TeX4

TEMPERATURE EXTENSION MODULE
WITH 4 CHANNELS

USER MANUAL
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1 Overview

The temperature extension module $TeX4$ is intended for usage in combination with the fiber-optic oxygen meter $FireStingO2$. The $FireStingO2$ provides up to 4 oxygen channels together with a single temperature port. Therefore, an automatic temperature compensation of the oxygen channels is only possible with one common temperature sensor. The $TeX4$ has been developed to enable individual temperature compensation for each oxygen channel by offering additional temperature ports. The temperature ports can be used in combination with the standard temperature sensors available from PyroScience.

The $TeX4$ has been designed for a tight mechanical coupling with the oxygen meter $FireStingO2$, as it fits smoothly to the bottom of the $FireStingO2$, where it can be fixed by integrated screws. Both the $TeX4$ and the $FireStingO2$ are connected via USB cables to a windows PC. The coupled modules are operated by the Pyro Oxygen Logger software.
2 Safety Guidelines

The $\text{TeX}_4$ is a laboratory instrument intended for combined usage with the fiber-optic oxygen meter $\text{FireStingO}_2$. In order to guarantee an optimal performance of the $\text{TeX}_4$ please follow these operation instructions and safety guidelines. Before starting the measurements please ensure for

- a proper installation of the *Pyro Oxygen Logger* software before connecting the $\text{TeX}_4$ for the first time to the USB-port of your PC,
- appropriate operation temperature (0-50ºC) and humidity (non-condensing conditions).

If any problems or damage evolve, please disconnect the instrument immediately, mark it to prevent any further use and consult *PyroScience* for repair or maintenance service. The $\text{TeX}_4$ should not be manipulated or opened by unauthorized persons, only by *PyroScience* or persons advised directly from *PyroScience*.

Please note that opening the housing will void the warranty. There are no serviceable parts inside the device.

The $\text{TeX}_4$ and the sensors should be kept and stored outside the reach of children in a secure place under dry and clean conditions at room temperature, avoiding moisture, dust, corrosive conditions and heating of the instrument. This device is not intended for medical, military or other safety relevant areas. It should be used in the laboratory by qualified personal only following the operation instructions and safety guidelines of this manual.

Please follow the appropriate laws and guidelines for safety like EEC directives for protective labor legislation, national protective labor legislation, safety regulations for accident prevention and
safety data-sheets from manufacturer of chemicals used during measurements.

When used in the field, the environmental conditions (like high humidity, dust, exposure to direct solar radiation) may cause damage or interference of the TeX4, which is on the user's authority.

Before using the TeX4 and its sensors, read carefully the instructions and user manuals.

In case of problems or damage, disconnect the instrument and mark it to prevent any further use! Consult PyroScience for advice! There are no serviceable parts inside the device. Please note that opening the housing will void the warranty!

The TeX4 is not watertight, is sensitive to corrosive conditions and to changes in temperature causing condensation. Avoid any condition (e.g. direct sun light) causing a heating of the device above 50°C (122°F).

Calibration and application of the sensors is on the user’s authority, as well as data acquisition, treatment and publication!

The sensors and the temperature extension box TeX4 are not intended for medical or military purposes or any safety-critical applications. The sensors must not be used for applications in humans and must not be brought in direct contact with foods intended for consumption by humans.

The sensors should be used in the laboratory by qualified personnel only, following the user instructions and the safety guidelines of the manual, as well as the appropriate laws and guidelines for safety in the laboratory!
Keep the sensors and the temperature extension box $\text{TeX}_4$ out of reach of children!

3 Mounting

Place *the FireStingO2* on top of the $\text{TeX}_4$ as indicated on the following image:

Carefully turn the complete assembly upside down. Introduce the included hexagon socket wrench (Allen key, Inbus) into the four holes 1-4 and tighten the internal "coupling screws" by turning the wrench clockwise (about 10 rotations) as shown here:
4 Software Installation

The temperature extension module $TeX_4$ is operated by the logger software $Pyro\ Oxygen\ Logger$ used for operating the oxygen meter $FireStingO2$. If you have installed this software already, you can skip this chapter. But ensure that you have installed a software version of 3.0 or higher. Older software versions of the $Pyro\ Oxygen\ Logger$ software do not support the $TeX_4$.

**System requirements:** PC with Windows 7/8/10 (but not "Windows 7 Starter Edition") and min. 700 MB free disk space.

**IMPORTANT:** Do not connect the $TeX_4$ to your PC before the $Pyro\ Oxygen\ Logger$ software has been installed. The software will install automatically the appropriate USB-drivers.

