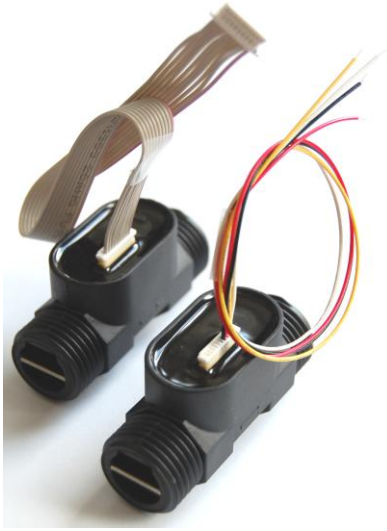
ScioSense



UFM-02

Ultrasonic Flow Sensing Modules

UFM-02 Datasheet

Revision: 9

Release Date: 2026-06-08

Document Status: Product Preview

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The UFM-02 is a family of ultrasonic flow sensing modules with diameters ranging from 3/8” to 1.5”. The modules are based on ScioSense static, contactless ultrasonic flow sensor technology, which goes away from moving rotors in traditional Hall sensor-based flow sensors. By contrast, the ultrasonic UFM-02 contain no moving parts and offer an extended lifetime when operated according to datasheet specifications.

The UFM-02 devices come with various interface options, starting with SPI and a pulse interface. They can easily be integrated into embedded systems.

The UFM-02 are suitable for use with food-grade material and can directly measure drinking water flow. Accurate to at least ±5 % at higher flow rates, the UFM-02 enables precise control of water flow and – via a built-in temperature calculation – liquid temperature in the control systems of products such as boilers, smart taps, beverage brewing machines and more. The capability to detect very low flow rates allows the application for leakage detection.

Key Features & Benefits

- **Long-time reliability**
  Solve the pain point, no movable parts, no risk of getting stuck
- **Wide sensing range**
  Various diameters available, from 2 to 800 l/h with 3/8” to 45 to 18000 l/h with 1.5”
- **High accuracy**
  3% measured value + 0.2% full scale
- **Low power**
  50µA average current with single 3.6 to 6 V power supply
- **Standard interface**
  SPI and pulse interface
- **Cost effective**
  Simplified system design to optimize the overall cost
- **Food grade material**
  Can be used for drinking water directly

Applications

- **Boilers**
- **Water purifiers**
- **Water dispenser**
- **Coffee machines**
- **Smart toilets**
- **Smart faucets & showers**
- **Cooling systems**

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1 Block diagram

The internal block diagram of UFM-02 is shown in Figure 1.

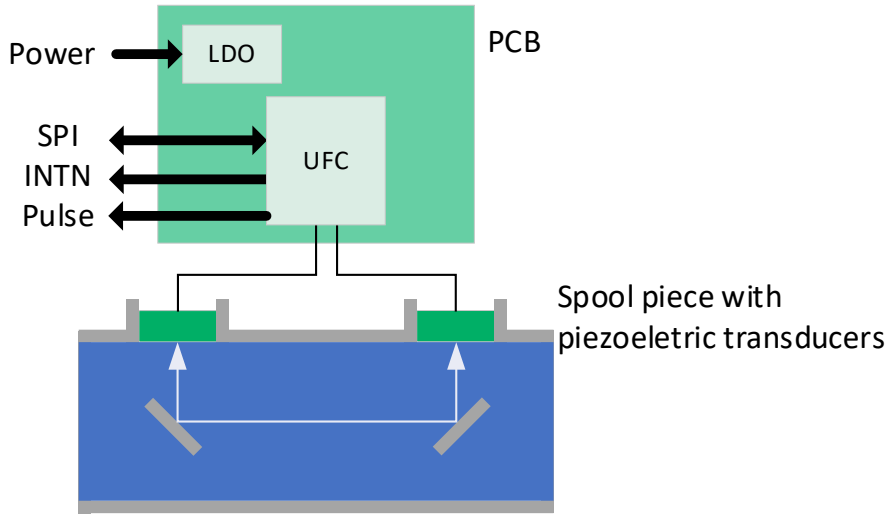

Figure 1: Functional blocks

2 Absolute Maximum Ratings

Stresses beyond those listed in this section may cause permanent damage to the device. These are - each at a time - stress ratings only. Functional operation of the device at these or any other conditions beyond those indicated under Electrical characteristics is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability. The UFM-02 should be protected against constant exposer to sunlight and humidity. It is also not designed for application submerge into water.

