**USER’S GUIDE**

**EE660 - Low Air Velocity Sensor**

**SCOPE OF SUPPLY**

- EE660 Low Air Velocity Sensor
- Cable gland (two pieces at output RS485 for daisy chain wiring)
- Mounting flange
- Mounting materials
- Protection cap
- Quick guide
- Two self-adhesive labels for configuration changes (see user guide at www.epluse.com/relabeling)
- Test report according to DIN EN10204 - 2.2

**CAUTION**

- Accurate measurement results are conditioned by the correct positioning of the sensing probe in the air stream. Best accuracy is achieved in laminar flow.
- Observe the minimum inlet and outlet path length, see page 5.
- Avoid mechanical stress onto the probe and mainly onto the sensing head.
- Observe the humidity working range 5...95% RH, non-condensing.
- Avoid installation in corrosive environment, as this may lead to sensor destruction.

**CONNECTING DIAGRAM**

**Analogue output**

![Analogue output diagram](image)

- Power supply
  - 24 V AC/DC ±20%
- 1 ... V+ = supply voltage
- 2 ... GND = ground
- 3 ... AV_U = voltage output air velocity
- 4 ... AV_I = current output air velocity

**RS485 Interface**

![RS485 interface diagram](image)

- Power supply
  - 24 V AC/DC ±20 %
- Address switch Remote probe
- Supply and RS485 interface

**Remote probe**

- S1: Response time t₉₀
  - ON: slow
  - OFF: fast
- S2: Termination resistor
  - 120 Ohm
  - ON/OFF
**ANALOGUE SETTINGS**

For performing EE660 settings via EE-PCS Product Configuration Software (download from www.epluse.com/configurator) the working range jumper must be on HI.

### Selection of response time $t_{90}$

<table>
<thead>
<tr>
<th>Jumper t90</th>
<th>90°</th>
<th>HI</th>
<th>MED</th>
<th>LO</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLOW</td>
<td>4 sec.</td>
<td>No jumper</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FAST</td>
<td>1 sec.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Selection of measuring range

<table>
<thead>
<tr>
<th>Jumper</th>
<th>90°</th>
<th>HI</th>
<th>MED</th>
<th>LO</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI</td>
<td>0...2 m/s (0...400 ft/min)</td>
<td>No jumper</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MED</td>
<td>0...1.5 m/s (0...300 ft/min)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LO</td>
<td>0...1 m/s (0...200 ft/min)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**DIGITAL SETTINGS**

**Hardware**

The bus termination shall be realized with the 120 Ohm resistor on board, slide switch S2.

**Very important:**

For proper function the power supply must be strong enough to ensure supply voltage within the specified range (see technical data) at any time and at all devices in the bus. This is particularly relevant when using long and thin cables which can cause high voltage drop; please note that a single EE660 requires peak current of 150 mA.

**Address Setting**

**Address setting via EE-PCS Product Configuration Software:**

All DIP switches at position 0 → address has to be set viaPCS

- **Modbus** (Slave device): factory setting EE660: 65 (permitted values: 1…247).
- **BACnet** (Master device): factory setting EE660: 65 (permitted values: 0…127).

*Example: Slave address is set via configuration software.*

**Address setting via DIP switch:**

- **Modbus** (Slave device): Setting the DIP switches to any other address than 0, overrules the slave address set via configuration software (permitted values: 1…247).
- **BACnet** (Master device): Setting the DIP switches to any other address than 0, overrules the slave address set via configuration software.

**BACnet Note:** permitted values are 0…127.

The 8th bit of the DIP switches is ignored (ID 127 = 0111 111).

To set address 0 via DIP switches, the 8th bit shall be set to 1 (ID 0 = 1000 0000).

*Example: Slave address set to 11 (= 0000 1011 binary).*
BACnet Setup
Please see PICS (Product Implementation Conformance Statement) - available on www.epluse.com/EE660

Modbus Setup

**FLOAT (read register):**

<table>
<thead>
<tr>
<th>Function code / Register number [Dec]</th>
<th>Register address [HEX]</th>
<th>Parameter name</th>
</tr>
</thead>
<tbody>
<tr>
<td>31003</td>
<td>0x03EA</td>
<td>Temperature [°C]</td>
</tr>
<tr>
<td>31005</td>
<td>0x03EC</td>
<td>Temperature [°F]</td>
</tr>
<tr>
<td>31041</td>
<td>0x0410</td>
<td>Airflow [m/s]</td>
</tr>
<tr>
<td>31043</td>
<td>0x0412</td>
<td>Airflow [ft/min]</td>
</tr>
</tbody>
</table>

