Grundfos Direct Sensors™

Vortex flow sensors
# Grundfos Direct Sensors™

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1. Product introduction

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

The Grundfos vortex flow sensor range comprises flow measurement systems as well as combined flow and temperature measurement systems (two-in-one) designed for harsh aqueous environments.

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.

When a bluff body is placed inside a pipe, a series of vortices will be generated on either side of the bluff body. These vortices propagate downstream, giving rise to periodic pressure variations which can be detected by the pressure sensor. The frequency of the pressure variations is proportional to the volume flow through the pipe.

The bluff body is designed to optimise the pulse strength of the pressure variations at the position of the 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 injection moulded flow pipe, or supplied as a separate composite or stainless steel part to be inserted in the flow pipe.

The chip has a square membrane, which wraps due to 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 resistive thin film (Silicoat®). The coating provides direct environmental robustness of the chip. The media-free zone is sealed by an O-ring.

Material

The Grundfos vortex flow sensors are available in two material variants, suitable for different media:

- EPDM: suitable for water (drinking-water approved).
- FKM: suitable for oily media and for water in heating applications.
# Type Key

This type key is common to all Grundfos Direct Sensors™ and thus not only specific to flow sensors.

<table>
<thead>
<tr>
<th>Type designation</th>
<th>XXX</th>
<th>X / XXX</th>
<th>X</th>
<th>X</th>
<th>X</th>
<th>X</th>
<th>XX</th>
<th>XXX</th>
<th>X</th>
<th>X</th>
<th>X</th>
<th>XXX</th>
</tr>
</thead>
</table>

**Product group**
- **Pressure sensors:**
  - DPI: Differential Pressure sensor Digital
  - DPS: Differential Pressure sensor Standard
  - LPS: Leader Pressure sensor Standard
  - RPD: Relative Pressure sensor Digital
  - RPI: Relative Pressure sensor Industrial
  - VFI: Vortex Flow sensor Industrial
  - VFD: Vortex Flow sensor Digital

**Pressure components:**
- DPC: Differential Pressure sensor Component
- RPC: Relative Pressure sensor Component

**Flow sensors:**
- MFS: Multi Flow sensor Standard
- VFS: Vortex Flow sensor Standard

**Range**
- Pressure: b: bar; p: psi
- Flow: m³/h; g: gallons/min.; l: litres/min.

### Generation
1: 1st generation; 2: 2nd generation; 3: 3rd generation; etc.

### Electrical output type
- B: 0-10 V; C: 4-20 mA, 2 wires; D: 2 x 0.5 - 3.5 V; E: 2 x 0.5 - 4.5 V; F: 2 x 0-10 V; G: 4-20 mA, 3 wires; H: Genibus protocol / RS485 (UART);
- I: V-bus protocol / Open-drain; J: LPS protocol / Tx: TTL (UART), Rx: Pulse;
- K: OEM protocol / TTL (open-drain) (UART); L: 0 - 3.5 V;
- M: Redwolf protocol / TTL (UART); N: SQuba protocol / TTL (UART); P: Passive;
- Q: Self-configuring Redwolf protocol / TTL (UART) or 2 x 0.5 - 3.5 V

**Sensor connector or cable type and cable connector in sensor end**
- A: Grundfos cover, 4-pin male; B: FCI 90312-004LF/77138-101, unscreened 4 wire cable;
- C: MPE-Gerry BL12-700, overmoulded, unscreened 4-wire cable;
- D: FCI 90312-004LF/77138-101, overmoulded, screened 4-wire cable;
- E: TE snap-on, female, angled, screened 3-wire cable and pig tail. Screen connected to GND pin;
- F: TE snap-on, female, angled, screened 4-wire cable;
- G: TE snap-on, female, straight, screened 4-wire cable; Screen connected to GND pin;
- H: TE snap-on, female, angled, unscreened 4-wire cable;
- I: TE snap-on, female, straight, unscreened 4-wire cable;
- J: TE snap-on, female, angled, screened 4-wire cable;
- K: TE snap-on, female, angled, unscreened 4-wire cable;
- L: TE snap-on, female, angled, screened 4-wire cable;
- M: M12x1, 4-pin male; N: M12x1, 4-pin male; P: M12x1, 4-pin male; Q: M12x1, 4-pin male; R: PCB pads

**Cable length**
- Cable length in metres (length below 1 metre is denoted without a “0” before the dot. Example: 105 mm is denoted .105)

**Sealing material and enclosure class**
1st character: E: EPDM; M: Both EPDM and FKM included; S: EPDM sealing cap and FKM O-rings; V: FKM; 2nd character: G: Gel-filled; 3rd character: 2: IP20; 4: IP44; 5: IP55; 6: IP67

**Material**
The first character represents the flow pipe or housing for DPS, the second represents the mechanical connection part.
- B: Brass (leaded); C: Composite; G: Cast iron; L: Low lead brass (≤ 0.25 % lead);
- Q: Stainless steel flow pipe with composite insert (QT); S: Stainless steel

**Dimension of mechanical connection**
01: 10 mm; 02: 1/4”; 03: 1/2”; 04: 3/4”; 05: 1”; 06: 6 mm; 07: 1 1/4”; 08: 8 mm; 09: 1 1/2”; 10: 2”; 11: 2 1/2”; 12: 3”; 13: 4”; 14: 1 1/2 mm; 15: 15 mm; 17: 7/16”; 18: 18 mm; 19: 18.75 mm; 21: 21.5 mm; 24: 21/8”;
30: DIN PN 25/40 DN 18/25/32, ANSI B16.5 Class 300 - 1 1/4”; 31: DIN PN 16/25 DN 40, ANSI B16.5 Class 300 - 2”;
32: DIN PN 16/25 DN 50, ANSI B16.5 Class 300 - 2”; 33: ISO/DIN PN 25/40 DN 65; 34: ANSI B16.5 Class 300 - 2.5”;
35: ISO/DIN PN 25/40 DN 80; 36: ANSI B16.5 Class 300 - 3”; 37: ISO/DIN PN 16 DN 100; 38: ANSI B16.5 Class 300 - 4”;
51: 1” - G 3/4; 52: f1 1/4” - G 1; 63: G 1/2 with ventilation opening; 64: 15.5 mm with ventilation opening

**Mechanical connection type**
- B: BSPT (ISO 7/1); C: Compression; Flange; G: Flange and BSPP (ISO 228/1); K: Clip; L: Special clip; M: NPSM; N: NPT; O: Groove for O-ring; P: BSPP (ISO 228/1); Q: For union nut; S: Sweat; T: Tube; U: UNF

**Packaging**
1st character: A: Set with preassembled components; M: Miscellaneous set; P: Spare parts set; S: Set; T: Set variant 2; V: Service set 2nd character: B: Plastic cap; C: Cardboard box; D: Blister pack and cardboard box, standard Grundfos; N: Blister pack, neutral white; T: Trays and cardboard box; W: Blister pack, standard Grundfos
3rd - 4th character: 1: 1 piece; 10: Bulk 10; 20: Bulk 20; 25: Bulk 25; 50: Bulk 50; 1H: Bulk 100; 5H: Bulk 500; 1A: Bulk 1081
2. Vortex flow sensor, industry (VFI)

VFI general data

Technical overview
The VFI sensor from Grundfos Direct Sensors™ is a flow sensor designed for industrial purposes. It is based on the principle of vortex shedding behind a bluff body. The VFI sensors are fully compatible with wet, aggressive media. They use MEMS sensing technology in combination with the Silicoat® corrosion-resistant coating technology on the sensor chip.

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

The sensor is supplied with a stainless steel flow pipe and has flanges or threaded ends for use with union nuts.

Fig. 4 VFI sensor

Fig. 5 Bluff body in a VFI sensor

Applications
- Water treatment and distribution
- Water utility
- Water monitoring
- HVAC systems
- Chiller systems
- HPC and IT cooling systems
- Micro CHP
- Heat pumps
- Solar systems: heating and cooling.

Features
- Wide operating temperature range: -30 - 120 °C (-22 to 248 °F)
- Compact design
- MEMS technology

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

Benefits
- No moving parts
- Compatible with wet, aggressive media
- Accurate, linearised and temperature-compensated output signal
- Quick temperature response (direct contact with medium)
- Cost-effective and robust design
- System solution with Grundfos pumps.