Table 1: UFM-02 absolute maximum ratings

Symbol	Parameter	Min	Max	Units	Comments
Electrical Parameters					
V_{CC}	Supply voltage	-0.30	7.0	V	
V_{IO}	IO voltage level SPI	-0.30	4.0	V	
V_{OD}	Open drain voltage level		60	V	Pulse interface
I_{OD}	Open drain on current		100	mA	Pulse interface
Electrostatic Discharge					
ESD_{IEC}	Contact discharge, all pins	±4000		V	IEC 61000-4-2

Water Pressure					
p_{Watr}	Burst water pressure		4.0	MPa	
p_{op}	Operating water pressure		1.0	MPa	
Operating and Storage Conditions					
T_{STRG}	Storage temperature	-25	100	°C	
T_A	Operating ambient temperature	-25	85	°C	
T_{Water}	Operating water temperature	0	60	°C	Not frozen
H_A	Operating ambient relative humidity	0	85	%RH	85/85 (85% at 85°C for 96h)
p_{Water}	Inspection water pressure		1.75	MPa	

3 Electrical characteristics

All limits are guaranteed. The parameters with min and max values are guaranteed with production tests or SQC (Statistical Quality Control) methods. All values refer to T_A = 25 °C and at 5V supply voltage, unless otherwise specified.

Table 2: Electrical characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CC}	Supply voltage		3.6		6.0	V
I_{DDavg}	Average Supply current			50		µA
V_{IH}	High-level input voltage		0.7×V_{DD}		V_{DD}+0.3	V
V_{IL}	Low-level input voltage		-0.5		0.7	V
V_{OH}	High-level output voltage	Ioh = 4 mA	3.3V-0.4V			V
V_{OL}	Low-level output voltage	Iol = -4 mA			0.4V	V
R_{od}	Open drain Static On–State Resistance	Iol = -4mA	3		4	Ω

4 Sensor hydraulic characteristics

Table 3: Hydraulic characteristics

Module	Thread	Min. Flow [1]	Nom. Flow [2]	Max. Flow [3]	Unit
UFM-02-03	3/8”	0.03	13.30	20	lpm Liters per minute
UFM-02-05	1/2”	0.08	33.30	50	
UFM-02-07	3/4”	0.20	83.33	125	
UFM-02-10	1”	0.33	133.3	200	
UFM-02-15	1.5”	0.75	300.0	450	
UFM-02-03	3/8”	0.01	3.50	5.25	gpm Gallons per minute
UFM-02-05	1/2”	0.02	8.80	13.2	
UFM-02-07	3/4”	0.05	22.02	33.03	
UFM-02-10	1”	0.09	35.20	52.8	
UFM-02-15	1.5”	0.20	79.20	118.89	
UFM-02-03	3/8”	2	800	1200	l/h Liters per hour
UFM-02-05	1/2”	5	2000	3000	
UFM-02-07	3/4”	12	5000	7500	
UFM-02-10	1”	20	8000	12000	
UFM-02-15	1.5”	45	18000	27000	
UFM-02-03	3/8”	0.002	0.8	1.2	m^3/h
UFM-02-05	1/2”	0.005	2	3	
UFM-02-07	3/4”	0.012	5	7.5	
UFM-02-10	1”	0,020	8	12	
UFM-02-15	1.5”	0,045	18	27	

[1] Minimum Flow = Leak flow threshold
[2] Above this nominal flow the precision is no longer guaranteed and output on SPI only.
[3] Maximum must not to be exceeded.

