Siargo Ltd.

FSP1000 User Manual VB.1

MEMS differential pressure sensors

Sold in North America by:
Servoflo Corporation
75 Allen Street
Lexington, MA 02472
www.servoflo.com/info@servoflo.com
781-862-9572

MEMS Differential Pressure Sensors

with MEMS thermal sensing technology

FSP1000 Series

User Manual

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Siargo Ltd.
3100 De La Cruz Boulevard, Suite 210
Santa Clara, California 95054
USA

Tel: +1(408)969.0368
Email: info@siargo.com

Attention !

- Please carefully read this manual prior to operating this product.
- Do not open or modify any hardware which may lead to irrecoverable damage.
- Do not use this product if you suspect any malfunctions or defection.
- Do not use this product for corrosive media or in a strong vibration environment.
- Use this product according to the specified parameters.
- Only the trained or qualified personnel shall be allowed to perform product services.

Use with caution !

- Be cautious for electrical safety, and even it operates at a low voltage, any electrical shock might lead to some unexpected damages.
- The gas to be measured should be clean and free of particles, as even light particles may be accumulated inside the tiny pressure port that may result in inaccuracy in metrology, clogging, or other irrecoverable damage.
- Do not apply for any unknown or non-specified gases that may damage the product.

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1. Overview

All contact information can be found at the end of this manual.

This manual provides essential information for the FSP1000 series of differential pressure sensors for various applications. The product performance, maintenance, and troubleshooting, as well as the information for product order, technical support, and repair, are also included.

The FSP1000 dual pressure sensors are manufactured with the company's proprietary MEMS (micro-electro-mechanical systems) sensing and package technology that offers a unique very low differential pressure sensing.

The designed sensor can be applied for HVAC control, medical CPAP (continuous positive airway pressure), medical ventilators, instrumentation, and many other applications where a low differential pressure or flow measurement is required.

2. Receipt / unpack of the products

Upon receipt of the products, please check the packing box before the dismantlement of the packing materials. Ensure no damages during shipping. If any abnormality is observed, please contact and notify the carrier who shipped the product and inform the distributors or sales representatives if the order is not placed directly with the manufacturer; otherwise, the manufacturer should be informed. For any further actions, please refer to the return and repair section in this manual.

If the packing box is intact, proceed to open the packing box, and you shall find the product (either the sensor formality per the actual order), together with any other accessories if the order is included.

FSP1000

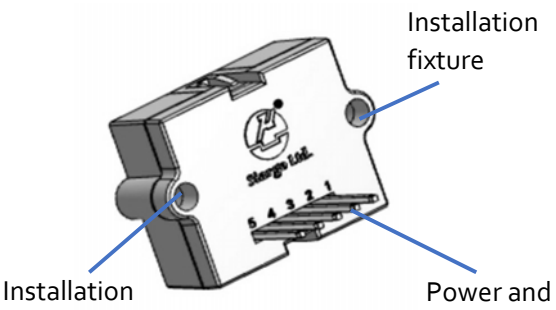
Optional cable

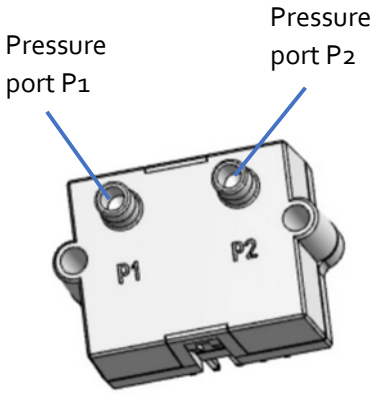
Please check immediately for the integrity of the product and the power and data cable; if any abnormality is identified, please notify the distributor/sales representative or manufacturer as soon as you can. If any defects are confirmed, an exchange shall be arranged immediately via the original sales channel. This user manual shall also be included in the packing box or via an online link for an electronic version which should be sent by your sales agent. In most cases, this manual shall be made available to the customer before the actual order.

Please note that the sensor has a pinout that is designed to be directly placed onto a printed circuitry board. Therefore, the power and data cable is an option that will not come with the order automatically.

3. Knowing the products

3.1 Product description





Note: for differentia pressure (flow) measurement, Port P1 should be placed upstream, unless a bi-directional model is ordered.

3.2 Power and data pinout description

Table 3.2: FSP1000 pin assignment.

