

# HPSPX-2

DIFFERENTIAL  
PRESSURE PI  
CONTROLLER

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 HPSPX -2 series are high resolution differential pressure controllers with analog / modulating output. 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. All parameters are accessible via Modbus RTU (3SModbus software or Sensistant).

## ARTICLE CODES

Article code	Power supply	Connection	Range, [Pa]
HPSPF-1K0-2	18–34 VDC	4-wire (separate grounds)	0–1.000 Pa
HPSPF-2K0-2			0–2.000 Pa
HPSPF-4K0-2			0–4.000 Pa
HPSPF-10K -2			0–10.000 Pa
HPSPG-1K0-2	18–34 VDC / 15–24 VAC ±10%	3-wire (common ground)	0–1.000 Pa
HPSPG-2K0-2			0–2.000 Pa
HPSPG-4K0-2			0–4.000 Pa
HPSPG-10K -2			0–10.000 Pa

## INTENDED AREA OF USE

- Differential pressure, air flow volume or air flow velocity measurement and control in HVAC applications
- Differential pressure / air flow monitoring and control in clean rooms
- Clean air and non-aggressive, non-combustible gases

## TECHNICAL DATA

- Built-in digital high resolution differential pressure sensor
- PI control with anti wind-up function and auto-tune function
- Active setpoint selection between differential pressure, air flow volume or air velocity
- Air flow velocity can be measured via Modbus RTU (by using an external PSET-PTX-200 Pitot tube connection set)
- Minimum and maximum output value selection
- Selectable analog / digital output: 0–10 VDC / 0–20 mA / PWM (open collector type):
  - ▶ 0–10 VDC mode: min. load 50 kΩ (RL ≥ 50 kΩ)
  - ▶ 0–20 mA mode: max. load 500 Ω (RL ≤ 500 Ω)
  - ▶ PWM mode: PWM Frequency: 1 kHz, min. load 50 kΩ (RL ≥ 50 kΩ)
- Variety of operating ranges and measurement windows
- 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
- Maximum power consumption:
  - ▶ HPSPF-2: 1,8 W
  - ▶ HPSPG-2: 1,68 W
- Nominal power consumption in normal operation:
  - ▶ HPSPF-2: 1,35 W
  - ▶ HPSPG-2: 1,26 W

- I<sub>max</sub>:
  - ▶ HPSPF-2: 75 mA
  - ▶ HPSPG-2: 70 mA
- Modbus registers reset function (to factory pre-set values)
- Four LEDs for controller status indication
- Modbus RTU communication
- Sensor calibration procedure via tact switch
- Aluminium pressure connection nozzles
- Accuracy:  $\pm 2\%$  of the operating range
- Protection class: IP65
- Operating ambient conditions:
  - ▶ Temperature:  $-5$ – $65$  °C
  - ▶ Rel. humidity:  $< 95\%$  rH (non-condensing)
- Storage temperature:  $-20$ – $70$  °C

