

# DPSPX-LP

DIFFERENTIAL PRESSURE  
PI CONTROLLER WITH  
DISPLAY

Mounting and operating instructions



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## SAFETY AND PRECAUTIONS

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Read all the information, the datasheet, Modbus map, mounting and operating instructions and study the wiring and connection diagram before working with the product. For personal and equipment safety, and for optimum product performance, make sure you entirely understand the contents before installing, using, or maintaining this product.



For safety and licensing (CE) reasons, unauthorised conversion and /or modifications of the product are inadmissible.



The product should not be exposed to abnormal conditions, such as extreme temperatures, direct sunlight or vibrations. Long-term exposure to chemical vapours in high concentration can affect the product performance. Make sure the work environment is as dry as possible; avoid condensation.



All installations shall comply with local health and safety regulations and local electrical standards and approved codes. This product can only be installed by an engineer or a technician who has expert knowledge of the product and safety precautions.



Avoid contacts with energised electrical parts. Always disconnect the power supply before connecting, servicing or repairing the product.



Always verify that you apply appropriate power supply to the product and use appropriate wire size and characteristics. Make sure that all the screws and nuts are well tightened and fuses (if any) are fitted well.



Recycling of equipment and packaging should be taken into consideration and these should be disposed of in accordance with local and national legislation / regulations.



In case there are any questions that are not answered, please contact your technical support or consult a professional.

## PRODUCT DESCRIPTION

The DPSPX-LP series are high resolution differential pressure controllers (-125–125 Pa). The integrated PI control with anti-windup function offers the possibility to directly control EC motors / fans. They are equipped with a fully digital state-of-the-art pressure transducer designed for a wide range of applications. Zero point calibration and Modbus registers reset can be executed via a tactile switch. They also feature integrated K-factor and an analogue / modulating output (0–10 VDC / 0–20 mA / 0–100% PWM). All parameters are accessible via Modbus RTU (3SModbus software or Sensistant).

## ARTICLE CODE

Codes	Power supply	Maximum power consumption	Nominal power consumption	I <sub>max</sub>	Operating range
DPSPF-LP	18–34 VDC	1,8 W	1,35 W	100 mA	-125–125 Pa
DPSPG-LP	18–34 VDC	1,71 W	1,28 W	95 mA	
	15–24 VAC ±10 %	3,3 W	2,475 W	220 mA	

## INTENDED AREA OF USE

- Building and controlled ventilation
- Volume flow control in HVAC applications
- Air velocity control (by using an external PSET-PTX-200 Pitot tube connection set) in HVAC applications
- Differential pressure / volume flow control in clean rooms
- Clean air and non-aggressive, non-combustible gases