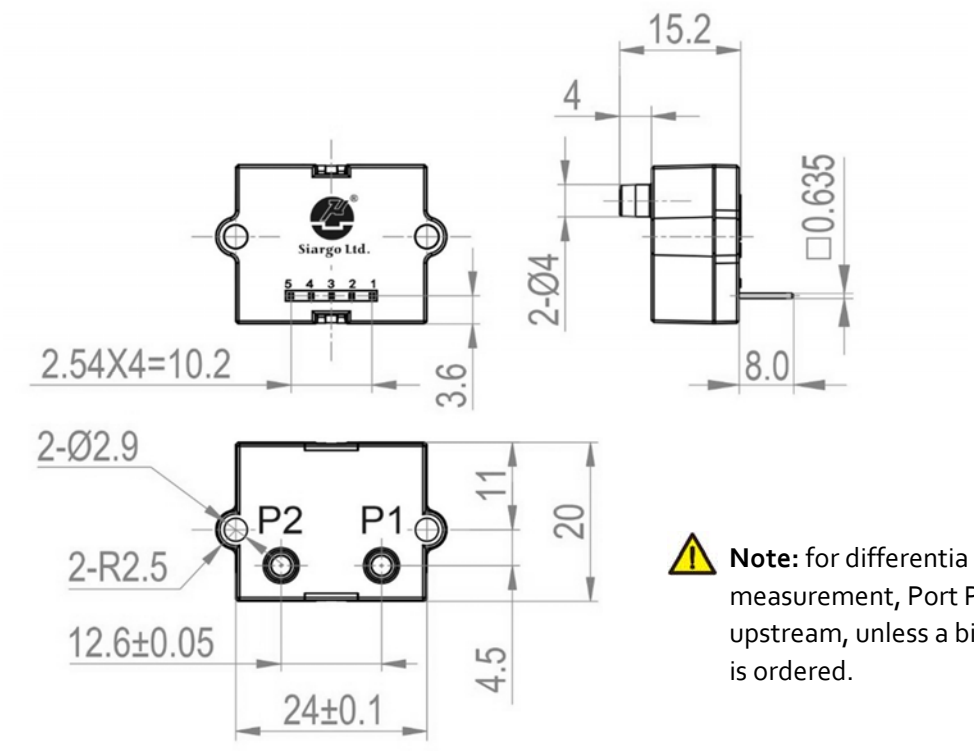
PIN	COLOR	DEFINITION
1	Blue	SDA, I²C data
2	Green	Analog output (+)
3	Red	VCC, power supply 3.0 ~ 5.5 Vdc(+)
4	Black	GND, ground
5	Yellow	SCL, I²C clock

FSP1000 electrical interface has 5 pins. The power supply is required to be 3.0 ~ 5.5 Vdc. The voltage is internally filtered and regulated to power the circuitry. The sensor consumes less than 10 mA normally but the minimum supply current must be larger than 10 mA for a stable performance.

For the I²C communication, please refer to the following descriptions.

If the optional data/power cable is ordered, please refer to the color code for connection.

3.3 Mechanical dimensions



Note: for differentia pressure (flow) measurement, Port P1 should be placed upstream, unless a bi-directional model is ordered.

Figure 3.3.1. FSP1000 mechanical dimensions.

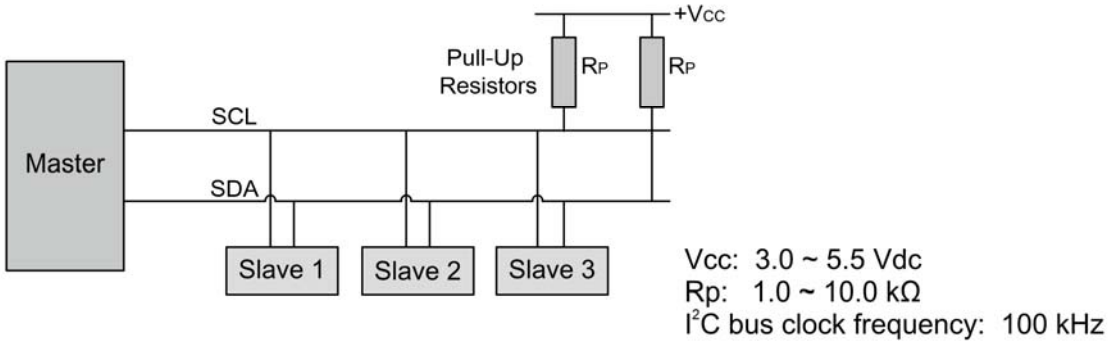
4. Installation

Do not open or alter any part of the product, which would lead to malfunction and irrecoverable damage.

