User Manual

EE600

Differential Pressure Sensor

E+E Elektronik Ges.m.b.H. accept warranty and liability claims neither upon this publication nor in case of improper treatment of the described products.

The document may contain technical inaccuracies and typographical errors. The content will be revised and updated on aregular basis. The described products can be improved and changed at any time without prior notice.

EMC note USA (FCC):

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

EMC note Canada (ICES-003):

CAN ICES-3 (A) / NMB-3 (A)

CONTENT

1 General

This user manual serves for ensuring proper handling and optimal functioning of the device.
The user manual shall be read before commissioning the equipment and it shall be provided to all staff involved in transport, installation, operation, maintenance and repair.
The user manual may not be used for the purposes of competition without the written consent of E+E Elektronik® and may not be forwarded to third parties. Copies may be made for internal purposes. All information, technical data and diagrams included in these instructions are based on the information available at the time of writing.

1.1 Explanation of symbols

This symbol indicates safety information.
It is essential that all safety information is strictly observed. Failure to comply with this information can lead to personal injuries or damage to property. E+E Elektronik® assumes no liability if this happens.

This symbol indicates instructions.
The instructions shall be observed in order to reach optimal performance of the device.

1.1.1 General safety instructions

- Avoid any unnecessary mechanical stress and inappropriate use.
- Installation, electrical connection, maintenance and commissioning shall be performed by qualified personnel only.
- Use the EE600 only as intended and observe all technical specs.
- Do not blow into the pressure connections.
- Connecting to EE600 a pressure beyond the measurement range according to the product specification may permanently damage the device.
- Do not use EE600 in explosive atmosphere or for measurement of aggressive gases.
- Do not apply the nominal voltage to the output terminals.

1.1.2 Mounting, start-up and operation

The EE600 differential pressure sensor has been produced under state of the art manufacturing conditions, has been thoroughly tested and has left the factory fulfilling all safety criteria. The manufacturer has taken all precautions to ensure safe operation of the device. The user must ensure that the device is set up and installed in a manner that does not have a negative effect on its safe use.

The user is responsible for observing all applicable safety guidelines, local and international, with respect to safe installation and operation on the device. This operating manual contains information and warnings that must be observed by the user in order to ensure safe operation.

- Mounting, start-up, operation and maintenance of the device may be performed by qualified staff only. Such staff must be authorised by the plant operator to carry out the mentioned activities.
- The qualified staff must have read and understood this operating manual and must follow the instructions contained within.
- All process and electrical connections shall be thoroughly checked by authorised staff before putting the device into operation.
- Do not install or start-up a device supposed to be faulty. Make sure that such devices are not accidentally used by marking them clearly as faulty.
- A faulty device may only be investigated and possibly repaired by qualified, trained and authorised staff. If the fault cannot be fixed, the device shall be removed from the process.
- Service operations other than described in this operating manual may only be performed by the manufacturer.

Disclaimer
The manufacturer or his authorised agent can only be held liable in case of willful or gross negligence. In any case, the scope of liability is limited to the corresponding amount of the order issued to the manufacturer. The manufacturer assumes no liability for damages incurred due to failure to comply with the applicable regulations, operating instructions or the operating conditions. Consequential damages are excluded from the liability.

1.2 Environmental aspects

Products from E+E Elektronik® are developed and manufactured observing of all relevant requirements with respect to environment protection. Please observe local regulations for the device disposal.

For disposal, the individual components of the device must be separated according to local recycling regulations. The electronics shall be disposed of correctly as electronics waste.

2 Scope of Supply

- EE600 differential pressure sensor according to ordering guide
- Quick user guide
- Test report according to DIN EN 10204 – 2.2
- Pressure connection kit, straight, including 2 m hose
- Mounting materials
- For digital version (J3 ordering code): one additional M16 x 1.5 cable gland for "Daisy chain" wiring

3   Product Description

Pressure fittings Ø 5mm
+ : High pressure
- : Low pressure
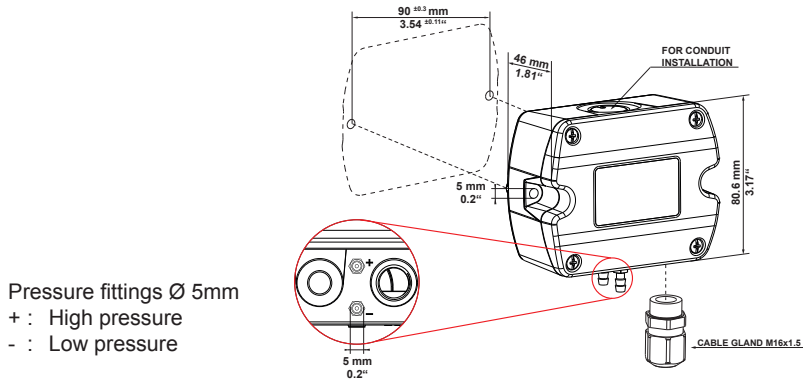
Fig. 1   Dimensions

Analogue version (A7)	Digital version (J3)
1. Pressure connection nipples	1. Pressure connection nipples
2. DIP switches: Configuration (Ranges, response time, ...)	2. DIP switches: RS485 addressing
3. Terminals: spring loaded	3. Terminals: screw
4. Push buttons for zero point and span point adjustment	4. Push buttons for zero point and span point adjustment
5. Status LED	5. Status LED
6. Cable gland for wiring	6. Slide switch termination resistor
	7. Service interface connector
	8. Cable gland for wiring
	9. Additional cable gland for daisy chain wiring

Fig. 2   Design and components

Analogue version (A7)	Digital version (J3)

Fig. 3   Connection diagram

User Manual EE600 Differential Pressure Sensor

4 Setup

4.1 Analogue version

Each EE600 leaves the E+E factory with the default setup (all switches on „0"):