Table 4: Pressure drop

Module	Thread	Int. Flow l/h	Nom. Flow l/h	Δp bar	Δp psi	Δp kPa
UFM-02-03	3/8”	240		0.06	0.9	6
UFM-02-05	1/2”	600		0.06	0.9	6
UFM-02-07	3/4”	1500		0.06	0.9	6
UFM-02-10	1”	3500		0.06	0.9	6
UFM-02-15	1.5”	5400		0.06	0.9	6
UFM-02-03	3/8”		800	0.7	10	70
UFM-02-05	1/2”		2000	0.7	10	70
UFM-02-07	3/4”		5000	0.7	10	70
UFM-02-10	1”		8000	0.7	10	70
UFM-02-15	1.5”		18000	0.7	10	70

Table 5: Accuracy

Symbol	Parameter	Comment	Min	Typ	Max	Unit
F_{acc}	Flow sensing accuracy[4] ±(MV+FS)	Measured Value (MV)		3		%
		Full Scale (FS)		0.2		%
T_{range}	Water temperature measurement range[5]	Pure water	5		60	°C
T_{acc}	Water temperature accuracy			±1		°C
f_{data}	Measuring and data update rate			10		Hz

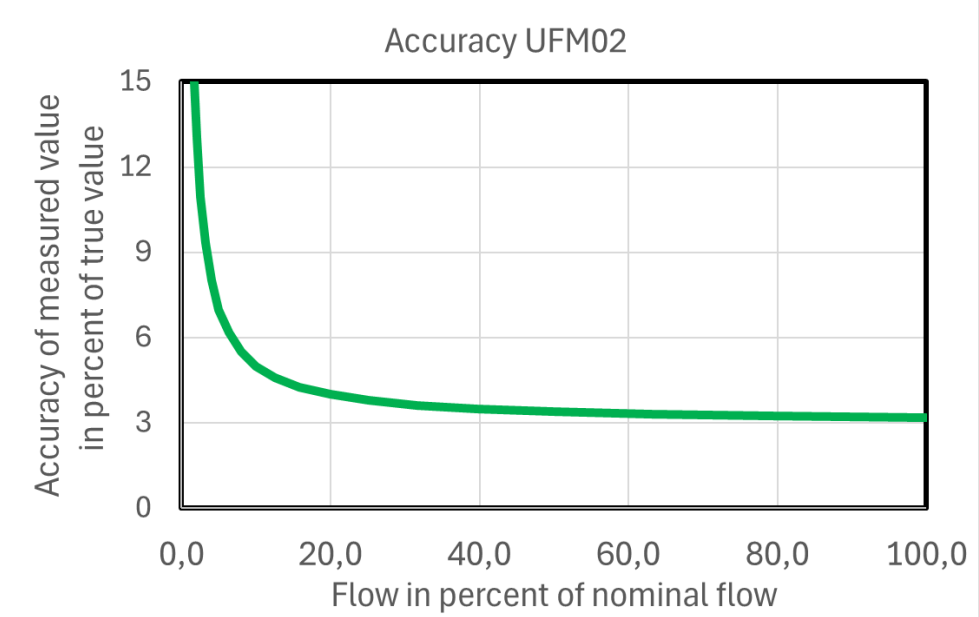

Figure 2 Accuracy UFM-02

[4] Measured under the recommended mounting conditions.
[5] The calculation of temperature is based on the speed of sound of pure water.

5 Mechanical Outline

Table 6: Mechanical dimensions

Nominal pipe diameter and Thread	3/8”	1/2”	3/4”	1”	1½”	Unit
Module width a	21.3	21.3	27.5	34.5	47.8	mm
Inner diameter d	10.5	13.3	17	22	35.5	mm
Thread length b	11.5	11.5	16.5	18.5	21.5	mm
Total spool piece length c	60	60	70	75	80	mm

