FS5
Thermal Mass Flow Sensor
Optimal for various gas flow applications

Benefits & Characteristics

- Easy adaptation in various applications and housings
- Simple signal processing
- Simple calibration
- No moving mechanical parts
- Excellent reproducibility
- Excellent long-term stability
- Bare sensor element resists up to 450 °C
- Stable platinum technology
- Customer specific sensor available upon request

Illustration

Technical Data

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions (L x W x H in mm):*</td>
<td>7 x 2.4 x 0.15 / Ø 6.0 , L = 14</td>
</tr>
<tr>
<td>Operating measuring range:</td>
<td>0 m/s to 100 m/s</td>
</tr>
<tr>
<td>Response sensitivity:</td>
<td>0.01 m/s</td>
</tr>
<tr>
<td>Accuracy:</td>
<td>&lt; 3 % of the measured value (dependent on the electronics and calibration)</td>
</tr>
<tr>
<td>Response time t_{63}:</td>
<td>&lt; 2 s</td>
</tr>
<tr>
<td>Temperature range:*</td>
<td>-20 °C to +150 °C</td>
</tr>
<tr>
<td>Temperature sensitivity:</td>
<td>&lt; 0.1 % / K (dependent on the electronics)</td>
</tr>
<tr>
<td>Wire:*</td>
<td>3 pins, AWG30/7, stranded wire, insulated with PTFE</td>
</tr>
<tr>
<td>Heater resistance:*</td>
<td>$R_H(0 \degree C) = 45 \text{ Ohm } +/- 1 %$</td>
</tr>
<tr>
<td>Temperature sensor:*</td>
<td>$R_s(0 \degree C) = 1200 \text{ Ohm } +/- 1 %$</td>
</tr>
<tr>
<td>Max. supply voltage (typical):*</td>
<td>2 V to 5 V (at $\Delta T = 30 K (0 \text{ m/s} \leq v_{\text{gas}} \leq 100 \text{ m/s}$)</td>
</tr>
<tr>
<td>Max. heater voltage:*</td>
<td>3 V (at 0 m/s)</td>
</tr>
<tr>
<td>Alternative construction:*</td>
<td>Moulded housing</td>
</tr>
</tbody>
</table>

* Customer specific alternatives available
FS5
Thermal Mass Flow Sensor
Optimal for various gas flow applications

Wire assignment:

Order Information - 3 pins, AWG30, insulated with PTFE

<table>
<thead>
<tr>
<th>Dimension (in mm)</th>
<th>Without housing</th>
<th>With housing</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 x 2.4 x 0.15</td>
<td>FS5.0.1L.195</td>
<td></td>
</tr>
<tr>
<td>Order code</td>
<td>050.00127</td>
<td></td>
</tr>
<tr>
<td>Ø 6.0 (+/- 0.1, L= 14 (+/- 0.2)</td>
<td>FS5.A.1L.195</td>
<td>050.00128</td>
</tr>
<tr>
<td>Order code</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Additional Electronics

Document name:

Module: DFFS5_FSL_Module_E
FS2
Thermal Mass Flow Sensor
Optimal for measuring gas flow and direction

Benefits & Characteristics

- Detection of flow direction
- Simple signal processing
- Outstanding sensitivity
- Stable platinum technology
- No moving mechanical parts
- Excellent long-term stability
- Simple calibration
- Bare sensor element resists up to 450 °C
- Excellent reproducibility
- Customer specific sensor available upon request

Illustration

Technical Data

Dimensions (L x W x H in mm):* 5 x 3.5 x 0.15
Operating measuring range:
- 0 ml/min to 50 ml/min (half bridge mode)
- 0 m/s to 1 m/s (half bridge mode)
- 0 m/s to 100 m/s (CTA mode)
- 0 l/min to 5 l/min (CTA mode)
Minimum operating range:
- 0 ml/min to 2.5 ml/min
Response sensitivity:
- 0.001 m/s (50 microliter/min)
Accuracy:
- < 2 % of the measured value (dependent on the electronics and calibration)
Response time $t_{63}$:
- < 0.5 s
Temperature range:*
- -20 °C to +150 °C
Temperature sensitivity:
- < 0.1% / K (dependent on the electronics)
Wire:
- enamelled Cu-wire, Ø 0.2 mm
Heater resistance:*
- $R_H(25 ^\circ C) = 34 \text{ Ohm} \pm/\pm 10 \%$
Measuring element:*
- $R_{ij}(25 ^\circ C) = 425 \text{ Ohm} \pm/\pm 10 \%$
Temperature sensor:*
- $R_T(25 ^\circ C) = 710 \text{ Ohm} \pm/\pm 10 \%$
Max. supply voltage (typical):
- 2 V to 5 V (dependent on flow rate)

* Customer specific alternatives available
FS2
Thermal Mass Flow Sensor
Optimal for measuring gas flow and direction