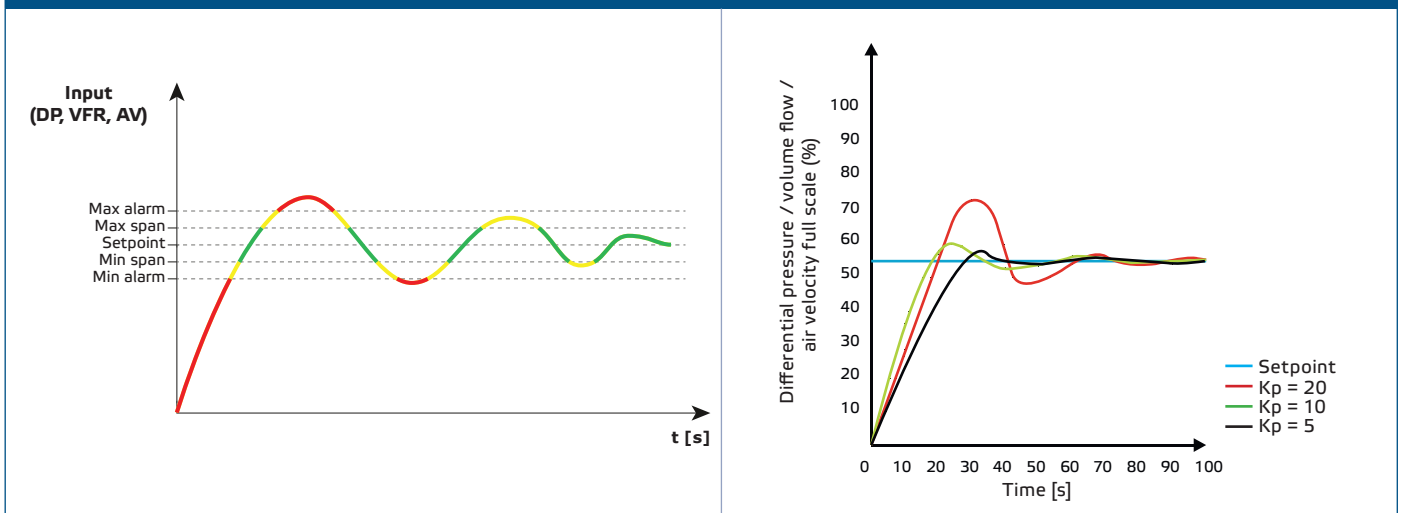
## STANDARDS

- Low Voltage Directive 2014/34/EC
- EMC Directive 2014/30/EC: EN 61000-6-3:2007/A1:2011/AC:2012
- WEEE Directive 2012/19/EC
- RoHS Directive 2011/65/EC



## OPERATIONAL DIAGRAM

### Diagrams



## WIRING AND CONNECTIONS

	HPSPF -2	HPSPG -2	
VIN	18–34 VDC	18–34 VDC	15–24 VAC ±10%
GND	Ground	Common ground	AC ~
A	Modbus RTU (RS485), signal A		
/B	Modbus RTU (RS485), signal /B		
AO1	Analog / modulating output (0–10 VDC / 0–20 mA / PWM)		
GND	Ground AO	Common ground	
Connections	Spring contact terminal blocks, cable cross section: 1,5 mm <sup>2</sup>		

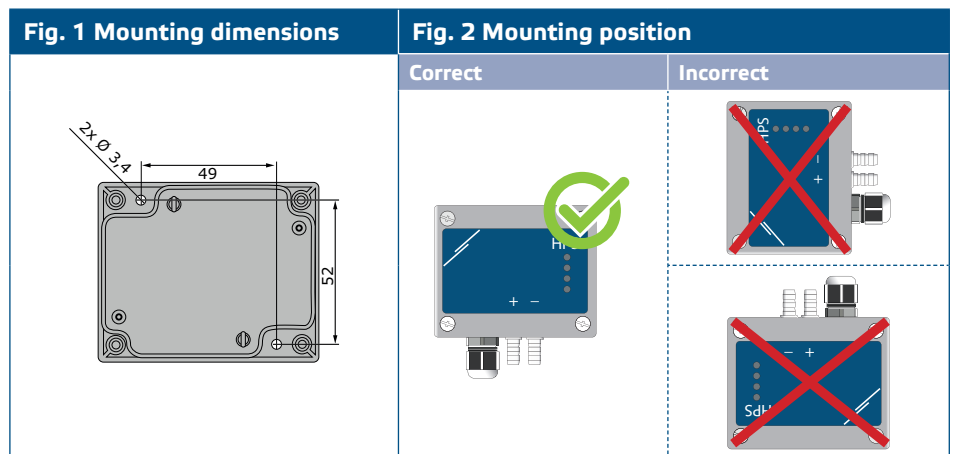
### ⚠ ATTENTION

*Never connect the common ground of G type articles to other devices powered by a DC voltage. If an AC power supply is used with a unit on a Modbus network, the GND terminal should NOT BE CONNECTED to other units on the network or via the CNVT-USB-RS485 converter. This may cause permanent damage to the communication semiconductors and / or the computer!*

