table>
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<tr>
<th>Temperature</th>
<th>Measuring range 0-120 °C (32-248 °F)</th>
</tr>
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<tbody>
<tr>
<td>Accuracy (± 1 o), 15-90 °C (59-194 °F)</td>
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</tr>
<tr>
<td>Accuracy (± 1 o), 0-120 °C (32-248 °F)</td>
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<td>Response time (63.2 % at 50 % FS flow)</td>
<td>250 ms</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.006 K</td>
</tr>
</tbody>
</table>

Differential Temperature

Accuracy 15-90 °C (59-194 °F) 0.3 K
Accuracy 0-120 °C (32-248 °F) 0.5 K

System conditions and environment

Liquid types
Aqueous media compatible with wetted materials. Kinematic viscosity less than or equal to 2 mm²/s (cSt)

Liquid temperature, operation
Water: 0-100 °C (32-212 °F)

Liquid temperature, peak
120 °C (248 °F) for 5 minutes, up to 3 weeks in sensor lifetime

Ambient temperature, operation
-25 to +60 °C (-13 to +140 °F)

Ambient temperature, peak
-5 to +90 °C (-47 to 194 °F)

Humidity, relative
0-95 %, non-condensing

Maximum System Pressure
24 bar (348 psig)

Burst Pressure
30 bar (435 psig)

Maximum system pressure examples
Max 10 bar (145 psig) at 100 °C (212 °F)

Electrical data

Power supply
5 VDC (± 5 %), PELV

Grounding of sensor supply required

Output signals
Ratiometric

Digital output signals
Grundfos open data protocol

Analog output signals
0.5 - 3.5 V for flow (zero at 0.35 V)
0.5 - 4.1 V for temperature (zero at 0.5 V and 100 °C at 3.5 V)

Power consumption
Appr. 75 mW

Load impedance
> 47 kΩ

Maximum cable length
3 m (9.10 ft)

Materials

Sensing element
Silicon-based MEMS

Sealing
EPDM-O-rings or FKM O-rings or EPDM sealing cap with FKM O-rings

Housing
Composite (PPS, PA66)

Flow pipe
PPA 40-GF

Wetted materials
Corrosion-resistant coating, EPDM or FKM, PPS, PPA 40-GF

Environmental standards

Enclosure class
IP44, cable connected

Temperature cycling
IEC 68-2-14

Vibration, non-destructive
20-2000 Hz, 10g, 4 h

Electromagnetic compatibility
EN 51328-1
Vortex Flow sensor, Standard (VFS and VFS QT)

Flow sensors

VFS, 5-100 l/min (1.3 - 26 gpm)

Fig. 47  VFS, 5-100 l/min

Dimensions

Fig. 48  Dimensions, VFS, 5-100 l/min, without adapter

Fig. 49  Dimensions, VFS, 5-100 l/min, with adapters

Sensor output signals

Fig. 50  Flow response in Analog mode

Specifications

Flow

Measuring range 5-100 l/min (1.3 to 26.4 gpm)

Accuracy (± 1 %) in water, 0-100 °C (32-212 °F) ± 1 % FS

Response time (63.2 %) Less than 1 s

Resolution max flow/16384 l/min or gpm

Temperature

Measuring range 0-120 °C (32-248 °F)

Accuracy (± 0.5 K), 15-90 °C (59-194 °F) ± 0.5 K

Accuracy (± 1 K), 0-120 °C (32-248 °F) ± 1 K

Response time (63.2 % at 50 % FS flow) 250 ms

Resolution 0.006 K

Differential Temperature

Accuracy 15-90 °C (59-194 °F) 0.3 K

Accuracy 0-120 °C (32-248 °F) 0.5 K

System conditions and environment

Liquid types

Aqueous media compatible with wetted materials. Kinematic viscosity less than or equal to 2 mm²/s (cSt)

Liquid temperature, operation

Water: 0-100 °C (32-212 °F)

Liquid temperature, peak

-25 °C (-13 °F), non-freezing

Ambient temperature, operation

-25 to +60 °C (-13 to +140 °F)

Ambient temperature, peak

-55 to +194 °F (-47 to +90 °C)

Humidity, relative

0-95 %, non-condensing

Maximum System Pressure

24 bar (348 psig)

Burst Pressure

30 bar (435 psig)

Maximum system pressure examples

Max 10 bar (145 psig) at 100 °C (212 °F)

Electrical data

Power supply

5 VDC (± 5 %), PELV

Grounding of sensor supply required

Output signals

Ratiometric

Digital output signals

Grundfos open data protocol

Analog output signals

0.5 - 3.5 V for flow (zero at 0.35 V)

0.5 - 4.1 V for temperature (zero at 0.5 V and 100 °C at 3.5 V)

Power consumption

Appr. 75 mW

Load impedance

> 47 kΩ

Maximum cable length

3 m (9.10 ft)

Materials

Sensing element

Silicon-based MEMS

Sealing

EPDM O-rings, FKM O-rings or EPDM sealing cap with FKM O-rings

Housing

Composite (PPS, PA66)

Flow pipe

PPA 40-GF

Wetted materials

Corrosion-resistant coating, EPDM or FKM, PPS, PPA 40-GF

Environmental standards

Enclosure class

IP44, cable connected

Temperature cycling

IEC 68-2-14

Vibration, non-destructive

20-2000 Hz, 10g, 4 h

Electromagnetic compatibility

EN 55328-1
Vortex Flow sensor, Standard (VFS and VFS QT)

VFS, 10-200 l/min (2.6 - 53 gpm)

Dimensions

Sensor output signals

Specifications

Flow
- Measuring range: 10-200 l/min (2.6 to 52.8 gpm)
- Accuracy (± 1 %): ± 1 % FS
- Response time: Less than 1 s
- Resolution: max flow/16384 l/min or gpm

Temperature
- Measuring range: 0-120 °C (32-248 °F)
- Accuracy (± 1 %): ± 0.5 K
- Response time: (63.2 % at 50 % FS flow) 250 ms
- Resolution: 0.35 K

Differential Temperature
- Accuracy: 0.3 K

System conditions and environment
- Liquid types: Aqueous media compatible with wetted materials. Kinematic viscosity less than or equal to 2 mm²/s (cSt)
- Liquid temperature, operation: Water: 0-100 °C (32-212 °F)
- Liquid temperature, peak: -25 °C (-13 °F), non-freezing
- Ambient temperature, operation: -25 to +60 °C (-13 to +140 °F)
- Ambient temperature, peak: -55 to +90 °C (-67 to +194 °F)
- Humidity, relative: 0-95 %, non-condensing
- Maximum System Pressure: 24 bar (348 psig)
- Burst Pressure: 30 bar (435 psig)
- System pressure examples: Max 10 bar (145 psig) at 100 °C (212 °F)

Electrical data
- Power supply: 5 VDC (± 5 %), PELV
- Grounding of sensor supply required
- Output signals: Ratiometric
- Digital output signals: Grundfos open data protocol
- Analog output signals: 0.5 - 3.5 V for flow (zero at 0.35 V)
- 0.5 - 4.1 V for temperature (zero at 0.5 V and 100 °C at 3.5 V)
- Power consumption: Appr. 75 mW
- Load impedance: > 47 kΩ
- Maximum cable length: 3 m (9.10 ft)

Materials
- Sensing element: Silicon-based MEMS
- Sealing: EPDM-O-rings or FKM O-rings or EPDM sealing cap with FKM O-rings
- Housing: Composite (PPS, PA66)
- Flow pipe: PPA 40-GF
- Wetted materials: Corrosion-resistant coating, EPDM or FKM, PPS, PPA 40-GF

Environmental standards
- Enclosure class: IP44, cable connected
- Temperature cycling: IEC 68-2-14
- Vibration, non-destructive: 20-2000 Hz, 10G, 4 h
- Electromagnetic compatibility: EN 51328-1
Vortex Flow sensor, Standard (VFS and VFS QT)

Flow sensors

VFS, 20-400 l/min (5.3 - 106 gpm)

Dimensions

Fig. 57 VFS, 20-400 l/min

Fig. 58 Dimensions, VFS, 20-400 l/min, without adapter

Fig. 59 Dimensions, VFS 20-400 l/min, with adapters

Sensor output signals

Fig. 60 Flow response in Analogue mode

Fig. 61 Temperature response in Analogue mode

Specifications

Flow

- Measuring range: 20-400 l/min (5.3 to 105.7 gpm)
- Accuracy (± 1 σ) in water:
  - 0-120 °C (32-248 °F): ± 1 % FS
- Response time (63.2 %) Less than 1 s
- Resolution: max flow/18384 l/min or gpm

Temperature

- Measuring range: 0-120 °C (32-248 °F)
- Accuracy (± 1 σ):
  - 0-120 °C (32-248 °F): ± 1 K
- Response time (63.2 % at 50 % FS flow): 250 ms
- Resolution: 0.006 K