**SHORT (read register):**

<table>
<thead>
<tr>
<th>Function code / Register number [Dec]</th>
<th>Register address [HEX]</th>
<th>Parameter name</th>
</tr>
</thead>
<tbody>
<tr>
<td>34002</td>
<td>0x0FA1</td>
<td>Temperature* [°C]</td>
</tr>
<tr>
<td>34003</td>
<td>0x0FA2</td>
<td>Temperature** [°F]</td>
</tr>
<tr>
<td>34021</td>
<td>0x0FB4</td>
<td>Airflow* [m/s]</td>
</tr>
<tr>
<td>34022</td>
<td>0x0FB5</td>
<td>Airflow*** [ft/min]</td>
</tr>
</tbody>
</table>

* Values are stored with the scale 1:100 (e.g.: 2550 is equivalent to 25.5 °C)
** Values are stored with the scale 1:50 (e.g.: 2550 is equivalent to 51 °F)
*** Values are stored with the scale 1:1

**INFO (read register):**

<table>
<thead>
<tr>
<th>Function code / Register number [Dec]</th>
<th>Register address [HEX]</th>
<th>Parameter name</th>
</tr>
</thead>
<tbody>
<tr>
<td>30001</td>
<td>0x00</td>
<td>Serial number (as ASCII)</td>
</tr>
<tr>
<td>30009</td>
<td>0x08</td>
<td>Firmware version</td>
</tr>
</tbody>
</table>

**INTEGER (write register):**

<table>
<thead>
<tr>
<th>Function code / Register number [Dec]</th>
<th>Register address [HEX]</th>
<th>Parameter name</th>
</tr>
</thead>
<tbody>
<tr>
<td>60001</td>
<td>0x00</td>
<td>Slave-ID* (modbus address)</td>
</tr>
<tr>
<td>60002</td>
<td>0x01</td>
<td>Modbus protocol settings*</td>
</tr>
</tbody>
</table>

* If the ID is set via DIP-Switch the response will be NAK.

**MODBUS RTU EXAMPLE**

Example of MODBUS RTU command for reading the temperature (float value) T = 26.652524 °C from the register 0x03EA

Device EE660; slave ID 65

Request [Hex]: 41 03 03 EA 00 02 EB 7B

```
<table>
<thead>
<tr>
<th>Modbus ID address</th>
<th>Function code</th>
<th>Starting address Hi</th>
<th>Starting address Lo</th>
<th>No. of register Hi</th>
<th>No. of register Lo</th>
<th>CRC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Request [Hex]:</td>
<td>41 03 03 EA 00 02 EB 7B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

Response [Hex]: 41 03 04 38 5F 41 D5 0A E3

```
<table>
<thead>
<tr>
<th>Modbus ID address</th>
<th>Function code</th>
<th>Byte count</th>
<th>Register 1 value Hi</th>
<th>Register 1 value Lo</th>
<th>Register 2 value Hi</th>
<th>Register 2 value Lo</th>
<th>CRC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response [Hex]:</td>
<td>41 03 03 04 38 5F 41 D5 0A E3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

For decoding of float values (according IEEE754 format), please refer to AN0103, chapter 7 (page 6).

**7.2 Modbus floating point format**

E+E devices use the Modbus floating point format. The byte pairs 1, 2 and 3, 4 are inverted as follows:

```
| MMMMMMMM | MMMMMMMM | SEEEEEEE | EMMMMMMM |
| Byte 3    | Byte 4   | Byte 1   | Byte 2   |
```

Example:

<table>
<thead>
<tr>
<th>Response [Hex]</th>
<th>Value in decimal</th>
</tr>
</thead>
<tbody>
<tr>
<td>41 D5 38 5F</td>
<td>26.652524</td>
</tr>
</tbody>
</table>

**Protocol setting:**
Address, baudrate, parity and stop bits can be set via:
1. Product Configurator Software (available on www.epluse.com/EE660)
2. Modbus protocol (please see Application Note Modbus (available on www.epluse.com/EE660)
CONFIGURATION AND ADJUSTMENT

The EE660 as ordered is ready for use immediately and requires no configuration by the user. If required, the optional USB configuration adapter and the E+E Product Configuration Software (EE-PCS) can be used for changing the factory setup as well as for adjusting of the air velocity measurement.

Note: The EE660 must not have any additional power supply when using the USB configuration adapter HA011066.

For product data sheets EE-PCS please see www.epluse.com.
The E+E Product Configuration Software (EE-PCS) is free and can be downloaded from www.epluse.com/configurator.