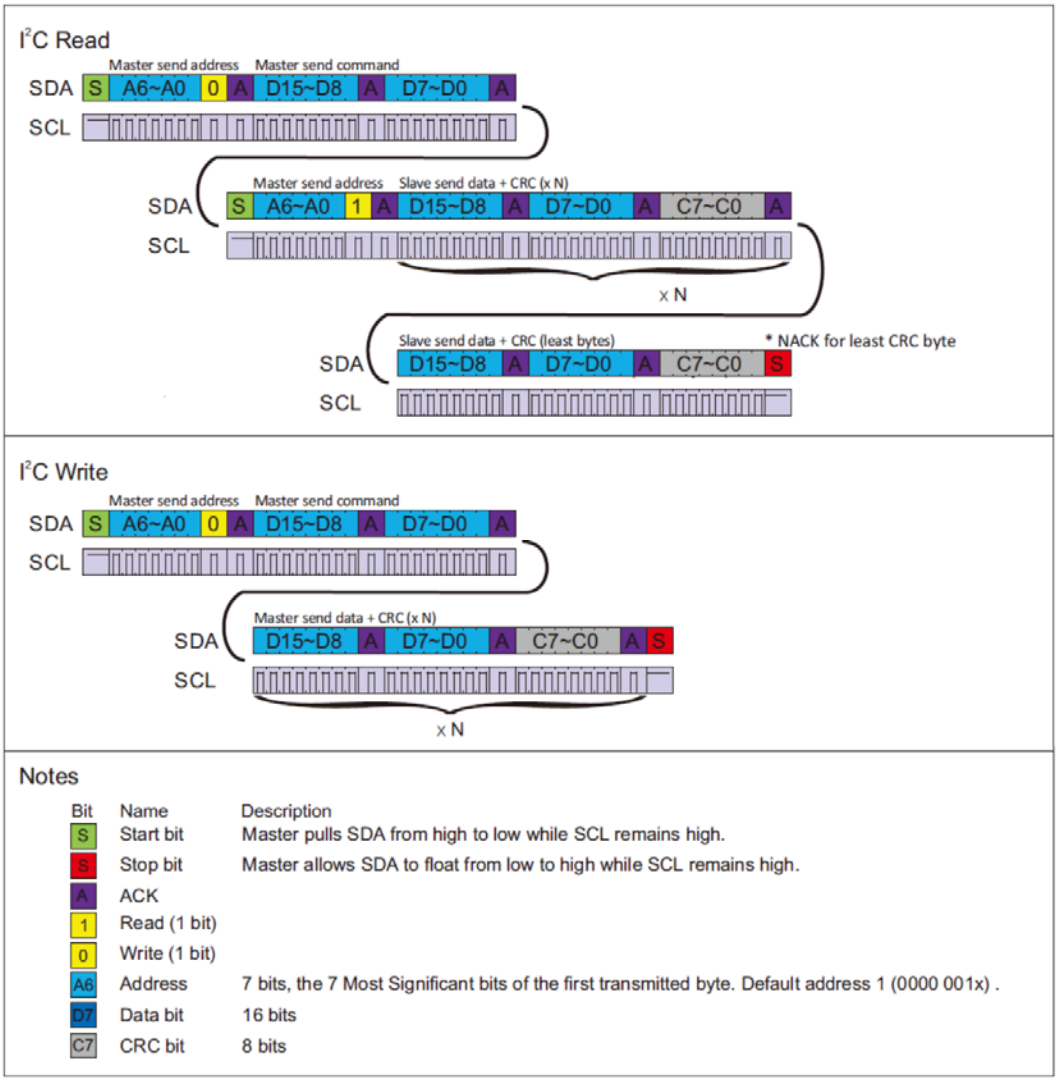
There are no other special requirements for the installation. But it is recommended that the user should make sure no leakage of the connections and all electrical pins are properly engaged.