Differential Temperature

- Accuracy 15-90 °C (59-194 °F): 0.3 K
- Accuracy 0-120 °C (32-248 °F): 0.5 K

System conditions and environment

- Liquid types: Aqueous media compatible with wetted materials. Kinematic viscosity less than or equal to 2 mm²/s (cSt)
- Liquid temperature, operation: Water: 0-100 °C (32-212 °F)
- Liquid temperature, peak: -25 °C (-13 °F), non-freezing
- Ambient temperature, operation: -25 to +60 °C (-13 to +140 °F)
- Ambient temperature, peak: -55 to +90 °C (-67 to +194 °F)
- Humidity, relative: 0-95 %, non-condensing
- Maximum System Pressure: 24 bar (348 psig)
- Burst Pressure: 30 bar (435 psig)
- Maximum system pressure examples: Max 10 bar (145 psig) at 100 °C (212 °F)

Electrical data

- Power supply: 5 VDC (± 5 %), PELV
- Grounding of sensor supply required
- Output signals: Ratiometric
- Digital output signals: Grundfos open data protocol
- Analog output signals: 0.5 - 3.5 V for flow (zero at 0.35 V) 0.5 - 4.1 V for temperature (zero at 0.5 V and 100 °C at 3.5 V)
- Power consumption: Appr. 75 mW
- Load impedance: > 47 kΩ
- Maximum cable length: 3 m (9.10 ft)

Materials

- Sensing element: Silicon-based MEMS
- Sealing: EPDM O-rings, FKM O-rings or EPDM sealing cap with FKM O-rings
- Housing: Composite (PPS, PA66)
- Flow pipe: PPA 40-GF
- Wetted materials: Corrosion-resistant coating, EPDM or FKM, PPS, PPA 40-GF

Environmental standards

- Enclosure class: IP44, cable connected
- Temperature cycling: IEC 68-2-14
- Vibration, non-destructive: 20-2000 Hz, 10G, 4 h
- Electromagnetic compatibility: EN 61326-1
Vortex Flow sensor, Standard (VFS and VFS QT)

Flow sensors

VFS QT, 1-18 l/min (0.2 - 4.8 gpm)

Fig. 62 VFS QT, 1-18 l/min

Dimensions

Fig. 63 Dimensions, VFS QT, 1-18 l/min, with threads

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
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<tr>
<td>mm</td>
<td>110</td>
<td>58.8</td>
</tr>
<tr>
<td>in</td>
<td>4.33</td>
<td>2.31</td>
</tr>
</tbody>
</table>

Sensor output signals

Fig. 64 Flow response in Analogue mode

Fig. 65 Temperature response in Analogue mode

Specifications

Flow

- Measuring range: 1-18 l/min (0.2 to 4.8 gpm)
- Accuracy (± 1 σ) in water, 0-120 °C (32-248 °F): ± 1 % FS
- Response time (63.2 %): Less than 1 s
- Resolution: max flow/16384 l/min or gpm

Temperature

- Measuring range: 0-120 °C (32-248 °F)
- Accuracy (± 1 σ), 15-90 °C (59-194 °F): ± 0.5 K
- Accuracy (± 1 σ), 0-120 °C (32-248 °F): ± 1 K
- Response time (63.2 % at 50 % FS flow): 250 ms
- Resolution: 0.006 K

Differential Temperature

- Accuracy 15-90 °C (59-194 °F): 0.3 K
- Accuracy 0-120 °C (32-248 °F): 0.5 K

System conditions and environment

Liquid types

- Aqueous media compatible with wetted materials. Kinematic viscosity less than or equal to 2 mm²/s (cSt)

Liquid temperature, operation

- Water: 0-120 °C (32-248 °F)
- -25 °C (-13 °F), non-freezing to 120 °C (248 °F)

Ambient temperature, operation

- -25 to +60 °C (-13 to +140 °F)

Humidity, relative

- 0-95 %, non-condensing

Maximum System Pressure

- 30 bar (435 psig)

Burst Pressure

- 40 bar (580 psig)

Maximum system pressure examples

- Max 16 bar (232 psig) at 100 °C (212 °F)
- Max 8 bar (116 psig) at 120 °C (248 °F)

Electrical data

- Power supply: 5 VDC (± 5 %), PELV
- Grounding of sensor supply required
- Output signals: Ratiometric
- Digital output signals: Grundfos open data protocol
- Analog output signals: 0.5 - 4.1 V for flow (zero at 0.28 V and 15 l/m at 3.5 V)
- 0.5 - 4.1 V for temperature (zero at 0.5 V and 100 °C at 3.5 V)
- Power consumption: Aprr. 75 mW
- Load impedance: > 47 kΩ
- Maximum cable length: 3 m (9.10 ft)

Materials

- Sensing element: Silicon-based MEMS
- Sealing: EPDM O-rings, FKM O-rings or EPDM sealing cap with FKM O-rings
- Housing: Composite (PPS, PA66)
- Flow pipe: Stainless steel AISI 316 EN 1.4406
- Insert: PPA 40 GF
- Wetted materials: Corrosion-resistant coating EPDM or FKM, PPS, PPA 40-GF, 1.4408

Environmental standards

- Enclosure class: IP44, cable connected
- Temperature cycling: IEC 68-2-14
- Vibration, non-destructive: 20-2000 Hz, 106g/4 h
- Electromagnetic compatibility: EN 61326-1
Vortex Flow sensor, Standard (VFS and VFS QT)

**VFS QT, 2-40 l/min (0.5 - 10.6 gpm)**

Fig. 66  VFS QT, 2-40 l/min

**Dimensions**

![Dimensions, VFS QT, 2-40 l/min, with threads](image)

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>110</td>
<td>58.8</td>
</tr>
<tr>
<td>in</td>
<td>4.33</td>
<td>2.31</td>
</tr>
</tbody>
</table>

**Sensor output signals**

![Flow response in Analogue mode](image)

![Temperature response in Analogue mode](image)

**Specifications**

**Flow**
- Measuring range: 2-40 l/min (0.5 - 10.6 gpm)
- Accuracy (± 1 %) in water, 0-120 °C (32-248 °F) ± 1 % FS
- Response time (63.2 %): Less than 3 s
- Resolution: max flow/16384 l/min or gpm

**Temperature**
- Measuring range: 0-120 °C (32-248 °F)
- Accuracy (± 1 %), 15-90 °C (59-194 °F) ± 0.5 K
- Accuracy (± 1 %), 0-120 °C (32-248 °F) ± 1 K
- Response time: (63.2 % at 50 % FS flow) 250 ms
- Resolution: 0.006 K

**Differential Temperature**
- Accuracy: 15-90 °C (59-194 °F) 0.3 K
- Accuracy: 0-120 °C (32-248 °F) 0.5 K

**System conditions and environment**
- Liquid types: Aqueous media compatible with wetted materials. Kinematic viscosity less than or equal to 2 mm²/s (cSt)
- Liquid temperature, operation: Water: 0-100 °C (32-212 °F)
- Liquid temperature, peak: -25 °C (-13 °F), non-freezing 120 °C (248 °F)
- Ambient temperature, operation: -25 to +60 °C (-13 to +140 °F)
- Ambient temperature, peak: -55 to +90 °C (-67 to +194 °F)
- Humidity, relative: 0-95 %, non-condensing
- Maximum System Pressure: 30 bar (435 psig)
- Burst Pressure: 40 bar (580 psig)
- Maximum system pressure examples: Max 16 bar (232 psig) at 100 °C (212 °F)
- Max 8 bar (116 psig) at 120 °C (248 °F)

**Electrical data**
- Power supply: 5 VDC (± 5 %), PELV
- Grounding of sensor supply required
- Output signals: Ratiometric
- Digital output signals: Grundfos open data protocol
- Analog output signals: 0.5 - 3.5 V for flow (zero at 0.35 V)
- 0.5 - 4.1 V for temperature (zero at 0.5 V and 100 °C at 3.5 V)
- Power consumption: Appr. 75 mW
- Load impedance ≥ 47 kΩ
- Maximum cable length: 3 m (9.10 ft)

**Materials**
- Sensing element: Silicon-based MEMS
- Sealing: EPDM O-rings, FKM O-rings or EPDM sealing cap with FKM O-rings
- Housing: Composite (PPS, PA66)
- Flow pipe: Stainless steel AISI 316 EN 1.4408
- Insert: PPA 40 GF
- Wetted materials: Corrosion-resistant coating, EPDM or FKM, PPS, PPA 40-GF, 1.4408

**Environmental standards**
- Enclosure class: IP44, cable connected
- Temperature cycling: IEC 68-2-14
- Vibration, non-destructive: 20-2000 Hz, 10G, 4 h
- Electromagnetic compatibility: EN 55238-1
Vortex Flow sensor, Standard (VFS and VFS QT)

**Flow sensors**

VFS QT, 5-100 l/min (1.3 - 26 gpm)

**Dimensions**

![Dimensions, VFS QT, 5-100 l/min, with threads](image)

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
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<tr>
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</table>

**Sensor output signals**

![Flow response in Analogue mode](image)

![Temperature response in Analogue mode](image)

**Specifications**

**Flow**

- Measuring range: 5-100 l/min (1.3 to 26.4 gpm)
- Accuracy (± 1σ), 0-100 °C (32-212 °F) ± 1 % FS
- Response time (63.2 %) Less than 1 s
- Resolution: max flow/16384 l/min or gpm