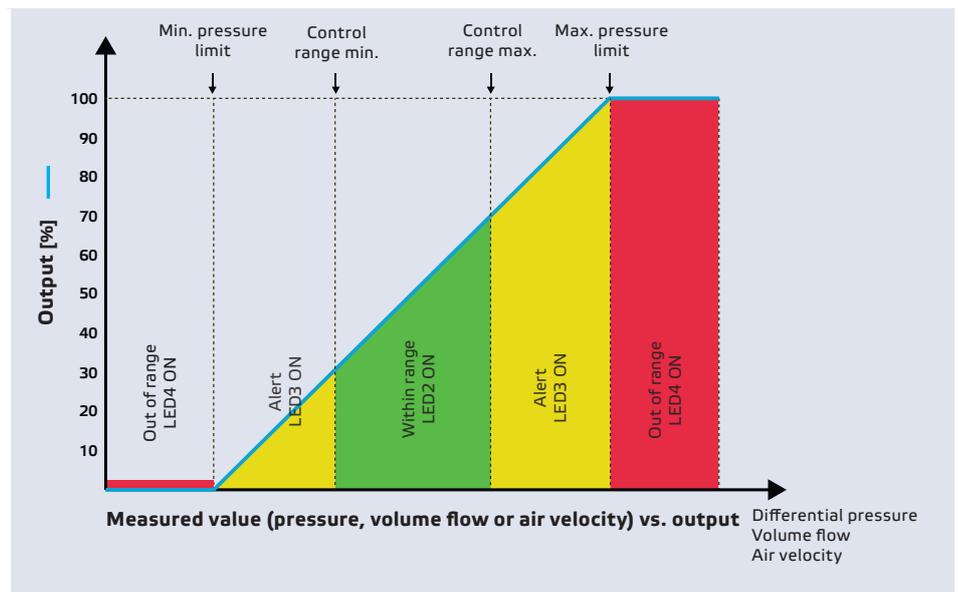
## TECHNICAL DATA

- 4-digit 7-segment LED display for indicating differential pressure or air volume flow
- Built-in digital high resolution differential pressure sensor
- Air velocity can be measured via Modbus RTU (by using an external PSET-PTX-200 Pitot tube connection set)
- Selectable analogue / digital output: 0–10 VDC / 0–20 mA / PWM (open collector type):
  - ▶ 0–10 VDC mode:  $R_L \geq 50 \text{ k}\Omega$
  - ▶ 0–20 mA mode:  $R_L \leq 500 \Omega$
  - ▶ PWM mode: PWM Frequency: 1 kHz,  $R_L \geq 50 \text{ k}\Omega$
- Minimum differential pressure span: 5 Pa
- Minimum volume flow range span: 10 m<sup>3</sup>/h
- Minimum air velocity range span: 1 m/s
- Selectable response time: 0,1–10 s
- Implemented K-factor
- Selectable internal voltage source for PWM output: 3,3 or 12 VDC
- Differential pressure, air volume or air velocity readout via Modbus RTU
- Selectable minimum and maximum operating ranges
- Modbus registers reset function (to factory pre-set values)
- Four LEDs for status indication
- Modbus RTU communication
- Sensor calibration procedure via tact switch
- Aluminium pressure connection nozzles
- Accuracy: ±2 % of the operating range
- Operating ambient conditions:
  - ▶ Temperature: -5–65 °C
  - ▶ Rel. humidity: < 95 % rH (non-condensing)
- Storage temperature: -20–70 °C

## STANDARDS

- EMC Directive 2014/30/EC: CE
  - ▶ EN 61326-1:2013 Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements
  - ▶ EN 61326-2-3:2013 Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 2-3: Particular requirements - Test configuration, operational conditions and performance criteria for transducers with integrated or remote signal conditioning
- RoHS Directive 2011/65/EC

## OPERATIONAL DIAGRAMS



## WIRING AND CONNECTIONS

Article type	DPSPF-LP	DPSPG-LP	
<b>Vin</b>	18–34 VDC	18–34 VDC	13–26 VAC
	Ground	Common ground	AC ~
<b>GND</b>	Ground / AC ~		
<b>A</b>	Modbus RTU (RS485), signal A		
<b>/B</b>	Modbus RTU (RS485), signal /B		
<b>AO1</b>	Analogue / modulating output (0–10 VDC / 0–20 mA / PWM)		
<b>GND</b>	Ground AO1	Common ground	
<b>Connections</b>	Cable cross section	1,5 mm <sup>2</sup>	

### ATTENTION

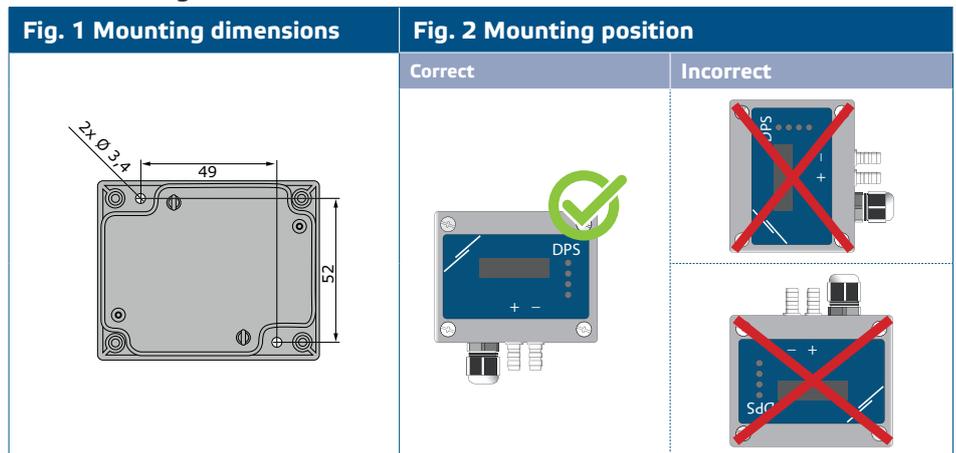
The -F version of the product is not suited for 3-wire connection. It has separate grounds for power supply and analogue output. Connecting both grounds together might result in incorrect measurements. Minimum 4 wires are required to connect -F type sensors.