## MOUNTING INSTRUCTIONS IN STEPS

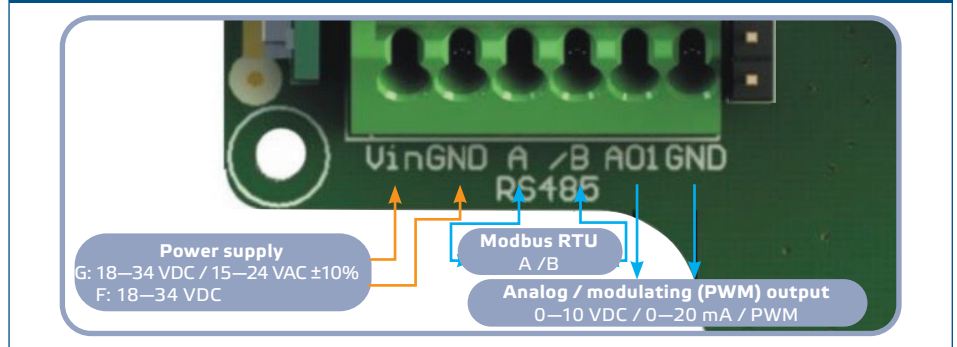
Before you start mounting the HPSPX-2 differential pressure PI controller, read carefully **“Safety and Precautions”**. Choose a smooth surface for installation (a wall, panel, etc.) and follow these steps:

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 Mounting dimensions** and the correct mounting position shown in **Fig. 2 Mounting position**.



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

**Fig. 3 Connections**



5. Connect the nozzles with the tubing.
6. Put back the front cover and secure it with the screws.
7. Switch on the power supply.

**NOTE**

*For sensor calibration and Modbus register reset procedures, refer to section "OPERATING INSTRUCTIONS". Always calibrate the sensor before initial use.*

**PWM voltage selection:**

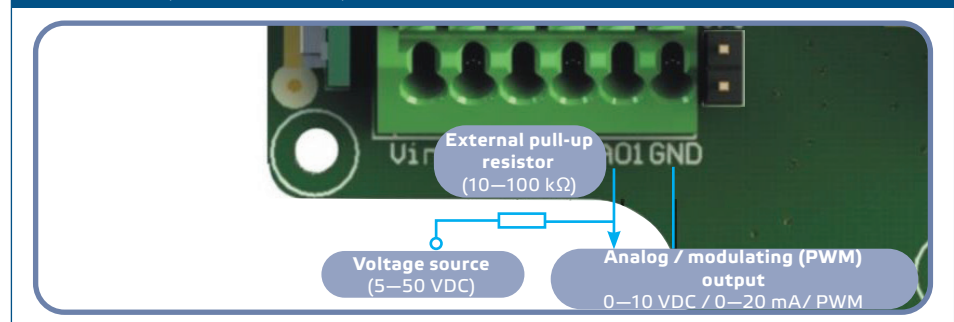
- When the internal pull-up resistor (JP1) is connected, the voltage source is set via Modbus holding register 48, i.e. 3,3 VDC or 12 VDC. See **Fig. 4 Pull-up resistor jumper 1**.