**Temperature**

- Measuring range: 0-120 °C (32-248 °F)
- Accuracy (± 1σ), 15-90 °C (59-194 °F) ± 0.5 K
- Accuracy (± 1σ), 0-120 °C (32-248 °F) ± 1 K
- Response time (63.2 % at 50 % FS flow): 250 ms
- Resolution: 0.006 K

**Differential Temperature**

- Accuracy 15-90 °C (59-194 °F): 0.3 K
- Accuracy 0-120 °C (32-248 °F): 0.5 K

**System conditions and environment**

**Liquid types**

- Aqueous media compatible with wetted materials. Kinematic viscosity less than or equal to 2 mm²/s (cSt)

**Liquid temperature, operation**

- Water: 0-120 °C (32-248 °F)
- -25 to +60 °C (-13 to +140 °F), non-freezing

**Liquid temperature, peak**

- -55 to +194 °C (-67 to +381 °F)

**Humidity, relative**

- 0-95 %, non-condensing

**Maximum System Pressure**

- 30 bar (435 psig)
- 40 bar (580 psig)

**Maximum system pressure examples**

- Max 16 bar (232 psig) at 100 °C (212 °F)
- Max 8 bar (116 psig) at 120 °C (248 °F)

**Electrical data**

- Power supply: 5 VDC (± 5 %). We recommend grounding of the sensor supply (PELV).

**Output signals**

- Ratiometric

**Digital output signals**

- Grundfos open data protocol

**Analogue output signals**

- 0.5 - 3.5 V for flow (zero at 0.35 V)
- 0.5 - 4.1 V for temperature (zero at 0.5 V and 100 °C at 3.5 V)

**Power consumption**

- Appr. 75 mW

**Load impedance**

- > 47 kΩ

**Maximum cable length**

- 3 m (9.10 ft)

**Materials**

- Sensing element: Silicon-based MEMS
- Sealing: EPDM O-rings, FKM O-rings or EPDM sealing cap with FKM O-rings
- Housing: Composite (PPS, PA66)
- Flow pipe: Stainless steel AISI 316 EN 1.4408
- Insert: PPA 40-GF
- Wetted materials: Corrosion-resistant coating, EPDM or FKM, PPS, PPA 40-GF, 1.4408

**Environmental standards**

- Enclosure class: IP44, cable connected
- Temperature cycling: IEC 68-2-14
- Vibration, non-destructive: 20-2000 Hz, 10g, 4 h
- Electromagnetic compatibility: EN 61326-1
Vortex Flow sensor, Standard (VFS and VFS QT)

**Flow sensors**

**VFS QT, 10-200 l/min (2.6 - 53 gpm)**

**Dimensions**

![Dimensions, VFS QT, 10-200 l/min, with threads](image)

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>137.5 ISO 228/1 - G1 1/4 A</td>
<td>74.1</td>
</tr>
<tr>
<td>in</td>
<td>5.41</td>
<td>2.92</td>
</tr>
</tbody>
</table>

**Sensor output signals**

![Flow response in Analogue mode](image)

![Temperature response in Analogue mode](image)

**Specifications**

**Flow**

- Measuring range: 10-200 l/min (2.6 to 52.8 gpm)
- Accuracy (± 1 %) in water, 0-100 °C (32-212 °F) ± 1 % FS
- Response time (63.2 %): Less than 1.0 s
- Resolution: Max flow/16384 l/min or gpm

**Temperature**

- Measuring range: 0-120 °C (32-248 °F)
- Accuracy (± 1 %):
  - 0-120 °C (32-248 °F) ± 1 °C
- Response time (63.2 % at 50 % FS flow): 250 ms
- Resolution: 0.006 K

**Differential Temperature**

- Accuracy 15-90 °C (59-194 °F): 0.3 K
- Accuracy 0-120 °C (32-248 °F): 0.5 K

**System conditions and environment**

**Liquid types**

- Aqueous media compatible with wetted materials. Kinematic viscosity less than or equal to 2 mm²/s (cSt)
- Water: 0-120 °C (32-248 °F)

**Liquid temperature, operation**

- -25 to +13 °F, non-freezing
- 120 °C (248 °F)

**Ambient temperature, operation**

- -25 to +20 °C (-13 to +68 °F)
- -65 to +90 °C (-67 to +194 °F)

**Humidity, relative**

- 0-95 %, non-condensing

**Maximum System Pressure**

- 16 bar (232 psig) at 100 °C (212 °F)
- 8 bar (116 psig) at 120 °C (248 °F)

**Electrical data**

- Power supply: 5 VDC (± 5 %), PELV
- Grounding of sensor supply required

**Output signals**

- Ratiometric

**Digital output signals**

- Grundfos open data protocol

**Analog output signals**

- 0.5 - 3.5 V for flow (zero at 0.35 V)
- 0.5 - 4.1 V for temperature (zero at 0.5 V and 100 °C at 3.5 V)

**Power consumption**

- Appr. 75 mW

**Maximum cable length**

- 3 m (9.10 ft)

**Materials**

- Sensing element: Silicon-based MEMS
- Sealing: EPDM O-rings, FKM O-rings or EPDM sealing cap with FKM O-rings
- Housing: Composite (PPS, PA66)
- Flow pipe: Stainless steel 1.4408 (AISI 316)
- Insert: PPA 40-GF
- Wetted materials: Corrosion-resistant coating, EPDM or FKM

**Environmental standards**

- Enclosure class: IP44, cable connected
- Temperature cycling: IEC 68-2-14
- Vibration, non-destructive: 20-2000 Hz, 10G, 4 h
- Electromagnetic compatibility: EN 51328-1
5. Multi Flow sensor, standard (MFS and MFS QT)

General data

![Image](MFS.png)

**Fig. 78** MFS and MFS QT, 4-40 l/min

Technical overview

The MFS is a combined flow, pressure and temperature sensor (three-in-one) from Grundfos Direct Sensors™. The sensor is based on the principle of vortex shedding behind a bluff body. The MFS sensor is designed for high-volume production and fully compatible with wet, aggressive liquids. The sensor is based on MEMS sensing technology in combination with a unique packaging concept using corrosion-resistant coating on the MEMS sensor chip. This makes the sensor very robust and ideal for high-volume OEM (Original Equipment Manufacturer) applications.

Applications

- Pump control
- HVAC systems
- temperature control and chiller systems
- renewable energies such as heat pumps, solar thermals, fresh water and micro-CHP systems
- monitoring and control systems
- water treatment plants
- water utility and distribution systems
- HPC (High-Performance Computing) and IT cooling systems.

Features and benefits

- Flow, pressure and temperature measurement in one sensor (three-in-one solution) for easy and cost-efficient installation
- Measurement principle with no movable parts, resulting in no wear and tear
- self-configuring digital or analog output
- MEMS technology
- direct contact with the liquid resulting in a fast response time
- plug and play for quick setup
- smart system solution with Grundfos pump controls
- compact and robust design
- compatible with aqueous media
- For aqueous media below 2 µS/cm contact your local Grundfos sensor representative

- suitable for a wide temperature range
- suitable for a wide range of application.

Approvals (w/EPDM O-rings)

- WRAS
- KTW
- ACS.

Certificates

![Certification](Certification.png)

Electrical connections

![Electrical Connections](ElectricalConnections.png)

**Pin configuration**

<table>
<thead>
<tr>
<th>Analog signal</th>
<th>Digital signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Analog signal 1</td>
<td>Rx</td>
</tr>
<tr>
<td>2 Analog signal 2</td>
<td>Tx</td>
</tr>
<tr>
<td>3 GND (0 V), PELV</td>
<td>GND (0 V), PELV</td>
</tr>
<tr>
<td>4 Power supply, + 5 VDC</td>
<td>Power supply, + 5 VDC</td>
</tr>
</tbody>
</table>

Power supply requirements

- 5 VDC ± 5 %, PELV
- maximum 10 mV ripple, 50 Hz
- minimum output current, 25 mA
- separated from hazardous live circuitry by double or reinforced insulation
- grounding of sensor supply is required.

Directives

The Grundfos Direct Sensors™ are in conformity with these council directives on the approximation of the laws of the EC member states:

- Low Voltage Directive (2014/35/EU)
  - Standards used: EN 61010-1:2010
  - Standards used: EN 61326-1:2013 and EN 61326-2-3:2013

The Grundfos Direct Sensors™ are exempted from the Pressure Equipment Directive (PED) according to Article 4, paragraph 3 in the PED 2014/68/EU.
Flow sensors

**MFS sensors**

The MFS flow sensor consists of a composite flow pipe and a sensor fitted with cable. The MFS flow sensor is available in 2-20, 4-40, 10-100, 20-200, 40-400 l/min versions.

**MFS QT sensors**

The MFS QT flow sensor consists of a composite insert, a stainless steel flow pipe and a sensor fitted with cable. The MFS QT flow sensor is available in 2-18, 4-40, 10-100, 20-200 l/min versions.

**Differential Temperature**

The differential temperature is between two standard Direct Sensors™ from Grundfos.