- Measurement range: 100 % of the full scale (1000 Pa or 10000 Pa)
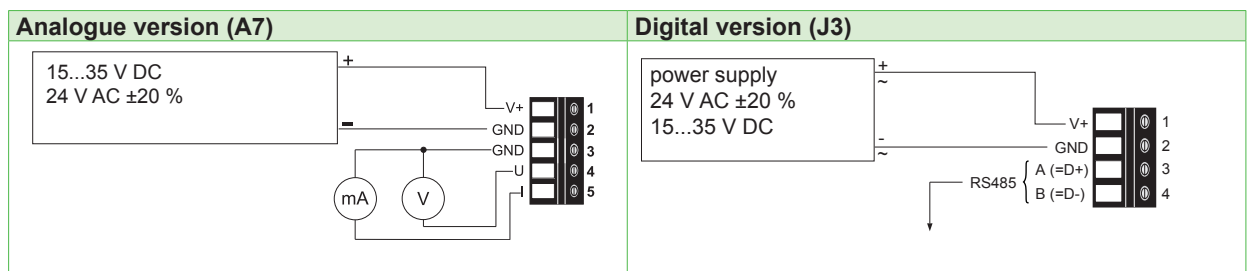- Response time: 50 ms
- Display unit: Pa
- Backlight display: on
- Output signals: 0-10 V and 4-20 mA

i EE600 is fully configurable. Before commissioning, set the individual configuration of EE600 according to the application requirements using the DIP switches S1 to S8 as described below. The function of the DIP switches is indicated also on the interior of the EE600 front cover.
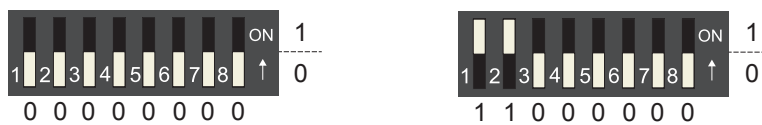

Fig. 4   DIP switches examples

4.1.1 Select the measurement range with S1 and S2

EE600-HV52A7:					
S1	**S2**	**Pa**	**mbar**	**inch WC**	**kPa**
0	**0**	1000	10	4	1
1	**0**	750	7.5	3	0.75
0	**1**	500	5	2	0.5
1	**1**	250	2.5	1	0.25

EE600-HV53A7:					
S1	**S2**	**Pa**	**mbar**	**inch WC**	**kPa**
0	**0**	10000	100	40	10
1	**0**	7500	75	30	7.5
0	**1**	5000	50	20	5
1	**1**	2500	25	10	2.5

Tab. 1   DIP switch settings - Measurement range

4.1.2 Select the response time with S3 and S4

S3	**S4**	**Response time**
0	**0**	50 ms
1	**0**	500 ms
0	**1**	2 s
1	**1**	4 s

Tab. 2   DIP switch settings - Response time

4.1.3 Select the display unit with S5 and S6

S5	**S6**	**Display unit**
0	**0**	Pa
1	**0**	mbar
0	**1**	inch WC
1	**1**	kPa

Tab. 3   DIP switch settings - Display unit

4.1.4 Select the backlight for the display with S7

S7	Backlight
0	on
1	off

Tab. 4   DIP switch settings - Blacklight

4.1.5 Select the output signal with S8

EE600 provides simultaneously a voltage and a current output signal at the spring terminals.

S8	Output signals
0	0-10 V and 4-20 mA
1	0-5 V and 0-20 mA

Tab. 5   DIP switch settings - Output signals

4.1.6 Outputs

The measured data is available at the spring terminals as 0-10 V and 4-20 mA or as 0-5 V and 0-20 mA signals (see „4.1.5 Select the output signal with S8").

Additionally, the analogue outputs indicate measurement out of range as follows.

Indication of Δp < -5 % MR and of negative difference pressure due to inverted pressure connection:

Output signal	Indication of negative differential pressure
0-10 V	-0.5 V
0-5 V	-0.25 V
4-20 mA	3.2 mA
0-20 mA	-1 mA

Tab. 6   Indication of Δp < -5 % MR

Indication of Δp > 105 % MR

Output signal	Indication of overload
0-10 V	10.5 V
0-5 V	5.25 V
4-20 mA	20.8 mA
0-20 mA	21 mA

Tab. 7   Indication of Δp > 105 % MR

4.2 Digital version

The EE600 is ready to use and does not require any configuration by the user. The factory setup of EE600 corresponds to the type number ordered. For ordering guide please see data sheet at www.epluse.com/ee600. If needed, the user can change the factory setup by using the USB configuration adapter (code HA011066) and the EE-PCS, Product Configuration Software.
One can change the application settings (see chapter „4.2.7 Application settings"), the display visualisation (see chapter „7.2.2 Digital version"), the digital communication parameters (see chapter „4.2.2 RS485 Digital Interface settings") and the response time.

Note: The EE600 may not be connected to any additional power supply when using the USB configuration adapter HA011066.
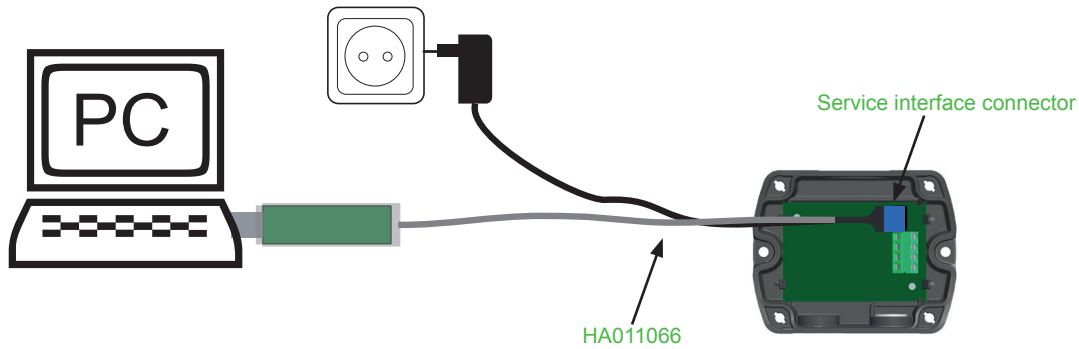
Fig. 5   Configuration adapter