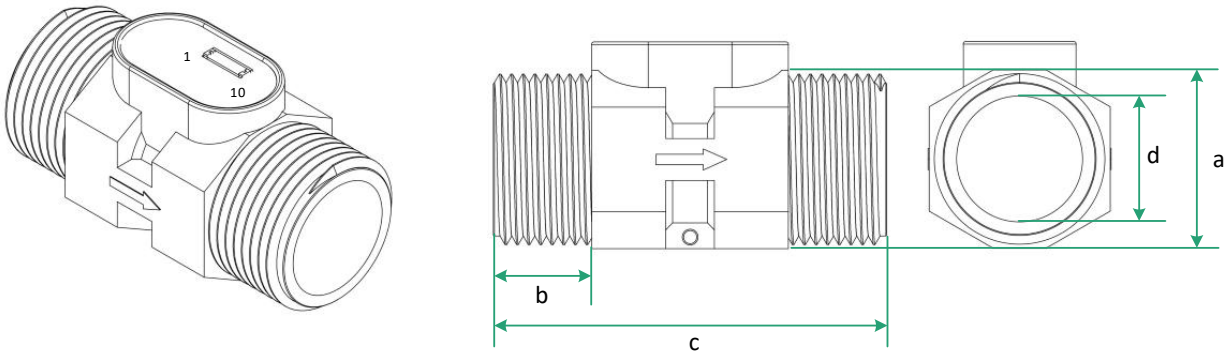

Figure 3: Mechanical drawings

Thread variants:

- BSPP British standard pipe parallel. 55° angle, rounded (Whitworth pipe thread, ISO 228-1 (DIN 259), external thread, parallel)
- NPS American national pipe straight. 60° angle, pointed (ASME B 1.20.1, external thread, parallel)

6 Interface Description

6.1 Cable and Connector

The UFM-02 family comes with two cable variants:

- 4-wire, pulse interface, power and ground, open drain
- 10-wire, SPI and pulse interface, power and ground,
  CWB: TJC1004 connector. Alternative connector: JST: SHR-10V-S[-B]
  Compatible PCB connectors, e.g. from JST:
  Top entry type: BM10B-SRSS-TB,
  Side entry type: SM10B-SRSS-TB

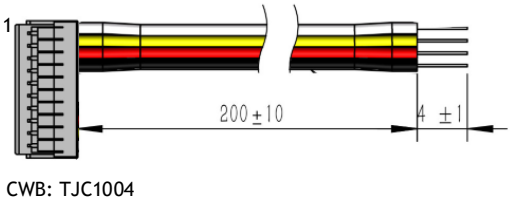

Figure 4: 4-wire pulse interface cable

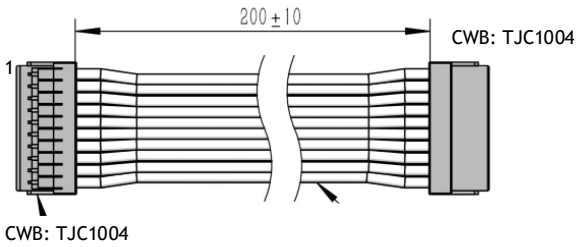

Figure 5: 10-wire SPI interface cable

Table 7: Pinout

Pin	Pin Name	4-wire		10-wire
1	IO1	Pulse error output, open drain	White	Pulse output error, open drain
2	IO0	Pulse output, open drain	Yellow	Pulse output, open drain
3	VCC	Power supply	Red	Power supply
4	GND	Ground	Black	Ground
5	VDD			Regulated voltage output
6	CS			SPI Chip select
7	MO			SPI Master out
8	SCK			SPI clock
9	MI			SPI Master in
10	INT			Interrupt

6.2 Pulse Interface

At pin IO0 of the pulse interface the user gets a positive pulse per specific volume which passed. IO1 can indicate an error when the amplitude is low, e.g. in no water situations. Of course, the volume per pulse depends on the diameter of the sensor. The number of pulses per liter is chosen such that a minimum pulse period of 9 ms is not undercut and that it does not exceed 111 pulses per second at maximum flow. In error cases PIN1 = IO0 (Pulse output) will switch to permanent high condition and PIN 2 = IO1 (Pulse output error) toggles with the measuring and data update rate (10 Hz).

Table 8: Pulse interface characteristics

Symbol	Parameter	Conditions	ml/pulse	Pulses/l	Max. Pulses/s
	Pulse output. pulses per liter	UFM-02-03	2	500	111
		UFM-02-05	5	200	111
		UFM-02-07	8	125	104
		UFM-02-10	20	50	111
		UFM-02-15	50	20	100

6.3 SPI Interface

The serial interface is SPI compatible, with clock phase bit =1 and clock polarity bit =0.

It is strongly recommended to keep SSN = HIGH when SPI interface is in IDLE state.