**Snap-on sensor**

Fig. 80 The MFS family

Fig. 81 The MFS QT family

Fig. 82 Snap-on sensor
MFS 2-20 l/min (0.53 - 5.3 gpm)

Fig. 83  MFS 2-20 l/min

Dimensions

Fig. 84  Dimensions, MFS 2-20 l/min, without adapter

Fig. 85  Dimensions, MFS 2-20 l/min, with adapters

Sensor output signals

Fig. 86  Flow response in Analogue mode

Flow

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Unit(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>2-20 l/min (0.53 to 5.3 gpm)</td>
</tr>
<tr>
<td>Accuracy (± 1 σ) in water, 0-120 °C (32-248 °F)</td>
<td>± 1 % FS</td>
</tr>
<tr>
<td>Response time (63.2 %)</td>
<td>Less than 4 s</td>
</tr>
<tr>
<td>Resolution</td>
<td>max flow/16384 l/min or gpm</td>
</tr>
</tbody>
</table>

Pressure

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Unit(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>0-10 bar (0-145 psig)</td>
</tr>
<tr>
<td>Accuracy (± 1 σ), 15-90 °C (59-194 °F)</td>
<td>± 2.0 % FS</td>
</tr>
<tr>
<td>Accuracy (± 1 σ), 0-120 °C (32-248 °F)</td>
<td>± 2.5 % FS</td>
</tr>
<tr>
<td>Response time for sensor electronic</td>
<td>250 ms</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.6 mbar (0.009 psig)</td>
</tr>
</tbody>
</table>

Temperature

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Unit(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>0-120 °C (32-248 °F)</td>
</tr>
<tr>
<td>Accuracy (± 1 σ), 15-90 °C (59-194 °F)</td>
<td>± 0.5 K</td>
</tr>
<tr>
<td>Accuracy (± 1 σ), 0-120 °C (32-248 °F)</td>
<td>± 1 K</td>
</tr>
<tr>
<td>Response time (63.2 % at 50 % FS flow)</td>
<td>250 ms</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.006 K</td>
</tr>
</tbody>
</table>

Differential Temperature

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Unit(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy 15-90 °C (59-194 °F)</td>
<td>0.3 K</td>
</tr>
<tr>
<td>Accuracy 0-120 °C (32-248 °F)</td>
<td>0.5 K</td>
</tr>
</tbody>
</table>

System conditions and environment

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Unit(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aqueous media compatible with wetted materials. Kinematic viscosity less than or equal to 2 mm²/s (cSt)</td>
<td></td>
</tr>
<tr>
<td>System temperature, operation</td>
<td>-25 °C to 131 °F, non-freezing</td>
</tr>
<tr>
<td>System temperature, peak</td>
<td>120 °C (248 °F) for 5 minutes, up to 3 weeks in sensor lifetime</td>
</tr>
<tr>
<td>Ambient temperature, operation</td>
<td>-25 to +60 °C (-13 to +140 °F)</td>
</tr>
<tr>
<td>Ambient temperature, peak</td>
<td>-55 to +90 °C (-67 to +194 °F)</td>
</tr>
<tr>
<td>Humidity, relative</td>
<td>0-95 %, non-condensing</td>
</tr>
<tr>
<td>Maximum System Pressure</td>
<td>24 bar (348 psig)</td>
</tr>
<tr>
<td>Burst Pressure</td>
<td>30 bar (435 psig)</td>
</tr>
<tr>
<td>Maximum system pressure example</td>
<td>Max 10 bar (145 psig) at 100 °C (212 °F)</td>
</tr>
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</table>

Electrical data

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Unit(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>5 VDC (± 5 %), PELV</td>
</tr>
<tr>
<td>Grounding of sensor supply required</td>
<td>Groundngs of sensor supply required</td>
</tr>
<tr>
<td>Digital output signals</td>
<td>Grundfos open data protocol</td>
</tr>
<tr>
<td>Analog output signals, only two signals possible (analogue variants are upon request)</td>
<td>0.5 - 3.5 for flow (zero at 0.35 V) and pressure (zero at 0.5 V)</td>
</tr>
<tr>
<td>0.5 - 4.1 V for temperature (zero at 0.5 V and 100 °C at 3.5 V)</td>
<td></td>
</tr>
<tr>
<td>Power consumption</td>
<td>Approximately 75 mW</td>
</tr>
<tr>
<td>Load impedance</td>
<td>&gt; 47 kΩ</td>
</tr>
</tbody>
</table>

Materials

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Unit(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensing element</td>
<td>Silicon-based MEMS</td>
</tr>
<tr>
<td>Sealing</td>
<td>EPDM O-ring or FKM O-ring</td>
</tr>
<tr>
<td>Housing</td>
<td>Composite (PPS, PA66)</td>
</tr>
<tr>
<td>Flow pipe</td>
<td>PPA 40-GF</td>
</tr>
<tr>
<td>Wetted materials</td>
<td>Corrosion-resistant coating, EPDM or FKM, PPS, PPA 40-GF</td>
</tr>
</tbody>
</table>

Environmental standards

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Unit(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enclosure class</td>
<td>IP44, cable connected</td>
</tr>
<tr>
<td>Temperature cycling</td>
<td>IEC 68-2-14</td>
</tr>
<tr>
<td>Vibration, non-destructive</td>
<td>20-2000 Hz, 10G, 4 h</td>
</tr>
<tr>
<td>Electromagnetic compatibility</td>
<td>EN 55122-1</td>
</tr>
</tbody>
</table>
Flow sensors

**MFS 4-40 l/min (1.06 - 10.6 gpm)**

**Specifications**

**Flow**
- Measuring range: 4-40 l/min (1.06 - 10.6 gpm)
- Accuracy (± 1 %) in water: ± 1 % FS
- Response time (63.2 %): Less than 4 s
- Resolution: Max flow/16384 l/min or gpm

**Pressure**
- Measuring range: 0-10 bar (0-145 psig)
- Accuracy (± 1 %): ± 2.0 % FS
- Accuracy (± 1 %): ± 2.5 % FS
- Response time for sensor electronic: 250 ms
- Resolution: 0.6 mbar (0.009 psig)

**Temperature**
- Measuring range: 0-120 °C (32-248 °F)
- Accuracy (± 1 %): ± 0.5 K
- Accuracy (± 1 %): ± 1 K
- Response time (63.2 % at 50 % FS flow): 250 ms
- Resolution: 0.006 K

**System conditions and environment**

**Liquids**
- Aqueous media compatible with wetted materials. Kinematic viscosity less than or equal to 2 mm²/s (cSt)
- System temperature, operation: 0-100 °C (32-212 °F)
- System temperature, peak: -25 °C (-13 °F), non-freezing
- Ambient temperature, operation: -25 to +60 °C (-13 to +140 °F)
- Ambient temperature, peak: -55 to +90 °C (-67 to +194 °F)
- Humidity, relative: 0-95 %, non-condensing
- Maximum system pressure example: Max 10 bar (145 psig) at 100 °C (212 °F)

**Electrical data**
- Power supply: 5 VDC (± 5 %), PELV
- Grounding of sensor supply required
- Digital output signals: Grundfos open data protocol
- Analog output signals, only two signals possible (analogue variants are upon request)
  - 0.5 - 3.5 V for flow (zero at 0.35 V) and pressure (zero at 0.5 V)
  - 0.5 - 4.1 V for temperature (zero at 0.5 V and 100 °C at 3.5 V)
- Power consumption: Approximately 75 mW
- Load impedance: > 47 kΩ

**Materials**
- Sensing element: Silicon-based MEMS
- Sealing: EPDM O-ring or FKM O-ring
- Housing: Composite (PPS, PA66)
- Flow pipe: PPA 40-GF
- Wetted materials: Corrosion-resistant coating, EPDM or FKM, PPS, PPA 40-GF

**Environmental standards**
- Enclosure class: IP44, cable connected
- Temperature cycling: IEC 68-2-14
- Vibration, non-destructive: 20-2000 Hz, 10G, 4 h
- Electromagnetic compatibility: EN 61326-1
**Specifications**

### Flow
- **Measuring range**: 10-100 l/min (2.6-26 gpm)
- **Accuracy**: ± 1 % FS
- **Response time**: Less than 4 s
- **Resolution**: max flow/16384 l/min or gpm

### Pressure
- **Measuring range**: 0-10 bar (0-145 psig)
- **Accuracy**: ± 2.0 % FS
- **Response time**: 250 ms
- **Resolution**: 0.6 mbar (0.009 psig)

### Temperature
- **Measuring range**: 0-120 °C (32-248 °F)
- **Accuracy**: ± 1 K
- **Response time**: 250 ms
- **Resolution**: 0.006 K