4.2.1   EE-PCS Product Configuration Software

1. Download the EE-PCS Product Configuration Software from www.epluse.com/configurator and install it on the PC.
2. Connect the E+E device to the PC using the appropriate configuration cable.
3. Start the EE-PCS software.
4. Follow the instructions on the EE-PCS opening page for scanning the ports and identifying the connected device.
5. Click on the desired setup or adjustment mode from the main EE-PCS menu on the left and follow the online instructions of the EE-PCS.

4.2.2   RS485 Digital Interface settings

Hardware Bus Termination
The bus termination can be realised enabling the slide switch on board (120 Ohm resistor). Factory setting disabled (see „Fig. 2 Design and components", Digital version J3).
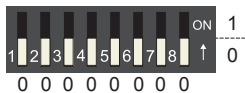
Address setting via Software
All DIP switches at position 0 → address has to be set via Software (via EE-PCS Product Configuration Software or via protocol BACnet / Modbus). Default address 43.
Example: Slave address is set via configuration software.

Address setting via Dip-Switch
Setting the DIP switches to any other address than 0, overrules the default address (43) or the address set via Software.
Example: Slave address set to 3 (0000 0011 binary).

4.2.3   BACnet Protocol Settings

	Factory settings	Selectable values
Baud rate	As per type number ordered	9600, 19200, 38400, 57600, 76800, 115200
Data bits	8	8
Parity	None	None
Stop bits	1	1
Slave address	43	0…127

Tab. 8   BACnet Protocol settings

[i] The recommended settings for multiple devices in a BACnet MS/TP network are 38400, 8, None, 1.

The EE600 PICS (Product Implementation Conformance Statement) is available on the website at www.epluse.com/EE600.
ID address, baud rate can be set via:

1. EE-PCS, Product Configuration Software and the USB configuration adapter cable code HA011066. BACnet protocol, see the PICS.

4.2.4   Modbus Protocol Settings

	Factory settings	Selectable values
Baud rate	As per type number ordered	9600, 19200, 38400, 57600, 76800, 115200
Data bits	8	8
Parity	Even	None, odd, even
Stop bits	1	1 or 2
Slave address	43	1…247

Tab. 9   Modbus Digital Settings

i

The recommended settings for multiple devices in a Modbus RTU network are 9600, 8, Even, 1.

ID address, baud rate, parity and stop bits can be set via:
1. EE-PCS, Product Configuration Software and the appropriate configuration cable.
2. Modbus protocol in the register 60001 (0x00) and 60002 (0x01). See Application Note Modbus AN0103 (available on www.epluse.com/EE600).

The measured values are saved as a 32 bit float value and as 16 Bit signed integer, see the Modbus Register map below.
The serial number as ASCII-code is located at read register address 30001-30008 (16 bit per address).
The firmware version is located at register address 30009 (bit 15...8 = major release; bit 7...0 = minor release).
The sensor name is located at register address 30010.

4.2.5   Modbus Register Map

FLOAT 32 bit			
Measured value	**Unit**	**Register number[1] [DEC]**	**Protocol Address [2] [HEX]**
Read register: function code 0x03 / 0x04			
Differential pressure	mm WC	1211	0x4BA
Differential pressure	mbar	1213	0x4BC
Differential pressure	Pa	1215	0x4BE
Differential pressure	kPa	1217	0x4C0
Differential pressure	inch WC	1219	0x4C2
Air velocity	m/s	1041	0x410
Air velocity	ft/min	1043	0x412
Volume flow	m^3/h	1055	0x41E
Volume flow	l/s	1057	0x420
Volume flow	m^3/s	1059	0x422
Volume flow	ft^3/min	1181	0x49C
Filter monitoring	%	1075	0x432
Level indicator	cm	1077	0x434
Level indicator	inch	1079	0x436

INTEGER 16 bit				
Measured value	**Unit**	**Scale[3]**	**Register number[1] [DEC]**	**Protocol Address [2] [HEX]**
Read register: function code 0x03 / 0x04				
Differential pressure	mm WC	10	4106	0x1009
Differential pressure	mbar	100	4107	0x100A
Differential pressure	Pa	1	4108	0x100B
Differential pressure	kPa	1000	4109	0x100C
Differential pressure	inch WC	100	4110	0x100D
Air velocity	m/s	100	4021	0xFB4
Air velocity	ft/min	1	4022	0xFB5
Volume flow	m^3/h	1	4028	0xFBB
Volume flow	l/s	1	4029	0xFBC
Volume flow	m^3/s	1000	4030	0xFBD
Volume flow	ft^3/min	1	4091	0xFFA
Filter monitoring	%	10	4038	0xFC5
Level indicator	cm	10	4039	0xFC6
Level indicator	inch	10	4040	0xFC7

INTEGER 16 bit			INFO (read register)		
Parameter name	Register number[1] [Dec]	Register address[2] [Hex]	Parameter name	Register number[1] [Dec]	Register address[2] [Hex]
Read and write register: function code 0x03 / 0x06			Read register: function code 0x03 / 0x04		
Slave-ID[4] modbus address	0001	0x00	Serial number (as ASCII)	0001	0x00
Modbus protocol settings[5]	0002	0x01	Firmware version	0009	0x08
			Sensor Name	0010	0x09
			Status / Error information	0602	0x259