5. Basic operation

5.1 I²C interface connection diagram



5.2 I²C interface read/write sequences



5.3 I²C interface command description

Command Byte	Length (int 16)	Command Name	Read/Write	Notes
0x00A4	1	I²C address	Read/Write	Int 16. bit 0 is R/W flag bit; bit 7 ~ bit 1 are available; bit 15 ~ bit 8 = 0.
0x0030	6	Sensor serial number	Read	ASCII
0x0043	2	Differential pressure	Read	Int 32/1000 Pa
0x008C	1	Filter depth	Read/Write	Int 16, 0 ~ 9, corresponding to 2^0 ~ 2^9 data in the software filter. The default value is 3, corresponding to 2^3 = 8 data in the software filter
0x00F0	1	Reset the offset of differential pressure	Write	Fixed value, 0xAA55

Note: The I²C address is set to bit7 ~ bit 1. E.g. if the I²C address is 1 (0000 001x), the write address will be 0x02 (0000 0010) and the read address will be 0x03 (0000 0011).

5.4 CRC checksum calculation

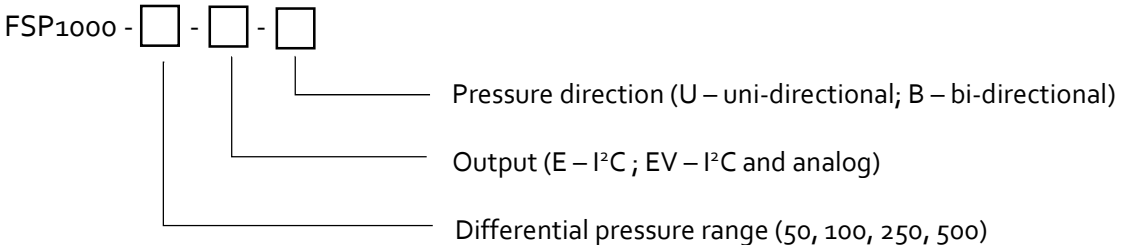
The 8-bit CRC checksum transmitted after each two data bytes (int 16) is generated by a CRC algorithm. Its properties are listed in the table below. To calculate the checksum, only these two previously transmitted data bytes are used.

Property	Value
Name	CRC-8
Protected data	I²C read and write
Width	8 bits
Polynomial	0x07 (x8 + x2 + x + 1)
Initialization	0x00
Reflect input	False
Reflect output	False
Final XOR	0x00
Example	CRC(0x4E20) = 0x6D

6. Product selection and order information

6.1 Product selection

The product part number is composed of the product model number and suffixes, indicating each of the selectable parameters. Refer to the following for details.



Note:

1. Example: FSP1000-500-EV-B: the differential pressure range will be ±500Pa, and outputs are analog and I²C.

6.2 Order contact and customer support

The sales offices and the sales distributors/representatives are listed at the end of this document. For small quantities, the order can be placed either through the Siargo website: www.siargo.com or the sales office. For large quantities, please contact the sales office, distributors, or sales representatives.

Siargo is making every effort to ensure the quality of the products. In case of questions and/or product supports, please contact the customer service listed at the end of the document.

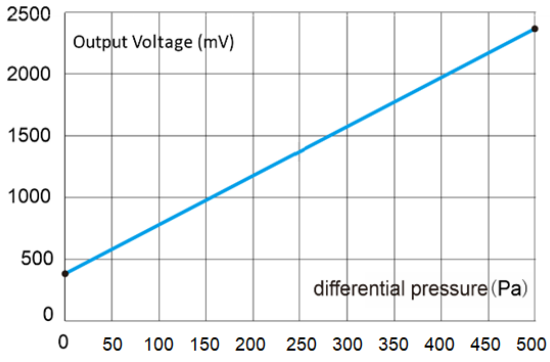
7. Technical specifications

All specifications listed in the following table, unless otherwise noted, apply for calibration conditions at 20°C and 101.325 kPa absolute pressure with air.

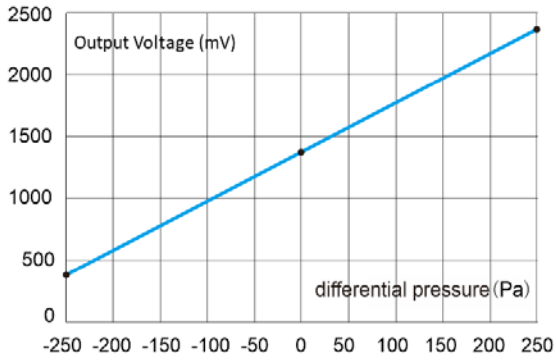
	Value	Unit
Differential pressure	2 ~ 50 / 2 ~ 100 / 5 ~ 250 / 5 ~ 500 ±50 / ±100 / ±250 / ±500	Pa
Power supply	3.0 ~ 5.5 (10mA)	Vdc
Output	Linear, analog (0.4 ~ 2.4Vdc) / I²C	
Output resolution	Analog: 12 bit / I²C: 14 bit	
Response time	20	msec
Pneumantic flow resistance	<95 @500 Pa	sccm
Span accuracy	±(2.0+0.5FS)	%
Span repeatability	±0.5	%
Span temperature shift	<0.16	%/°C
Temperature range	-5 ~ +65	°C
Offset tolerance	0.5	Pa
Offset repeatability	±0.1	Pa
Altitude correction	Full compensated	
Pressure rating	2.0	bar
Humidity	<95, no condensation	%RH
Warm-up time	<500	msec
Storage temperature	-20 ~ 70	°C
Vibration	20g; MIL-STD-883E, Method 2002.4.	
Compliance	RoHS; REACH	