### Differential Temperature
- **Accuracy**: 0.3 K

### System conditions and environment
- **Liquid types**: Aqueous media compatible with wetted materials. Kinematic viscosity less than or equal to 2 mm²/s (cSt)
- **System temperature, operation**: 0-120 °C (32-248 °F)
- **System temperature, peak**: -25 °C (-13 °F), non-freezing
- **Ambient temperature, operation**: 0-100 °C (32-212 °F)
- **Ambient temperature, peak**: -55 to +90 °C (-67 to +194 °F)
- **Humidity, relative**: 0-95 %, non-condensing
- **Maximum System Pressure**: 24 bar (348 psig)
- **Burst Pressure**: 30 bar (435 psig)
- **Maximum system pressure example**: Max. 10 bar (145 psig) at 100 °C (212 °F)

### Electrical data
- **Power supply**: 5 VDC (± 5 %), PELV
- **Grounding of sensor supply**: required
- **Digital output signals**: Grundfos open data protocol
- **Analog output signals**: only two signals possible (analogue variants are upon request)
  - 0.5 - 3.5 V for flow (zero at 0.35 V)
  - 0.5 - 4.1 V for temperature (zero at 0.5 V and 100 °C at 3.5 V)
- **Power consumption**: Approximately 75 mW
- **Load impedance**: > 47 kΩ

### Materials
- **Sensing element**: Silicon-based MEMS
- **Sealing**: EPDM O-ring or FKM O-ring
- **Housing**: Composite (PPS, PA66)
- **Flow pipe**: PPA 40-GF
- **Wetted materials**: Corrosion-resistant coating, EPDM or FKM, PPS, PPA 40-GF

### Environmental standards
- **Enclosure class**: IP44, cable connected
- **Temperature cycling**: IEC 68-2-14
- **Vibration, non-destructive**: 20-2000 Hz, 10G, 4 h
- **Electromagnetic compatibility**: EN 61326-1
Flow sensors

**MFS 20-200 l/min (5.3 - 53 gpm)**

![Fig. 98 MFS 20-200 l/min](image)

**Dimensions**

![Fig. 99 Dimensions, MFS 20-200 l/min, without adapter](image)

![Fig. 100 Dimensions, MFS 20-200 l/min, with adapters](image)

**Sensor output signals**

![Fig. 101 Flow response in Analogue mode](image)

![Fig. 102 Pressure and temperature response in Analogue mode](image)

**Specifications**

**Flow**
- **Measuring range**: MFS 20-200 (5.3 - 53 gpm)
- **Accuracy**: ± 1 % FS
- **Response time**: Less than 4 s
- **Resolution**: max flow/16384 l/min or gpm

**Pressure**
- **Measuring range**: 0-10 bar (0-145 psig)
- **Accuracy**: ± 2.0 % FS
- **Response time**: 250 ms
- **Resolution**: 0.6 mbar (0.009 psig)

**Temperature**
- **Measuring range**: 0-120 °C (32-248 °F)
- **Accuracy**: ± 0.5 K
- **Response time**: 250 ms
- **Resolution**: 0.006 K

**Differential Temperature**
- **Accuracy**: 0.3 K
- **Accuracy**: 0.5 K

**System conditions and environment**

**Liquid types**
- Aqueous media compatible with wetted materials
- Kinematic viscosity less than or equal to 2 mm²/s (cSt)

**System temperature, operation**
- 0-100 °C (32-212 °F)
- 0-120 °C (32-248 °F)
- 25 °C (77 °F), non-freezing
- 120 °C (248 °F) for 5 minutes, up to 3 weeks in sensor lifetime

**Ambient temperature, operation**
- -25 to +80 °C (-13 to +140 °F)
- -55 to +90 °C (-67 to +194 °F)

**Humidity, relative**
- 0-95 %, non-condensing

**Maximum System Pressure**
- 24 bar (348 psig)
- 30 bar (435 psig)
- Max 10 bar (145 psig) at 100 °C (212 °F)

**Electrical data**
- **Power supply**: 5 VDC (± 5 %), PELV
- **Grounding of sensor supply**: required
- **Digital output signals**: Grundfos open data protocol
- **Analog output signals**: only two signals possible (analogue variants are upon request)
  - 0.5 - 3.5 for flow (zero at 0.35 V) and pressure (zero at 0.5 V)
  - 0.5 - 4.1 V for temperature (zero at 0.5 V and 100 °C at 3.5 V)
- **Power consumption**: Approximately 75 mW
- **Load impedance**: > 47 kΩ

**Materials**
- **Sensing element**: Silicon-based MEMS
- **Sealing**: EPDM O-ring or FKM O-ring
- **Housing**: Composite (PPS, PA66)
- **Flow pipe**: PPA 40-GF
- **Wetted materials**: Corrosion-resistant coating, EPDM or FKM, PPS, PPA 40-GF

**Environmental standards**
- **Enclosure class**: IP44, cable connected
- **Temperature cycling**: IEC 68-2-14
- **Vibration, non-destructive**: 20-2000 Hz, 10G, 4 h
- **Electromagnetic compatibility**: EN 61326-1
**MFS 40-400 l/min (10.6 - 106 gpm)**

**Dimensions**

![Dimensions, MFS 40-400 l/min, without adapter]

![Dimensions, MFS 40-400 l/min, with adapters]

**Sensor output signals**

![Flow response in Analogue mode]

![Pressure and temperature response in Analogue mode]

**Specifications**

<table>
<thead>
<tr>
<th>Flow</th>
<th>MFS 40-400 (10.6 - 106 gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>0-120 °C (32-248 °F)</td>
</tr>
<tr>
<td>Accuracy (± 1 σ), in water</td>
<td>± 1 % FS</td>
</tr>
<tr>
<td>Response time (63.2 %)</td>
<td>Less than 4 s</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pressure</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>0-10 bar (0-145 psig)</td>
</tr>
<tr>
<td>Accuracy (± 1 σ), 0-120 °C (32-248 °F)</td>
<td>± 2.5 % FS</td>
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<tr>
<td>Response time for sensor electronic</td>
<td>250 ms</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.6 mbar (0.009 psig)</td>
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</table>

<table>
<thead>
<tr>
<th>Temperature</th>
<th></th>
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<tbody>
<tr>
<td>Measuring range</td>
<td>15-90 °C (194-392 °F)</td>
</tr>
<tr>
<td>Accuracy (± 1 σ)</td>
<td>± 0.5 K</td>
</tr>
<tr>
<td>Maximum System Pressure</td>
<td>24 bar (345 psig)</td>
</tr>
<tr>
<td>Burst Pressure</td>
<td>3 bar (45 psig)</td>
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</table>

<table>
<thead>
<tr>
<th>System conditions and environment</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid types</td>
<td>Aqueous media compatible with wetted materials. Kinematic viscosity less than or equal to 2 mm²/s (cSt)</td>
</tr>
<tr>
<td>System temperature, operation</td>
<td>0-100 °C (32-212 °F)</td>
</tr>
<tr>
<td>System temperature, peak</td>
<td>120 °C (248 °F)</td>
</tr>
<tr>
<td>Ambient temperature, operation</td>
<td>-25 °C (-13 °F), non-freezing</td>
</tr>
<tr>
<td>Ambient temperature, peak</td>
<td>-55 to +90 °C (-67 to +194 °F)</td>
</tr>
<tr>
<td>Humidity, relative</td>
<td>0-95 %, non-condensing</td>
</tr>
<tr>
<td>Maximum system pressure example</td>
<td>Max 10 bar (145 psig) at 100 °C (212 °F)</td>
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<thead>
<tr>
<th>Electrical data</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>5 VDC (± 5 %), PELV</td>
</tr>
<tr>
<td>Grounding of sensor supply</td>
<td>Required</td>
</tr>
<tr>
<td>Analog output signals</td>
<td>Grundfos open data protocol</td>
</tr>
<tr>
<td>Analog output signals, only two signals possible (analogue variants are upon request)</td>
<td>0.5 - 3.5 V for flow (zero at 0.35 V) and pressure (zero at 0.5 V)</td>
</tr>
<tr>
<td>Load impedance</td>
<td>&gt; 47 kΩ</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Materials</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensing element</td>
<td>Silicon-based MEMS</td>
</tr>
<tr>
<td>Sealing</td>
<td>EPDM O-ring or FKM O-ring</td>
</tr>
<tr>
<td>Housing</td>
<td>Composite (PPS, PA66)</td>
</tr>
<tr>
<td>Flow pipe</td>
<td>PPA 40-GF</td>
</tr>
<tr>
<td>Wetted materials</td>
<td>Corrosion-resistant coating, EPDM or FKM, PPS, PPA 40-GF</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Environmental standards</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Enclosure class</td>
<td>IP44, cable connected</td>
</tr>
<tr>
<td>Temperature cycling</td>
<td>IEC 68-2-14</td>
</tr>
<tr>
<td>Vibration, non-destructive</td>
<td>20-2000 Hz, 10G, 4 h</td>
</tr>
<tr>
<td>Electromagnetic compatibility</td>
<td>EN 61326-1</td>
</tr>
</tbody>
</table>
Flow sensors

MFS QT 2-18 l/min (0.39 - 4.8 gpm)

**Fig. 108** MFS QT 2-18 l/min

**Dimensions**

![Dimensions, MFS QT 2-18 l/min, with threads](image)

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>110</td>
<td>58.8</td>
</tr>
<tr>
<td>in</td>
<td>4.33</td>
<td>2.31</td>
</tr>
</tbody>
</table>

