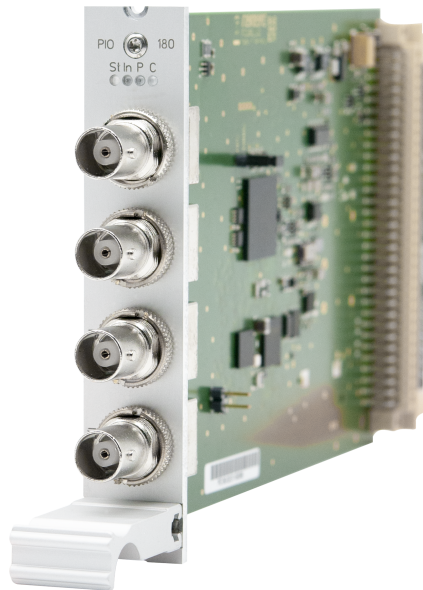




The Synchronization Experts.



## **SETUP GUIDE**

**IMS-PIO180**

**Hot-Plug Module**

February 13, 2024

Meinberg Funkuhren GmbH & Co. KG



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# 1 Imprint

**Meinberg Funkuhren GmbH & Co. KG**  
Lange Wand 9, 31812 Bad Pyrmont, Germany

Phone: + 49 (0) 52 81 / 93 09 - 0  
Fax: + 49 (0) 52 81 / 93 09 - 230

Website: <https://www.meinbergglobal.com>  
Email: [info@meinberg.de](mailto:info@meinberg.de)

Date: February 13, 2024

Manual  
Version: 1.03

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## 3 Introduction

This Setup Guide is a systematically structured guideline which supports you during the set-up of your Meinberg product.

The four I/O ports of the IMS module PIO180 (PIO=Programmable Input/Output) can be used as inputs as well as outputs. Primarily, the module was developed to perform measurements of e.g. PPS signals of external systems against the internal reference time.

### Functionality

The offset from the external reference against the high-precision time of the internal oscillator is measured with an accuracy of 5 ns (measurement resolution 1 ns). With the SyncMon these measurements can be logged and analyzed. If the ports of the PIO180 are to be used as outputs, the signal direction can be set to output in the LTOS web GUI (see Chapter Configuration of the IMS-PIO180).

The LANTIME firmware manual provides a complete description of all configurations and status monitoring options of your Meinberg product.

Download link: <http://www.mbg.link/ltos-manual>

### Compatibility

The PIO180 is an IMS module which is compatible with all systems of the IMS family. It can also be used on any slot (MRI, ESI, I/O). For example, it is possible to build up a central measurement system with a LANTIME M3000, which can log and analyze the accuracy of up to 40 PPS signals of external systems with the help of the SyncMon, which acts as a central measurement system with a PIO180 module.

## 4 Important Safety Information



The safety information provided in this chapter as well as specific safety warnings provided at relevant points in this manual must be observed during every installation and operation procedure of the device, as well as its removal from service.

Any safety information affixed to the product itself must also be observed.

Any failure to observe this safety information, these safety warnings, and other safety-critical operating instructions in the product documentation, or any other improper usage of the product may result in unpredictable behavior from the product, and may result in injury or death.

Depending on your specific device configuration and installed options, some safety information may not be applicable to your device.

Meinberg accepts no responsibility for injury or death arising from a failure to observe the safety information, warnings, and safety-critical instructions provided in the product documentation.

It is the responsibility of the operator to ensure that the product is safely and properly used.

Should you require additional assistance or advice on safety-related matters for your product, Meinberg's Technical Support team will be happy to assist you at any time. Simply send a mail to [techsupport@meinberg.de](mailto:techsupport@meinberg.de).

### 4.1 Appropriate Usage



**The device must only be used appropriately in accordance with the specifications of the product documentation!** Appropriate usage is defined exclusively by this manual as well as any other relevant documentation provided directly by Meinberg.

**Appropriate usage includes in particular compliance with specified limits!** The device's operating parameters must never exceed or fall below these limits!