Note: *FS = full scale at one direction. A customized differential pressure range is available upon request.

1 cmH_2O (4 °C) = 98.06 Pa = 0.014 PSI



Typical analog output : 500Pa.



Typical analog output : ±250Pa.

8. Technical notes for the product performance

8.1 Measurement principle

The products utilize the Company's proprietary micro-machined (MEMS) sensing technology. The differential pressure is via a pass-through flow sensing at two ports where the flow channel defines the differential pressure from the channel design.

8.2 Precautions for the best performance of the product

8.2.1 Particle contamination

It is critical to have the measured gas free of particle contamination. Since the data ports for both the gauge pressure and differential pressure are small, any particle's presence may create a deformed channel leading to large measurement errors. The particle deposition may also clog the channel, creating unstable data output and other instability, resulting in unpredictable measurement circumstances.

8.2.2 Altitude changes

Unlike some other products on market, the design of the sensor has a built-in pressure balancer that preventing membrane deformation due to altitude changes. Therefore, the sensor is intrinsically insensitive to the altitude change-induced errors.

8.2.3 Excessive humidity or condensation

The humidity change will not alter the performance of the sensor. However, if excessive humidity is present resulting in condensation, the measurement port or channel could be blocked or altered. This would result in a very unreliable data output. Please filter or other tools to prevent this situation to occur when using this product.

9. Warranty and Liability

(Effective January 2018)

Siargo warrants the products sold hereunder, properly used, and properly installed under normal circumstances and service. As described in this user manual, it shall be free from faulty materials or workmanship for 180 days for OEM products and 365 days for non-OEM products from the date of shipment. This warranty period is inclusive of any statutory warranty. Any repair or replacement serviced product shall bear the same terms in this warranty.

Siargo makes no warranty, representation, or guarantee and shall not assume any liability regarding the suitability of the products described in this manual for any purposes that are not specified in this manual. The users shall be held for full responsibility for validating the performance and suitability of the products for their particular design and applications. For any of the misusage of the products out of the scope described herein, the user shall indemnify and hold Siargo and its officers, employees, subsidiaries, affiliates, and sales channels harmless against all claims, costs, damages, and expense or reasonable attorney fee from direct or indirect sources.

Siargo makes no other warranty, express or implied, and assumes no liability for any special or incidental damage or charges, including but not limited to any damages or charges due to installation, dismantling, reinstallation, etc. other consequential or indirect damages of any kind. To the extent permitted by law, the exclusive remedy of the user or purchaser, and the limit of Siargo's liability for any and all losses, injuries, or damages concerning the products, including claims based on contract, negligence, tort, strict liability, or otherwise shall be the return of products to Siargo, and upon verification of Siargo to prove to be defective, at its sole option, to refund, repair or replacement of the products. Regardless of form, no action may be brought against Siargo more than 365 days after a cause of action has accrued. The products returned under warranty to Siargo shall be at the user or purchaser's risk of loss and will be returned, if at all, at Siargo's risk of loss. Purchasers or users are deemed to have accepted this limitation of warranty and liability, which contains the complete and exclusive limited warranty of Siargo. It shall not be amended, modified, or its terms waived except by Siargo's sole action.

This manual's product information is believed to be accurate and reliable at the time of release or made available to the users. However, Siargo shall assume no responsibility for any inaccuracies and/or errors and reserves the right to make changes without further notice for the relevant information herein.