**Installation steps:**

- Download the installer package for the newest version of the $Pyro\ Oxygen\ Logger$ software from the $PyroScience$ homepage: [www.pyro-science.com/downloads.html](http://www.pyro-science.com/downloads.html)
• Unzip and start the installer and follow the instructions.

After the successful installation a new program group "Pyro Oxygen Logger" is added to the start menu, and a short-cut named "Oxygen Logger" can be found on the desktop.
5 Operation

5.1 Connectors

The front of the *TeX4* provides four connectors T1-T4 for temperature sensors from *PyroScience*. The red status LED shows a short flashing when connecting the USB port to the PC, and it lights up constantly during normal operation.

![Connectors](image1)

The back of the *TeX4* provides the USB port (micro USB), an analog output (see chapter 6) and an extension port (see chapter 7).

![Back View](image2)
5.2 Coupling the TeX4 with the FireStingO2

When using a specific TeX4 for the first time, it must be "coupled" by the Oxygen Logger software to a specific FirestingO2 device. This is done by the following steps:

- Connect the TeX4 with the USB cable to your PC. A short flashing of the status LED indicates a proper connection.
- Connect the FireStingO2 with the USB cable to your PC. A short flashing of the logo indicates a proper connection.

**IMPORTANT**: No other TeX4 or FireStingO2 must be connected to the PC. Otherwise the coupling procedure will not work!

- Start the Oxygen Logger software. The software should show immediately the following dialog window:

![Dialog Window](image)

- Click "Yes". Now the TeX4 is programmatically coupled to the specific FireStingO2 indicated by the message "Coupled to TeX4" visible below the "Pyro Oxygen Logger" logo in the main window

![Pyro Oxygen Logger](image)

The coupling information is stored within the flash memory of the TeX4. Therefore, at the next startup of the Oxygen Logger software, the coupling is automatically detected by the software.
5.3 Using the Oxygen Logger software

The operation of a FireSting-TeX4 couple with the Oxygen Logger software is widely unchanged compared to the operation of a sole FireSting device. Please refer to the manual of the FireSting for general operation instructions.

The temperature channels of the TeX4 are automatically activated, if "Temperature Sensor" is chosen in the settings of a specific oxygen channel (Settings → Environmental Conditions in the Sample → Temperature Sensor). For example, if the user selects "Temperature Sensor" for the oxygen channel 3, then the temperature reading for this channel is not taken from the single temperature port T at the FireSting device. Instead it is taken from the temperature sensor connected to the temperature port T3 of the TeX4.
The temperature port T at the *FireSting* device is actually not used anymore for any temperature compensation. However, the data of a connected temperature sensor can be still logged by the software, and hence can be used for an additional independent temperature measurement.

The settings of the *TeX4* can be adjusted within the *FireSting Settings* in the *Temperature* tab by clicking the *Settings* button:

For more details please refer to the manual of the *FireStingO2*. 
5.4 Several FireSting-TeX4-couples at a single PC

Several FireSting-TeX4 couples can be operated at a single PC. The coupling between a FireSting device and a TeX4 device is specifically related to the serial numbers of the devices. The coupling procedure is performed for each individual pair of FireSting and TeX4 devices as described in the previous sections. During the coupling it is important, that only a single FireSting and a single TeX4 is connected to the PC.

After all FireSting and TeX4 devices have been coupled properly by this procedure, all couples can be connected to a single PC. The Oxygen Logger software should then be started repeatedly for each couple, which opens a separate logging window for each couple. The Flash Logo button in the main window can be used to identify the FireSting-TeX4 couple connected to a specific logger window. Clicking this button will cause a short flashing of the FireSting logo followed by a short flashing of the status LED of the TeX4.

The coupling information is stored within the flash memory of the TeX4. Therefore, once the coupling has been performed, it will be valid even if the coupled devices are connected to a different PC.