## 4.2 Product Documentation

The information in this manual is intended for readers with an appropriate degree of safety awareness.

The following are deemed to possess such an appropriate degree of safety awareness:

- **skilled persons** with a familiarity with relevant national safety standards and regulations,
- **instructed persons** having received suitable instruction from a skilled person on relevant national safety standards and regulations



Read the product manual carefully and completely before you set the product up for use.

If any of the safety information in the product documentation is unclear for you, do **not** continue with the set-up or operation of the device!

Safety standards and regulations change on a regular basis and Meinberg updates the corresponding safety information and warnings to reflect these changes. It is therefore recommended to regularly visit the Meinberg website at <https://www.meinbergglobal.com> or the Meinberg Customer Portal at <https://meinberg.support> to download up-to-date manuals.

Please keep all product documentation, including this manual, in a safe place in a digital or printed format to ensure that it is always easily accessible.

Meinberg's Technical Support team is also always available at [techsupport@meinberg.de](mailto:techsupport@meinberg.de) if you require additional assistance or advice on safety aspects of your system.

## 4.3 Electrical Safety

The IMS LANTIME system in which the module is installed is operated at a hazardous voltage. Please refer to the specific safety information contained within the manual of your IMS system for more information.

When removing a hot-pluggable power supply module, the power supply cable must first be disconnected from the module before the module itself is removed.

Never open a power supply module—hazardous voltages may still reside within the module even after it is disconnected from the power source. If a power supply module is defective, it can be sent to Meinberg for repair.

The installation, set-up, and operation of an IMS system must be performed by suitably qualified personnel.

Failure to observe these safety instructions can result in severe injury.





## 5 Important Product Information

### 5.1 CE Marking

This product bears the CE mark as is required to introduce the product into the EU Single Market.



The use of this mark is a declaration that the product is compliant with all requirements of the EU directives effective and applicable as at the time of manufacture of the product.

### 5.2 UKCA Marking

This product bears the British UKCA mark as is required to introduce the product into the United Kingdom (excluding Northern Ireland, where the CE marking remains valid).



The use of this mark is a declaration that the product is in conformity with all requirements of the UK statutory instruments applicable and effective as at the time of manufacture of the product.

### 5.3 Ensuring the Optimum Operation of Your Device

- Ensure that ventilation slots are not obscured or blocked by dust, or else heat may build up inside the device. While the system is designed to shut down safely and automatically in the event of temperature limits being exceeded, the risk of malfunctions and product damage following overheating cannot be entirely eliminated.
- The device is only deemed to be appropriately used and EMC limits (electromagnetic compatibility) are only deemed to be complied with while the device housing is fully assembled in order to ensure that requirements pertaining to cooling, fire safety, electrical shielding and (electro)magnetic shielding are upheld.

### 5.4 Maintenance and Modifications



#### Important!

Before performing any maintenance work on or authorized modification to your Meinberg system, we recommend making a backup of any stored configuration data (e.g., to a USB flash drive from the Web Interface).

## 5.5 Prevention of ESD Damage



An **ESDS** device (electrostatic discharge-sensitive device) is any device at risk of damage or malfunction due to electrostatic discharge (ESD) and thus requires special measures to prevent such damage or malfunction. Systems and modules with ESDS devices usually bear this symbol.

Precautionary measures should be taken to protect ESDS components from damage and malfunction.

- Before removing or installing a module, ground your body first (for example, by touching a grounded object) before touching ESDS components.
- Ensure that you wear a grounding strap on your wrist when handling such ESDS components. These straps must in turn be attached to an uncoated, non-conductive metal part of the system.
- Use only tools and equipment that are free of static electricity.
- Ensure that your clothing is suitable for the handling of ESDS components. In particular, do not wear garments that are susceptible to electrostatic discharges (wool, polyester). Ensure that your shoes enable a low-resistance path for electrostatic charges to dissipate to the ground.
- Only touch or hold ESDS components by the edges. Never touch any pins or conductors on the ESDS components.
- When removing or installing ESDS components, avoid coming into contact with persons who are not grounded. Such contact may compromise your connection with the grounding conductor and thus also compromise the ESDS component's protection from any static charges you may be carrying.
- Always store ESDS components in ESD-proof ("antistatic") bags. These bags must not be damaged in any way. ESD-proof bags that are crumpled or have holes cannot provide effective protection against electrostatic discharges. ESD-proof bags must have a sufficient electrical resistance and must not be made of conductive metals if the ESDS component has a lithium battery fitted on it.