6.3.1 SPI Timing

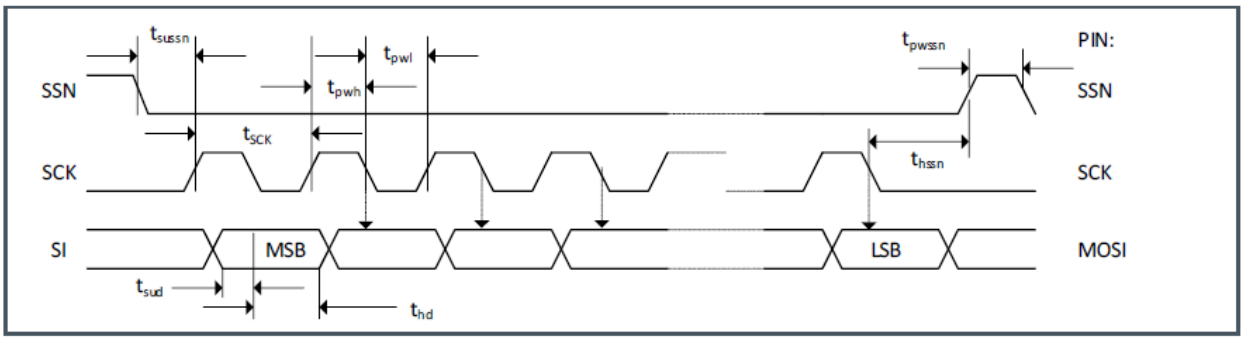

Figure 6: SPI write

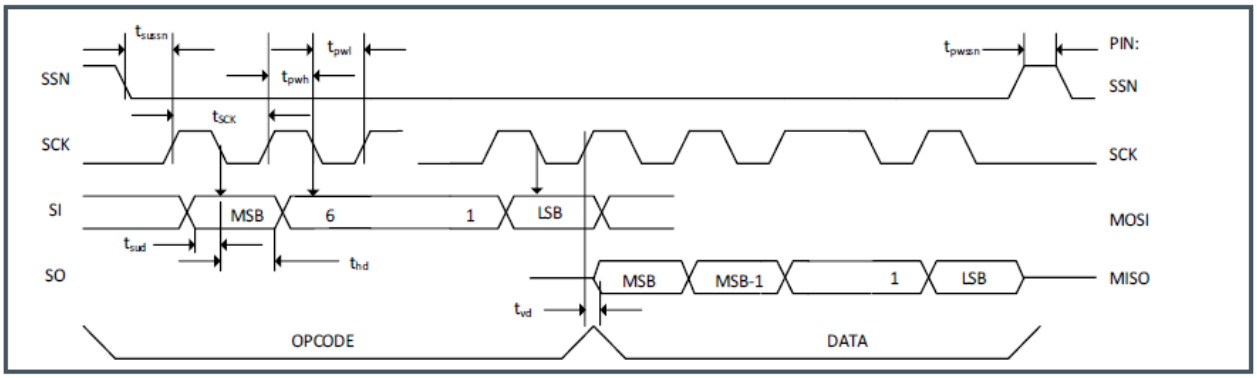

Figure 7: SPI read

Table 9: SPI timing

Symbol	Parameter	Min	Typ	Max	Unit
f_{SCK}	Serial clock frequency			8	MHz
t_{SCK}	Serial clock time period	125			ns
t_{pwh}	Serial clock, pulse width high	0.45 * t_{SCK}			ns
t_{pwl}	Serial clock, pulse width low	0.45 * t_{SCK}			ns
t_{sussn}	SSN enable to valid latch clock	0.5 * t_{SCK}			ns
t_{hssn}	SSN hold time after SCK falling	0.5 * t_{SCK}			ns
t_{pwssn}	SSN pulse width between two cycles	t_{SCK}			ns
t_{sud}	Data set-up time prior to SCK falling	5			ns
t_{hd}	Data hold time before SCK falling	5			ns
t_{vd}	Data valid after SCK rising			25	ns

6.3.2 SPI Commands

Table 10: SPI commands

Remote Command	Code	Description
SYS_INIT	0x9A	Resets main part of digital core without register part and triggers bootloading process
RD_RAM	0x7A	Read from RAM or register area
RD_FWD	0x7B	Read from firmware data area (NVRAM)
RC_IF_CLR	0x8D	Clear interrupt

For the read commands the 8-bit opcode is followed by the 8-bit address and then the 32-bit data.