Approvals
- WRAS
- KTW
- ACS

Certificates

Electrical connections

<table>
<thead>
<tr>
<th>Pin</th>
<th>Power supply</th>
<th>Wire not used</th>
<th>Flow signal</th>
<th>Wire not used</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Brown</td>
<td>White</td>
<td>Blue</td>
<td>Black</td>
</tr>
</tbody>
</table>

Power supply: 12.5 - 30 V (screened cable).
Type: 2-wire (loop-powered).
Vortex flow sensor, industry (VFI)

VFI 0.3 - 6 m³/h (1.3 - 26.4 gpm)

**Dimensions**

**Fig. 7** Dimensions VFI sensor with flanges

**Fig. 8** Dimensions VFI sensor with thread

**Sensor output signals**

**Specifications**

<table>
<thead>
<tr>
<th>Flow</th>
<th>Measuring range</th>
<th>0.3 - 6 m³/h (1.32 to 26.42 gpm)*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Accuracy (± 1σ)</td>
<td>± 1.5 % FS*</td>
</tr>
<tr>
<td></td>
<td>0-100 °C (32-212 °F)</td>
<td>non-freezing</td>
</tr>
<tr>
<td></td>
<td>Response time</td>
<td>&lt; 1 s</td>
</tr>
<tr>
<td></td>
<td>Resolution</td>
<td>0.0075 m³/h (0.03 gpm)</td>
</tr>
</tbody>
</table>

**Media and environment**

<table>
<thead>
<tr>
<th>Medium types</th>
<th>Kinematic viscosity ≤ 10 mm²/s (cSt)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>See appendix Minimum flow rate curves</td>
</tr>
<tr>
<td>Max. medium pressure</td>
<td>28 bar (406 psi)</td>
</tr>
<tr>
<td>Medium temperature (operation)</td>
<td>-30 - 120 °C (-22 - 248 °F), non-freezing</td>
</tr>
<tr>
<td>Medium temperature (peak)</td>
<td>-30 - 120 °C (-22 - 248 °F), non-freezing</td>
</tr>
<tr>
<td>Ambient air temperature (operation)</td>
<td>-25 - 60 °C (-13 - 140 °F)</td>
</tr>
<tr>
<td>Ambient air temperature (peak)</td>
<td>-55 - 70 °C (-67 - 158 °F)</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-55 - 70 °C (-67 - 158 °F)</td>
</tr>
<tr>
<td>Humidity</td>
<td>0-95 % (relative), non-condensing</td>
</tr>
<tr>
<td>System burst pressure</td>
<td>60 bar (870 psi)</td>
</tr>
</tbody>
</table>

**Electrical data**

<table>
<thead>
<tr>
<th>Power supply</th>
<th>12.5 - 30 VDC (± 5 %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output signals</td>
<td>4-20 mA</td>
</tr>
<tr>
<td>Power consumption</td>
<td>Max. 660 mW</td>
</tr>
<tr>
<td>Load impedance</td>
<td>Max. 60 Ω at 12.5 VDC</td>
</tr>
<tr>
<td></td>
<td>Max. 100 Ω at 13.3 VDC</td>
</tr>
<tr>
<td></td>
<td>Max. 600 Ω at 24 VDC</td>
</tr>
<tr>
<td></td>
<td>Max. 900 Ω at 30 VDC</td>
</tr>
<tr>
<td>Maximum cable length</td>
<td>30 m (98 ft)</td>
</tr>
</tbody>
</table>

**Materials**

| Sensing element | Silicon-based MEMS sensor |
| O-ring | EPDM or FKM |
| Sensor housing | Stainless steel AISI 316 L 1.4404 |
| Flow pipe | Stainless steel AISI 316 L 1.4408 |
| Flange | Cast iron or stainless steel |
| Bluff body | Stainless steel AISI 316 L 1.4401 |
| Wetted materials | Corrosion-resistant coating, EPDM or FKM |

**Environmental standards**

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

**Weight**

| With cast iron flanges | 4.38 kg (9.66 lbs) |
| With stainless steel flanges | 4.44 kg (9.79 lbs) |
| Without flange | 1.39 kg (3.06 lbs) |

* Reference condition
- Media at 20 °C (68 °F), 1013 mbar (1 atmosphere), ρ = 998 kg/m³ (62.3 lb/ft³), v = 1 x 10-6 m²/s (1 cSt).

The VFI sensor with threaded ends to be installed by means of union nuts.
Vortex flow sensor, industry (VFI)

VFI 0.6 - 12 m³/h (2.6 - 52.8 gpm)

Specifications

Flow
Measuring range 0.6 - 12 m³/h (2.64 to 52.83 gpm)*
Accuracy (± 1%)
0-100 °C (32-212 °F) ± 1.5 % FS*
Response time < 1 s
Resolution 0.015 m³/h (0.07 gpm)

Media and environment
Medium types Kinematic viscosity ≤ 10 mm²/s (cSt)
See appendix Minimum flow rate curves
Max. medium pressure 28 bar (406 psi)
Medium temperature (operation) -30 - 120 °C (-22 - 248 °F), non-freezing
Medium temperature (peak) -30 - 120 °C (-22 - 248 °F), non-freezing
Ambient air temperature (operation) -25 - 60 °C (-13 - 140 °F)
Ambient air temperature (peak) -55 - 70 °C (-67 - 158 °F)
Storage temperature -55 - 70 °C (-67 - 158 °F)
Humidity 0-95 % (relative), non-condensing
System burst pressure 60 bar (870 psi)

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

Materials
Sensing element Silicon-based MEMS sensor
O-ring EPDM or FKM
Sensor housing Stainless steel AISI 316 L 1.4404
Flow pipe Stainless steel AISI 316 L 1.4408
Flange Cast iron or stainless steel
Bluff body Stainless steel AISI 316 L 1.4401
Wetted materials Corrosion-resistant coating, EPDM or FKM

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

Weight
With cast iron flanges 4.52 kg (9.96 lbs)
With stainless steel flanges 4.58 kg (10.10 lbs)
Without flange 1.53 kg (3.37 lbs)

* Reference condition:
- Media at 20 °C (68 °F), 1013 mbar (1 atmosphere), p = 998 kg/m³ (62.3 lb/ft³), v = 1 x 10⁻⁶ m²/s (1 cSt).

The VFI sensor with threaded ends to be installed by means of union nuts.
Vortex flow sensor, industry (VFI)

**VFI 1.3 - 25 m³/h (5.7 - 110 gpm)**

**Dimensions**

**Fig. 13** Dimensions VFI sensor with flanges

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>Flange</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>200</td>
<td>18</td>
<td>128</td>
<td>140</td>
</tr>
<tr>
<td>in</td>
<td>7.87</td>
<td>0.71</td>
<td>5.04</td>
<td>5.51</td>
</tr>
</tbody>
</table>

**Fig. 14** Dimensions VFI sensor with thread

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>Thread size</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>200</td>
<td>19</td>
<td>128</td>
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<tr>
<td>in</td>
<td>7.87</td>
<td>0.75</td>
<td>5.04</td>
</tr>
</tbody>
</table>

**Sensor output signals**

**Fig. 15** Flow response

- 4 mA
- 20 mA
- 21 mA

**Specifications**

**Flow**

- Measuring range: 1.3 - 25 m³/h (5.72 to 110.07 gpm)*
- Accuracy (± 1σ): ± 1.5 % FS*
- Response time: < 1 s
- Resolution: 0.031 m³/h (0.14 gpm)

**Media and environment**

- Kinematic viscosity ≤ 10 mm²/s (cSt)
- See appendix Minimum flow rate curves

**Electrical data**

- Power supply: 12.5 - 30 VDC (± 5 %)
- Output signals: 4-20 mA
- Power consumption: Max. 660 mW
- Load impedance:
  - Max. 60 Ω at 12.5 VDC
  - Max. 100 Ω at 13.3 VDC
  - Max. 600 Ω at 24 VDC
  - Max. 900 Ω at 30 VDC

**System burst pressure**

- 60 bar (870 psi)

**Materials**

- Sensing element: Silicon-based MEMS sensor
- O-ring: EPDM or FKM
- Sensor housing: Stainless steel AISI 316 L 1.4404
- Flow pipe: Stainless steel AISI 316 L 1.4408
- Flange: Cast iron or stainless steel
- Bluff body: Stainless steel AISI 316 L 1.4401
- Wetted materials: Corrosion-resistant coating, EPDM or FKM
- Stainless steel AISI 316 L 1.4401/04/08

**Environmental standards**

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

**Weight**

- With cast iron flanges: 4.47 kg (9.85 lbs)
- With stainless steel flanges: 4.53 kg (9.99 lbs)
- Without flange: 1.31 kg (2.89 lbs)

* Reference condition:
- Media at 20 °C (68 °F), 1013 mbar (1 atmosphere), p = 998 kg/m²
  (62.3 lb/ft²), v = 1 x 10⁻⁶ m²/s (1 cSt).

