



# SFS Flow module

## Thermal mass flow module

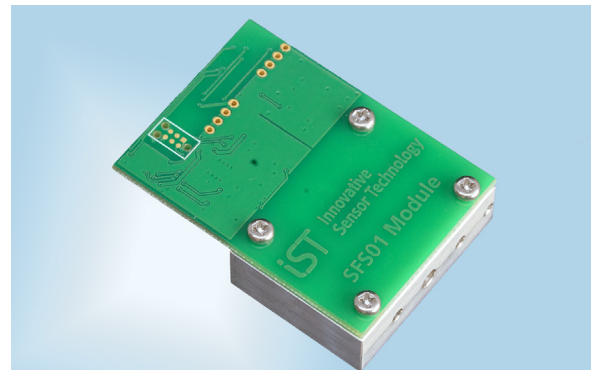
### Benefits & Characteristics

- Fast, continuous gas flow monitoring with  $\leq 20$  ms response time
- Ready-to-use module with digital and analog outputs
- Compact design for easy integration into measuring devices - integration space 5x4x2 cm sufficient
- Factory calibrated in sccm (ml/min) with 0.2% reproducibility
- Direction independent calorimetric measurement
- Hardware address pins for systems with up to 4 modules
- Custom, application specific adaptation possible

### Applications

- Gas analyzers
- Gas supply and dosing systems
- Gas mixing valves
- Process control
- Medical devices
- Environmental monitoring and analytical equipment

### Product image



### Evaluation kit with fluidic block adapter





## Sensor Performance

### Available modules

Module type	Bidirectional flow range*	Material number
SFS01-M-01-01000	±1000 sccm	154807
SFS01-M-01-00200	±200 sccm	154808
SFS01-M-01-00050	±50 sccm	154809

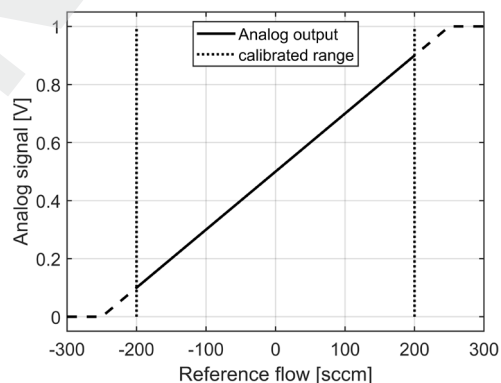
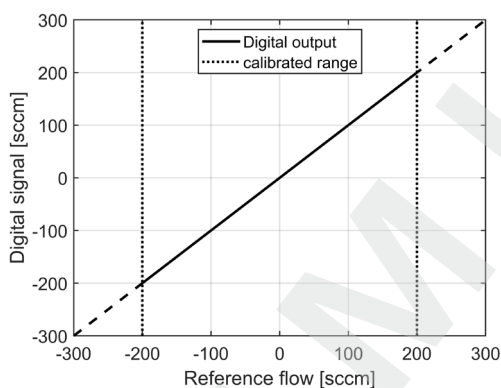
\* calibrated for N<sub>2</sub> at 23 °C (sccm ~ ml/min)

### Flow parameters\*

Accuracy	±2 % f.s. digital output ±5 % f.s. analog output
Repeatability	±0.2 % f.s.
Response time t <sub>63</sub>	20 ms
Temperature Sensitivity**	0.3 % / K

\* for N<sub>2</sub>

\*\* signal not temperature compensated



Digital and analog output as a function of flow (displayed 200 sccm module variant as example).