The -G version is intended for 3-wire connection and features a 'common ground'. This means that the ground of the analogue output is internally connected with the ground of the power supply. For this reason, -G and -F types cannot be used together on the same network. Never connect the common ground of -G type articles to other devices powered by a DC voltage. Doing so might cause permanent damage to the connected devices.

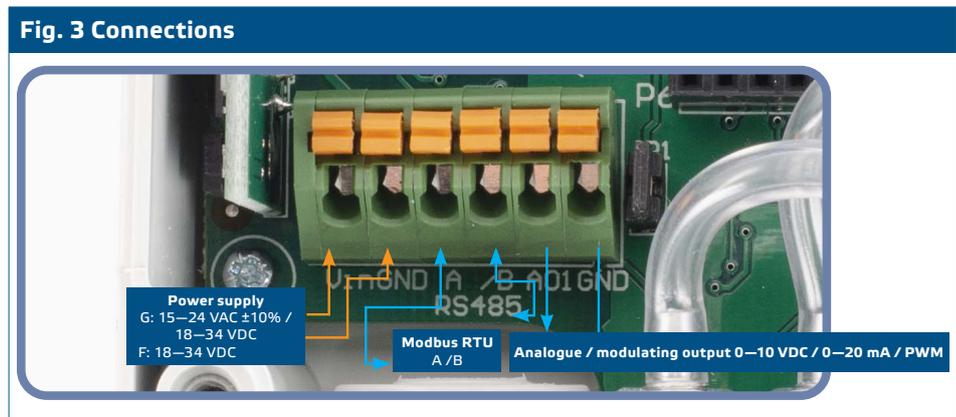
## MOUNTING INSTRUCTIONS IN STEPS

Before you start mounting the unit, read carefully **“Safety and Precautions”**. Choose a smooth surface for installation (a wall, panel, etc.) and follow these steps:

1. Unscrew the front cover of the enclosure to remove it.
2. Fix the enclosure onto the surface by means of suitable fasteners while adhering to the mounting dimensions shown in **Fig. 1** and the correct mounting position shown in **Fig. 2** below.



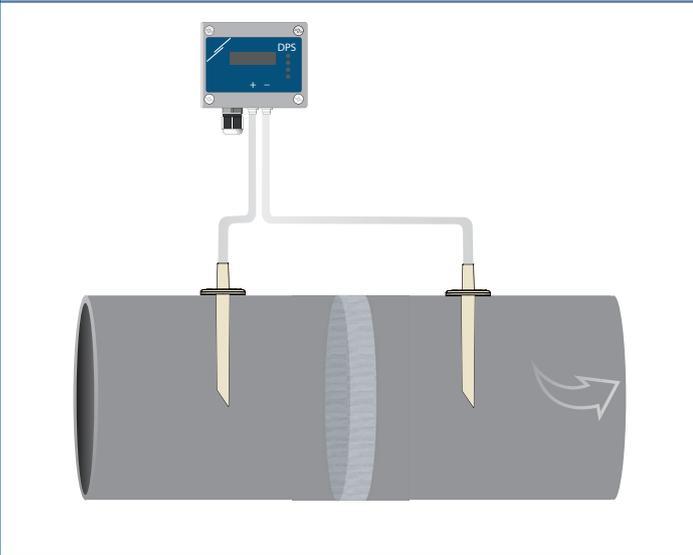
3. Insert the cable into the cable gland.
4. Connect as shown in **Fig. 3 Connections** adhering to the information in section **“Wiring and connections”**.