The VFI sensor with threaded ends to be installed by means of union nuts.
**Specifications**

**Flow**
- Measuring range: 2-40 m³/h (8.81 to 176.11 gpm)*
- Accuracy (± 1σ): ± 1.5 % full-scale (FS)*
- Response time: < 1 s
- Resolution: 0.05 m³/h (0.22 gpm)

**Media and environment**
- Kinematic viscosity: ≤ 10 mm²/s (cSt)
- See appendix Minimum flow rate curves
- Maximum medium pressure: 28 bar (406 psi)
- Medium temperature (operation): -30 - 120 °C (-22 - 248 °F), non-freezing
- Medium temperature (peak): -30 - 120 °C (-22 - 248 °F), non-freezing
- Ambient air temperature (operation): -25 - 60 °C (-13 - 140 °F)
- Ambient air temperature (peak): -55 - 70 °C (-67 - 158 °F)
- Storage temperature: -55 - 70 °C (-67 - 158 °F)
- Humidity: 0-95 % (relative), non-condensing
- System burst pressure: 60 bar (870 psi)

**Electrical data**
- Power supply: 12.5 - 30 VDC (± 5 %)
- Output signals: 4-20 mA
- Power consumption: Max. 660 mW

**Sensor output signals**

![Flow response](image)

**Materials**
- Sensing element: Silicon-based MEMS sensor
- O-ring: EPDM or FKM
- Sensor housing: Stainless steel AISI 316 L 1.4404
- Flow pipe: Stainless steel AISI 316 1.4408
- Flange: Cast iron or stainless steel
- Bluff body: Stainless steel AISI 316 L 1.4401

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

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

**Weight**
- With cast iron flanges: 5.58 kg (12.30 lbs)
- With stainless steel flanges: 6.45 kg (14.22 lbs)

*Reference condition:
- Media at 20 °C (68 °F), 1013 mbar (1 atmosphere), \( p = 998 \text{ kg/m}^3 \) (62.3 lb/ft³), \( v = 1 \times 10^{-6} \text{ m}^2/\text{s} \) (1 cSt),
Vortex flow sensor, industry (VFI)

**VFI 3.2 - 64 m³/h (14 - 282 gpm)**

![Image](file1.png)

**Fig. 19** VFI 3.2 - 64 sensor

**Dimensions**

![Image](file2.png)

**Fig. 20** Dimensions VFI sensor with flanges

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>Flange</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td></td>
<td></td>
<td></td>
<td>DN 50</td>
</tr>
<tr>
<td>in</td>
<td></td>
<td></td>
<td></td>
<td>ANSI 2&quot;</td>
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**Sensor output signals**

![Image](file3.png)

**Fig. 21** Flow response

**Specifications**

<table>
<thead>
<tr>
<th>Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
</tr>
<tr>
<td>Accuracy (± 1σ)</td>
</tr>
<tr>
<td>Response time</td>
</tr>
<tr>
<td>Resolution</td>
</tr>
</tbody>
</table>

**Media and environment**

<table>
<thead>
<tr>
<th>Medium types</th>
<th>Kinematic viscosity ≤ 10 mm²/s (cSt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. medium pressure</td>
<td>28 bar (406 psi)</td>
</tr>
<tr>
<td>Medium temperature (operation)</td>
<td>-30 - 120 °C (-22 - 248 °F), non-freezing</td>
</tr>
<tr>
<td>Medium temperature (peak)</td>
<td>-30 - 120 °C (-22 - 248 °F), non-freezing</td>
</tr>
<tr>
<td>Ambient air temperature (operation)</td>
<td>-25 - 60 °C (-13 - 140 °F)</td>
</tr>
<tr>
<td>Ambient air temperature (peak)</td>
<td>-55 - 70 °C (-67 - 158 °F)</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-55 - 70 °C (-67 - 158 °F)</td>
</tr>
<tr>
<td>Humidity</td>
<td>0-95 % (relative), non-condensing</td>
</tr>
<tr>
<td>System burst pressure</td>
<td>60 bar (870 psi)</td>
</tr>
</tbody>
</table>

**Electrical data**

<table>
<thead>
<tr>
<th>Power supply</th>
<th>12.5 - 30 VDC (± 5 %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output signals</td>
<td>4-20 mA</td>
</tr>
<tr>
<td>Power consumption</td>
<td>Max. 660 mW</td>
</tr>
<tr>
<td>Load impedance</td>
<td>Max. 60 Ω at 12.5 VDC</td>
</tr>
<tr>
<td></td>
<td>Max. 100 Ω at 13.3 VDC</td>
</tr>
<tr>
<td></td>
<td>Max. 600 Ω at 24 VDC</td>
</tr>
<tr>
<td></td>
<td>Max. 900 Ω at 30 VDC</td>
</tr>
<tr>
<td>Maximum cable length</td>
<td>30 m (98 ft)</td>
</tr>
</tbody>
</table>

**Materials**

<table>
<thead>
<tr>
<th>Sensing element</th>
<th>Silicon-based MEMS sensor</th>
</tr>
</thead>
<tbody>
<tr>
<td>O-ring</td>
<td>EPDM or FKM</td>
</tr>
<tr>
<td>Sensor housing</td>
<td>Stainless steel AISI 316 L 1.4404</td>
</tr>
<tr>
<td>Flow pipe</td>
<td>Stainless steel AISI 316 L 1.4408</td>
</tr>
<tr>
<td>Flange</td>
<td>Cast iron or stainless steel</td>
</tr>
<tr>
<td>Bluff body</td>
<td>Stainless steel AISI 316 L 1.4401</td>
</tr>
<tr>
<td>Wetted materials</td>
<td>Corrosion-resistant coating, EPDM or FKM, Stainless steel AISI 316 L 1.4401/04/08</td>
</tr>
</tbody>
</table>

**Environmental standards**

<table>
<thead>
<tr>
<th>Enclosure class</th>
<th>IP67</th>
</tr>
</thead>
<tbody>
<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>

**Weight**

| With cast iron flanges | 6.94 kg (15.30 lbs) |
| With stainless steel flanges | 5.94 kg (13.10 lbs) |

* Reference condition:
  - Media at 20 °C (68 °F), 1013 mbar (1 atmosphere), ρ = 998 kg/m³ (62.3 lb/ft³), v = 1 x 10⁻⁶ m²/s (1 cSt),
Vortex flow sensor, industry (VFI)

Grundfos Direct Sensors™

**VFI 5.2 - 104 m³/h (23 - 458 gpm)**

**Fig. 22 VFI 5.2 - 104 sensor**

**Dimensions**

**Fig. 23 Dimensions VFI sensor with flanges**

**Sensor output signals**

**Fig. 24 Flow response**

**Specifications**

**Flow**
- Measuring range: 5.2 - 104 m³/h (22.89 to 457.89 gpm)*
- Accuracy (± 1σ), 0-100 °C (32-212 °F): ± 1.5 % FS*
- Response time: < 1 s
- Resolution: 0.13 m³/h (0.57 gpm)

**Media and environment**

**Medium types**
- Kinematic viscosity ≤ 10 mm²/s (cSt)

**Max. medium pressure**: 28 bar (406 psi)

**Medium temperature (operation)**: -30 - 120 °C (-22 - 248 °F), non-freezing

**Temperature range**:
- Ambient air temperature (operation): -25 - 60 °C (-13 - 140 °F)
- Ambient air temperature (peak): -55 - 70 °C (-67 - 158 °F)
- Storage temperature: -55 - 70 °C (-67 - 158 °F)
- Humidity: 0-95 % (relative), non-condensing