### Operational conditions

Gas temperature	0 to +80 °C
Pressure	< 4 bar
Humidity	0 to 95 % RH (non-condensing conditions required)
Storage temperature	-20 to +80 °C
Recommended warm-up time (electronics)	30 s



### Pressure loss

Module type	Pressure loss*
SFS01-M-01-01000	< 1 mbar
SFS01-M-01-00200	< 1 mbar
SFS01-M-01-00050	< 6 mbar

\* operated at maximum flowrate with N<sub>2</sub> at 23 °C

### Electrical parameters

Supply voltage	5V DC ±10%
Sampling rate	> 100 Hz
Power Consumption	< 10 mA at 5V VCC
Electrical Connector	JST SM08B-SRSS-TB

A 200 mm cable assembly with a compatible connector is available at DigiKey with part no. 455-3658-ND

### Digital output

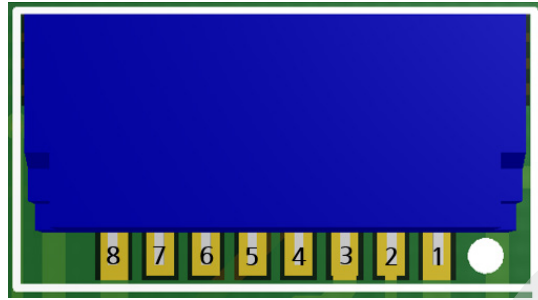
Communication Protocol	I <sup>2</sup> C
I <sup>2</sup> C clock frequency	10 ... 400 kHz (Typical 100kHz)
I <sup>2</sup> C default address	0x28 (see section address pins, only 7 bit addresses supported)
Digital output (calibrated signal)	calibrated flow rate sccm (signed integer - 16 bit)
50 sccm	fixed point (Q7 decoding)
200 sccm	fixed point (Q5 decoding)
1000 sccm	fixed point (Q3 decoding)

### Analog output

Analog signal	0-1 V (0.1V at calibration range minimum, 0.5V at zero flow, 0.9 V at calibration range maximum)
Resistive load	>100kΩ (The output is protected by a 1kΩ series resistor)



## Pin Assignment



1	2	3	4
SCL (I <sup>2</sup> C serial clock)	SDA (I <sup>2</sup> C serial data)	VCC (positive voltage supply)	GND (ground)
5	6	7	8
Addr0 (Address Pin 0*)	Addr1 (Address Pin 1*)	Analog output	GND (Ground)

\* Leave open it if not used, connect to VCC to change the Serial Address

## Digital Interface I<sup>2</sup>C Protocol

### Reading Data

After a power-on reset, the module waits for 1000ms before the measurement starts. After this time, sensor data is available and can be read out.

Sensor data can be read out by a simple read command and a consecutive read of 2 Bytes. The calibrated data are encoded as signed 16-bit integers.

S	6	5	4	3	2	1	0	R	A	7	6	5	4	3	2	1	0	A	7	6	5	4	3	2	1	0	NA	P
S	0	1	0	1	0	0	0	1	A	D	D	D	D	D	D	D	D	A	D	D	D	D	D	D	D	D	NA	P
Device Address (0x28)									Calibrated Data [15...8]									Calibrated Data [7...0]										

Signal flow for data readout (2 Bytes)

S	Start	A	Acknowledge
R	Read	P	Stop
W	Write	D	Data
NA	Not Acknowledge		
	Signal generated by Device		Signal generated by Master

### Decoding the data

The calibrated flow rates are represented in a signed fixed-point notation. For each version of the module a different coefficient is required to convert the digital value to the actual flow rate. See table below for examples.

Module	Digital value	Coefficient	Calculation example	Calculated Flow rate
50 sccm	4848 (0x12F0)	128	4848 / 128	37.875 sccm
200 sccm	4848 (0x12F0)	32	4848 / 32	151.5 sccm
	4848 (0x12F0)	9	4848 / 8	606 sccm



A negative value corresponds with opposite flow direction and is represented in a two's complement.

Module	Digital value	Coefficient	Calculation example	Calculated Flow rate
50 sccm	-3240 (0xF358)	128	-3240 / 128	-25.3125 sccm
200 sccm	-3240 (0xF358)	32	-3240 / 32	-101.25 sccm
1000 sccm	-3240 (0xF358)	9	-3240 / 8	-405 sccm

#### I<sup>2</sup>C Address pins

Addressable pins as a hardware setting for simple manifold assemblies with up to 4 modules

Addr1	Addr0	Resulting Address (Hex)	Resulting Address (Bin)
Low	Low	0x28	0b0101000
Low	High	0x29	0b0101001
High	Low	0x2A	0b0101010
High	High	0x2B	0b0101011
Open	Open	0x28	0b0101000

To change the I<sup>2</sup>C address, the module needs to reboot. Either restart the module by a power cycle or send the command 0xA2 to the module.