In general, an interrupt-based communication is needed. Remote communication should be started when an interrupt is set via pin INTN. The interrupt is set at the end of each sample and needs to be cleared via OP Code after reading: RC_IF_CLR 0x8D Interrupt flags clear.

6.3.3 Read Registers

The RAM is read with opcode RD_RAM. The result registers have 32 bits. The addresses are 8-bit values.

Table 11: Read registers

Addr.	Variable name	Description	Format
0x00	VOLUME_INT	Signed integer part of total volume of water flow in cubic meters	1LSB = $1m^3$
0x01	VOLUME_FRAC	Unsigned fractional part of total volume of water flow in cubic meters	1LSB = $1m^3/2^{32}$
0x03	FLOW_LPH	Filtered flow volume (l/h),	1LSB = 1lph $/2^{16}$
0x04	TEMPERATURE	Temperature (°C) calculated based on the speed of sound of water	1LSB = 1°C $/2^{16}$
0x27	ERROR_FLAGS	Error flags	Details below

Table 12: Error flags

Bit	Error Flags Description, address 0x27
6	Measurement not ok, e.g. low or no signal
14	Bubbles detected

7 Application Information

7.1 Pulse Interface

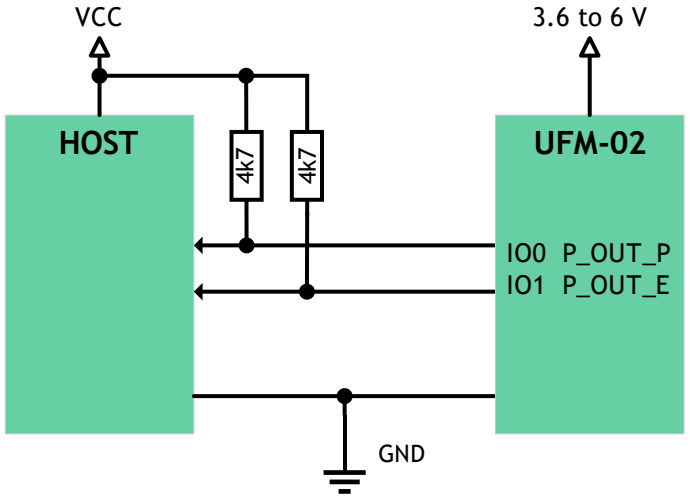

Figure 8: UFM-02 typical application with pulse interface connection

7.2 SPI

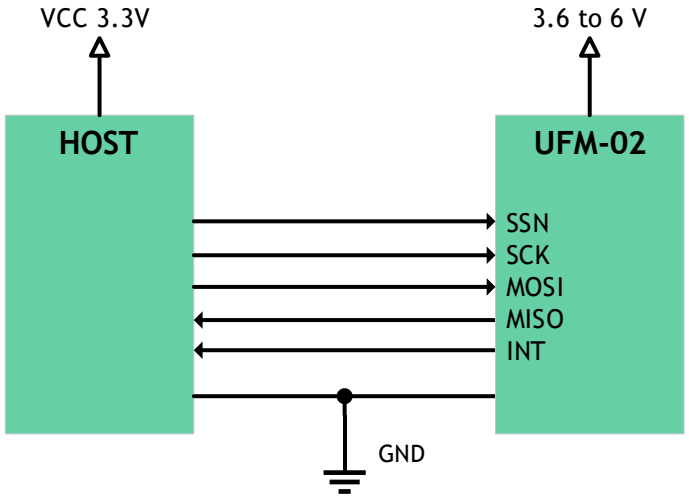

Figure 8: UFM-02 typical application with SPI connection

7.3 Mounting Restrictions

The following instructions must be observed for the sensor to function correctly:

- The inner diameter of the connecting pipe should never be smaller than the inner incoming/outcoming diameter of the measuring pipe.