**Fig. 4 Pull-up resistor jumper 1**



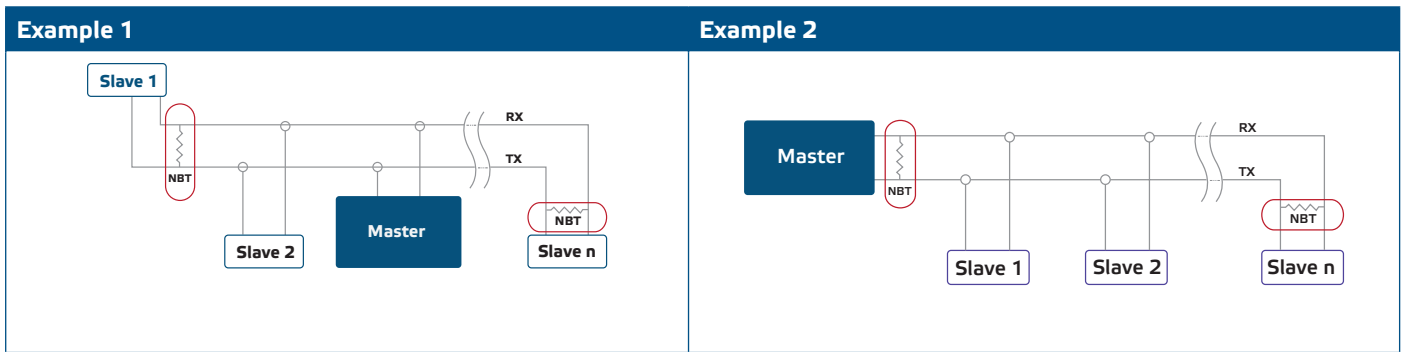
- When JP1 is disconnected, the output type is Open collector. See **Fig. 5 PWM (Open collector) connection**.
- Only when JP1 is not connected and the analog output (AO1) is assigned as PWM output (via Holding register 40 - see Modbus Maps below), an external pull-up resistor is used.

**Fig. 5 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 41).



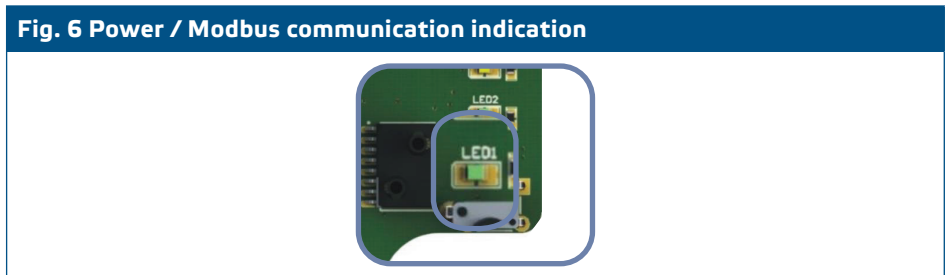
## NOTE

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

## VERIFICATION OF INSTALLATION INSTRUCTIONS

Continuous green LED1 indication as shown in **Fig. 6 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. 6 Power / Modbus communication indication** means the unit has detected a Modbus network. If LED1 does not blink, check the connections again.



## ATTENTION

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

## OPERATING INSTRUCTIONS

### Calibration procedure:

8. Disconnect the nozzles.
9. There are two options for starting the calibration process:
10. Either write "1" in holding register 49 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**).
11. After 2 seconds, the green LED2 and yellow LED3 will blink twice once again to indicate that the calibration procedure has finished.



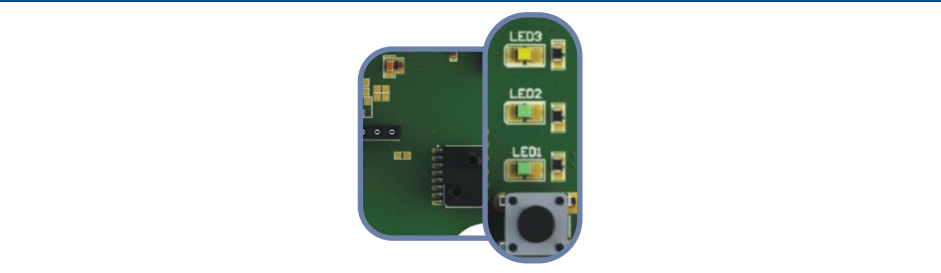
## ATTENTION

*Make sure that the nozzles are free and disconnected.*

### Modbus registers reset procedure:

12. Press button SW1 for 4 seconds until the green LED2 and yellow LED3 on the printed circuit board blink twice and hold the button until both LEDs blink again three times (see **Fig. 7** *Sensor calibration and Modbus register reset tact switch and indication*).
13. The Modbus registers are restored to their default values (factory pre-set).