#### Reset the module

S	6	5	4	3	2	1	0	W	A	7	6	5	4	3	2	1	0	A
S	0	1	0	1	0	0	0	0	A	1	0	1	0	0	0	1	0	A
Device Address (0x28)									Reset (0xA2)									

This reset command equals a power on reset. After a reset, the module is booting up and waits ~1000ms until the measurements start again.

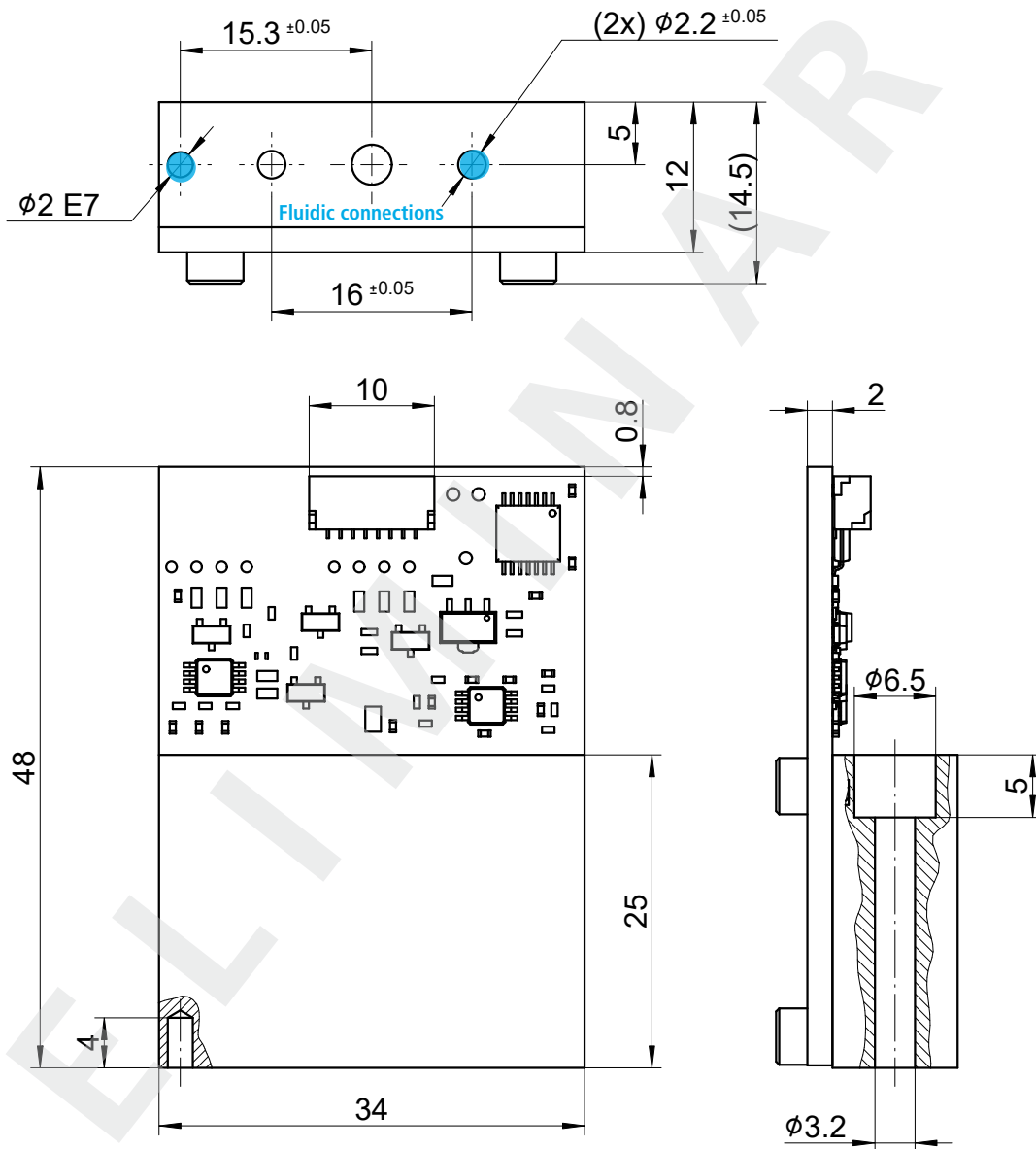
#### Mechanical parameters (SFS module only, i.e. without fluidic block adapter)