## 5.6 Disposal

### Disposal of Packaging Materials



The packaging materials that we use are fully recyclable:

Material	Use for	Disposal
Polystyrene	Packaging frame/filling material	Recycling Depot
PE-LD (Low-density polyethylene)	Accessories packaging, bubble wrap	Recycling Depot
Cardboard	Shipping packaging, accessories	Paper Recycling

For information on the proper disposal of packaging materials in your specific country, please inquire with your local waste disposal company or authority.

### Disposal of the Device



This product falls under the labeling obligations of the Waste Electrical and Electronic Equipment Directive 2012/19/EU ("*WEEE Directive*") and thus bears this WEEE symbol. The presence of this symbol indicates that this electronic product may only be disposed of in accordance with the following provisions.



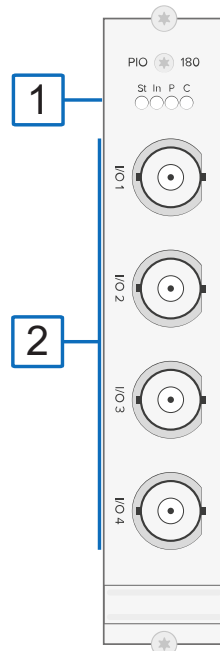
#### Important!

Do not dispose of the product via the household waste. Inquire with your local waste disposal company or authority on how to best dispose of the product if necessary.

This product is considered to be a "B2B" product for the purposes of the WEEE Directive and is also classified as "IT and Telecommunications Equipment" in accordance with Annex I of the Directive.

It can be returned to Meinberg for disposal. In this case, the shipping costs are to be borne by the customer, while Meinberg will cover the costs for disposal. If you wish for Meinberg to handle disposal for you, please get in touch with us. Otherwise, please use the return and collection systems provided within your country to ensure that your device is disposed of in a compliant fashion to protect the environment and conserve valuable resources.

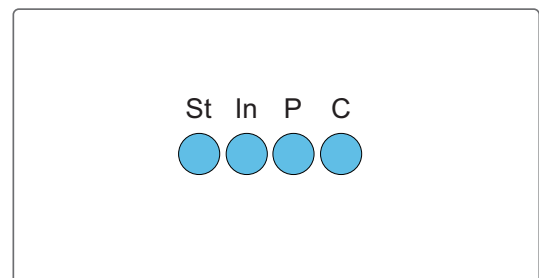
## 6 Front Connectors IMS-PIO180



### 6.1 Status LEDs

#### Status Indicators

LED St:	PIO status
LED In:	Status of the backplane's output signals
LED P:	display for preset PPS
LED C:	display for preset 10 MHz
Initialisation:	LED St: blue until USB is configured LED In - LED B: off until USB is configured



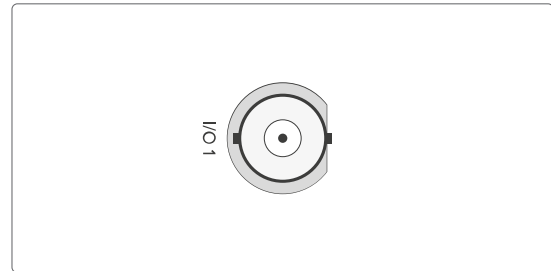
USB is configured:	LED St: blue LED In: 0,5 sec. red -> 0,5 sec. yellow -> 0,5 sec. green -> 0,5 sec. off
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Normal Operation:	LED St. + LED In: green LED P: green, if card is preset to PPS LED C: green, if card is preset to 10 MHz
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## 6.2 In- Outputs (PPS or 10 MHz)