[1] Register number starts from 1

[2] Register address starts from 0

[3] 100 is scale 1:100 (2550 is equivalent to 25.50)

[4] If the ID is set via DIP-switch the response will be NAK

[5] For Modbus protocol settings please see Application Note Modbus AN0103 (available on www.epluse.com/EE600)

4.2.6   Reading example

Example of MODBUS RTU command for reading the differential pressure (float value) Δp = 497,965972 Pa from the register 0x4BE:

Device EE600; slave ID 43 [2B in Hex]
Reference document, chapter 6.3: www.modbus.org/docs/Modbus_Application_Protocol_V1_1b.pdf

Request [Hex]:   2B 04 04 BE 00 02 17 15

	Modbus ID address	Function code	Starting address Hi	Starting address Lo	No. of register Hi	No. of register Lo	CRC	
Request [Hex]:	2B	04	04	BE	00	02	17	15

Response [Hex]:   2B 04 04 FB A5 43 F8 61 F3

	Modbus ID address	Function code	Byte count	Register 1 value Hi	Register 1 value Lo	Register 2 value Hi	Register 2 value Lo	CRC	
Response [Hex]:	2B	04	04	FB	A5	43	F8	61	F3

For decoding of float values (stored according standard IEEE754), please refer to AN0103, chapter 7 (available on www.epluse.com/EE600).

Example of decoding

Response [Hex]				Value in decimal
Byte 1 (Register 2 - Hi)	Byte 2 (Register 2 – Lo)	Byte 3 (Register 1 - Hi)	Byte 4 (Register 1 - Lo)	
43	F8	FB	A5	497,965972

4.2.7   Application settings

Beside differential pressure measurement (Pa, kPa, mbar, mm WC, inch WC), the EE600 can be set up for the following applications:

• volume flow (k-factor input)
• air velocity (k-factor input)
• filter monitoring
• level indication

Using the EE-PCS Product Configuration Software and the USB configuration adapter (code HA011066) the user can set the required parameters for each application.

With an optional display (ordering code D2) different units and limit bars can be set. Please see chapter „7.2.2 Digital version" for display settings.

Volume flow measurement

By entering a k-factor under application settings, the EE600 is able to calculate the volume flow (q) according to the formula:

$$q = k * \sqrt{\Delta p}$$

q = volume flow	[m³/h]
Δp = differential pressure	[Pa]
k = k-factor	

The k-factor is a characteristic theoretical parameter for each fan model, specified by the manufacturer in the datasheet of the fan.

Note: If the data sheet of the fan manufacturer specifies a different method or unit of calculating the volume flow, the k-factor must be converted accordingly to fit the above formula.

For example: If the k-factor (kspecific) in the data sheet of the fan manufacturer applies for volume flow calculation in m³/s it has to be converted as follows:

$$q[\mathrm{m^3/s}] = kspecific * \sqrt{\Delta p} \qquad kE + E = kspecific * 3600$$
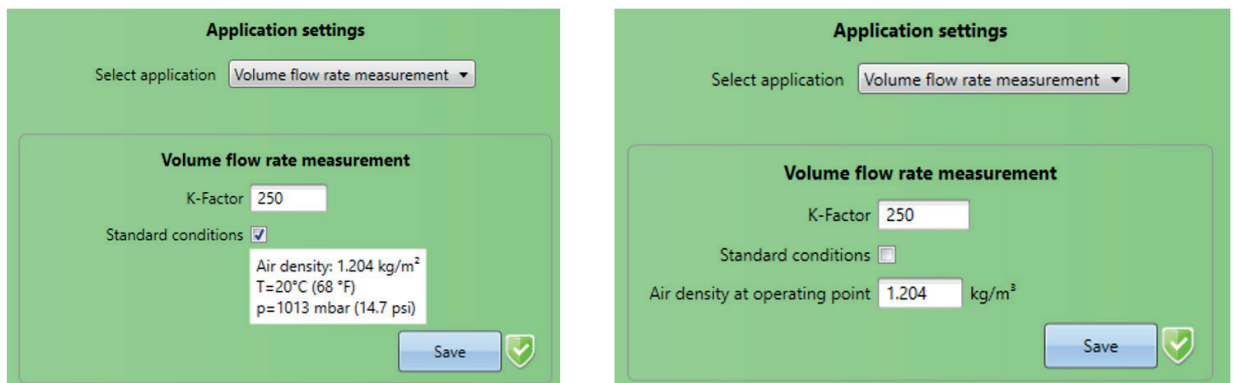

Fig. 6   Application settings - volume flow rate measurement

The calculated volume flow (q) is available via BACnet or Modbus protocol in four different units: m³/h, m³/s, ft³/min, l/s.

The default air density (ρ20) value at standard conditions is defined as follows:

Air density (ρ_{20}): 1,204 kg/m³   @: T = 20 °C (68 °F), p = 1013 mbar (14,7 psi)

If the air density deviates from standard conditions, a compensation for the calculated volume flow is necessary.
By entering the specific air density (ρ′) [kg/m³] at the operating point, the EE600 applies a compensation to the calculated volume flow (q′) according to the formula:

$$q' = k * \sqrt{\Delta p} * \sqrt{\frac{\rho 20}{\rho'}}$$

q′= volume flow at specific density	[m³/h]
Δp = differential pressure	[Pa]
k = k-factor	
ρ′ = specific air density	[kg/m³]
ρ20 = air density at 20 °C (68 °F)	[kg/m³]

Air velocity measurement

By entering a k-factor and the dimensions of the duct (round or square), the EE600 is able to calculate the air velocity (v) out of the volume flow (q) and the area of the duct.

$$v = \frac{q/3600}{A}$$

v = air velocity	[m/s]
q = volume flow	[m³/h]
A = Area	[m²]