5.5 Uncoupling a FireSting from a TeX4

If a formerly coupled FireSting device should be operated without the coupled TeX4 device, you just have to start the FireSting Logger software without having the TeX4 device connected to the PC.
6 Analog Output

The TeX4 provides at the backside of the housing analog outputs at the connector with 5 pins:

![Connector Diagram]

This connector provides 4 independent analog outputs with a range of 0-2.5V DC at a resolution of 14 bits. The 4 analog outputs can be configured very flexible within the TeX4 settings window.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Name</th>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GND</td>
<td></td>
<td>Ground</td>
</tr>
<tr>
<td>2</td>
<td>AO_A</td>
<td>Analog Output (0 – 2.5 V DC) (14 bit resolution)</td>
<td>Analog Output Port A</td>
</tr>
<tr>
<td>3</td>
<td>AO_B</td>
<td>Analog Output (0 – 2.5 V DC) (14 bit resolution)</td>
<td>Analog Output Port B</td>
</tr>
<tr>
<td>4</td>
<td>AO_C</td>
<td>Analog Output (0 – 2.5 V DC) (14 bit resolution)</td>
<td>Analog Output Port C</td>
</tr>
<tr>
<td>5</td>
<td>AO_D</td>
<td>Analog Output (0 – 2.5 V DC) (14 bit resolution)</td>
<td>Analog Output Port D</td>
</tr>
</tbody>
</table>
7 Extension Port

For OEM-applications the TeX4 provides at the backside of the housing an extension port (connector with 7 pins):

![Extension Port Image]

Pins 1-2 are for the power supply of the module. The transmit and receive pins of the UART-interface are given at pins 4+5. The additional pins 6+7 are only needed if the module should be operated in auto-mode (see following chapter). In standard operation mode both pins 6+7 should be left unconnected.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Name</th>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GND</td>
<td>Power</td>
<td>Ground</td>
</tr>
<tr>
<td>2</td>
<td>VCC</td>
<td>Power</td>
<td>Power supply min. 3.5V max. 5.0V DC max. 50 mA (typical 30 mA)</td>
</tr>
<tr>
<td>3</td>
<td>/USB_DISABLE</td>
<td>Disbale USB-port</td>
<td>Connect to GND for disabling the USB-port</td>
</tr>
<tr>
<td>4</td>
<td>TXD</td>
<td>Digital Output (0V or 3.3V)</td>
<td>Data transmission pin of the UART interface</td>
</tr>
<tr>
<td>5</td>
<td>RXD</td>
<td>Digital Input (0V or 3.3V) (5V tolerant)</td>
<td>Data receive pin of the UART interface</td>
</tr>
<tr>
<td>6</td>
<td>/AUTO</td>
<td>Digital Input</td>
<td>Not supported yet</td>
</tr>
<tr>
<td>7</td>
<td>/TRIG</td>
<td>Digital Input</td>
<td>Not supported yet</td>
</tr>
</tbody>
</table>
The UART interface operates at 3.3V levels (5V tolerant) consisting merely of a receive and a transmit line (pins 4+5). The configuration of the UART-interface is as follows:

**19200 baud, 8 data bit, 1 stop bit, no parity, no handshake**

The baud rate can be changed by a special command of the communication protocol (refer to the communication protocol for further information). However, after power cycling the module always reverts to the standard baud rate of 19200.

In the following different operation modes of the extension port are described.

### 7.1 Full-Control Mode

The standard operation mode of the module is the full-control mode. The necessary electrical connections are shown in Fig. 5.

![Connector X1 Pin assignment in full-control mode](image)

**Fig. 1 Pin assignment in full-control mode**

The full-control mode allows exploiting the full functionality of the module. Each action of the module is triggered by transmitting a text-command via the UART interface. The measurement results
can be either read out via the same UART interface. Alternatively, measurement results can be also read from the analog output.

For further details please refer to the separately available communication protocol.

### 7.2 Listening Mode

In this mode the *FirestingO2* is powered and controlled via the USB-interface together with the versatile logging software *Oxygen Logger*. However, the "UART transmit"-pin of the extension port can be used to listen to the data stream by third-party software. In this mode only the pins 1 and 4 are used:

![Connector X1 Diagram](image)

The data stream contains all sampled temperature data in a simple ASCII-format. The communication protocol is available on request.
8 Specifications of the TeX4

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions</td>
<td>68 x 120 x 30 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>300 g</td>
</tr>
<tr>
<td>Interface</td>
<td>Micro USB</td>
</tr>
<tr>
<td>Power Supply</td>
<td>USB-powered (max 60mA at 5V)</td>
</tr>
</tbody>
</table>
| Supported operating systems | Windows 7, 8, 10  
(but not “Windows 7 Starter Edition”) |
| Operating temperature of the electronics | 0 to 50°C                                   |
| Max. relative humidity    | Non-condensing conditions                    |
| Temperature channels      | 4                                            |
| Temp. measuring principle | 4-wire PT100                                  |
| Resolution                | 0.02 °C                                      |
| Accuracy                  | ±0.2 °C                                      |
| Measuring range           | -30 to 150 °C                                |
| Extension port            | UART interface  
(contact us for details) |