### Technische Daten:

<b>General:</b>	
Signals:	PPS or 10 MHz (selectable via Jumper)
Connectors:	4 x BNC connectors, by software as in- or outputs individually switchable
Connection type:	BNC female



### PPS

#### PPS - Signal input:

Input signal:	PPS (Puls pro Sekunde)
Signallevel:	TTL
Signal detection:	Rising edge
Impedance:	50 Ohm

Measuring accuracy: 5 ns (1 ns resolution)

#### PPS - Signal output:

Output signal:	PPS (Pulse per second)
Signal level:	TTL, 2.5 V at 50 Ohm
Pulse length:	200 ms

### 10 MHz

#### 10 MHz - Signal input:

Input signal:	10 MHz frequency
Signallevel:	Sinus (1.5 V <sub>SS</sub> - 5 V <sub>SS</sub> ) or TTL
Signal detection:	Rising edge

#### 10 MHz - Signalausgang:

Output signal:	10 MHz frequency
Signal level:	TTL, 2.5 V at 50 Ohm

## 7 Before you start

### 7.1 Contents of Delivery

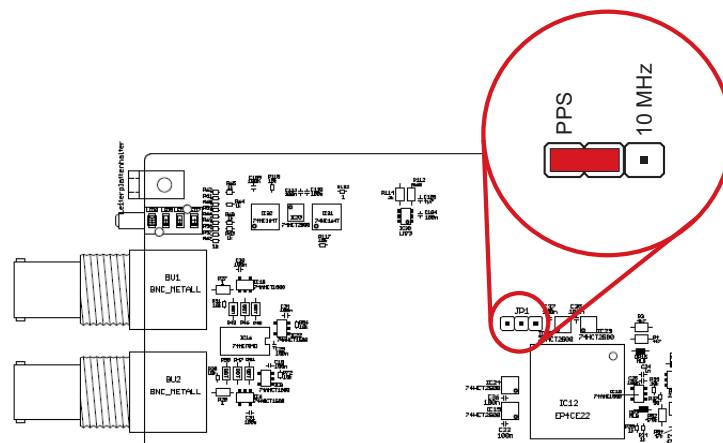
Unpack the IMS-PIO180 and all accessories carefully and check the contents of the delivery against the enclosed packing list to ensure that no parts are missing. If any of the listed items are missing, please contact our Sales Department at [sales@meinberg.de](mailto:sales@meinberg.de).

Check that the product has not been damaged in transit. If the product is damaged or fails to operate upon installation, please contact Meinberg immediately. Only the recipient (the person or company receiving the system) may file claims or complaints against the forwarder for damage caused in transit.

Meinberg recommends that you keep the original packaging materials in case the product needs to be shipped or transported again at a later date.

### 7.2 Pre-selection (PPS, 10 MHz)

Before installing the PIO180 module, select the required signal using the jumper setting (PPS or 10 MHz). Upon delivery all ports are preset to PPS (Pulse Per Second).



#### Information:

Mixed operation is not possible. All inputs/outputs are set to either PPS or 10 MHz.

## 8 System Installation

### 8.1 Important Information Regarding Hot-Pluggable IMS Modules

The following information should be strictly observed when replacing IMS modules during operation. Not all IMS modules are fully hot-pluggable. For example, it is naturally not possible to replace a power supply unit in a system without PSU redundancy without first having installed a second power supply unit while the system is in operation.

The following rules apply for the individual IMS slots:

<b>PWR Slot:</b>	"Hot-Swappable"	If you operate your system with only one power supply unit, a second power supply unit must be installed before removing or replacing it in order to keep your system operational.
<b>I/O, ESI, and MRI Slots:</b>	"Hot-Pluggable"	
<b>CLK1, CLK2 Slots:</b>	"Hot-Pluggable"	When a clock module is replaced or installed, it is important to rescan the reference clocks (" <b>Rescan Refclocks</b> ") in the " <b>System</b> " menu of the Web Interface.
<b>RSC/SPT Slots:</b>	"Hot-Pluggable"	It will not be possible for your IMS system to switch between signal generators while the RSC/SPT is not installed.