Details for k-factor see application settings for volume flow measurement.
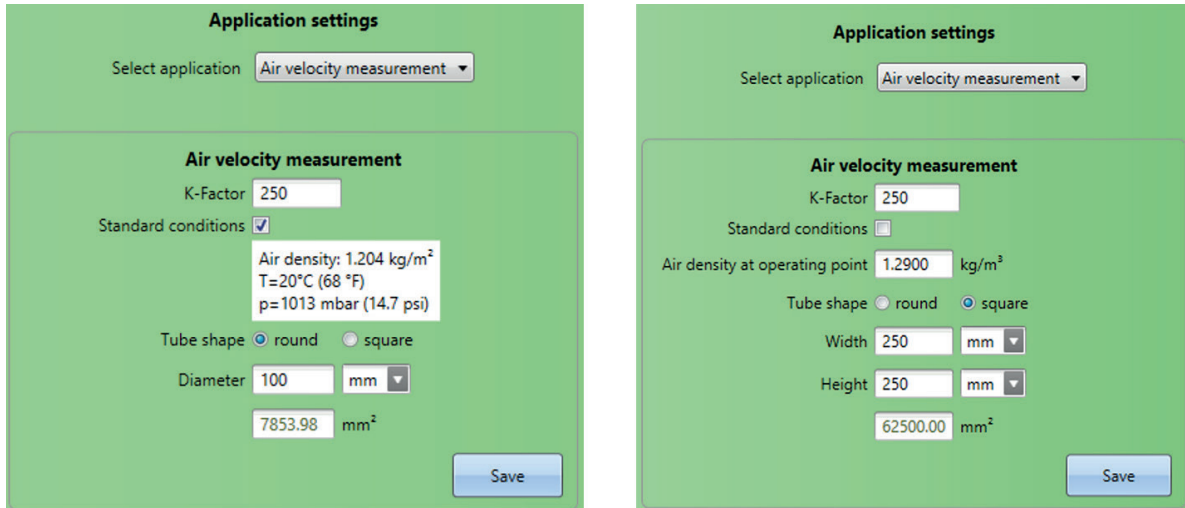

Fig. 7   Application settings - Air velocity measurement

The calculated air velocity (v) is available via BACnet or Modbus protocol in two different units: m/s and ft/min.

Details for setting air density (when deviating from default air density at standard conditions) see application settings for volume flow measurement.

Filter monitoring

By entering filter limits for differential pressure, the EE600 is able to calculate a contamination level for the observed filter in order to plan for maintenance purposes.
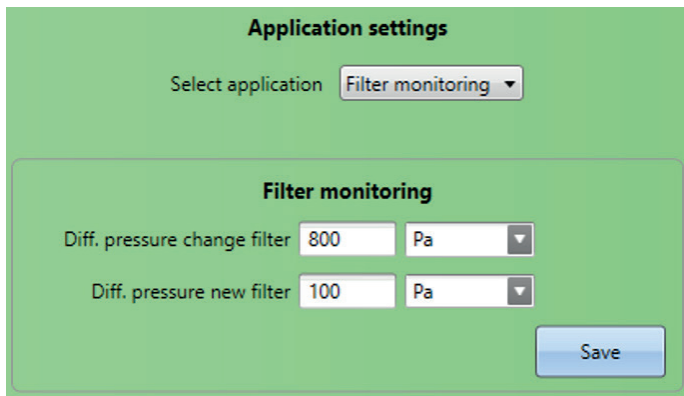

Fig. 8   Application settings - Filter monitoring

For the given application setting (Δp change filter = 800 Pa, Δp new filter = 100 Pa) a measured differential pressure at the filter of Δp = 450 Pa, would mean a contamination level of 50 %:

$$\text{contamination level } [\%] \; = \; \frac{\text{measured } \Delta p \; - \; \Delta p \text{ new filter}}{\Delta p \text{ change filter} \; - \; \Delta p \text{ new filter}}$$

The filter contamination level is available via BACnet or Modbus protocol expressed in percentage [%].

Level indicator

By entering the density [kg/m³] of a fluid the EE600 can act as a level indicator. The differential pressure level measurement uses the pressure values and the specific weight of the fluid to represent the level in a tank (see „Fig. 14 Mounting examples").
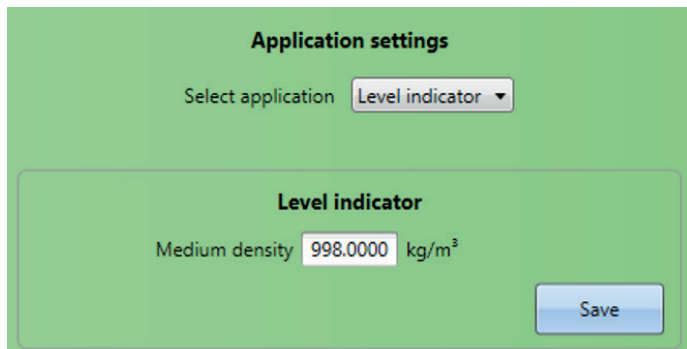

Fig. 9   Application settings - Level indicator

$$h = \frac{\Delta p}{\rho * g} * 100$$

h = Level (cm)

Δp = Differential pressure (Pa)

ρ = Density of fluid (kg/m³)

g = Gravitational acceleration (9,81 m/s²)

By applying the positive pressure connection into the tank, the user can measure the height of the column of that fluid.

The level measurement is available via BACnet or Modbus protocol in two different units: cm and inch.

The maximum measurable level is limited by the highest differential pressure range 0…10000 Pa.
For example, for water with density 998 kg/m³, at 10000 Pa the maximum height is 102 cm (40 inch).