**System burst pressure**: 60 bar (870 psi)

**Electrical data**
- Power supply: 12.5 - 30 VDC (± 5 %)
- Output signals: 4-20 mA
- Power consumption: Max. 660 mW
- Load impedance:
  - Max. 60 Ω at 12.5 VDC
  - Max. 100 Ω at 13.3 VDC
  - Max. 600 Ω at 24 VDC
  - Max. 900 Ω at 30 VDC

**Maximum cable length**: 30 m (98 ft)

**Materials**
- Sensing element: Silicon-based MEMS sensor
- O-ring: EPDM or FKM
- Sensor housing: Stainless steel AISI 316 L 1.4404
- Flow pipe: Stainless steel AISI 316 L 1.4408
- Flange: Cast iron or stainless steel
- Bluff body: Stainless steel AISI 316 L 1.4401

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

**Weight**
- With cast iron flanges: 9.31 kg (20.53 lbs)
- With stainless steel flanges: 9.90 kg (21.83 lbs)

---

*Reference condition:
- Media at 20 °C (68 °F), 1013 mbar (1 atmosphere), ρ = 998 kg/m³ (62.3 lb/ft³), ν = 1 x 10-6 m²/s (1 cSt).*
Vortex flow sensor, industry (VFI)

Grundfos Direct Sensors™

VFI 8 - 160 m³/h (35 - 704 gpm)

Dimensions

Sensor output signals

Specifications

Flow

<table>
<thead>
<tr>
<th>Measuring range</th>
<th>8-160 m³/h (35.22 to 704.46 gpm)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>± 1.5 % FS*</td>
</tr>
<tr>
<td>Response time</td>
<td>&lt; 1 s</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.2 m³/h (0.88 gpm)</td>
</tr>
</tbody>
</table>

Media and environment

<table>
<thead>
<tr>
<th>Medium types</th>
<th>Kinematic viscosity ≤ 10 mm²/s (cSt)</th>
<th>See appendix Minimum flow rate curves</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. medium pressure</td>
<td>28 bar (406 psi)</td>
<td></td>
</tr>
<tr>
<td>Medium temperature (operation)</td>
<td>-30 - 120 °C (-22 - 248 °F), non-freezing</td>
<td></td>
</tr>
<tr>
<td>Medium temperature (peak)</td>
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<td></td>
</tr>
<tr>
<td>Ambient air temperature (operation)</td>
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<td></td>
</tr>
<tr>
<td>Ambient air temperature (peak)</td>
<td>-55 - 70 °C (-67 - 158 °F)</td>
<td></td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-55 - 70 °C (-67 - 158 °F)</td>
<td></td>
</tr>
<tr>
<td>Humidity</td>
<td>0-95 % (relative), non-condensing</td>
<td></td>
</tr>
<tr>
<td>System burst pressure</td>
<td>60 bar (870 psi)</td>
<td></td>
</tr>
</tbody>
</table>

Electrical data

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

Materials

<table>
<thead>
<tr>
<th>Sensing element</th>
<th>Silicon-based MEMS sensor</th>
</tr>
</thead>
<tbody>
<tr>
<td>O-ring</td>
<td>EPDM or FKM</td>
</tr>
<tr>
<td>Sensor housing</td>
<td>Stainless steel AISI 316 L 1.4404</td>
</tr>
<tr>
<td>Flow pipe</td>
<td>Stainless steel AISI 316 L 1.4408</td>
</tr>
<tr>
<td>Flange</td>
<td>Cast iron or stainless steel</td>
</tr>
<tr>
<td>Bluff body</td>
<td>Stainless steel AISI 316 L 1.4401</td>
</tr>
<tr>
<td>Wetted materials</td>
<td>Corrosion-resistant coating EPDM or FKM, Stainless steel AISI 316 L 1.4401/04/08</td>
</tr>
</tbody>
</table>

Environmental standards

<table>
<thead>
<tr>
<th>Enclosure class</th>
<th>IP67</th>
</tr>
</thead>
<tbody>
<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>

Weight

| With cast iron flanges | 11.51 kg (25.38 lbs) |
| With stainless steel flanges | 16.00 kg (35.27 lbs) |

* Reference condition:
- Media at 20 °C (68 °F), 1013 mbar (1 atmosphere), \( p = 998 \text{ kg/m}^3 \) (62.3 lb/ft³), \( v = 1 \times 10^{-6} \text{ m}^2/\text{s} \) (1 cSt),
**Specifications**

**Flow**
- Measuring range: 12-240 m³/h (52.83 to 1056.69 gpm)*
- Accuracy (± 1σ): ± 1.5 % FS*
- Response time: < 1 s
- Resolution: 0.30 m³/h (1.32 gpm)

**Media and environment**
- Medium types: Kinematic viscosity ≤ 10 mm²/s (cSt)
- Maximum medium pressure: 16 bar (232 psi)
- Maximum medium temperature (operation): -30 - 120 °C (-22 - 248 °F), non-freezing
- Maximum medium temperature (peak): -30 - 120 °C (-22 - 248 °F), non-freezing
- Ambient air temperature (operation): -25 - 60 °C (-13 - 140 °F)
- Ambient air temperature (peak): -55 - 70 °C (-67 - 158 °F)
- Storage temperature: -55 - 70 °C (-67 - 158 °F)
- Humidity: 0-95 % (relative), non-condensing
- System burst pressure: 60 bar (870 psi)

**Electrical data**
- Power supply: 12.5 - 30 VDC (± 5 %)
- Output signals: 4-20 mA
- Power consumption: Max. 660 mW
- Load impedance:
  - Max. 60 Ω at 12.5 VDC
  - Max. 100 Ω at 13.3 VDC
  - Max. 600 Ω at 24 VDC
  - Max. 900 Ω at 30 VDC

**Maximum cable length:** 30 m (98 ft)

**Materials**
- Sensing element: Silicon-based MEMS sensor
- O-ring: EPDM or FKM
- Sensor housing: Stainless steel AISI 316 L 1.4404
- Flow pipe: Stainless steel AISI 316 L 1.4401
- Flange: Cast iron or stainless steel
- Bluff body: Stainless steel AISI 316 L 1.4401
- Corrosion-resistant coating, EPDM or FKM
- Stainless steel AISI 316 L 1.4401/04/08

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

**Weight**
- With cast iron flanges: 13.56 kg (29.89 lbs)
- With stainless steel flanges: 14.00 kg (30.86 lbs)

---

* Reference condition:
  - Media at 20 °C (68 °F), 1013 mbar (1 atmosphere), ρ = 998 kg/m³ (62.3 lb/ft³), v = 1 x 10⁻⁶ m²/s (1 cSt)
3. Vortex flow sensor, standard (VFS)

VFS general data

Fig. 31 VFS and VFS QT Sensors

Technical overview

The VFS sensor from Grundfos Direct Sensors™ is a combined flow and temperature sensor (two-in-one solution). It is based on the principle of vortex shedding behind a bluff body. The VFS sensors are fully compatible with wet, aggressive media. They use MEMS sensing technology in combination with the Silicoat® corrosion-resistant coating technology on the sensor chip. The sensor is supplied with a flow pipe.

Applications

• Water treatment and distribution
• water utility
• water monitoring
• HVAC systems
• chiller systems
• HPC and IT cooling systems
• micro CHP
• heat pumps
• solar systems: heating and cooling.

Features

• Wide temperature measuring range: 0-100 °C (32-212 °F)
• compact design
• MEMS technology.

<table>
<thead>
<tr>
<th>Flow ranges</th>
<th>l/min</th>
<th>gpm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-12</td>
<td>0.26</td>
<td>3.17</td>
</tr>
<tr>
<td>1-15</td>
<td>0.26</td>
<td>3.86</td>
</tr>
<tr>
<td>1.3 - 20</td>
<td>0.34</td>
<td>5.28</td>
</tr>
<tr>
<td>2-40</td>
<td>0.53</td>
<td>10.57</td>
</tr>
<tr>
<td>5-100</td>
<td>1.32</td>
<td>26.42</td>
</tr>
<tr>
<td>10-200</td>
<td>2.64</td>
<td>52.83</td>
</tr>
<tr>
<td>20-400</td>
<td>5.26</td>
<td>105.67</td>
</tr>
</tbody>
</table>

Benefits

• Flow and temperature measurement in one sensor (two-in-one solution)
• no moving parts
• compatible with wet, aggressive media
• accurate, linearised and temperature-compensated output signal
• quick temperature response (direct contact with medium)
• cost-effective and robust design
• system solution with Grundfos pumps.