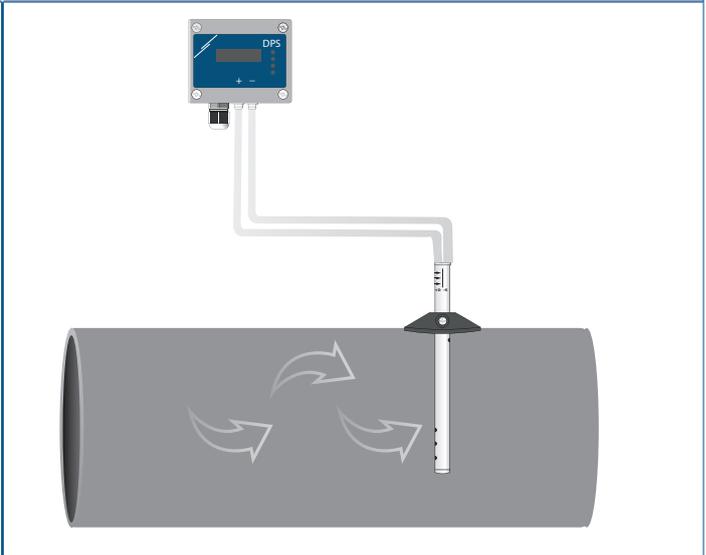
5. Connect the nozzles to the duct (see **Fig. 4**). Depending the application you must use a specific connection set to connect the nozzles of the unit to the duct:
  - 5.1 To measure differential pressure, use PSET-QF or PSET-PVC set (pressure measurement is the unit default setting);
  - 5.2 To measure volume flow, use PSET-PT Pitot tube connection set, PSET-QF or PSET-PVC connection set. If you use PSET-PT, you should enter the duct cross sectional area [cm<sup>2</sup>] in Modbus register 63. If you use PSET-QF or PSET-PVC, enter the K-factor of the fan (provided by the fan /motor manufacturer) in Modbus holding register 62.  
 In case the K-factor is not known, volume flow is calculated from a duct cross sectional area (holding register 63) multiplied by air velocity (Pitot air velocity (holding register 64) should be enabled and Pitot tube connected).
  - 5.3 To measure air velocity, use PSET-PT set and enable Pitot tube air velocity via holding register 64. In this case the K-factor of the fan has to be 0

**Fig. 4 Connecting with accessories**

**Application 1: Measuring differential pressure [Pa] or volume flow [m<sup>3</sup>/h] using PSET-PVC**



**Application 2: Measuring volume flow [m<sup>3</sup>/h] or air velocity [m/s] using PSET-PT**



6. Switch on the power supply.

**NOTE**

*For sensor calibration and Modbus registers reset procedures, refer to section "Operating instructions". Always calibrate the sensor before initial use.*

**PWM voltage selection:**

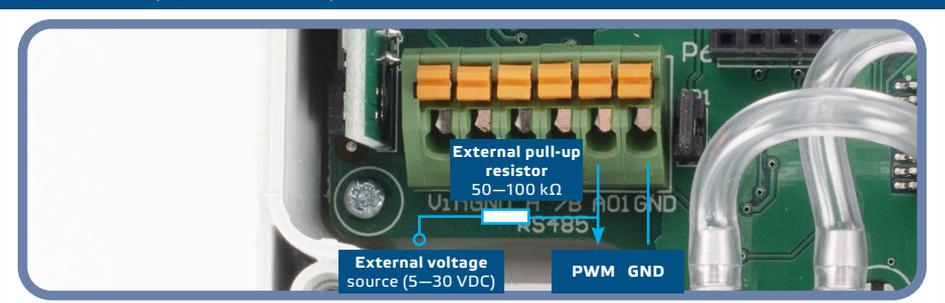
- When the internal pull-up resistor (JP1) is connected, the voltage source is set via Modbus holding register 54, i.e. 3,3 VDC or 12 VDC. See **Fig. 5 Pull-up resistor jumper 1**.

**Fig. 5 Pull-up resistor jumper 1**



- When JP1 is disconnected, the output type is Open collector. See **Fig. 6 PWM (Open collector) connection**.
- Only when JP1 is not connected and the analogue/ modulating output (AO1) is assigned as PWM output (via holding register 54 - see the Modbus Map), an external pull-up resistor is used.