5   Installation

- Mount the EE600 onto a vertical, smooth surface.
- Important**:** The pressure connection nipples must point downwards.
- Avoid installation close to heaters and sources of strong electromagnetic interference.
- Insert the cable for supply voltage and output signal through the cable gland and connect it to the spring terminals according to the wiring diagram („Fig. 3 Connection diagram").
- Important: Make sure that the connecting cable or wires do not impact with the push buttons in order to prevent unintentional trigger of the span or zero point adjustment.
- Close tightly the cable gland. This is essential for the compliance with the IP65 / NEMA4 protection class of the EE600 enclosure.
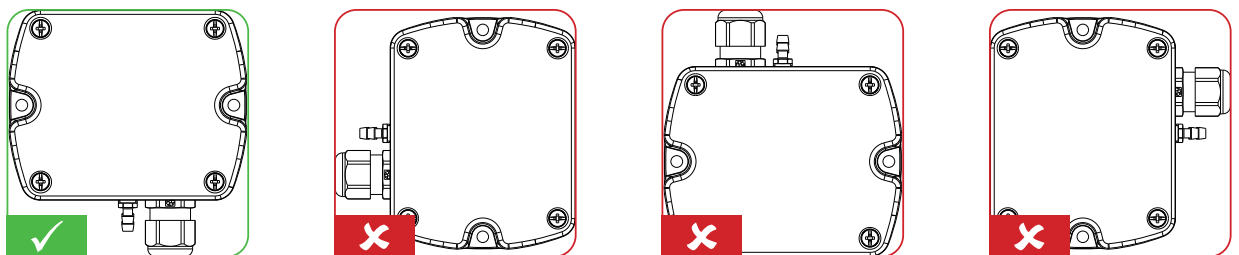

Fig. 10   Mounting orientation
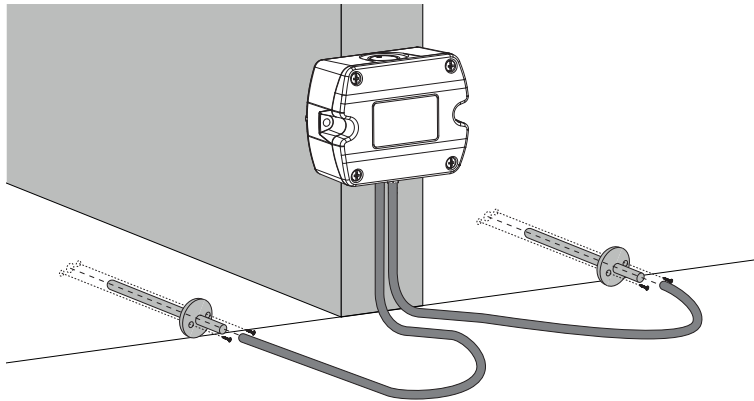
5.1 Pressure connection
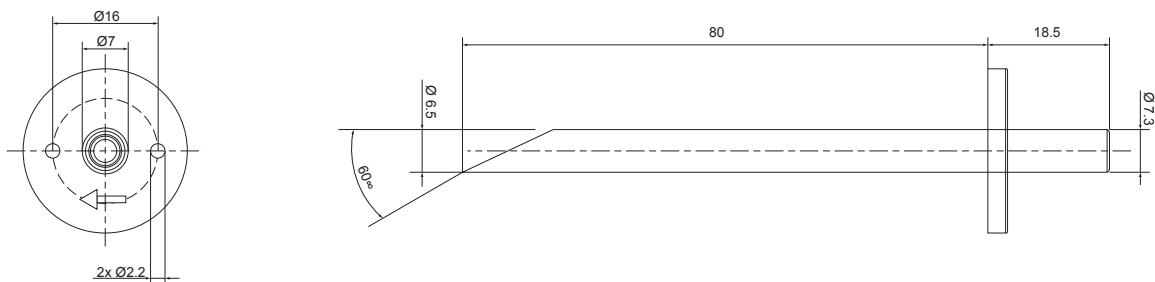

Fig. 11   Pressure connection

Fig. 12   Dimension of pressure connection nipples

- Install first the pressure connection nipples (included in the scope of supply) onto the duct. Use a Ø 7.5 mm drill.
- Connect the pressure hose (included in the scope of supply) first to the EE600 and then to the nipples at the duct. Route the pressure hose for avoiding sharp bends which might lead to the hose obstruction („Fig. 13 Pressure hose route").
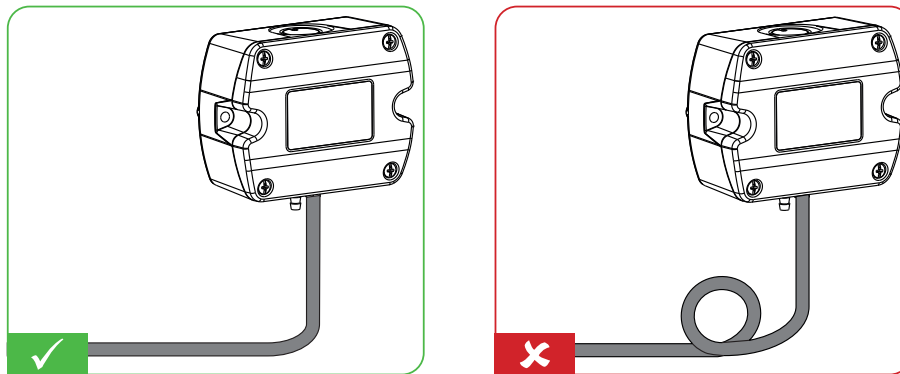