Approvals

• WRAS
• KTW
• ACS.

Certificates

Electrical connections

Fig. 32 Electrical connections

<table>
<thead>
<tr>
<th>Pin configuration</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Temperature signal (0.5 to 3.5 V relative to pin 3)</td>
<td>Yellow</td>
</tr>
<tr>
<td>2 Flow signal (0.5 to 3.5 V relative to pin 3)</td>
<td>White</td>
</tr>
<tr>
<td>3 GND (0 V), PELV</td>
<td>Green</td>
</tr>
<tr>
<td>4 Power supply (+ 5 VDC)</td>
<td>Brown</td>
</tr>
</tbody>
</table>

Power supply requirements

5 VDC ± 5%, PELV

• separated from hazardous live circuitry by double or reinforced insulation
• we recommend separate ground for the sensor power supply.
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 1-12, 1-15, 2-40, 5-100, 10-200 l/min versions.

Snap-on sensor

The Snap-on sensor consists of a composite flow pipe and a sensor fitted with cable. The Snap-on sensor is available in 1-10, 2-30, 5-100, 10-200 l/min versions.
**VFS 1 - 20 l/min (0.2 - 5.3 gpm)**

**Dimensions**

**Sensor output signals**

**Specifications**

**Flow**
- Measuring range: 1-20 l/min (0.2 to 5.3 gpm)
- Accuracy (± 1σ): 0-100 °C (32-212 °F) ± 1.5 % FS
- Response time (63.2 %): < 1 s
- Resolution: 0.1 l/min (0.03 gpm)

**Temperature**
- Measuring range: 0-100 °C (32-212 °F)
- Accuracy (± 1σ): 25-80 °C (77-176 °F) ± 1 K
- Accuracy (± 1σ): 0-100 °C (32-212 °F) ± 2 K
- Response time (63.2 % at 50 % FS flow): 250 ms
- Resolution: 0.35 K

**Media and environment**
- Medium types: Kinematic viscosity ≤ 2 mm²/s (cSt)
- Medium temperature (operation): Water: 0-100 °C (32-212 °F)
- Medium temperature (peak): -25 °C (-13 °F), non-freezing
  - 120 °C (248 °F) for 5 minutes, up to 3 weeks in sensor lifetime
- Ambient air temperature (operation): -25 - 60 °C (-13 to 140 °F)
- Ambient air temperature (peak): -55 - 90 °C (-67 to 194 °F)
- Humidity: 0-95 % (relative), non-condensing
- System burst pressure: > 16 bar (232 psi)

**Electrical data**
- Power supply: 5 VDC (± 5 %). We recommend grounding of the sensor supply (PELV)
- Output signals: Ratiometric
- Flow signal: 0.5 - 3.5 V (Zero at 0.35 V)
- Temperature signal: 0.5 - 3.5 V
- Power consumption: < 50 mW
- Load impedance: > 10 kΩ
- Maximum cable length: 3 m (9.10 ft)

**Materials**
- Sensing element: Silicon-based MEMS sensor
- Seal (sensor to housing): EPDM
- Housing: Composites (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)

Grundfos Direct Sensors™

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

Fig. 41 VFS 2-40 sensor

Dimensions

Fig. 42 Dimensions without adapter

Fig. 43 Dimensions with adapters

Sensor output signals

Fig. 44 Flow response

Specifications

Flow
Measuring range 2-40 l/min (0.5 to 10.6 gpm)
Accuracy (±1σ), 0-100 °C (32-212 °F) ± 1.5 % FS
Response time (63.2 %) < 1 s
Resolution 0.2 l/min (0.05 gpm)

Temperature
Measuring range 0-100 °C (32-212 °F)
Accuracy (±1σ), 25-80 °C (77-176 °F) ± 1 K
Accuracy (±1σ), 0-100 °C (32-212 °F) ± 2 K
Response time (63.2 % at 50 % FS flow) 250 ms
Resolution 0.35 K

Media and environment
Medium types Kinematic viscosity ≤ 2 mm²/s (cSt)
Medium temperature (operation) Water: 0-100 °C (32-212 °F)
Medium temperature (peak) -25 °C (-13 °F), non-freezing
Ambient air temperature (operation) -25 - 60 °C (-13 - 140 °F)
Ambient air temperature (peak) -55 - 90 °C (-67 to 194 °F)
Humidity 0-95 % (relative), non-condensing
System burst pressure > 16 bar (232 psi)

Electrical data
Power supply 5 VDC (± 5 %). We recommend grounding of the sensor supply (PELV)
Output signals Ratiometric
Flow signal 0.5 - 3.5 V (Zero at 0.35 V)
Temperature signal 0.5 - 3.5 V
Power consumption < 50 mW
Load impedance > 10 kΩ
Maximum cable length 3 m (9.10 ft)

Materials
Sensing element Silicon-based MEMS sensor
Seal (sensor to housing) EPDM
Housing Composites (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)

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

Fig. 46 VFS 5-100 sensor

Dimensions

Fig. 47 Dimensions without adapter

Fig. 48 Dimensions with adapters

Sensor output signals

Fig. 49 Flow response

Specifications

Flow
- Measuring range 5-100 l/min (1.3 to 26.4 gpm)
- Accuracy (± 1σ), 0-100 °C (32-212 °F) ± 1.5 % FS
- Response time (63.2 %) < 1 s
- Resolution 0.5 l/min (0.13 gpm)

Temperature
- Measuring range 0-100 °C (32-212 °F)
- Accuracy (± 1σ), 25-80 °C (77-176 °F) ± 1 K
- Accuracy (± 1σ), 0-100 °C (32-212 °F) ± 2 K
- Response time (63.2 % at 50 % FS flow) 250 ms
- Resolution 0.35 K

Media and environment
- Medium types Kinematic viscosity ≤ 2 mm²/s (cSt)
- Medium temperature (operation) Water: 0-100 °C (32-212 °F)
- Medium temperature (peak) -25 °C (-13 °F), non-freezing 120 °C (-248 °F) for 5 minutes, up to 3 weeks in sensor lifetime
- Ambient air temperature (operation) -25 - 60 °C (-13 - 140 °F)
- Ambient air temperature (peak) -55 - 90 °C (-67 to 194 °F)
- Humidity 0-95 % (relative), non-condensing
- System burst pressure > 16 bar (232 psi)

Electrical data
- Power supply 5 VDC (± 5 %). We recommend grounding of the sensor supply (PELV)
- Output signals Ratiometric
- Flow signal 0.5 - 3.5 V (Zero at 0.35 V)
- Temperature signal 0.5 - 3.5 V
- Power consumption < 50 mW
- Load impedance > 10 kΩ
- Maximum cable length 3 m (9.10 ft)

Materials
- Sensing element Silicon-based MEMS sensor
- Seal (sensor to housing) EPDM
- Housing Composites (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)

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

Fig. 51 VFS 10-200 sensor

Dimensions

Fig. 52 Dimensions without adapter

Fig. 53 Dimensions with adapters

Sensor output signals

Fig. 54 Flow response

Specifications

Flow
Measuring range 10-200 l/min (2.6 to 52.8 gpm)
Accuracy (± 1σ), 0-100 °C (32-212 °F) ± 1.5 % FS
Response time (63.2 %) < 1 s
Resolution 1.0 l/min (0.26 gpm)

Temperature
Measuring range 0-100 °C (32-212 °F)
Accuracy (± 1σ), 25-80 °C (77-176 °F) ± 1 K
Accuracy (± 1σ), 0-100 °C (32-212 °F) ± 2 K
Response time (63.2 %) 250 ms
Resolution 0.35 K

Media and environment
Medium types Kinematic viscosity ≤ 2 mm²/s (cSt)
Medium temperature (operation) Water: 0-100 °C (32-212 °F)
Medium temperature (peak) -25 °C (-13 °F), non-freezing
Ambient air temperature (operation) -25 - 60 °C (-13 - 140 °F)
Ambient air temperature (peak) -55 - 90 °C (-67 to 194 °F)
Humidity 0-95 % (rel.), non-condensing