**Sensor output signals**

![Flow response in Analogue mode](image)

**Specifications**

**Flow**

- **Measuring range**: 2-18 l/min (0.39 - 4.8 gpm)
- **Accuracy (± 1 %)** in water, 0-120 °C (32-248 °F)
  - ± 1 % FS
- **Response time (63.2 %)**: Less than 4 s
- **Resolution**: max flow/16384 l/min or gpm

**Pressure**

- **Measuring range**: 0-10 bar (0-145 psig)
- **Accuracy (± 1 %)**, 15-90 °C (59-194 °F)
  - ± 2.0 % FS
- **Accuracy (± 1 %)**, 0-120 °C (32-248 °F)
  - ± 2.5 % FS
- **Response time for sensor electronic**: 250 ms
- **Resolution**: 0.6 mbar (0.009 psig)

**Temperature**

- **Measuring range**: 0-120 °C (32-248 °F)
- **Accuracy (± 1 %)**, 15-90 °C (59-194 °F)
  - ± 0.5 K
- **Accuracy (± 1 %)**, 0-120 °C (32-248 °F)
  - ± 1 K
- **Response time** (63.2 % at 50 % FS flow): 250 ms
- **Resolution**: 0.008 K

**Differential Temperature**

- **Accuracy 15-90 °C (59-194 °F)**: 0.3 K
- **Accuracy 0-120 °C (32-248 °F)**: 0.5 K

**System conditions and environment**

- **Liquid types**: Aqueous media compatible with wetted materials
  - Kinematic viscosity less than or equal to 2 mm²/s (cSt)
- **System temperature, operation**: 0-120 °C (32-248 °F)
- **System temperature, peak**: -25 °C (-13 °F), non-freezing
  - 120 °C (248 °F)
- **Ambient temperature, operation**: -25 to +60 °C (-13 to +140 °F)
- **Ambient temperature, peak**: -55 to +90 °C (-67 to +194 °F)
- **Humidity, relative**: 0-95 %, non-condensing
- **Maximum System Pressure**: 30 bar (435 psig)
- **Burst Pressure**: 40 bar (580 psig)
- **Maximum system pressure example**: Max 16 bar (232 psig) at 100 °C (212 °F)
  - Max 8 bar (116 psig) at 120 °C (248 °F)

**Electrical data**

- **Power supply**: 5 VDC (± 5 %), PELV
  - Grounding of sensor supply required
- **Digital output signals**: Grundfos open data protocol
- **Analogue output signals, only two signals possible (analogue variants are upon request)**
  - 0.5 - 4.1 for flow (zero at 0.28 V and 15 l/m at 3.5 V) and pressure (zero at 0.5 V)
  - 0.5 - 4.1 V for temperature (zero at 0.5 V and 100 °C at 3.5 V)
- **Power consumption**: Approximately 75 mW
- **Load impedance**: > 47 kΩ

**Materials**

- **Sensing element**: Silicon-based MEMS
- **Sealing**: EPDM O-ring or FKM O-ring
- **Housing**: Composite (PPS, PA66)
- **Flow pipe**: Stainless steel AISI 316 EN 1.4408
- **Insert**: PPA 40 GF
- **Wetted materials**: Corrosion-resistant coating, EPDM or FKM, PPS, PPA 40-GF, 1.4408

**Environmental standards**

- **Enclosure class**: IP44, cable connected
- **Temperature cycling**: IEC 68-2-14
- **Vibration, non-destructive**: 20-2000 Hz, 10G, 4 h
- **Electromagnetic compatibility**: EN 61326-1

---

**Fig. 109** Dimensions, MFS QT 2-18 l/min, with threads

**Fig. 110** Flow response in Analogue mode

**Fig. 111** Pressure and temperature response in Analogue mode
**MFS QT 4-40 l/min (1 - 10.6 gpm)**

**Dimensions**

![Dimensions, MFS QT 4-40 l/min, with threads](image)

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>in</td>
<td></td>
</tr>
<tr>
<td>110</td>
<td>4.33</td>
<td>58.8</td>
</tr>
<tr>
<td>ISO 228/1 - G3/4 A</td>
<td>2.31</td>
<td></td>
</tr>
</tbody>
</table>

**Sensor output signals**

![Flow response in Analogue mode](image)

![Pressure and temperature response in Analogue mode](image)

**Specifications**

**Flow**
- Measuring range: QT 4-40 l/min (1-10.6 gpm)
- Accuracy (± 1 %) in water: 0-120 °C (32-248 °F)
- ± 1 % FS
- Response time: Less than 4 s
- Resolution: max flow/16384 l/min or gpm

**Pressure**
- Measuring range: 0-10 bar (0-145 psig)
- Accuracy (± 1 %):
  - 15-90 °C (59-194 °F): ± 2.0 % FS
  - 0-120 °C (32-248 °F): ± 2.5 % FS
- Response time: 250 ms
- Resolution: 0.6 mbar (0.009 psig)

**Temperature**
- Measuring range: 0-120 °C (32-248 °F)
- Accuracy (± 1 %):
  - 15-90 °C (59-194 °F): ± 0.5 °C
  - 0-120 °C (32-248 °F): ± 1 °C
- Response time: 250 ms
- Resolution: 0.006 K

**Differential Temperature**
- Accuracy:
  - 15-90 °C (59-194 °F): ± 0.3 K
  - 0-120 °C (32-248 °F): ± 0.5 K

**System conditions and environment**

- Liquid types: Aqueous media compatible with wetted materials
  - Kinematic viscosity less than or equal to 2 mm²/s (cSt)
- System temperature, operation: 0-120 °C (32-248 °F)
- System temperature, peak: -25 °C (-13 °F), non-freezing 120 °C (-248 °F)
- Ambient temperature, operation: -25 to +60 °C (-13 to +140 °F)
- Ambient temperature, peak: -55 to +90 °C (-67 to +194 °F)
- Humidity, relative: 0-95 %, non-condensing
- Maximum System Pressure: 30 bar (435 psig)
- Burst Pressure: 40 bar (580 psig)
- Maximum system pressure example: Max 16 bar (232 psig) at 100 °C (212 °F)
- Max 8 bar (116 psig) at 120 °C (248 °F)

**Electrical data**
- Power supply: 5 VDC (± 5 %), PELV
- Grounding of sensor supply required
- Digital output signals: Grundfos open data protocol
- Analog output signals, only two signals possible (analogue variants are upon request):
  - 0.5 - 3.5 for flow (zero at 0.35 V) and pressure (zero at 0.5 V)
  - 0.5 - 4.1 V for temperature (zero at 0.5 V and 100 °C at 3.5 V)
- Power consumption: Approximately 75 mW
- Load impedance: > 47 kΩ

**Materials**
- Sensing element: Silicon-based MEMS
- Sealing: EPDM O-ring or FKM O-ring
- Housing: Composite (PPS, PA66)
- Flow pipe: Stainless steel AISI 316 EN 1.4408
- Insert: PPA 40 GF
- Wetted materials: Corrosion-resistant coating, EPDM or FKM, PPS, PPA 40-GF, 1.4408

**Environmental standards**
- Enclosure class: IP44, cable connected
- Temperature cycling: IEC 68-2-14
- Vibration, non-destructive: 20-2000 Hz, 10G, 4 h
- Electromagnetic compatibility: EN 61326-1
**MFS QT 10-100 l/min (2.6 - 26 gpm)**

**Fig. 116** MFS QT 10-100 l/min

**Dimensions**

![Dimensions diagram]

**Fig. 117** Dimensions, MFS QT 10-100 l/min, with threads

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>129</td>
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<tr>
<td>in</td>
<td>5.08</td>
<td>2.62</td>
</tr>
</tbody>
</table>

**Sensor output signals**

- **Flow**
  - **Flow response in Analogue mode**: 
    - ![Flow response graph](image)
    - **Fig. 118 Flow response in Analogue mode**

- **Pressure and temperature response in Analogue mode**: 
  - ![Pressure and temperature graph](image)
  - **Fig. 119 Pressure and temperature response in Analogue mode**

**Specifications**

**Flow**
- **Measuring range**: 10-100 (2.6 - 26 gpm)
- **Accurary (± 1 o)**: ± 1 % FS
- **Response time** (63.2 %): Less than 4 s
- **Resolution**: Max flow/16384 l/min or gpm

**Pressure**
- **Measuring range**: 0-10 bar (0-145 psig)
- **Accurary (± 1 o)**: ± 2.0 % FS
- **Response time** (63.2 %): 250 ms
- **Resolution**: 0.6 mbar (0.009 psig)

**Temperature**
- **Measuring range**: 0-120 °C (32-248 °F)
- **Accurary (± 1 o)**: ± 0.5 K
- **Response time** (63.2 %): 250 ms
- **Resolution**: 0.006 K