Fig. 13   Pressure hose route

i Important: Make sure to connect the higher pressure at the "+" pressure connector and the lower pressure at the "-" pressure connector. Inverted connection leads to "out of range" information on the optional display and at the analogue outputs, see „4.1.6 Outputs" and „7.2.3 Out of range".
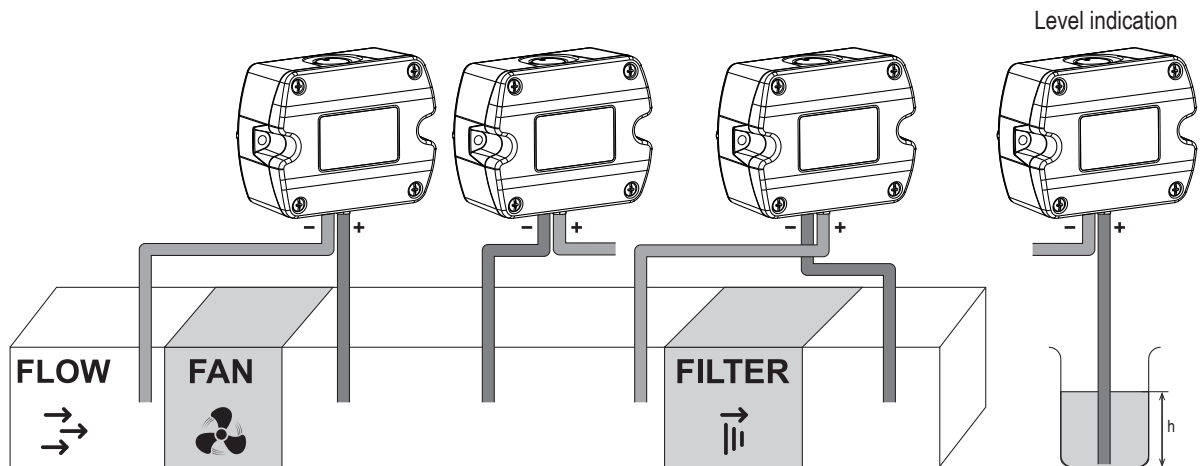
Level indication

Fig. 14   Mounting examples

6   Maintenance and service

EE600 does not require any special maintenance, nevertheless it is recommended to perform a zero point adjustment every 12 month. If needed, the enclosure may be cleaned and the device may be re-adjusted as described below.

6.1   Cleaning

Use a damp soft cloth to remove deposits of dust or dirt from the exterior of the device and from the display. Do not attempt to clean the interior of the device. Do not use any solvents, alcohol or abrasive cleaning agents.

6.2   Repairs

Repairs may be carried out by the manufacturer only. The attempt of unauthorised repair excludes any warranty claims.

6.3   Readjustment of EE600

A periodical readjustment of EE600 might be required by the regulations of certain industries or by the need of best long-term measurement accuracy. The zero point and the span point can be adjusted with push buttons on the EE600 electronics board.

For adjustment the device must be powered and the enclosure cover removed. Consequently, the adjustment may be performed by authorised staff only, observing the handling of electrical sensitive devices (ESD).

6.3.1   Zero Point Adjustment

The zero point adjustment is used to correct an eventual zero point deviation.

a.   Remove the tubes from both pressure connections of the EE600. By this the pressure equal on both connections.
b.   Press "zero point" button 1-2 sec. (see „3 Product Description").
c.   The successful zero point adjustment is confirmed by the green LED turning on for 2 seconds.
d.   The red LED turning on for 2 seconds indicates that the zero point adjustment did not succeed. In this case repeat b.

User Manual EE600 Differential Pressure Sensor

e. The zero point adjustment (b.) may not succeed because of a deviation higher than 5 % of the original full scale of the device. This is 50 Pa for the 0 – 1000 Pa range and 500 Pa from the 0 – 10000 Pa range. In such a case, the zero point adjustment can be forced by pressing and holding the zero point button for min. 10 sec.
f. The successful zero point adjustment is confirmed by the green LED turning on for 2 seconds.

6.3.2 Span Point Adjustment

The span point adjustment is used to correct an eventual deviation of the span value.

i Important:
Make sure to perform a zero point adjustment as above before any span point adjustment.

a. Connect the differential pressure reference device/calibrator to the EE600 and set it according to the EE600 span value to be adjusted.
b. Note: The span value has to be set according to the selected measurement range.

Example:
Analogue version: (see „4.1.1 Select the measurement range with S1 and S2", Tab. 1)
                       EE600-HV53A7, S1 = 0, S2 = 1, span value = 5000 Pa

Digital version: EE600-HV52J3, span value = 1000 Pa
                     EE600-HV53J3, span value = 10000 Pa

i Observe the operation manual of the reference device.

c. Press the span point adjustment button (see „3 Product Description").
d. The successful span point adjustment is confirmed by the green LED turning on for 2 seconds.
e. The red LED turning on for 2 seconds indicate that the span point adjustment did not succeed. In this case repeat b.
f. The span point adjustment (b.) may not succeed because of a deviation higher than 5 % of the original full scale of the device.
    This is 50 Pa for the 0 – 1000 Pa range and 500 Pa from the 0 – 10000 Pa range. In such a case, the set point adjustment can be forced by pressing and holding the span point button for 10 sec.
g. The successful span point adjustment is confirmed by the green LED turning on for 2 seconds.

6.3.3 Return to Factory Adjustment

a. Press and hold simultaneously both "zero" and "span" buttons for 5 sec.
b. The successful return to factory adjustment is confirmed by the green LED turning on for 2 seconds.
c. The red LED turning on for 2 seconds indicates that the return to factory adjustment did not succeed. In this case repeat b.

i Important:
Return to factory adjustment affects both zero and span.

7 User Interface

7.1 LED indication

Green LED

flashing (1 s interval) = EE600 operates normally, the measured data is within the selected measuring range

one flash (2 s) = confirms adjustment or return to factory settings (see 6.3)

off = no power supply or electronics failure

Red LED

flashing (1 s interval) = the measured data is out of the selected range (overload or reversed pressure connection)

one flash (2 s) = indicates the failure of the attempt to adjust zero point or span point, or to return to factory adjustment (see 6.3)

7.2 Display

7.2.1 Analogue version

The display shows the measured differential pressure and the selected unit (see „4.1.3 Select the display unit with S5 and S6").