Electrical data
Power supply 5 VDC (± 5 %). We recommend grounding of the sensor supply (PELV)
Output signals Ratiometric
Flow signal 0.5 - 3.5 V (Zero at 0.35 V)
Temperature signal 0.5 - 3.5 V
Power consumption < 50 mW
Load impedance > 10 kΩ
Maximum cable length 3 m (9.10 ft)

Materials
Sensing element Silicon-based MEMS sensor
Seal (sensor to housing) EPDM
Housing Composites (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, 1G, 4 h
Electromagnetic compatibility EN 61326-1
Vortex flow sensor, standard (VFS)

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

**Dimensions**

![Fig. 56 VFS 20-400 sensor](image)

![Fig. 57 Dimensions without adapter](image)

![Fig. 58 Dimensions with adapters](image)

**Sensor output signals**

![Fig. 59 Flow response](image)

**Specifications**

**Flow**
- Measuring range: 20-400 l/min (5.3 to 106.7 gpm)
- Accuracy (± 1σ), 0-100 °C (32-212 °F) ± 1.5 % FS
- Response time (63.2 %) < 1.0 s
- Resolution: 2.0 l/min (0.53 gpm)

**Temperature**
- Measuring range: 0-100 °C (32-212 °F)
- Accuracy (± 1σ), 25-80 °C (77-176 °F) ± 1 K
- Accuracy (± 1σ), 0-100 °C (32-212 °F) ± 2 K
- Response time (63.2 % at 50 % FS flow): 250 ms
- Resolution: 0.35 K

**Media and environment**
- Kinematic viscosity ≤ 2 mm²/s (cSt)
- Water: 0-100 °C (32-212 °F)
- Medium temperature (peak): -25 °C (-13 °F), non-freezing
- 120 °C (-248 °F) for 5 minutes, up to 3 weeks in sensor lifetime
- Ambient air temperature (operation): -25 - 60 °C (-13 - 140 °F)
- Ambient air temperature (peak): -55 - 90 °C (-67 to 194 °F)
- Humidity: 0-95 % (relative), non-condensing
- System burst pressure: > 16 bar (232 psi)

**Electrical data**
- Power supply: 5 VDC (± 5 %). We recommend grounding of the sensor supply (PELV)
- Output signals: Ratiometric
- Flow signal: 0.5 - 3.5 V (Zero at 0.35 V)
- Temperature signal: 0.5 - 3.5 V
- Power consumption: < 50 mW
- Load impedance: > 10 kΩ
- Maximum cable length: 3 m (9.10 ft)

**Materials**
- Sensing element: Silicon-based MEMS sensor
- Seal (sensor to housing): EPDM
- Housing: Composites (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)

Grundfos Direct Sensors™

VFS 1 - 12 QT l/min (0.2 - 3.2 gpm)

**Dimensions**

![Dimensions Diagram]

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>110</td>
<td>ISO 228/1 - G3/4 A</td>
</tr>
<tr>
<td>in</td>
<td>4.33</td>
<td>3/4&quot; - 14 NPSM</td>
</tr>
</tbody>
</table>

**Sensor output signals**

![Sensor Output Signals Diagram]

<table>
<thead>
<tr>
<th>Flow signal</th>
<th>0.5 - 3.5 V (Zero at 0.25 V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>0.5 - 3.5 V (0.25 °C)</td>
</tr>
<tr>
<td>Power consumption</td>
<td>&lt; 50 mW</td>
</tr>
<tr>
<td>Load impedance</td>
<td>&gt; 10 kΩ</td>
</tr>
<tr>
<td>Maximum cable length</td>
<td>3 m (9.10 ft)</td>
</tr>
</tbody>
</table>

**Materials**

- **Sensing element**: Silicon-based MEMS sensor
- **Seal (sensor to housing)**: EPDM
- **Housing**: Composites (PPS, PA66)
- **Flow pipe**: 1.4408 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: 1-12 l/min (0.2 to 3.2 gpm)
- Accuracy (± 1σ), 0-100 °C (32-212 °F): ± 1.5 % FS
- Response time (63.2 %): < 3 s
- Resolution: 0.06 l/min (0.016 gpm)

**Temperature**

- Measuring range: 0-100 °C (32-212 °F)
- Accuracy (± 1σ), 25-80 °C (77-176 °F): ± 1 K
- Accuracy (± 1σ), 0-100 °C (32-212 °F): ± 2 K
- Response time (63.2 % at 50 % FS flow): 250 ms
- Resolution: 0.35 K

**Media and environment**

- **Medium types**: Kinematic viscosity ≤ 4 mm²/s (cSt)
- **Medium temperature (operation)**: Water: 0-100 °C (32-212 °F)
- **Medium temperature (peak)**: 25 °C (77 °F), non-freezing; 120 °C (248 °F) for 5 minutes, up to 3 weeks in sensor lifetime
- **Ambient air temperature (operation)**: -25 - 60 °C (-13 - 140 °F)
- **Ambient air temperature (peak)**: -55 - 90 °C (-67 to 194 °F)
- **Humidity**: 0-95 % (relative), non-condensing
- **System burst pressure**: > 16 bar (232 psi)

**Electrical data**

- **Power supply**: 5 VDC (± 5 %). We recommend grounding of the sensor supply (PELV)
- **Output signals**: Ratiometric
- **Flow signal**: 0.5 - 3.5 V (Zero at 0.25 V)
- **Power consumption**: < 50 mW
- **Load impedance**: > 10 kΩ
- **Maximum cable length**: 3 m (9.10 ft)
Vortex flow sensor, standard (VFS)

Fig. 64 VFS 1-15 QT sensor

Dimensions

<table>
<thead>
<tr>
<th></th>
<th>A</th>
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<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>110</td>
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<td>3/4” - 14 NPSM</td>
<td>2.31</td>
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</tbody>
</table>

Sensor output signals

<table>
<thead>
<tr>
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<th>A</th>
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<th>C</th>
<th>D</th>
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<tr>
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<td>2.38</td>
<td>1.17</td>
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</table>

Specifications

**Flow**
- Measuring range: 1-15 l/min (0.2 to 3.9 gpm)
- Accuracy (± 1σ): ± 1.5 % FS
- Response time (63.2 %): < 1 s
- Resolution: 0.075 l/min (0.019 gpm)

**Temperature**
- Measuring range: 0-100 °C (32-212 °F)
- Accuracy (± 1σ): ± 1 K
- Accuracy (± 1σ): ± 2 K
- Response time (63.2 % at 50 % FS flow): 250 ms
- Resolution: 0.35 K

**Media and environment**
- Medium types: Kinematic viscosity ≤ 2 mm²/s (cSt)
- Medium temperature (operation): Water: 0-100 °C (32-212 °F)
- Medium temperature (peak): -25 °C (-13 °F), non-freezing
- Ambient air temperature (operation): -25 - 60 °C (-13 - 140 °F)
- Ambiant air temperature (peak): -55 - 90 °C (-67 to 194 °F)
- Humidity: 0-95 % (relative), non-condensing
- System burst pressure: > 16 bar (232 psi)

**Electrical data**
- Power supply: 5 VDC (± 5 %). We recommend grounding of the sensor supply (PELV)
- Output signals: Ratiometric
- Flow signal: 0.5 - 3.5 V (Zero at 0.25 V)
- Temperature signal: 0.5 - 3.5 V
- Power consumption: < 50 mW
- Load impedance: > 10 kΩ
- Maximum cable length: 3 m (9.10 ft)

**Materials**
- Sensing element: Silicon-based MEMS sensor
- Seal (sensor to housing): EPDM
- Housing: Composites (PPS, PA66)
- Flow pipe: 1.4408
- Insert: PPA 40 GF
- Wetted materials: Corrosion-resistant coating
- Enclosure class: IP44 (cable connected)
- Temperature cycling: IEC 68-2-14
- Vibration (non-destructive): 20-2000 Hz, 10G, 4 h
- Electromagnetic compatibility: EN 51326-1
VFS 2 - 40 QT  l/min (0.5 - 10.6 gpm)

Dimensions

<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>
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</table>

Sensor output signals

Specifications

Flow
- Measuring range: 2-40 l/min (0.5 to 10.6 gpm)
- Accuracy (± 1σ): 0-100 °C (32-212 °F) ± 1.5 % FS
- Response time (63.2 %): < 1 s
- Resolution: 0.2 l/min (0.05 gpm)