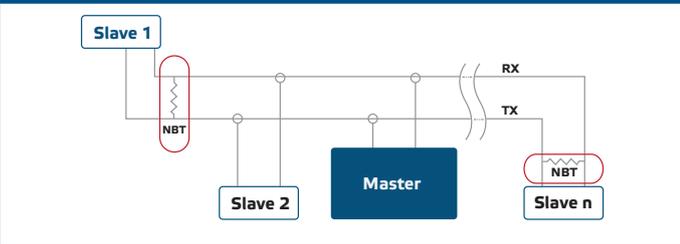
**Fig. 6 PWM (Open collector) connection**



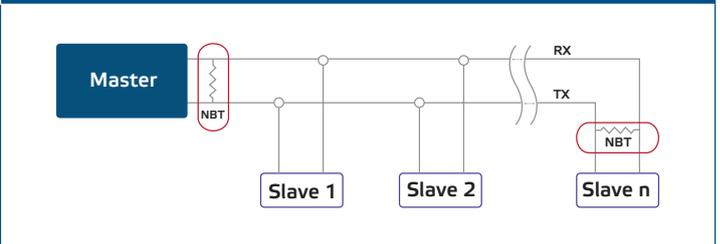
### Optional settings

To assure correct communication, the NBT needs to be activated in only two devices on the Modbus RTU network. If necessary, enable the NBT resistor via 3SModbus or Sensistant (*Holding register 9*).

#### Example 1



#### Example 2



### NOTE

*On a Modbus RTU network, two bus terminators (NBTs) need to be activated.*

7. Put back the front cover and secure it with the screws.
8. Customise the factory settings to the desired ones via the 3SModbus software or the Sensistant configurator. For the default factory settings, see *Modbus register map*.

### NOTE

*For the complete Modbus register data, refer to the product Modbus Register Map, which is a separate document attached to the article code on the website and contains the registers list. Products with earlier firmware versions may not be compatible with this list.*

## VERIFICATION OF INSTALLATION

Continuous green LED1 indication as shown in **Fig. 7 Power / Modbus communication indication** means the unit is supplied. If LED1 is not on, check the connections again.

Blinking green LED1 indication as shown in **Fig. 7 Power / Modbus communication indication** means the unit has detected a Modbus network. If LED1 does not blink, check the connections again.

### NOTE

*For the complete Modbus register data, refer to the product Modbus Register Map, which is a separate document attached to the article code on the website and contains the registers list. Products with earlier firmware versions may not be compatible with this list.*

**Fig. 7 Power / Modbus communication indication**



### ATTENTION

*The status of the LEDs can be checked only when the unit is energised. Take the relevant safety measures!*

### ATTENTION

*Green LED intensity can be adjusted between 0 and 100 % with step of 10 % according to the value set in Holding register 80.*

## OPERATING INSTRUCTIONS

### NOTE

For detailed information and settings, refer to the product Modbus register map, which is attached to the article code on our website.

#### Calibration procedure

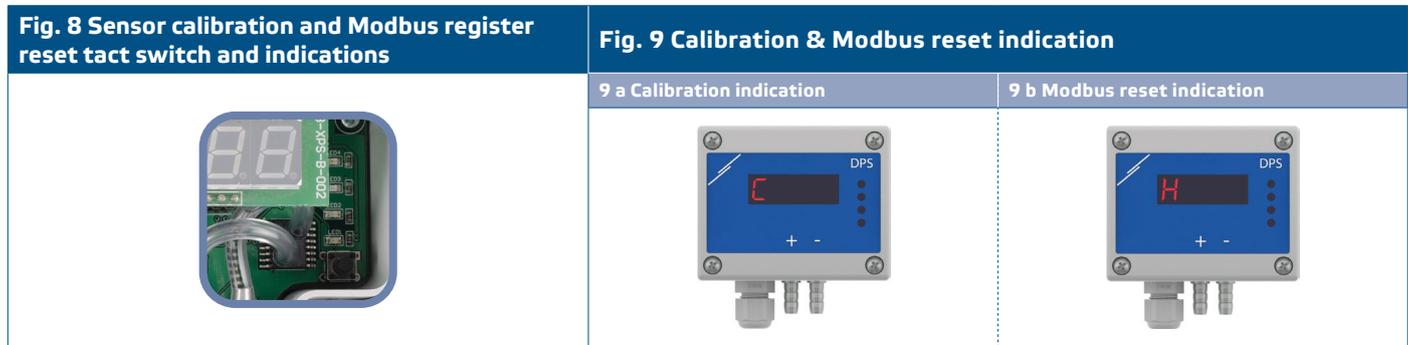
1. Disconnect the nozzles and make sure they are not clogged.
2. There are two options for starting the calibration process:  
Either write "1" in holding register 70 or press button SW1 for 4 seconds until the green LED2 and yellow LED3 on the printed circuit board blink twice and release it (see **Fig. 7 Sensor calibration and Modbus register reset tact switch and indication**).
3. "C" for calibration will appear on the display (see **Fig. 9 a Calibration Indication**).
4. After 2 seconds the green LED2 and yellow LED3 will blink twice once again to indicate that the calibration procedure has finished.

