ZBXYO Series

Evaluation interface board for XYO optical oxygen sensors

FEATURES

- **Provides three outputs simultaneously:**
  - **RS232 (serial interface voltage levels)**
  - **RS485 (Modbus RTU) allows multiple sensors to be addressed on a bus**
  - **0...5 V analog output for basic measurements of oxygen only**
- **Auto detects ppO$_2$ or O$_2$% variants of XYO sensor**
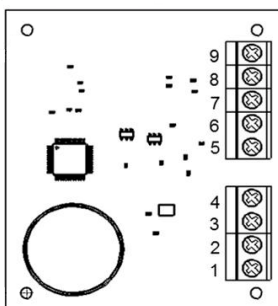- **RoHS compliant**

SPECIFICATIONS

Maximum ratings

Supply voltage	4.75...5.25 V$_{DC}$
Supply current	<50 mA
Temperature limits	
Storage	0...60 °C
Operating	0...50 °C

ELECTRICAL CONNECTION

Pin	Connection
1	Vs (+5 V$_{DC}$)
2	GND (0 V)
3	0...5 V GND (0 V)
4	0...5 V Signal
5	RS232 Rx
6	RS232 Tx
7	RS232/RS485 GND (0 V)
8	RS485 A (+)
9	RS485 B (-)

Notes:

Care should be taken not to connect the 5 V supply voltage and 0 V connections the wrong way round as this may damage the interface. With power supplied correctly the green LED on the interface will illuminate.

RS232 Rx and Tx and RS485 A and B (pins 5, 6, 8 and 9) are referenced to the RS232/RS485 GND (pin 7). A connection should be made between pin 7 and the reference or common connection of the RS232 serial port or RS485 bus.

Care should be taken when connecting the RS485 A and B connections to your system. The EIA-485 signalling specification states that signal A is the inverting or '-' pin and signal B is the non-inverting or '+' pin. This is in conflict with the A and B naming used by a number of differential transceiver manufacturers, including the transceiver used in the ZBXYO interface. Therefore always ensure the '+' of the ZBXYO interface is connected to the '+' input of the RS485 Bus and the '-' of the ZBXYO interface is connected to the '-' input of the RS485 Bus.

PERFORMANCE CHARACTERISTICS

(At ambient conditions, T_A=20 °C, P_A=1013 mbar. Following extreme temperature fluctuations, re-calibration may be required.)

Characteristics		Min.	Typ.	Max.	Unit
Oxygen measuring range	ppO_2 partial pressure	0		300	mbar
	O_2 concentration (XYO...P)	0		25	$\%O_2$
DIGITAL OUTPUT					
Resolution	ppO_2 partial pressure			0.1	mbar
	O_2 concentration (XYO...P)			0.01	%
ANALOG OUTPUT					
Resolution				0.01	V

RS232 OUTPUT

RS232 setup

The following setup should be used when using the RS232 interface.

Baudrate	9600
Flow Control	None
Parity	None
Stop bits	One
Data Length	8 bits

RS232 command set

All RS232 communication is performed using ascii characters, the table shows the legal characters for each description block. There are three modes available: Poll Mode, Stream Mode and Off Mode.

Description block	Legal character(s)	Hex
<Command>	"M", "O", "%", "T", "P", "A", "#", "e"	0x4D, 0x4F, 0x25, 0x54, 0x50, 0x41, 0x23, 0x65
<Argument>	"0" – "9"	0x30 – 0x39
<Separator>	" "	0x20
<Terminator>	"\r\n"	0x0D, 0x0A

Poll Mode (M 1)

Each request is built using a combination of the description blocks. A typical arrangement will be one of the following formats:

<Command><Terminator>
<Command><Separator><Argument><Terminator>

Each response will be in the following format:

<Command><Separator><Argument><Terminator>

Command description

Description of all commands and the valid arguments that can be applied to the interface when in Poll Mode (M1). All commands are case sensitive.