**Differential Temperature**
- **Accuracy**: 15-90 °C (59-194 °F) 0.3 K
- **Accuracy**: 0-120 °C (32-248 °F) 0.5 K

**System conditions and environment**

- **Liquid types**: Aqueous media compatible with wetted materials
- **Kinematic viscosity**: less than or equal to 2 mm²/s (cSt)
- **System temperature, operation**: 0-120 °C (32-248 °F)
- **System temperature, peak**: -25 °C (-13 °F), non-freezing 120 °C (-248 °F)
- **Ambient temperature, operation**: -25 to +60 °C (-13 to +140 °F)
- **Ambient temperature, peak**: -35 to +90 °C (-67 to +194 °F)
- **Humidity, relative**: 0-95 %, non-condensing
- **Maximum System Pressure**: 30 bar (435 psig)
- **Burst Pressure**: 40 bar (580 psig)
- **Maximum system pressure example**: Max 16 bar (232 psig) at 100 °C (212 °F)
- **Max 8 bar (116 psig) at 120 °C (248 °F)**

**Electrical data**
- **Power supply**: 5 VDC (± 5 %), PELV
- **Grounding of sensor supply required**: Grounded
- **Digital output signals**: Grundfos open data protocol
- **Analog output signals, only two signals possible (analogue variants are upon request)**: 0.5 - 3.5 V for flow (zero at 0.35 V) and pressure (zero at 0.5 V)
  - **0.5 - 4.1 V for temperature (zero at 0.5 V and 100 °C at 3.5 V)**
- **Power consumption**: Approximately 75 mW
- **Load impedance**: > 47 kΩ

**Materials**
- **Sensing element**: Silicon-based MEMS
- **Sealing**: EPDM O-ring or FKM O-ring
- **Housing**: Composite (PPS, PA66)
- **Flow pipe**: Stainless steel AISI 316 EN 1.4408
- **Insert**: PPA 40 GF
- **Wetted materials**: Corrosion-resistant coating, EPDM or FKM, PPS, PPA 40-GF, 1.4408

**Environmental standards**
- **Enclosure class**: IP44, cable connected
- **Temperature cycling**: IEC 68-2-14
- **Vibration, non-destructive**: 20-2000 Hz, 10G, 4 h
- **Electromagnetic compatibility**: EN 61326-1

---

**Flow sensors**
Multi Flow sensor, standard (MFS and MFS QT)

Flow sensors

MFS QT 20-200 l/min (5.3 - 53 gpm)

Fig. 120 MFS QT 20-200 l/min

Dimensions

Fig. 121 Dimensions, MFS QT 20-200 l/min, with threads

Sensor output signals

<table>
<thead>
<tr>
<th>A</th>
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</thead>
<tbody>
<tr>
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<tr>
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<td>2.92</td>
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Fig. 122 Flow response in Analogue mode

<table>
<thead>
<tr>
<th>Flow output signal</th>
<th>Q min</th>
<th>Q max</th>
</tr>
</thead>
<tbody>
<tr>
<td>[V]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>3.5</td>
</tr>
<tr>
<td>0.5</td>
<td>0.5</td>
<td>3.0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>2.5</td>
</tr>
<tr>
<td>1.5</td>
<td>1.5</td>
<td>2.0</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>1.5</td>
</tr>
<tr>
<td>2.5</td>
<td>2.5</td>
<td>1.0</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>0.5</td>
</tr>
<tr>
<td>3.5</td>
<td>3.5</td>
<td>0</td>
</tr>
</tbody>
</table>

Fig. 123 Pressure and temperature response in Analogue mode

<table>
<thead>
<tr>
<th>Pressure and temperature output signal</th>
<th>P max</th>
<th>T max</th>
<th>T Peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>[V]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>0</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td>0.5</td>
<td>0.5</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>3.5</td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td>1.5</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>2.5</td>
<td>2.5</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>3.5</td>
<td>3.5</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Specifications

Flow

- Measuring range: 20-200 l/min (5.3 - 53 gpm)
- Accuracy (± 1 %) in water: 0-120 °C (32-248 °F) ± 1 % FS
- Response time (63.2 %): Less than 4 s
- Resolution: max flow/16384 l/min or gpm

Pressure

- Measuring range: 0-10 bar (0-145 psig)
- Accuracy (± 1 %), 15-90 °C (59-194 °F): ± 2.0 % FS
- Accuracy (± 1 %), 0-120 °C (32-248 °F): ± 2.5 % FS
- Response time for sensor electronic: 250 ms
- Resolution: 0.6 mbar (0.009 psig)

Temperature

- Measuring range: 0-120 °C (32-248 °F)
- Accuracy (± 1 %), 15-90 °C (59-194 °F): ± 0.5 K
- Accuracy (± 1 %), 0-120 °C (32-248 °F): ± 1 K
- Response time (63.2 % at 50 % FS flow): 250 ms
- Resolution: 0.008 K

Differential Temperature

- Accuracy 15-90 °C (59-194 °F): 0.3 K
- Accuracy 0-120 °C (32-248 °F): 0.5 K

System conditions and environment

- Liquid types: Aqueous media compatible with wetted materials
- Kinematic viscosity less than or equal to 2 mm²/s (cSt)
- System temperature, operation: 0-120 °C (32-248 °F)
- System temperature, peak: -25 °C (-13 °F), non-freezing 120 °C (-248 °F)
- Ambient temperature, operation: -25 to +60 °C (-13 to +140 °F)
- Ambient temperature, peak: -55 to +90 °C (-67 to +194 °F)
- Humidity, relative: 0-95 %, non-condensing
- Maximum System Pressure: 30 bar (435 psig)
- Burst Pressure: 40 bar (580 psig)
- Maximum system pressure example: Max 16 bar (232 psig) at 100 °C (212 °F)
- Max 8 bar (116 psig) at 120 °C (248 °F)

Electrical data

- Power supply: 5 VDC (± 5 %), PELV
- Grounding of sensor supply required
- Digital output signals: Grundfos open data protocol
- Analog output signals, only two signals possible (analogue variants are upon request)
  - 0.5 - 3.5 V for flow (zero at 0.35 V) and pressure (zero at 0.5 V)
  - 0.5 - 4.1 V for temperature (zero at 0.5 V and 100 °C at 3.5 V)
- Power consumption: Approximately 75 mW
- Load impedance: > 47 kΩ

Materials

- Sensing element: Silicon-based MEMS
- Sealing: EPDM O-ring or FKM O-ring
- Housing: Composite (PPS, PA66)
- Flow pipe: Stainless steel AISI 316, EN 1.4408
- Insert: PPA 40 GF
- Wetted materials: Corrosion-resistant coating, EPDM or FKM, PPS, PPA 40-GF, 1.4408

Environmental standards

- Response class: IP44, cable connected
- Temperature cycling: IEC 68-2-14
- Vibration, non-destructive: 20-2000 Hz, 10G, 4 h
- Electromagnetic compatibility: EN 61326-1
# 6. Product range

## VFI transmitters

**Scope of delivery**
- Flow pipe with transmitter
- flanges, only for flange versions
- fittings and union nuts for threaded versions
- 5 m (16.4 ft) cable with free cable end
- quick guide.