TECHNICAL DATA
(Modification rights reserved)

Measurand

<table>
<thead>
<tr>
<th>Working range 1)</th>
<th>0...1 m/s (0...200 ft/min)</th>
<th>0...1.5 m/s (0...300 ft/min)</th>
<th>0...2 m/s (0...400 ft/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy at 20 °C 2) (68 °F), 45 % RH, 1013 hPa</td>
<td>± (0.04 m/s (7.9 ft/min) + 2 % of mv)</td>
<td>± (0.05 m/s (9.8 ft/min) + 2 % of mv)</td>
<td>± (0.06 m/s (11.8 ft/min) + 2 % of mv)</td>
</tr>
<tr>
<td>Response time τ 90</td>
<td>typ. 4 sec or typ. 1 sec (at constant temperature)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Output

<table>
<thead>
<tr>
<th>Analogue</th>
<th>0 - 10 V and 4 - 20 mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>0...1 m/s / 0...1.5 m/s / 0...2 m/s 1)</td>
<td>-1 mA &lt; I L &lt; 1 mA</td>
</tr>
<tr>
<td>R &lt; 450 Ω (linear, 3-wires)</td>
<td></td>
</tr>
</tbody>
</table>

Digital interface

RS485 with max. 32 devices on one bus

Protocol

Modbus RTU or BACnet MS/TP

General

<table>
<thead>
<tr>
<th>Power supply (Class III)</th>
<th>24 V AC/DC ± 20 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current consumption (max.)</td>
<td>AC supply - no display</td>
</tr>
<tr>
<td>Analogue output</td>
<td>74 mA rms</td>
</tr>
<tr>
<td>Digital output</td>
<td>120 mA rms</td>
</tr>
</tbody>
</table>

Angular dependence

< 3% of the measured value at | Δα | < 10°

Electrical connection

screw terminals max. 1.5 mm² (AWG 16)

Cable gland

M16x1.5

Electromagnetic compatibility

EN61326-1 EN61326-2-3 Industrial Environment

Housing material

Polycarbonate, UL94V-0 (with Display UL94HB) approved

Protection class

Enclosure IP65 / NEMA4, remote probe IP20

Temperature range

working temperature probe -25 ... +50 °C (-13...122 °F) working temperature electronic -10 ... +50 °C (14...122 °F) storage temperature -30 ... +60 °C (-22...140 °F)

Working range humidity

5...95 % RH (non-condensing)

1) Selectable by jumper, only for analogue output
2) The accuracy statement includes the uncertainty of the factory calibration with an enhancement factor k=2 (2-times standard deviation). The accuracy was calculated in accordance with EA-4/02 and with regard to GUM (Guide to the Expression of Uncertainty in Measurement).
3) Selectable by jumper (analogue) and slide switch (digital)

ACCESSORIES

- USB configuration adapter HA011066
- Product configuration software EE-PCS (free download: www.epluse.com/EE660)
- Power supply adapter V03 (see data sheet Accessories)
**MOUNTING**

**DRILLING IN THE WALL OF THE DUCT FOR INSTALLING THE MOUNTING FLANGE**

The arrow engraved on the sensing head of EE660 indicates the direction of the air stream during factory adjustment. When installing the EE660 probe, make sure that the arrow matches exactly the flow direction.

The mounting flange allows for precise setting of the EE660 immersion depth in a duct. The entire sensing head must be in the air flow to be measured.
POSITIONING OF AIR VELOCITY SENSOR IN A VENTILATION DUCT

The reliable and accurate measurement of air velocity depends on the correct positioning of the sensor in the ventilation duct. Accurate measurements are only possible if the air velocity probe is positioned at a location with a laminar (not-turbulent) flow.

The required length of the calming section after a fault is a function of the tube diameter $D$. For a rectangular channel $a \times b$ applies:

$$D_{gl} = \frac{2 \cdot a \cdot b}{a + b}$$

INCORRECT

CORRECT

Mounting the sensing probe in the middle of the channel.

The optimal position is after the filter. Please note sufficient distance.

Positioning the probe ahead of diffusor, at a place with high flow rate.

Positioning the probe at a location with a laminar (not-turbulent) flow.

Turbulent flows are caused by pipe bends, branches, behind flaps, flans, air heaters, air coolers or cross-sectional changes.

MAINTENANCE OF THE E+E AIR VELOCITY TRANSMITTERS

Due to the absence of moving parts, the E+E air velocity transmitters are not subject to wear. The construction (shape, dimensions and materials) of the hot film air velocity sensor is per se highly insensitive to dust and dirt. No maintenance is required under normal environmental conditions. For operation in polluted environment it is advisable to periodically clean the sensing head by washing it in isopropyl alcohol, preferably in an ultrasound cleaner. Alternatively shake it gently few minutes in a pot with isopropyl alcohol and let it dry free. Do not touch or rub the sensor and do not use any mechanical tools for cleaning.
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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)