Additionally, the bar graph indicates the actual pressure within the selected range (see „4.1.1 Select the measurement range with S1 and S2").

Fig. 15   Display units

7.2.2 Digital version

The factory setting of the display (if present) shows the measured differential pressure in Pascal [Pa]. Using the optional USB configuration adapter HA011066 and the EE-PCS Product Configuration Software, the user can change the display layout and the visualised parameter according the selected application:

Differential pressure measurement
Unit: Pa, kPa, mbar, mm H_2O, inch WC,
Layout: one line with limit bar

Volume flow measurement
Unit: m^3/h, m^3/s, ft^3/min, l/s
Layout: one line with limit bar or two lines (volume flow and differential pressure) without limit bar.

Air velocity measurement
Unit: m/s, ft/min
Layout: one line with limit bar or two lines (air velocity and differential pressure) without limit bar.

Filter monitoring
Unit: %
Layout: one line with limit bar or two lines (filter monitoring and differential pressure) without limit bar.

Level indicator
Unit: cm, inch
Layout: one line with limit bar or two lines (level indicator and differential pressure) without limit bar.

Examples of display visualisation

Fig. 16   Display with one line with limit bar and two lines without limit bar

7.2.3   Out of range

In case of differential pressure out of the measuring range or negative pressure due to inverse pressure connection the display indicates:
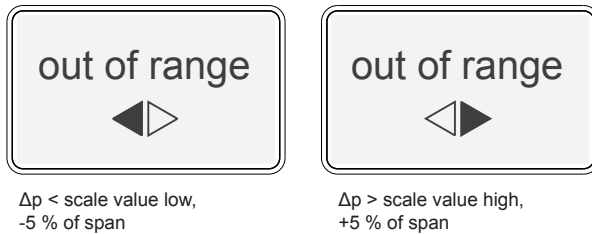

Δp < scale value low,
-5 % of span

Δp > scale value high,
+5 % of span

Fig. 17   Out of ranges indication

8 Technical Data

Measured Value

Differential Pressure (Δp)

Measurement principle	Piezoresistive, no flow-through	
Accuracy at 20 °C (68 °F)	± 0.5 % FS	FS = full scale (1000 Pa or 10000 Pa)
(incl. hysteresis, non-linearity and repeatability)		
Response time t_{90}		
Analogue outputs	50 ms / 500 ms / 2 s / 4s selectable with DIP switches[1]	
RS485	selectable in the range from 0.5 to 30 s using EE-PCS[2]	
Temperature dependency	typ. < 0.03 % from FS/K	
Long-term stability	< 0.5 % from FS/year	
Overload limits		
0...1000 Pa (4 inch WC)	± 10000 Pa (± 40 inch WC)	
0...10000 Pa (40 inch WC)	± 80000 Pa (± 320 inch WC)	

Outputs

Analogue outputs[3]	0-5 V or 0-10 V	-1 mA < I_L < 1 mA I_L = load current
selectable with	and	
DIP switches[1]	0-20 mA or 4-20 mA (3-wire) R_L ≤ 500 Ohm	R_L = load resistor
Measurement range	I: 0...250 / 500 / 750 / 1000 Pa	(0...1 / 2 / 3 / 4 inch WC)
selectable with DIP switches[1]	II: 0...2500 / 5000 / 7500 / 10000 Pa	(0...10 / 20 / 30 / 40 inch WC)
Digital interface	RS485 (EE600 = 1/2 unit load)	
Protocol	Modbus RTU or BACnet MS/TP	

General

Power supply	15-35 V DC or 24 V AC ±20 %	

Current consumption, typ. at 0 Pa / 24 V DC

	Analogue outputs	RS485
without display	23 mA	8 mA
with display and backlight	49 mA	29 mA

Display	Graphic, with backlight	
Display units	Pa, mbar, inch WC, kPa	
Analogue outputs	selectable with DIP switches[1]	
RS485	configurable using EE-PCS[2]	
Connection		
Analogue outputs	spring terminals, max. 1.5 mm² (AWG16)	
RS485	screw terminals, max. 2.5 mm² (AWG14)	

1) Factory setup analogue outputs: measurement range 0...100 % FS; response time t90: 50 ms; display unit: Pa; display backlight: on; analogue outputs: 0-10 V and 4-20 mA. Other ranges upon request.
2) Factory setup RS485: response time t90: 500 ms; display unit: Pa; display backlight: on
3) Voltage and current output signals available simultaneously at the spring loaded terminals.

HEADQUARTERS

E+E Elektronik Ges.m.b.H.
Langwiesen 7
A-4209 Engerwitzdorf
Austria
Tel: +43 7235 605 0
Fax: +43 7235 605 8
info@epluse.com
www.epluse.com

SUBSIDIARIES

E+E Elektronik Germany
info@epluse.de

Office Bad Homburg
Tel: +49 6172 13881-0

Office Hamburg
Tel: +49 160 9050 6460

Office Stuttgart
Tel: +49 151 538 37 500

E+E Elektronik Italy
info@epluse.it
Tel: +39 02 2707 86 36

E+E Elektronik France
info@epluse.fr
Tel: +33 4 74 72 35 82

E+E Elektronik USA
office@epluse.com

Office Boston
Tel: ++1 847 490 0520

Office Chicago
Tel: +1 847 490 0520

E+E Elektronik Korea
Tel: +82 31 732 6050
info@epluse.co.kr

E+E Elektronik China
info@epluse.cn

Office Beijing
Tel: +86 10 8499 2361

Office Shanghai
Tel: +86 21 6117 6129

Office Guangzhou
Tel: +86 20 3898 7052

YOUR PARTNER IN SENSOR TECHNOLOGY **E+E ELEKTRONIK**®
Ges.m.b.H.