### NOTE

Make sure that the nozzles are disconnected and unobstructed.

#### Reset of Modbus registers procedure:

1. Press tact switch SW1 for 4 seconds until the green LED2 and yellow LED3 on the printed circuit board blink twice and hold the switch until both LEDs blink again three times (see **Fig. 8 Sensor calibration and Modbus register reset tact switch and indication**).
2. The Modbus registers are reset to their default values (factory pre-set).
3. During the Modbus reset procedure the display will indicate "H" (See **Fig. 9 b Modbus reset indication**)



### NOTE

Press and hold the tact switch until both LEDs on the PCB blink twice and hold it until both LEDs blink again three times. If the tact switch is released before both LEDs blink again three times, the sensor will have carried out a calibration procedure instead of Modbus registers reset procedure.

#### Communication holding registers reset procedure:

1. Put the jumper onto pins 1 and 2 of the P4 connector for more than 20 s while the device is powered (see **Fig. 10**).

**Fig. 10 Modbus holding register reset jumper**



2. Modbus communication holding registers from 1 to 3 will be reset to the default values.
3. Remove the jumper.

**ATTENTION**

*Correct reading of air velocity is possible only if it is enabled by holding register 64 (Pitot air velocity) and a transmitter is connected to the appropriate Pitot tube connection set (PSET-PTX-200).*

**Differential pressure, air volume flow and air velocity mode indications:**

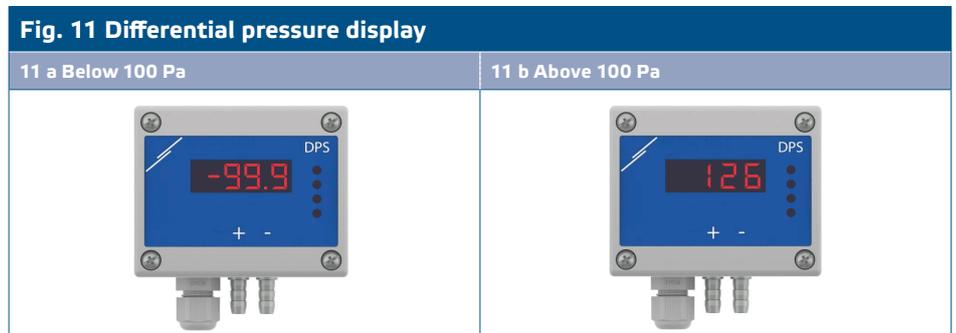
The display is enabled via writing "1" in holding register 91 (Measurement readout). Writing "0" will disable the display.

When the display is enabled, its mode depends on the value in holding register 61 (Operating mode). There are three display modes activated via writing the relevant figure in holding register 61 - see the table below:

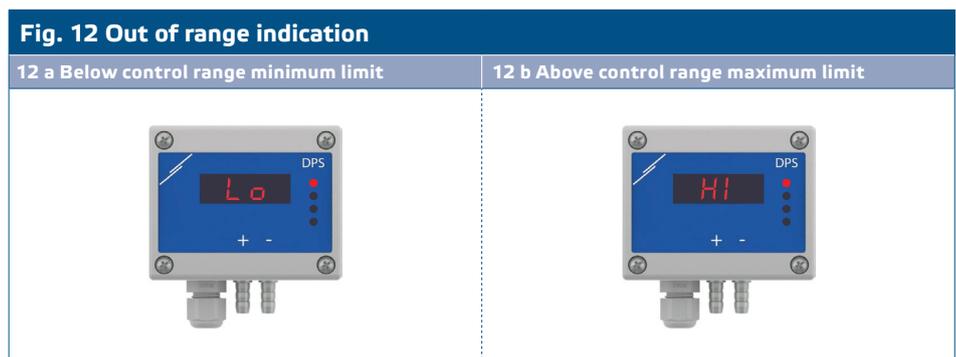
Measurement readout enabled	
Value of holding register 61:	Display mode:
<b>1</b>	Differential pressure
<b>2</b>	Volume flow rate
<b>3</b>	Air velocity