Size	48 x 34 x 14.5 mm
Weight	30g
Flow channel	Aluminium
Wetted materials	Aluminium, gold, FR4, silicon, silicon nitride, epoxy, nitrile
Assembly recommendation	Flat sealing with two sealing rings; Ø 2.50 mm x 1.00 mm



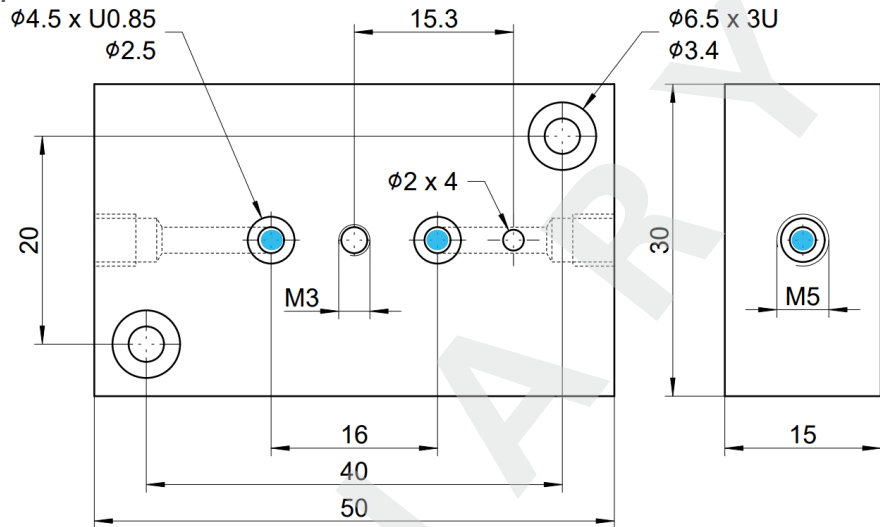
## Mechanical Drawing

Dimensions tolerances according to ISO 2768-mK: +/-0.1mm up to 6 mm; +/-0.2 mm up to 30 mm





Fluidic block adapter



Please contact IST if you require a STEP file for product design-in.

## Order Information

Product name	Description	Order code	Flow range
SFS01-M-01-01000	SFS Flow module	154807	±1000 sccm
SFS01-M-01-00200	SFS Flow module	154808	±200 sccm
SFS01-M-01-00050	SFS Flow module	154809	±50 sccm
<b>Evaluation Kits:</b>			
SFS01-M-01-01000-EVA	SFS01 Evaluation Kit	156602	±1000 sccm
SFS01-M-01-00200-EVA	SFS01 Evaluation Kit	156603	±200 sccm
SFS01-M-01-00050-EVA	SFS01 Evaluation Kit	156604	±50 sccm
<b>Related Products</b>			
SFS01	Flow Sensor Element	105050	
SFS01 EvaKit	EvaKit with 1x1 mm PEEK channel	105059	
SFS01-MFB-01	Fluidic block adapter, separate	155638	
FGF-E1-M-01-01000-EVA	Flow + density module	156393	±1000 sccm
FGF-E1-M-01-00200-EVA	Flow + density module	156601	±200 sccm

## Additional Documents

	Document name:
Application Note SFS01	AHSFS01
Datasheet SFS01	DFSFS01_E
Datasheet SFS01 EvaKit	DFSFS01_EvaKit_E