Command	Description	Arguments	Response
"M"	Output Mode	0=Stream 1=Poll	"M xx\r\n" where xx equals the Argument of the command
"O"	Request current ppO_2 value	N/a	"O xxxx.x\r\n" where xxxx.x equals the ppO_2 in mbar
"%"	Request current O_2 value (only valid with XYO...P. Otherwise returns "- - - - - -")	N/a	"% xxx.xx\r\n" where xxx.xx equals the O_2 in %
"T"	Request current temperature inside sensor	N/a	"T yxx.x\r\n" where y equals the sign '-' or '+' and xx.x equals the temperature in °C
"P"	Request current barometric pressure (only valid with XYO...P. Otherwise returns "- - - - - -")	N/a	"P xxxx\r\n" Where xxxx equals the pressure in mbar
"e"	Sensor status	N/a	"e 0000\r\n" = Sensor Status Good "e xxxx\r\n" = Any other response contact First Sensor for advice.
"A"	Request all values (see above: O, T, P, % and e)	N/a	See section Stream Mode (M 0)
"#"	Sensor information	0=Date of manufacture 1=Serial number 2=Software revision	"# 0YYYY00DDD\r\n" (DDD=day of the year) "# xxxxx xxxxx\r\n" "# xxxxx\r\n"

Example 1	Legal characters	Hex
Request: current ppO_2 value	"O\r\n"	"0x4F 0x0D 0x0A"
Response: 210.3 mbar	"O 0210.3\r\n"	"0x4F 0x20 0x30 0x32 0x31 0x30 0x2E 0x33 0x0D 0x0A"

Example 2	Legal characters	Hex
Request: streaming mode	"M 0\r\n"	"0x4D 0x20 0x30 0x0D 0x0A"
Response: streaming mode	"M 00\r\n"	"0x4D 0x20 0x30 0x30 0x0D 0x0A"

Error codes

When a request has been unsuccessfully received, an error code may appear in a response format.

Response	Description	Possible cause	Action
"E 00\r\n"	RS232 Receiver Overflow	No <Terminator> received before overflow	Check RS232 setup, confirm correct termination.
"E 01\r\n"	Invalid Command	Unrecognised <Command> received	Check command is valid. Check command is upper Case "M" instead of "m".
"E 02\r\n"	Invalid Frame	Incorrect character in frame <Separator>	Check correct separator is used.
"E 03\r\n"	Invalid Argument	<Argument> not allowed or in limits	Check Argument is no longer than 6 characters. Check Argument is within limits. Check Argument is available for command.

Stream Mode (M 0)

By default stream mode is initiated on sensor power-up and will supply an output string approximately once every second. This provides the data for ppO_2, Temperature, Pressure, $\%O_2$ and Sensor Status. The format and equivalent block description is as follows:

"O xxxx.x T yxx.x P xxxx % xxx.xx e xxxx\r\n"
<Command><Separator><Argument><Separator> ... <Command><Separator><Argument><Terminator>

RS485 MODBUS OUTPUT

RS485 Modbus setup

The modbus interface is configured using the following setup:

Modbus mode	RTU
Address	One
Baudrate	9600
Parity	None
Stop bits	One

Modbus registers

Name	Register address	Register type	Description
ppO_2	0x7531	Input register	= x/10 ppO_2 (where: 0 = 0 ppO_2, 2105 = 210.5 ppO_2)
Temperature	0x7532	Input register	= x (signed) / 10 C (where: 65231 = -30.5 C , 201 = 20.1 C)
O_2	0x7533	Input register	= x/ 100 (where: 0 = 0 %, 2070 = 20.70 %)
Pressure	0x7534	Input register	= x mBar (where: 1017 = 1017 mbar)
Sensor status	0x7535	Input register	0 = Sensor status good Anything else contact First Sensor for guidance
Sensor day	0x7536	Input register	Day number of manufacture
Sensor year	0x7537	Input register	Year of manufacture
Sensor ID 0	0x7538	Input register	Serial number 0
Sensor ID 1	0x7539	Input register	Serial number 1
Address	0x9C41	Holding register	Range = 1 to 247 (0x01 to 0xF7) Default = 1
Baudrate	0x9C42	Holding register	0 (0x00) = 2400 1 (0x01) = 4800 2 (0x02) = 9600 (Default) 3 (0x03) = 19200 4 (0x04) = 38400 5 (0x05) = 57600 6 (0x06) = 115200
Parity	0x9C43	Holding register	0 (0x00) = None (Default) 1 (0x01) = Odd 2 (0x02) = Even
Stop bits	0x9C44	Holding register	0 (0x00) = 1 (Default) 1 (0x01) = 2
Communication settings	0x9C45	Holding register	0 (0x00) = No action 1 (0x01) = Reset and apply changes to Modbus communication settings (see note 1)
0...5 V output representation	0x9C46	Holding register	0 (0x00) = Auto Detect (Default) 1 (0x01) = ppO2 2 (0x02) = O2 % (see note 2)