<b>CPU Slot:</b>	" <u>Not</u> Hot-Pluggable"	Before the CPU is removed, the IMS system must be powered down.  Please note that after powering on and rebooting the LANTIME Operating System, the configuration of some IMS modules may be reset to factory defaults!
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#### Information:

The NTP service and access to the Web Interface will be unavailable while the CPU is not installed. Management and monitoring functions will also be disabled.

## 8.2 Installation and Removal of Hot-Pluggable IMS Modules

A Torx screwdriver is required (T8 x 60) to remove and install IMS modules.

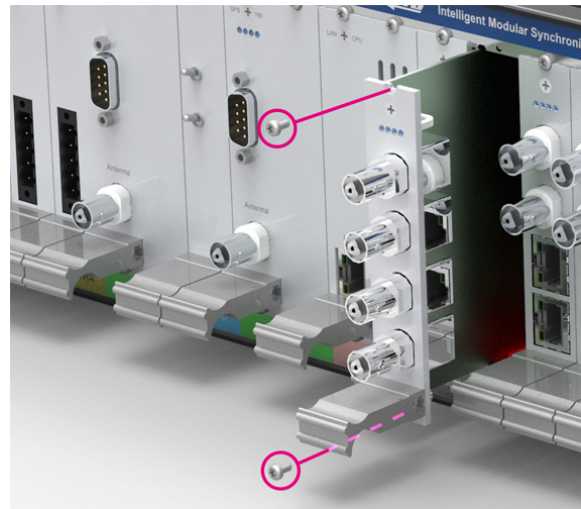


### Important!

Heed the safety information in Chapter 4 of this manual!

### Removing a Module

1. Remove the two marked Torx screws from the module faceplate.
2. Pull the module **carefully** out of the guide rail. Note that the module will be securely seated in the connector block inside the chassis—a certain amount of force must be applied to release the module. Once the module has been detached from the connector block on the system backplane, the module can be easily pulled out.
3. If the removed module is not to be replaced with another module, a suitable one-slot or two-slot 'placeholder' faceplate should be fitted using the two Torx screws in order to cover this space.



*Locations of fixture screws in a 1U IMS system*



## Installing a Module

1. To replace a module, remove the installed module in accordance with the guide "**Removing a Module**" on the previous page. Otherwise, remove the two Torx screws from the cover plate of the unused slot. We recommend keeping the cover plate in a safe place for later use.
2. Insert the module correctly into the two guide rails of the system chassis. If it cannot be inserted with minimal force, it is possible that the module is not properly seated in the guide rails. In this case, you should pull the module out and try again. **Do not use excessive force when pushing the module in!** Failure to heed this instruction may result in damage to the module and/or chassis.
3. Once the module has reached the connector block of the system backplane, a little more force will be required to insert the module into the connector block. Ensure that the module is locked securely into place and that the faceplate of the module is flush with that of the adjacent modules or cover plates.
4. Insert and tighten the two Torx screws with a **max. torque of 0.6 Nm**.

The installed module is now ready to be set up for use.

### 8.3 Connecting the System

The following illustration shows an IMS-LANTIME M3000, which acts as a central measuring system by using a PIO180 module.