Order Information - Enamelled Cu-wire, Ø 0.2 mm

<table>
<thead>
<tr>
<th>Wire length</th>
<th>25 mm</th>
<th>300 mm (+/- 20 mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FS2T.0.1E.025</td>
<td>FS2T.0.1E.300</td>
</tr>
<tr>
<td></td>
<td>050.00130</td>
<td>350.00053</td>
</tr>
</tbody>
</table>
MFS02
Thermal Mass Flow Sensor
Optimal for ultra fast measuring of gas flow and direction

Benefits & Characteristics

- Detection of flow direction
- Ultra fast response time
- Excellent for low mass flow
- Low power consumption
- Small thermal mass
- Robust construction
- Excellent long term stability
- Bare sensor element resists up to 450 °C
- Customer specific sensor available upon request

Illustration

Technical Data

Dimensions (L x W x H in mm):
- 3.5 x 5.1 x 0.5
- 38.2 x 10.8 x 1.0 (including glob top 2.0)
- 37.4 x 10.8 x 1.0 (including glob top 2.0)

Operating measuring range:
- 0 m/s to 1.5 m/s (full bridge mode)
- 0 ml/min to 100 ml/min (full bridge mode)
- 0 m/s to 150 m/s (CTA mode)
- 0 l/min to 10 l/min (CTA mode)

Minimum operating range:
- 0 ml/min to 1 ml/min

Response sensitivity:
- 0.0003 m/s (20 microliter/min)

Accuracy:
- < 2 % of the measured value (dependent on the electronics and calibration)

Response time \( t_{63} \):
- < 10 ms

Temperature range - Chip:
- -40 °C to +160 °C

Temperature range - Gas:
- -40 °C to + 80 °C (max. 80 °C less than chip temperature)

Temperature sensitivity:
- < 0.1 % / K (dependent on the electronics)

Contacts:
- bonding pads

2 elements:
- \( R_{\text{high}} (0 °C) = 710 \text{ Ohm } +/- 10 \% R_A, R_D \)
- \( R_{\text{low}} (0 °C) = 530 \text{ Ohm } +/- 10 \% R_B, R_C \)

Matching between elements:
- < 2 %

1 element:
- Pt RTD similar to Pt1000

Max. supply voltage (typical):
- 2 V to 6 V (Full bridge mode)
MFS02
Thermal Mass Flow Sensor
Optimal for ultra fast measuring of gas flow and direction

Bridge offset (full bridge mode): Max. +/- 50 mV at VCC = 5 V; typical +/- 10 mV
TCR bridge offset (full bridge mode): Max. +/- 50 ppm/K x VCC/2
Power consumption (no flow): 10 mW to 50 mW (resp. chip temperature 50 °C to 160 °C)

* Customer specific alternatives available

Order Information - Bonding Pads

<table>
<thead>
<tr>
<th>Bare sensor element</th>
<th>MFS 02</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order code</td>
<td>350.00069</td>
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</table>

<table>
<thead>
<tr>
<th>Sensor element on PCB</th>
<th>MFS 02 auf PCB_Standardversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order code</td>
<td>350.00093</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sensor element on PCB</th>
<th>MFS 02 auf PCB_Exposedversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order code</td>
<td>350.00095</td>
</tr>
</tbody>
</table>

Additional Electronics

Document name:
Evakit: MFS02 EvaKit_E
Amplifier module: DFMFS_Amplifier_Modul_E

Innovative Sensor Technology IST AG, Stegrütistrasse 14, CH-9642 Ebnat-Kappel, Switzerland,
Phone: +41 (0) 71 992 01 00 | Fax: +41 (0) 992 01 99 | E-mail: info@ist-ag.com | Web: www.ist-ag.com

All mechanical dimensions are valid at 25 °C ambient temperature, if not differently indicated • All data except the mechanical dimensions only have information purposes and are not to be understood as assured characteristics • Technical changes without previous announcement as well as mistakes reserved • The information on this data sheet was examined carefully and will be accepted as correct; No liability in case of mistakes • Load with extreme values during a longer period can affect the reliability • The material contained herein may not be reproduced, adapted, merged, translated, stored, or used without the prior written consent of the copyright owner • Typing errors and mistakes reserved • Product specifications are subject to change without notice • All rights reserved
FS5-Flowmodule
Thermal Mass Flow Sensor
Optimal for gas flow sensor evaluation

Benefits & Characteristics

- Easy to use plug & play module
- Simple constant temperature anemometer
- Simple gain adjustment
- No microprocessor or software influenced signal
- Power supply over USB possible
- Customer specific sensor available upon request

