

# PO2ES I2C-to-RS485 Converter

## Datasheet



### 1 Features

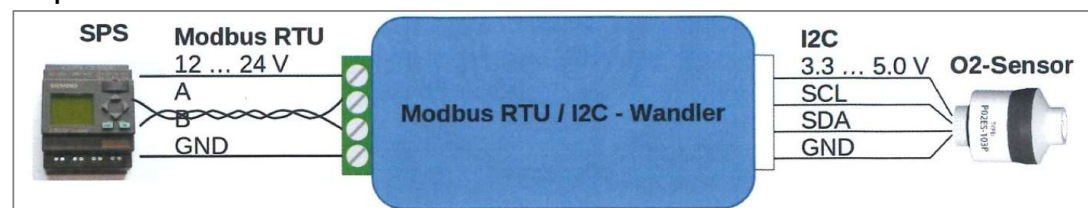
The PO2ES I2C-to-RS485 Converter provides RS485 Modbus protocol for I2C PO2S Oxygen concentration sensors.

- Modbus communication protocol
- 100ms sampling rate
- Device status information – 2 LEDs
- Enclosure IP-rating IP65
- RS485 Connector: industry standard M12
- Max RS485 cable length: 1200 m
- Sensor cable length: 50cm

### Device Information

|                    |  |
|--------------------|--|
| Product Name       | PO2ES I2C-to-RS485 Converter                     |
| Product MPN        | 1620141690                                       |
| Compatible Sensors | O2 25%Vol: PO2ES-103PD<br>O2 100%Vol: PO2ES-103D |

### Simplified Schematic



|               |          |
|---------------|----------|
| <b>Status</b> | Released |
|---------------|----------|

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|                 |            |
|-----------------|------------|
| <b>Revision</b> | 1.2        |
| <b>Date</b>     | 15.10.2021 |

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## Revision History

| Rev. No. | Change              | Date       | Author    |
|----------|---------------------|------------|-----------|
| 1.1      | Preliminary version | 21.12.2020 | W.Osmelak |
| 1.2      | Update              | 15.10.2021 | OSWO      |
|          |                     |            |           |

## References

| Ref. No. | Document               | Date | Author |
|----------|------------------------|------|--------|
| 1        | O2 25%Vol: PO2ES-103PD |      | APSP   |
| 2        | O2 100%Vol: PO2ES-103D |      | APSP   |

## 2 Description

The Modbus-I2C-Converter communicates the PO2S Sensor every 500ms, reads out the ADC count and saves it in the internal memory.



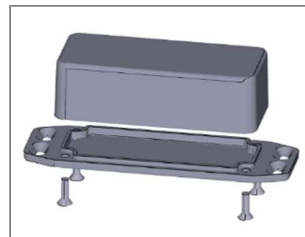
**Figure 1** Modbus adapter box prototype.

On the right-hand side with RS485 Modbus M12 TE Socket; on the left-hand side with attached strain relief and sensor cable.



## 3 Specifications

### 3.1 Enclosure

- Type: Hammond, 1590AFL
- Size: 92/ 39/ 27 mm (H/ W/ D)
- IP rating: IP65
- Opening for Status-LED's
- Openings for connectors
- CAD Data available on manufacturer Website: [1590 Part Details](#)



### 3.2 Connections and Connectors

| Connection  | Details  |
|---|--|
| Sensor Cable<br>           | I2C & supply for the sensor<br>Fixed to the enclosure with strain relief<br>Length: 500 mm<br><br>Molex KK 254, 4-pin, female<br>Pinning: 1(yel) – VCC, 2(grn) – SCL, 3(red) - SDA, 4(wht) - GND |
| RS485 Modbus connector<br> | Connector type: M12, male, 4-pol, shielded<br><a href="#">TE Connectivity T4132012041-000</a><br>Pinning: 1-Vin, 2-A, 3- GND, 4-B<br>Fitting receptacle: TE Connectivity, T4110001041-000        |

### 3.3 RS485 Interface

Standard settings for communication protocol:

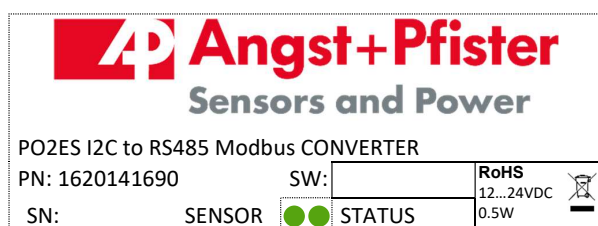
|                              |              |
|------------------------------|--------------|
| Modbus-Address               | 0xAB (171)   |
| Baud rate                    | 9600         |
| Parity                       | Odd          |
| Stop bits                    | 1            |
| Data bits                    | 8, LSB first |
| Max message size incl. CRC16 | 32 Bytes     |

## 4 Electrical characteristics

| Parameter             | Condition              | Value     | Unit |
|-----------------------|------------------------|-----------|------|
| Supply voltage        | T <sub>A</sub> = 25°C  | 12 ... 24 | VDC  |
| Power dissipation     | T <sub>A</sub> = 25°C  | 500       | mW   |
| Operating temperature | No condensation        |           | °C   |
| Storage temperature   | No condensation        | -         | °C   |
| I2C Pull-up resistors |                        | 4.7       | kOhm |
| ESD Ratings           | Human body model (HBM) | ±1000     | V    |

## 5 UI/ LED Information

On the top of the converter enclosure there are located 2 LEDs, which inform about status of the converter



| LED    | Color | Description  |
|--------|-------|--|
| Status | Off   | No communication   |
| Status | Green | Last transfer was successful                             |
| Status | Red   | Last transfer unsuccessful                               |
| Sensor | OFF   | The converter is switched off                            |
| Sensor | Green | The O2 sensor was successfully read-out by the converter |
| Sensor | Red   | The sensor-converter read-out failed                     |

## 6 Application and Implementation

The sensor communicates via RS485 interface

Communication via Modbus RTU protocol.

Max sampling frequency: 10Hz (sampling time 100ms)

## 6.1 Measurement value query

The query format:

|       | Addr | Func | Data | CRC16 | CRC16 |
|-------|------|------|------|-------|-------|
| Query | 0xAB | 0x0A | CMD  | CRC L | CRC H |

CMD – reserved for future development; the value will be ignored. The best CMD = 0

## 6.2 Response to the query

The sensor responds automatically after receiving the command with the most recent measured value.

The delay is < 20ms.

The response format:

|          | Addr | Func | Data | Data | Data  | Data  | CRC16 | CRC16 |
|----------|------|------|------|------|-------|-------|-------|-------|
| Response | 0xAB | 0x0A | STAT | TYPE | RAW L | RAW H | CRC L | CRC H |

STAT - Status of the ADC value

1: valid value

0: invalid value, error at O2 sensor

TYPE – O2-Sensor type

0: PO2ES-103D

1: PO2ES-103PD

RAW – last ADC value, LSB first

**Note:** The first read out raw-value is not valid, check the STAT

**Example:**

Query in HEX to calculate CRC:

AB 0A 00 06 80

## 6.3 Echo-function

In order to test the proper communication in between sensor and system there is implemented the echo function.

After the query, the sensor responds with incremented both data bytes values DATA0 and DATA1.

The delay is < 20 ms.

|         | Addr | Func | Data    | Data    | CRC16 | CRC16 |
|---------|------|------|---------|---------|-------|-------|
| Query   | 0xAB | 0x0E | DATA0   | DATA1   | CRC L | CRC H |
| Respond | 0xAB | 0x0E | DATA0+1 | DATA1+1 | CRC L | CRC H |

**Example:**

Echo command for CRC calculation:

AB 0E AB CD FF 66

## 6.4 CRC Calculation

According to the Modbus specification

**Examples:**

| Input, bytes in HEX | Calculated CRC16            |
|---------------------|-----------------------------|
| AB 0E AB CD         | 0x66ff (Transferred: FF 66) |
| AB 0A 00            | 0x8006 (Transferred: 06 80) |

## We are here for you. Addresses and Contacts.

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