Specification notes:

1. If any changes are made to the holding registers 0x9C41 to 0x9C44 the changes will not be applied until 0x9C45 is set to "1". At this point, if the changes made are valid, the new settings will be committed to memory and communication will be lost until the RS485 master is reconfigured to the same settings.

2. The 0...5 V analog output is default to represent the variant of the sensor connected to the interface, so if the sensor attached is a ppO_2 variant (XYOM300N) the 0...5 V output will represent 0...300 mbar or if the sensor attached is an O_2% variant (XYOM300P) the 0...5 V output will represent 0...25 % O_2. However when the attached sensor is an O_2% variant the auto detect setting can be overridden so the 0...5 V output can represent either ppO_2 or O_2%. This feature is not compatible with the ppO_2 variant so if this register is changed to "2" in this instance the 0...5 V output will remain at 0 V.

ANALOG OUTPUT

ppO$_2$ variant (with XYOM300N sensor)

The current ppO$_2$ level can be calculated as follows:

$$ppO_2 = \frac{300}{V_{max}} \cdot V = \frac{300}{5} \cdot V = 60 \cdot V$$

Where:
ppO$_2$ = Current ppO$_2$ in mbar
V$_{max}$ = 5 V
V = Analog voltage on the signal output

ppO$_2$ examples

Signal output (V)	ppO$_2$ (mbar)
0	0
3.5	210
5	300

O$_2$% variant (with XYOM300P sensor)

The current O$_2$% level can be calculated as follows:

$$O_2\% = \frac{25}{V_{max}} \cdot V = \frac{25}{5} \cdot V = 5 \cdot V$$

Where:
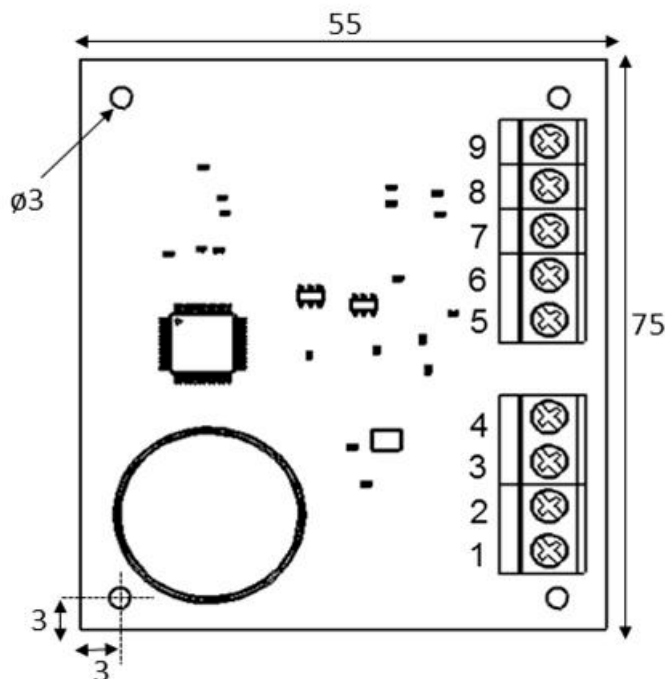O$_2$% = Current O$_2$ concentration (%)
V$_{max}$ = 5 V
V = Analog voltage on the signal output

ppO$_2$ examples

Signal output (V)	O$_2$ (%)
0	0
3.5	17.5
5	25

OUTLINE DRAWING

dimensions in mm

ORDERING INFORMATION

Series	
ZBXYO	Evaluation interface board for XYO optical oxygen sensors*
* Please order the XYO sensor separately	

www.first-sensor.com
www.sensortechnics.com