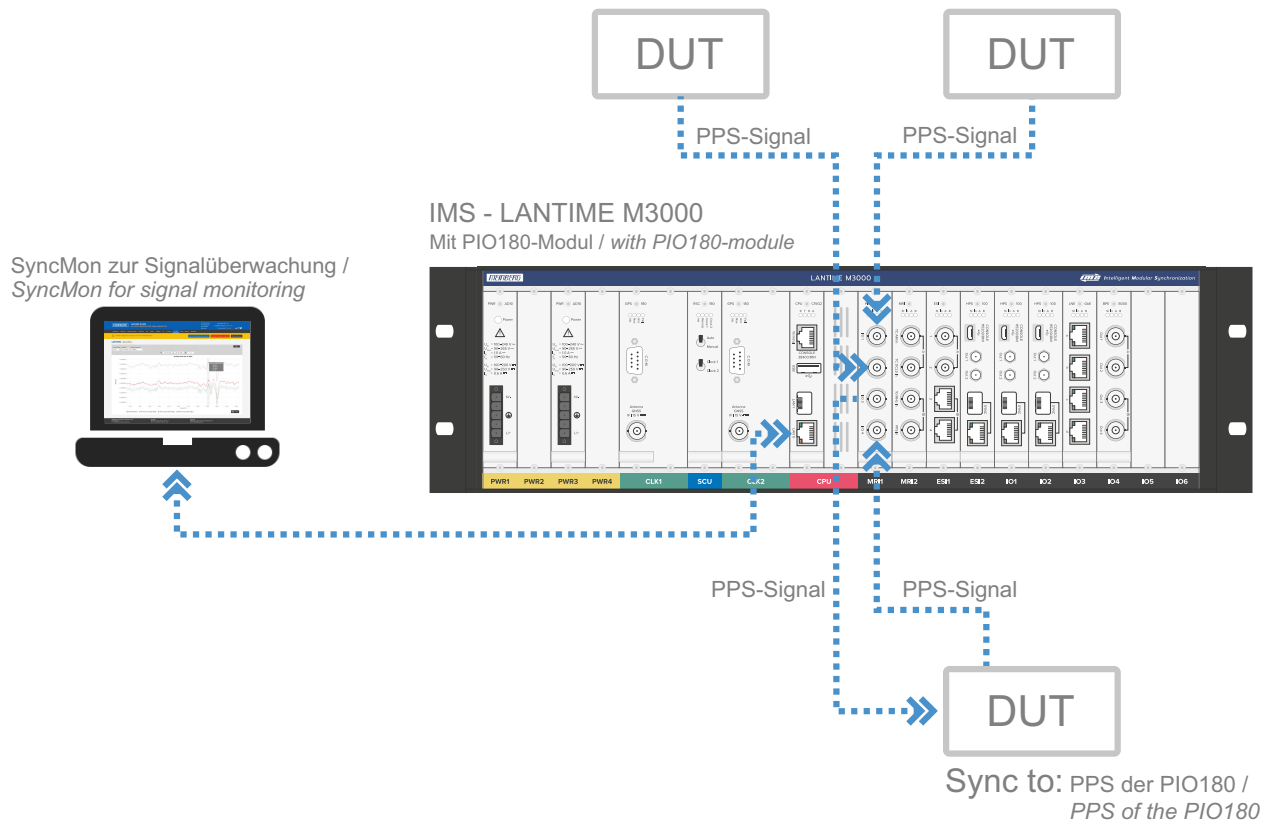


Figure: Measurement of the PPS signal of DUT (Devices Under Test) accuracy using the PIO180 module

## 9 Configuration of the IMS-PIO180

This chapter explains how to put a IMS-PIO180 into operation via the web interface.

### 9.1 Menu - IO Config

In the "IO Config" menu of the web interface, each port of the PIO180 can be set separately to "Input" or "Output". To use the individual ports in **SyncMon**, the direction "Input" must be selected.

**"Port Type"** By using a jumper on the board the port type is set to PPS (standard configuration) or 10 MHz (optional configuration).

**Direction:** "Output" In this mode either the PPS or the 10 MHz of the reference clock will be issued.

"Input" The input signal is compared with either the PPS or the 10 MHz of the reference clock. The offset values are displayed in the submenu "status" or can be used as node in the SyncMon (Port Type PPS only).

### Configuration

1. Open the menu "I/O configuration"
2. Open the submenu "Configuration of the outputs"
3. Select the PIO180 module you want to configure
4. Select the desired signal direction in the tab of the port to be configured

# 10 Status Monitoring of the IMS-PIO180

This chapter describes the status monitoring of the IMS-PIO180 via the web interface.