Illustration

Technical Data

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions (L x W in mm)</td>
<td>45 x 25</td>
</tr>
<tr>
<td>Operating measuring range</td>
<td>0 m/s to 100 m/s</td>
</tr>
<tr>
<td>Accuracy</td>
<td>&lt; 5 % of the measured value (dependent on the electronics and calibration)</td>
</tr>
<tr>
<td>Temperature range</td>
<td>-40 °C to 85 °C (module)</td>
</tr>
<tr>
<td>Temperature sensitivity</td>
<td>&lt; 0.5 % / K</td>
</tr>
<tr>
<td>Contacts</td>
<td>solder pads on PCB</td>
</tr>
<tr>
<td>Heater resistance</td>
<td>$R_h(0 \degree C) = 45 \text{ Ohm } \pm 1 %$</td>
</tr>
<tr>
<td>Temperature sensor</td>
<td>$R_s(0 \degree C) = 1200 \text{ Ohm } \pm 1 %$</td>
</tr>
<tr>
<td>Max. supply voltage (typical)</td>
<td>5 V DC +/- 5 % (internal main voltage is 10 V)</td>
</tr>
<tr>
<td>Warm-up time</td>
<td>&lt; 30 s</td>
</tr>
<tr>
<td>Analogue output, non linear</td>
<td>0 V (2) to 10 V; 50 mA (operating point at still air = 3.5 V)</td>
</tr>
</tbody>
</table>

* Customer specific alternatives available

Order Information - Solder Pads

<table>
<thead>
<tr>
<th>Order Information - Solder Pads</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order code</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

1) The module does not contain any sensor. The sensor should be ordered separately.
Microflow Amplifier Module
Thermal Mass Flow Sensor
Optimal for demonstration and evaluation of the MFS02

Benefits & Characteristics

- Single supply 12 V\text{dc}
- Separate temperature sensor on chip
- Interfacing with screw termination block
- Adjustment with 3 multiturn trimming potentiometer (gain, offset, heater voltage)
- Monitoring for internal supply, offset and heater voltages at termination block
- Flow channel and pneumatic connectors mounted

Illustration

![Image of the Microflow Amplifier Module](image)

Technical Data

- **Dimensions (L x W x H in mm):** 70 x 35 x 30
- **Operating measuring range:** >0 m/s to 2 m/s (0 ml/min to 240 ml/min)
- **Supported sensor:** MFS02
- **Temperature sensor:** PT1000 temperature sensor (DIN IEC 60751) (passive - directly wired to output)
- **Heater voltage range:** 2 V\text{dc} to 5 V\text{dc}
- **Current consumption:** < 50 mA
- **Supply voltage:** 12 V\text{dc} external supply (no reverse polarity protection)
- **Output signal range:** -1.8 V\text{dc} to 12 V\text{dc} (not linearized), adjustable with trimming potentiometer
- **Gain:** 23 to 10000 (adjustable with trimming potentiometer)
- **Analog output load:** R\text{L} < 25 kΩ (output short circuit protected)
- **Heater power dissipation:** 6.6 mW at 2 V heater voltage, 14.9 mW at 3 V heater voltage, 26.4 mW at 4 V heater voltage, 41.3 mW at 5 V heater voltage
- **Channel cross section:** 2 mm\text{²}
- **Mounting:** 4 x M3 screw

For further details see application note
Microflow Amplifier Module
Thermal Mass Flow Sensor
Optimal for demonstration and evaluation of the MFS02

Order Information

<table>
<thead>
<tr>
<th>Circuit and analog sensor electronic</th>
<th>IST_A05_Flowmodul mit MFS02</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order code</td>
<td>350.00097</td>
</tr>
</tbody>
</table>

1 VCC = 12 V$_{dc}$
2 GND
3 $V_{out}$ diff [-1.8 V$_{dc}$ to 12 V$_{dc}$]
4 Temperature sensor PT1000
5 Temperature sensor PT1000
6 5.5 V$_{dc}$ out
7 -5 V$_{dc}$ out
8 Heater voltage output [0 V$_{dc}$ to 5.7 V$_{dc}$]
9 Offset voltage output [-1.8 V$_{dc}$ to 5.7 V$_{dc}$]
MicroflowSens EvaKit
Thermal Mass Flow Sensor
Optimal for an easy evaluation of the MFS02 flow sensor

Benefits & Characteristics

- High sensitivity
- Excellent measuring dynamics
- Fully calibrated and with USB connection
- Software included with graphical signal representation
- Data logging function
- Integrated flow channel with pneumatic connectors

Technical Data

<table>
<thead>
<tr>
<th>Operating measuring range:</th>
<th>0 ml/min to 200 ml/min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply:</td>
<td>USB</td>
</tr>
<tr>
<td>Accuracy:</td>
<td>+/- 1 % at 25 °C</td>
</tr>
<tr>
<td>Pneumatic connection:</td>
<td>Hose with ID = 6 mm</td>
</tr>
<tr>
<td>PC connection:</td>
<td>USB 1.1 or 2.0 compatible</td>
</tr>
</tbody>
</table>

For details about the MFS02 flow sensor see specific MFS02 data sheet.

For configuration details see application note

Order Information

Microflowsens EVA-KIT
Order code
250.00007