- Mount the module away from elbows to avoid swirls in the sensor. The recommended mounting distances are shown in table 12. Shorter distances are possible depending on the system setup.

Table 13: Recommended mounting distances

	3/8"	1/2"	3/4"	1"	1.5"
[cm]	5	10	20	25	40
[inch]	1.97	3.94	7.9	9.85	15.75

- Install the unit to ensure that the measuring pipe is completely filled with water.

- Install the unit in a section of the plant where the medium is under pressure. This avoids disturbance by air bubbles.

- Avoid mounting the module close to shut-offs, controls, or pumps.

8 Ordering information

8.1 Product naming structure

Table 14: Ordering naming structure[6]

Product line		Thread	Mechanical Connector	Interface	Electrical Connector
UFM-02	-	03	B	S	A

03	3/8"	B	BSPP	N	No cable	0	no wire
05	1/2"	N	NPS	S	SPI	3	3-wire
07	3/4"	F	Flat	P	Pulse	4	4-wire
10	1"			U	UART	A	10-wire
15	1.5"			V	Analog		
				J	I2C		

[6] Grey: Optional variants for the future

8.2 Order codes

Table 15: Ordering information

Ordering Code	Material ID	Size & Thread	Interface	
UFM-02-03NSA	501020311	3/8" NPS	SPI	
UFM-02-03NP4	501020312	3/8" NPS	Pulse	
UFM-02-03BSA	501020301	3/8" BSPP	SPI	
UFM-02-03BP4	501020302	3/8" BSPP	Pulse	
UFM-02-05NSA	501020511	1/2" NPS	SPI	
UFM-02-05NP4	501020512	1/2" NPS	Pulse	
UFM-02-05BSA	501020501	1/2" BSPP	SPI	
UFM-02-05BP4	501020502	1/2" BSPP	Pulse	
UFM-02-07NSA	501020711	3/4" NPS	SPI	
UFM-02-07NP4	501020712	3/4" NPS	Pulse	
UFM-02-07BSA	501020701	3/4" BSPP	SPI	
UFM-02-07BP4	501020702	3/4" BSPP	Pulse	
UFM-02-10NSA	501021011	1” NPS	SPI	
UFM-02-10NP4	501021012	1” NPS	Pulse	
UFM-02-10BSA	501021001	1” BSPP	SPI	
UFM-02-10BP4	501021002	1” BSPP	Pulse	
UFM-02-15NSA	501021511	1.5” NPS	SPI	
UFM-02-15NP4	501021512	1.5” NPS	Pulse	
UFM-02-15BSA	501021501	1.5” BSPP	SPI	
UFM-02-15BP4	501021502	1.5” BSPP	Pulse	
UFM-02_EK V1	501020000	1/2” BSPP	SPI	Evaluation kit with UFM-02-05BSA, adapter board, PicoProg Lite and USB-C cable

9 RoHS Compliance & ScioSense Green Statement

RoHS: The term RoHS compliant means that Sciosense B.V. products fully comply with current RoHS directives. Our semiconductor products do not contain any chemicals for all 6 substance categories. including the requirement that lead does not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures. RoHS compliant products are suitable for use in specified lead-free processes.

ScioSense Green (RoHS compliant and no Sb/Br): ScioSense Green defines that in addition to RoHS compliance. our products are free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material).

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11 Document status

Table 16: Document status

Document Status	Product Status	Definition
Preliminary Datasheet	Pre-Production	Information in this datasheet is based on products in the design. validation or qualification phase of development. The performance and parameters shown in this document are preliminary without any warranty and are subject to change without notice.
Datasheet	Production	Information in this datasheet is based on products in ramp-up to full production or full production which conform to specifications in accordance with the terms of ScioSense B.V. standard warranty as given in the General Terms of Trade.

12 Revision information

Table 17: Revision history

Revision(s)	Date	Comment	Page
1	29.09.2025	First release version	All
6	01.04.2026	Adding variants	17
7	17.04.2026	Adding pressure drop values Adding Information on Pulse interface Adding information about use case	18 X 4

Notes:

1. Page and figure numbers for the previous version may differ from page and figure numbers in the current revision.
2. Correction of typographical errors is not explicitly mentioned.

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