This warranty is subject to the following exclusions:

(1) Products that have been altered, modified, or have been subject to unusual physical or electrical circumstances indicated but not limited to those stated in this document or any other actions which cannot be deemed as proper use of the products;

(2) Products that have been subject to chemical attacks, including exposure to corrosive substances or contaminants. In the case of battery usage, long term discharge or leakage induced damages;
(3) Products that have been opened or dismantled for whatever reasons;
(4) Products that have been subject to working conditions beyond the technical specification as described by this manual or related datasheet published by the manufacturer;
(5) Any damages incurred by the incorrect usage of the products;
(6) Siargo does not provide any warranty on finished goods manufactured by others. Only the original manufacturer's warranty applies;
(7) Products that are re-sold by unauthorized dealers or any third parties.

10.Service contact and information

Siargo Ltd. is making every effort to ensure the quality of the products. In case of questions and or product supports, please contact customer service at the address listed below. We will respond to your request in a timely fashion and work with you toward your complete satisfaction.

Customer service and all orders should be addressed to

Siargo Ltd.
3100 De La Cruz Boulevard, Suite 210,
Santa Clara, California 95054, USA
Phone: +01(408)969-0368
Email: info@Siargo.com

For orders, please provide an accurate and full postal address. Siargo will not ship to P.O. Boxes or via a third party.

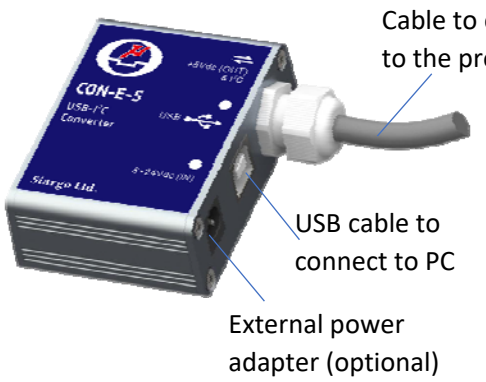
Please contact info@siargo.com to obtain a Return Materials Authorization (RMA) before shipping the product back to the factory for returns or factory services such as calibration. Please specify as clear and detailed as possible in your email message the product's status that you intend to ship back to the factory. Be sure to write the RMA on the returned package or include a letter with the RMA information.

For further information and updates, please visit www.Siargo.com.

Appendix I: Sensor evaluation kit

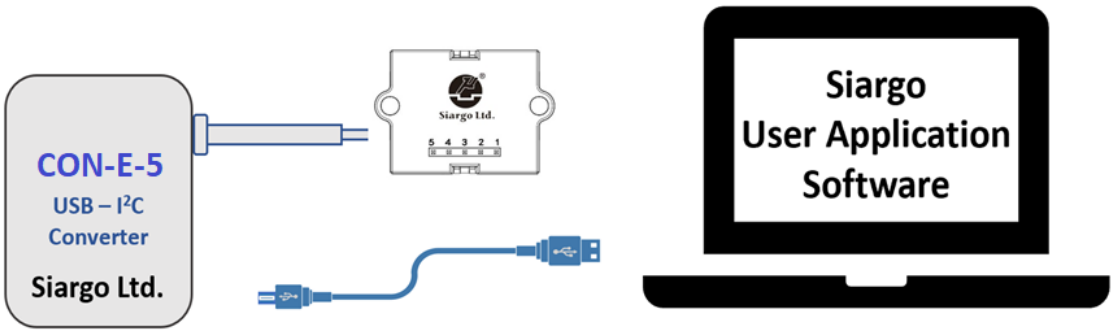
Siargo offers a sensor evaluation kit, including a digital data converter, USB data cable, and User Application software, that allows the user to evaluate the product performance on a Microsoft Windows-based computer. The user can read and visualize the flow rate of the product, obtain the totalized values, and save the data for further analysis. It can read from up to 128 sensors with the I²C interface in serial.

For further information and purchase of the evaluation kit, please contact the manufacturer or the sales representative.



Each converter has a fixed cable that can be directly connected to the product. The USB cable connected to the PC is also included.

For most of the products, the power from the PC via the USB cable will be sufficient to power the sensor product, no external power will be required. However, for multiple sensors in serial, the power via the USB cable may not be enough, an external power adapter with 8 ~ 24 Vdc will be required.



Appendix II: Document history

11.2021	VB.1 – Corrected the power supply voltage.
06.2021	VB.0 – Reformated and I²C communication update.
10.2020	VA.7 – ISO 45001 update.
07.2019	VA.6 – Update mountings.
07.2018	VA.5 – Update response time, temperature shift, and warm-up time; update I²C protocol.
09.2017	VA.4 – Added range (50 and 100 Pa); add working electrical current requirement.
07.2017	VA.3 – Added uni-directional option. Added document history tracking.