Temperature
- Measuring range: 0-100 °C (32-212 °F)
- Accuracy (± 1σ): 0-100 °C (32-212 °F) ± 1 K
- Accuracy (± 1σ): 25-80 °C (77-176 °F) ± 2 K
- Response time: 63.2 % at 50 % FS flow: 250 ms
- Resolution: 0.35 K

Media and environment
- Medium types:
  - Kinematic viscosity: ≤ 2 mm²/s (cSt)
  - Medium temperature (operation): Water: 0-100 °C (32-212 °F)
- Medium temperature (peak): -25 °C (-13 °F), non-freezing
- Ambient air temperature (operation): -25 - 60 °C (-13 - 140 °F)
- Ambient air temperature (peak): -55 - 90 °C (-67 to 194 °F)
- Humidity: 0-95 % (relative), non-condensing
- System burst pressure: > 16 bar (232 psi)

Electrical data
- Power supply: 5 VDC (± 5 %). We recommend grounding of the sensor supply (PELV)
- Output signals: Ratiometric
- Flow signal: 0.5 - 3.5 V (zero at 0.35 V)
- Temperature signal: 0.5 - 3.5 V
- Power consumption: < 50 mW
- Load impedance: > 10 kΩ
- Maximum cable length: 3 m (9.10 ft)

Materials
- Sensing element: Silicon-based MEMS sensor
- Seal (sensor to housing): EPDM
- Housing: Composites (PPS, PA66)
- Flow pipe: 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 50352-1
Vortex flow sensor, standard (VFS)

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

Dimensions

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<td>66.5</td>
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<tr>
<td>in</td>
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<td>1&quot; - 11.5 NPSM</td>
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</table>

Sensor output signals

- **Flow**
  - Measuring range: 5-100 l/min (1.3 to 26.4 gpm)
  - Accuracy (± 1σ): ± 1.5 % FS
  - Response time (63.2 %): < 1 s
  - Resolution: 0.5 l/min (0.13 gpm)

- **Temperature**
  - Measuring range: 0-100 °C (32-212 °F)
  - Accuracy (± 1σ): ± 2 K
  - Response time (63.2 % at 50 % FS flow): 250 ms
  - Resolution: 0.35 K

- **Media and environment**
  - Medium types: Kinematic viscosity ≤ 2 mm²/s (cSt)
  - Medium temperature (operation): Water: 0-100 °C (32-212 °F)
  - Medium temperature (peak): 25 °C (77 °F), non-freezing
  - Ambient air temperature (operation): -25 - 60 °C (-13 - 140 °F)

- **Electrical data**
  - Power supply: 5 VDC (± 5 %), We recommend grounding of the sensor supply (PELV)
  - Output signals: Ratiometric
  - Flow signal: 0.5 - 3.5 V (Zero at 0.35 V)
  - Temperature signal: 0.5 - 3.5 V
  - Power consumption: < 50 mW
  - Load impedance: > 10 kΩ
  - Maximum cable length: 3 m (9.10 ft)

- **Materials**
  - Sensing element: Silicon-based MEMS sensor
  - Seal (sensor to housing): EPDM
  - Flow pipe: 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. 70 VFS 5-100 QT sensor

Fig. 71 Flow response

Fig. 72 Temperature response
Vortex flow sensor, standard (VFS)

Grundfos Direct Sensors™

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

Fig. 73 VFS 10-200 QT sensor

Dimensions

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>137.5</td>
<td>ISO 228/1 - G 1 1/4 A or 1 1/4&quot; - 11.5 NPSM</td>
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<tr>
<td>in</td>
<td>5.41</td>
<td>2.92</td>
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</table>

Sensor output signals

- **Flow**
  - Measuring range: 10-200 l/min (2.6 to 52.8 gpm)
  - Accuracy (± 1σ): 0-100 °C (32-212 °F) ± 1.5 % FS
  - Response time (63.2 %): < 1.0 s
  - Resolution: 1.0 l/min (0.26 gpm)

- **Temperature**
  - Measuring range: 0-100 °C (32-212 °F)
  - Accuracy (± 1σ): 0-100 °C (32-212 °F) ± 2 K
  - Response time (63.2 % at 50 % FS flow): 250 ms
  - Resolution: 0.35 K

- **Media and environment**
  - Kinematic viscosity ≤ 2 mm²/s (cSt)
  - Water: 0-100 °C (32-212 °F)
  - Medium temperature (operation): -25 °C (-13 °F), non-freezing
  - Medium temperature (peak): 120 °C (248 °F) for 5 minutes, up to 3 weeks in sensor lifetime
  - Ambient air temperature (operation): -25 - 60 °C (-13 - 140 °F)
  - Ambient air temperature (peak): -55 - 90 °C (-67 to 194 °F)
  - Humidity: 0-95 % (relative), non-condensing
  - System burst pressure: > 16 bar (232 psi)

**Flow response**

**Temperature response**

Specifications

**Flow**

- Measuring range: 10-200 l/min (2.6 to 52.8 gpm)
- Accuracy (± 1σ): 0-100 °C (32-212 °F) ± 1.5 % FS
- Response time (63.2 %): < 1.0 s
- Resolution: 1.0 l/min (0.26 gpm)

**Temperature**

- Measuring range: 0-100 °C (32-212 °F)
- Accuracy (± 1σ): 0-100 °C (32-212 °F) ± 2 K
- Response time (63.2 % at 50 % FS flow): 250 ms
- Resolution: 0.35 K

**Media and environment**

- Kinematic viscosity ≤ 2 mm²/s (cSt)
- Water: 0-100 °C (32-212 °F)
- Medium temperature (operation): -25 °C (-13 °F), non-freezing
- Medium temperature (peak): 120 °C (248 °F) for 5 minutes, up to 3 weeks in sensor lifetime
- Ambient air temperature (operation): -25 - 60 °C (-13 - 140 °F)
- Ambient air temperature (peak): -55 - 90 °C (-67 to 194 °F)
- Humidity: 0-95 % (relative), non-condensing
- System burst pressure: > 16 bar (232 psi)

**Electrical data**

- Power supply: 5 VDC (± 5 %). We recommend grounding of the sensor supply (PELV)
- Output signals: Ratiometric
- Flow signal: 0.5 - 3.5 V (Zero at 0.35 V)
- Temperature signal: 0.5 - 3.5 V
- Power consumption: < 50 mW
- Load impedance: ≥ 10 kΩ
- Maximum cable length: 3 m (9.10 ft)

**Materials**

- Sensing element: Silicon-based MEMS sensor
- Seal (sensor to housing): EPDM
- Flow pipe: 1.4408
- Insert: PPA 40-GF
- 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
## 4. Product range

### VFI sensor

Scope of delivery:
- Flow pipe with sensor
- 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>Product number</th>
</tr>
</thead>
<tbody>
<tr>
<td>VFI- 0.3-6m-1-C-M5.000X-FG6-SG-30F-A-1</td>
<td>0.3 - 6 m³/h</td>
<td>EPDM</td>
<td>Cast iron flange</td>
<td>Thread</td>
<td>97686127</td>
</tr>
<tr>
<td>VFI- 0.3-6m-1-C-M5.000X-FG6-SG-30F-A-1</td>
<td>0.3 - 6 m³/h</td>
<td>FKM</td>
<td>Stainless steel flange</td>
<td></td>
<td>97686128</td>
</tr>
<tr>
<td>VFI- 0.3-6m-1-C-M5.000X-EG6-SS-30F-A-1</td>
<td>0.3 - 6 m³/h</td>
<td>EPDM</td>
<td>Cast iron flange</td>
<td>Thread</td>
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</tr>
<tr>
<td>VFI- 0.3-6m-1-C-M5.000X-EG6-SS-30F-A-1</td>
<td>0.3 - 6 m³/h</td>
<td>FKM</td>
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<tr>
<td>VFI- 0.6-12m-1-C-M5.000X-FG6-SG-30F-A-1</td>
<td>0.6 - 12 m³/h</td>
<td>EPDM</td>
<td>Cast iron flange</td>
<td>Thread</td>
<td>97686131</td>
</tr>
<tr>
<td>VFI- 0.6-12m-1-C-M5.000X-FG6-SG-30F-A-1</td>
<td>0.6 - 12 m³/h</td>
<td>FKM</td>
<td>Stainless steel flange</td>
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<td>VFI- 1.3-25m-1-C-M5.000X-EG6-SS-30F-A-1</td>
<td>1.3 - 25 m³/h</td>
<td>EPDM</td>
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<td>VFI- 1.3-25m-1-C-M5.000X-EG6-SS-30F-A-1</td>
<td>1.3 - 25 m³/h</td>
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<td>VFI- 2-40m-1-C-M5.000X-EG6-SG-31F-A-1</td>
<td>2 - 40 m³/h</td>
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<td>2 - 40 m³/h</td>
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<td>Stainless steel flange</td>
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<tr>
<td>VFI- 3.2-64m-1-C-M5.000X-FG6-SG-32F-A-1</td>
<td>3.2 - 64 m³/h</td>
<td>EPDM</td>
<td>Cast iron flange</td>
<td>Thread</td>
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<td>VFI- 3.2-64m-1-C-M5.000X-FG6-SG-32F-A-1</td>
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<td>VFI- 8-160m-1-C-M5.000X-FG6-SG-35F-A-1</td>
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<tr>
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<td>EPDM</td>
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<td>12 - 240 m³/h</td>
<td>EPDM</td>
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<td>12 - 240 m³/h</td>
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<td>FKM</td>
<td>Stainless steel flange</td>
<td></td>
<td>97686150</td>
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<td>Thread</td>
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</tr>
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<td>97686154</td>
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</tbody>
</table>
VFS sensor