The submenu "Status" of the "IO Config" allows you to view the status of each port of installed PIO180 modules.

▼ Status

PIO - Programmable Input/Output Module 1 [Chassis 0, Slot ES11]

Input	Type	Status	Offset
Input 1	PPS in	Carrier detected, Input signal is avail	-0.000000040s
Input 2	PPS in	Input signal is currently lost	
Input 3	PPS in	Input signal is currently lost	
Input 4	PPS in	Carrier detected, Input signal is avail	-0.000124083s

Temperature Sensor 1    Temperature Sensor 2

Current: 41.50°C    Current: 36.75°C

## 10.1 The SyncMon

When using the PIO180 as an input module, the SyncMon offers extensive possibilities of status monitoring. To do this, select the menu **SyncMon** in the web interface and then **Node monitoring**.



### Important!

Node monitoring via a PIO180 is only possible if Port Type is set to PPS (via jumper). Also see chapter **Pre-selection (PPS, 10 MHz)**.

### Node monitoring

To monitor the signals applied to the PIO180, each input to be monitored must be added as node to the SyncMon.

1. To add a node, first click on the "Add Node" button.
2. The menu "**Configuration of Monitoring Nodes**" opens.
3. Select the PIO180 module in the drop down menu "**Monitoring via**".
4. Use the "Monitoring Type" drop down box to select the desired input of the PIO180.
5. Further specific configurations, such as the request interval [s], can be made.
6. To save the configuration, click on the "Save Member" button.

The PIO module is now visible in the "Node Monitoring" and important input parameters can be monitored.

Node Monitoring

Grp	+ -	Location	Alias	Address	Monitoring via	Protocol	ReqI	LogI	Measured Value	Status	Action
0	<input type="checkbox"/>	Rack_IMS_2	PPS-su-rims2-1	PIO-Module	PIO/MRI1 Port0	Pulses	4s	4s	-128.2us	Pulses available	
0	<input type="checkbox"/>	Rack_IMS_2	PPS-su-rims2-2	PIO-Module	PIO/MRI1 Port1	Pulses	4s	4s	-61ns	Pulses available	
0	<input type="checkbox"/>	Rack_IMS_2	PPS-su-rims2-3	PIO-Module	PIO/MRI1 Port2	Pulses	4s	4s	-46ns	Pulses available	
0	<input type="checkbox"/>	Rack_IMS_2	PPS-su-rims2-4	PIO-Module	PIO/MRI1 Port3	Pulses	4s	4s	197ns	Pulses available	
0	<input type="checkbox"/>	Rack_IMS_2	PPS-su-rims2-5	PIO-Module	PIO/ESI1 Port0	Pulses	4s	4s	-38ns	Pulses available	
0	<input type="checkbox"/>	Rack_IMS_2	PPS-su-rims2-8	PIO-Module	PIO/ESI1 Port3	Pulses	4s	4s	-126.7us	Pulses available	

## PPS Offset

The measured difference between the PPS input signal and the PPS of the reference clock can be displayed as a value or as a graph. To display the graph of the respective port, click on the ICON "Graph".

By setting the parameters Time Range, Y Range and Update Interval, the graph can be customized.

# 11 RoHS Conformity

## Conformity with EU Directive 2011/65/EU (RoHS)

We hereby declare that this product is compliant with the European Union Directive 2011/65/EU and its delegated directive 2015/863/EU "Restrictions of Hazardous Substances in Electrical and Electronic Equipment" and that no impermissible substances are present in our products pursuant to these Directives.

We warrant that our electrical and electronic products sold in the EU do not contain lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyls (PBBs), polybrominated diphenyl ethers (PBDEs), bis(2-ethylhexyl)phthalat (DEHP), benzyl butyl phthalate (BBP), dibutyl phthalate (DBP), or diisobutyl phthalate (DIBP) above the legal limits.