<table>
<thead>
<tr>
<th>Complete product</th>
<th>Flow range</th>
<th>Flange size</th>
<th>O-ring</th>
<th>Connection type</th>
<th>Outside usage*</th>
</tr>
</thead>
<tbody>
<tr>
<td>VFI--0.3-6m/1/C/M5.00-X/EG6/SG/30F/AC-1</td>
<td>0.3 - 6 m³/h</td>
<td>DN 25/32</td>
<td>EPDM</td>
<td>cast iron flange</td>
<td></td>
</tr>
<tr>
<td>VFI--0.3-6m/1/C/M5.00-X/EG6/SS/30F/AC-1</td>
<td>1.32 - 26.4 gpm</td>
<td>ANSI 1 1/4&quot;</td>
<td>FKM</td>
<td>stainless steel flange</td>
<td></td>
</tr>
<tr>
<td>VFI--0.3-6m/1/C/M5.00-X/EG6/SS/07P/AC-1</td>
<td>2.64 - 52.8 gpm</td>
<td>ANSI 1 1/4&quot;</td>
<td>EPDM</td>
<td>thread</td>
<td></td>
</tr>
<tr>
<td>VFI--0.6-12m/1/C/M5.00-X/EG6/SG/30F/AC-1</td>
<td>1.3 - 25 m³/h</td>
<td>DN 25/32</td>
<td>EPDM</td>
<td>outside usage*</td>
<td></td>
</tr>
<tr>
<td>VFI--0.6-12m/1/C/M5.00-X/EG6/SS/30F/AC-1</td>
<td>5.72 - 110.1 gpm</td>
<td>ANSI 1 1/4&quot;</td>
<td>FKM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VFI--0.6-12m/1/C/M5.00-X/EG6/SS/07P/AC-1</td>
<td>1.3 - 25 m³/h</td>
<td>ANSI 1 1/4&quot;</td>
<td>EPDM</td>
<td>outside usage*</td>
<td></td>
</tr>
<tr>
<td>VFI--1.3-25m/1/C/M5.00-X/EG6/SG/30F/AC-1</td>
<td>1.3 - 25 m³/h</td>
<td>DN 25/32</td>
<td>EPDM</td>
<td>outside usage*</td>
<td></td>
</tr>
<tr>
<td>VFI--1.3-25m/1/C/M5.00-X/EG6/SS/30F/AC-1</td>
<td>5.72 - 110.1 gpm</td>
<td>ANSI 1 1/4&quot;</td>
<td>FKM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VFI--1.3-25m/1/C/M5.00-X/EG6/SS/07P/AC-1</td>
<td>1.3 - 25 m³/h</td>
<td>ANSI 1 1/4&quot;</td>
<td>EPDM</td>
<td>outside usage*</td>
<td></td>
</tr>
<tr>
<td>VFI--2.40m/1/C/M5.00-X/EG6/SG/31F/AC-1</td>
<td>2 - 40 m³/h</td>
<td>DN 40</td>
<td>EPDM</td>
<td>outside usage*</td>
<td></td>
</tr>
<tr>
<td>VFI--2.40m/1/C/M5.00-X/EG6/SS/31F/AC-1</td>
<td>8.81 - 176.1 gpm</td>
<td>ANSI 1 1/2&quot;</td>
<td>EPDM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VFI--3.2-64m/1/C/M5.00-X/EG6/SG/32F/AC-1</td>
<td>3.2 - 64 m³/h</td>
<td>DN 50</td>
<td>EPDM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VFI--3.2-64m/1/C/M5.00-X/EG6/SS/32F/AC-1</td>
<td>14.09 - 281.1 gpm</td>
<td>ANSI 2&quot;</td>
<td>EPDM</td>
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</tr>
<tr>
<td>VFI--5.2-104m/1/C/M5.00-X/EG6/SG/33F/AC-1</td>
<td>5.2 - 104 m³/h</td>
<td>DN 65</td>
<td>EPDM</td>
<td></td>
<td></td>
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<tr>
<td>VFI--5.2-104m/1/C/M5.00-X/EG6/SS/33F/AC-1</td>
<td>22.89 - 457.9 gpm</td>
<td>ANSI 2 1/2&quot;</td>
<td>EPDM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VFI--8-160m/1/C/M5.00-X/EG6/SG/35F/AC-1</td>
<td>8-160 m³/h</td>
<td>DN 80</td>
<td>EPDM</td>
<td></td>
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<tr>
<td>VFI--8-160m/1/C/M5.00-X/EG6/SS/35F/AC-1</td>
<td>35.22 - 704.5 gpm</td>
<td>ANSI 3&quot;</td>
<td>EPDM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VFI--12-240m/1/C/M5.00-X/EG6/SG/42F/AC-1</td>
<td>12-240 m³/h</td>
<td>DN 100</td>
<td>EPDM</td>
<td></td>
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<tr>
<td>VFI--12-240m/1/C/M5.00-X/EG6/SS/42F/AC-1</td>
<td>52.83 - 1057 gpm</td>
<td>ANSI 4&quot;</td>
<td>EPDM</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Outside usage only with cable connected.
## VFS and VFS QT sensors

### Scope of delivery

- Flow pipe with sensor
- Composite flow pipe with brass adapter (only VFS)
- Stainless steel flow pipe (only VFS QT)
- Quick guide.

<table>
<thead>
<tr>
<th>Complete product</th>
<th>Flow range</th>
<th>O-ring</th>
<th>Flow pipe</th>
<th>Connection type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>EPDM</td>
<td>FKM</td>
<td>Stainless steel</td>
</tr>
<tr>
<td>VFS/---1-20l/l/D/S------/EG4/Cb/03P/SW-1</td>
<td>1.3 - 20 l/min</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>VFS/---1-20l/l/D/S------/VG4/Cb/03P/SW-1</td>
<td>1.3 - 20 l/min</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>VFS/---2-40l/l/D/S------/EG4/Cb/04P/SW-1</td>
<td>2-40 l/min</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>VFS/---2-40l/l/D/S------/VG4/Cb/04P/SW-1</td>
<td>2-40 l/min</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>VFS/---5-100l/l/D/S------/EG4/Cb/04B/SW-1</td>
<td>5-100 l/min</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>VFS/---5-100l/l/D/S------/VG4/Cb/04B/SW-1</td>
<td>5-100 l/min</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>VFS/---10-200l/l/D/S------/EG4/Cb/05B/SW-1</td>
<td>10-200 l/min</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>VFS/---10-200l/l/D/S------/VG4/Cb/05B/SW-1</td>
<td>10-200 l/min</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>VFS/---20-400l/l/D/S------/EG4/Cb/07B/SW-1</td>
<td>20-400 l/min</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>VFS/---20-400l/l/D/S------/VG4/Cb/07B/SW-1</td>
<td>20-400 l/min</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>VFS/---1-18l/l/D/S------/EG4/Q-/04P/SW-1</td>
<td>1-18 l/min</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>VFS/---1-18l/l/D/S------/VG4/Q-/04P/SW-1</td>
<td>1-18 l/min</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>VFS/---2-40l/l/D/S------/EG4/Q-/04P/SW-1</td>
<td>2-40 l/min</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>VFS/---2-40l/l/D/S------/VG4/Q-/04P/SW-1</td>
<td>2-40 l/min</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>VFS/---5-100l/l/D/S------/EG4/Q-/05P/SW-1</td>
<td>5-100 l/min</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>VFS/---5-100l/l/D/S------/VG4/Q-/05P/SW-1</td>
<td>5-100 l/min</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>VFS/---10-200l/l/D/S------/EG4/Q-/07P/SW-1</td>
<td>10-200 l/min</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>VFS/---10-200l/l/D/S------/VG4/Q-/07P/SW-1</td>
<td>10-200 l/min</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
</tbody>
</table>
7. Accessories

Sensor interface, converter unit
The SI Converter sensor interface from Grundfos Direct Sensors™ is an external power supply, signal amplifier and signal converter for Grundfos sensors, standard variants (MFS, VFS, RPS and DPS).
SI Converter has built-in precision resistors enabling the sensor to give 4-20 mA, 1-5 V and 2-10 V output signals.
SI Converter is designed for applications where sensors from the standard product range are used. The sensor interface delivers a 4-20 mA input signal to external controllers.

Specifications
- Voltage range: 115-230 VAC ± 10 % or 24 VDC
- frequency: 50-60 Hz
- power consumption: Maximum 2.5 W
- ambient temperature: -20 to +50 °C (-4 to +122 °F)
- enclosure class: IP20.

M12 cable
The 4-wire screened cable with M12 connector in the sensor end and open end in the equipment end is available as an accessory. Use the cable for the industrial sensor series such as RPI, DPI II and VFI.

Snap-on cable
Cable with snap-on connection in sensor end and different variants in the equipment end, such as open end, ferrules and various types of connectors.
Use the cable for the standard sensor series such as MFS, VFS, RPS and DPS.
The cable is available in various lengths, mainly 1.2 m and 2.9 m.

<table>
<thead>
<tr>
<th>Description</th>
<th>Length [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ferrules, 1.2 m</td>
<td>1200</td>
</tr>
<tr>
<td>Ferrules, 2.9 m</td>
<td>2900</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable, industry M2.000X</td>
<td>2 m (6.6 ft)</td>
</tr>
<tr>
<td>Cable, industry M5.000X</td>
<td>5 m (16.4 ft)</td>
</tr>
</tbody>
</table>
8. Appendix

Pressure drop curves

VFI sensor
Selection of flow sensor to minimise pressure drop at 1 cSt

\[
H = 100,000 \cdot \frac{\Delta p}{\rho \times 9.81} \text{[m]}
\]
VFS sensor

Selection of flow sensor to minimise pressure drop at 1 cSt

\[ H = \frac{100,000 \Delta p}{\rho \times 9.81} [m] \]
Installation of the VFI sensor

- Minimum 10 x D
- Minimum 5 x D

- Minimum 20 x D
- Minimum 0.2 bar (2.9 PSI)

- Max. 28 bar (406 PSI)

- -25 to 60 °C (-13 to 140 °F)
- -30 to 120 °C (-22 to 248 °F)

- IP67

- 0 bar

- TM05 2306 2118

- Flow sensors
Flow sensors

Intended use for pressurised systems

1. Flow < 125% x Q_{max}
2. Speed < 125% x Q_{max}
3. ≥ 5 sec.
4. ≥ 5 sec.
9. Grundfos Product Center

Online search and sizing tool to help you make the right choice.

http://product-selection.grundfos.com

SIZING enables you to size a pump based on entered data and selection choices.

REPLACEMENT enables you to find a replacement product. Search results will include information on:
- the lowest purchase price
- the lowest energy consumption
- the lowest total life cycle cost.

CATALOGUE gives you access to the Grundfos product catalogue.

LIQUIDS enables you to find pumps and sensors designed for aqueous media or other special liquids.

All the information you need in one place

Performance curves, technical specifications, pictures, dimensional drawings, motor curves, wiring diagrams, spare parts, service kits, 3D drawings, documents, system parts. The Product Center displays any recent and saved items - including complete projects - right on the main page.

Downloads

On the product pages, you can download installation and operating instructions, data booklets, service instructions, etc. in PDF format. For aqueous media below 2 µS/cm contact your local Grundfos sensor representative.