Sensor selection
Grundfos offers a wide range of custom-built VFS sensors.
The VFS sensors can be customized depending on the application. The tables below list all the variants. Be aware that not all combinations are possible. Therefore, please contact Grundfos Direct Sensors when proceeding to selection.

Example of a type key:
VFS / 20-400 L / 1 / D / C 1.200 E / G4 / CS / 25P / W·1

1. Product group
2. Product range and units
3. Generation
4. Electrical output type
5. Cable and connectors
6. O-ring material and enclosure class
7. Material
8. Dimension of mechanical connection
9. Mechanical connection type
10. Packaging

---

**VFS 20-400 L / 1 / D / C 1.200 E / G4 / CS / 25P / W·1**

1. **Product group**
2. **Product range and units**
   - **Product range**
   - **Range of unit**
     - 20-400
     - L: litres/min.

3. **Generation**
   - **Code**
   - **Generation**
     - 1 1st generation
     - 2 2nd generation
     - 3 3rd generation

4. **Electrical output type**
   - **Code**
   - **Output**
     - B 0-10 V
     - C 4-20 mA, 2 wires
     - D 0.5 - 3.5 V
     - E 0.5 - 4.5 V
     - F 2 x 0-10 V
     - G 4-20 mA, 3 wires

5. **Cable and connectors:**
   - **Code**
   - **Cable connector description**
     - B FCI 90312-004LF/771138-101
     - C CKM 42010107/42010311, tin plated
     - D AMP 103848-3/104479-9
     - E Molex 51004-0400/50011-8000
     - F AMP 172167-1/0-170365-1
     - G Tyco Val-U-Lok 794954-4/794958-2, gold plated
     - J JST XHP-4/SXH-001-TP0.6
     - L Lumberg 3510-04 K02
     - N Lumberg 3510-04 K03
     - P Molex 43025-0400/43030-0005, 43030-001/ Cembre 1910M16
     - Q Molex 43025-0400/43030-0006
     - R Molex 51004-0400/50011-8000/ Cembre 1900M12
     - X Open ended

6. **O-ring material and enclosure class**
   - **Code**
   - **Sealing description**
     - E EPDM (drinking water approved)
     - F FKM (for use in oily media)
     - G Gel-filled

7. **Material**
   - **Code**
   - **Material description**
     - B Brass
     - C Composite
     - Q Stainless steel flow pipe with composite insert (QT)
     - S Stainless steel

8. **Dimension of mechanical connection**
   - **Code**
   - **Dimension**
     - 03 G 1/2" 13 G4*
     - 04 G 3/4" 17 7/16" 16.75 mm
     - 05 G1" 19 16.75 mm
     - 06 6 mm 21 21.5 mm
     - 07 G 1 1/4" 24 1/8 - 27
     - 08 8 mm 25 3/4 - 14
     - 09 G 1 1/2" 26 1 - 11.5
     - 10 G 1 1/2" 27 1 1/4 - 11.5
     - 11 G 2 1/2" 51 f1" - G 3/4
     - 12 G 3" 52 f1 1/4" - G 1

9. **Mechanical connection type**
   - **Code**
   - **Description**
     - B BSPT (ISO 7/1)
     - C Compression
     - F Flange
     - G Flange and BSPP (ISO 228/1)
     - K Clips
     - M NPSM
     - N NPT
     - P BSPP (ISO 228/1)
     - S Sweat
     - T Tube
     - U UNF

10. **Packaging**
    - **Code**
    - **Description of packaging**
      - A Set with pre-assembled components
      - C Cardboard box
      - D Blister pack and cardboard box, standard Grundfos
      - P Spare parts set
      - S Set
      - V Service set
      - W Blister pack, standard Grundfos cardboard
      - N Blister pack, neutral while cardboard
      - 1 1 piece
      - 10 Bulk 10
      - 25 Bulk 25
      - 50 Bulk 50
      - 1H Bulk 100
      - 5H Bulk 500
5. Accessories

**Sensor interface - converter unit**

The sensor interface, type SI 010 CNV, from Grundfos Direct Sensors™ is an external power supply, signal amplifier and signal converter for Grundfos sensors, standard variants (VFS, RPS, DPS).

SI 010 CNV has built-in precision resistors enabling the transmitter to give 4-20 mA, 1-5 V and 2-10 V output signals.

SI 010 CNV should be used in applications where sensors from the standard product range are used, but the controller requires a 4-20 mA input signal.

![Sensor interface, SI 010 CNV](image)

**Specification:**
- Voltage range: 115-230 VAC ± 10 % or 24 VDC
- Frequency: 50-60 Hz
- Power consumption: Max. 2.5 W
- Ambient temperature: -20 - 50 °C (-4 to 122 °F)
- Enclosure class: IP20.

<table>
<thead>
<tr>
<th>Part</th>
<th>Product Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor interface, SI 010 CNV, IP20</td>
<td>96983684</td>
</tr>
</tbody>
</table>
6. Appendix

Minimum flow rate curves

Minimum flow rate as a function of the kinematic viscosity

The minimum detectable flow rate \( Q_{\text{min}} \) for the VFI sensors depends on the kinematic viscosity of the medium. The chart below shows \( Q_{\text{min}} \) as a function of the kinematic viscosity.

\[
\begin{array}{|c|c|}
\hline
\text{Kinematic Viscosity [cSt]} & \text{GPM} \\
\hline
0 & 0 \\
0.1 & 0 \\
1 & 0 \\
10 & 0 \\
22 & 0 \\
31 & 0 \\
39 & 0 \\
44 & 0 \\
10 & 9 \\
20 & 13 \\
30 & 18 \\
40 & 22 \\
50 & 26 \\
60 & 31 \\
70 & 35 \\
80 & 39 \\
90 & 44 \\
100 & 50 \\
110 & 55 \\
120 & 60 \\
130 & 65 \\
140 & 70 \\
150 & 75 \\
160 & 80 \\
170 & 85 \\
180 & 90 \\
190 & 95 \\
200 & 100 \\
\hline
\end{array}
\]

* Reference condition:
  - Media at 20 °C (68 °F), 1013 mbar (1 atmosphere), \( \rho = 998 \text{ kg/m}^3 \) (62.3 lb/ft³), \( v = 1 \times 10^{-6} \text{ m}^2/\text{s} \) (1 cSt).
**Pressure drop curves**

*Reference condition:*
- Media at 20 °C (68 °F), 1013 mbar (1 atmosphere), $p = 998$ kg/m$^3$ (62.3 lb/ft$^3$), $v = 1 \times 10^{-6}$ m$^2$/s (1 cSt).
Installation of VFI sensor

- Min. 10 x D₁
- Min. 5 x D₁

- Min. 20 x D₁
- -0.05 bar (0.725 PSI)

- 0 bar

- -25 to 60 °C (-13 to 140 °F)
- Max. 28 bar (406 PSI)
- -30 to 120 °C (-22 to 248 °F)

- IP67

- Thermometer

- Pressure gauge
7. 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 designed for aggressive, flammable 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.

Subject to alterations.