**Fig. 7** Sensor calibration and Modbus register reset tact switch and indications



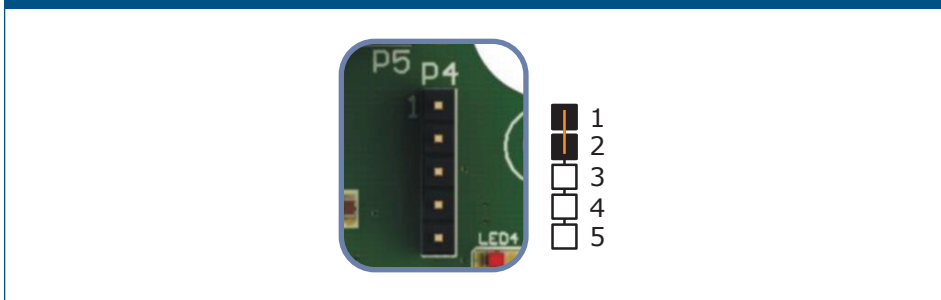
## NOTE

*Press and hold the button until both LEDs on the PCB blink twice and hold it until both LEDs blink again three times. If the button 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:

14. Put the jumper onto pins 1 and 2 of the P4 connector for more than 20 s while the device is powered. (See **Fig. 8** *Modbus holding register reset jumper*).

**Fig. 8** Modbus holding register reset jumper



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

## ATTENTION

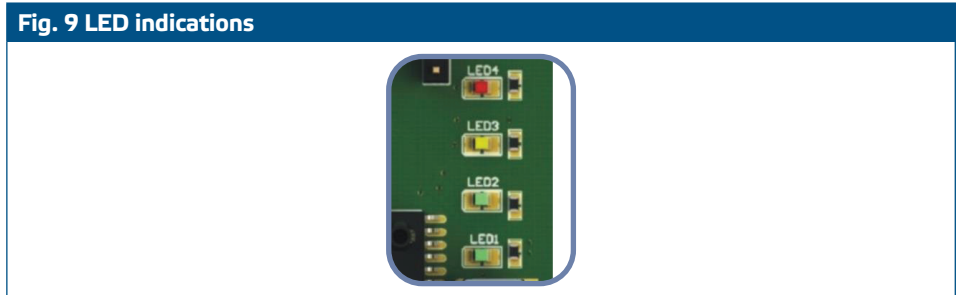
*Make sure that the nozzles are free and not connected.*

### LED indications (See Fig. 9):

17. When the green LED1 is on, the power supply is adequate, but there is no active Modbus communication; if it blinks, the Modbus RTU communication is active.
18. When the green LED2 is on, the measured differential pressure, air volume or air velocity is stabilized between the minimum span and maximum span.
19. When the yellow LED3 is on, the measured differential pressure, air volume or air velocity has exceeded the minimum or maximum span threshold.

- 20. When the red LED4 blinks, there is a problem with the sensor element.
- 21. When the red LED4 is solid on, the differential pressure, air volume or air velocity has exceeded the minimum or maximum alarm threshold.

**Fig. 9 LED indications**



**22. Sensor element failure indication:**

In case of failure of the sensor element or loss of communication with it, the red LED4 blinks.

**Autotune function:**

The auto-tune function computes the  $K_p$  and  $T_i$  parameters according to the system response. Writing '1' into holding register 36 starts the auto-tune procedure. When it is completed, the HPSPX -2 controller automatically writes '0' in holding register 36 and overrides holding registers 34 and 35 by entering the new values of  $K_p$  and  $T_i$ . Once started, the Auto-tune procedure cannot be stopped while the controller is on. If the HPSPX -2 is restarted, however, auto-tune is aborted.

 **NOTE**

*Auto-tune function calculates the  $K_p$  and  $T_i$  parameters necessary for the good system performance. However, if you have extensive knowledge of PI control, you can change these parameters via writing in Modbus holding registers 34 and 35.*

## 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.