**1. Differential pressure display mode (see Fig. 11):**

- 1.1 The LED display indicates the differential pressure level with a resolution of 0,1 Pa if the level is below 100 Pa. However, above 100 Pa, the resolution is 1 Pa. In both cases the 3SModbus software indicates the actual value. See Fig. 11 below.

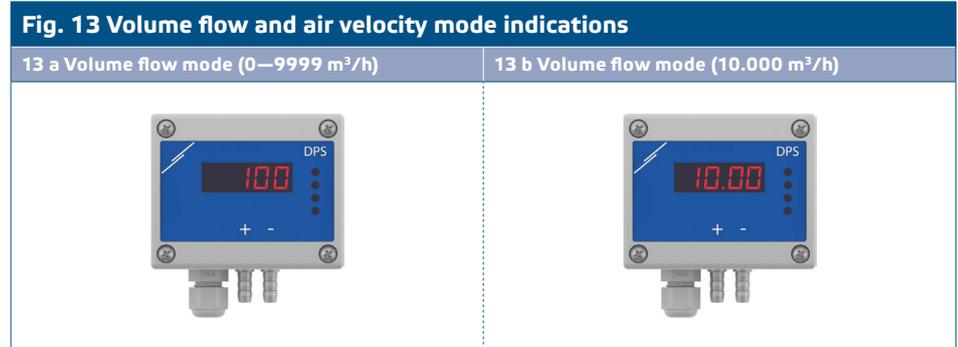


- 1.2 Out of range indication:
  - ▶ The display shows "Lo" every 3 seconds in case the measured differential pressure is lower than the minimum limit of the control range (see Fig. 12 a).
  - ▶ In case the measured differential pressure is higher than the control range maximum limit, the display shows 'HI' every 3 seconds (see Fig. 12 b)



## 2. Air volume flow display mode:

- 2.1 Air volume flow rate within the range 0–9999 m<sup>3</sup>/h is displayed with a resolution of 1 m<sup>3</sup>/h. An example of displaying 100 m<sup>3</sup>/h is given in **Fig. 13 a** below.
- 2.2 Air volume flow rate above 10.000 m<sup>3</sup>/h is displayed divided by 1.000. An example of displaying 10.000 m<sup>3</sup>/h is given in **Fig. 13 b** below.



## 3. Air velocity display mode:

- 3.1 Air velocity is displayed with a resolution of 0,1 m/s. An example of displaying 1,0 m/s is given in **Fig. 14** below.



**NOTE**

*Press and hold the tact switch until both LEDs on the PCB blink twice and hold it until both LEDs blink again three times. If the tact switch is released before both LEDs blink again three times, the sensor will have carried out a calibration procedure instead of Modbus registers reset procedure.*

## 4. Sensor element failure indication:

In case of failure of sensor element or loss of communication with it, an 'Err' message is displayed and the red LED4 blinks. See **Fig. 15**.



**NOTE**

*Sensor failure condition is displayed only if the display is not in OFF mode (enabled and disabled via holding register 91).*

## TRANSPORT AND STORAGE

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Avoid shocks and extreme conditions; stock in original packing.

## WARRANTY AND RESTRICTIONS

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Two years from the delivery date against defects in manufacturing. Any modifications or alterations to the product after the date of publication relieve the manufacturer of any responsibilities. The manufacturer bears no responsibility for any misprints or mistakes in this data.

## MAINTENANCE

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In normal conditions this product is maintenance-free. If soiled, clean with a dry or damp cloth. In case of heavy pollution, clean with a non-aggressive product. In these circumstances the unit should be disconnected from the supply. Pay attention that no fluids enter the unit. Only reconnect it to the supply when it is completely dry.