

*IO-Link Description*

# Manual PBMx-M1

*V1.0*

Last Update: 29 April 2021



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# 1 History

**Tab 1** Document History

Vers.	Date	Note
1.0	29 April 2021	New Layout Design

## 2 Abbreviations and Explanations

### 2.1 Abbreviations

- HMI            Human-Machine-Interface
- ICT            Information and Communication System
- IO             Input/Output
- IODD         IO Device Description
- PLC          Programmable Logic Controller
- RO            Read only: parameter can only be read
- RW            Read/write: parameter can be read and written

### 2.2 Explanations

#### *Symbols*

- M1 c/ac        The function is valid for the PBMx-M1 ("M1") and the value is available as *cyclic* and as *acyclic* type.
- M1 c/-         The function is valid for the PBMx-M1 ("M1") and the function is available only as *cyclic* type.
- M1 -/ac        The function is valid for the PBMx-M1 ("M1") and the function is available as *acyclic* type.

#### *Main Referenced Documents*

Within this manual there are three main documents referenced to:

- *IO-Link Common Profile Specification*, Version 1.0, July 2017, 10.072
- *IO-Link Smart Sensor Profile 2<sup>nd</sup> Edition Specification*, Version 1.0, March 2017, 10.042
- *IO-Link Interface and System Specification*, Version 1.1.2, July 2013, 10.002

#### *Note*

If the alarm bit is set to 1 (= alarm, IO-Link mode) an unreliable state has occurred, all the other SSC are set to low (0) except the process value is recognised as "out of range". This information is especially important, in case the sensor is used in SIO mode. Also here, the SSC mapped to the SIO is set to low (0) except the process value is recognised as "out of range". (See chapter **Fehler! Verweisquelle konnte nicht gefunden werden.Fehler! Verweisquelle konnte nicht gefunden werden.**, page **Fehler! Textmarke nicht definiert.**)

## 3 Sensor Covered By This Manual

This manual applies for all configurations of the PBMX containing the output signal code M1: PBMx-x.xxxxx.M1xx.xxxxx.xxx<sup>1</sup>.

- “M” stands for the output signal combination of the IO-Link channel or the 4 ... 20 mA analogue signal
- “1” stands for the functional range

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<sup>1</sup> Reference is the configurator of the PBMX, see <https://www.baumer.com/ch/p/38450>

## 4 IO-Link Introduction

IO-Link is an input/output technology standardised worldwide according to IEC 61131-9. It permits manufacturer independent digital, bidirectional point-to-point communication. For this purpose, sensors are connected to the IO-Link master via standardised three-wire plug-in cables. IO-Link is available for various sensor technologies therefore use following link: *Knowledge page*<sup>2</sup>.

With the IO-Link master, which bundles several sensors, the connection to the controller is made via the respective fieldbus system. In addition, an Ethernet-based connection from the master allows direct communication from the sensor to IT systems. IO-Link masters are available as field devices for decentralized mounting or as versions for mounting in control cabinets. Many control suppliers also offer IO-Link input terminals and thus an IO-Link master implemented directly on the control. The maximum cable length between sensor and master is 20 m. However, significantly longer connections from the sensor to the controller can be realized by connecting a field master to a field bus system. This gives them maximum flexibility in the connection solution.

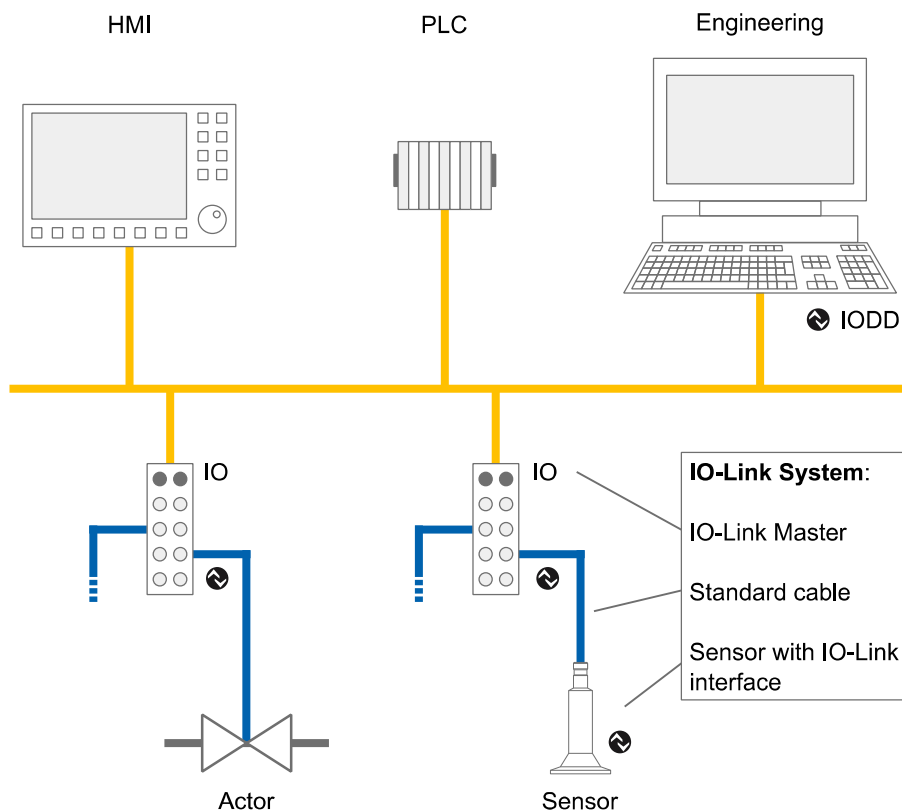


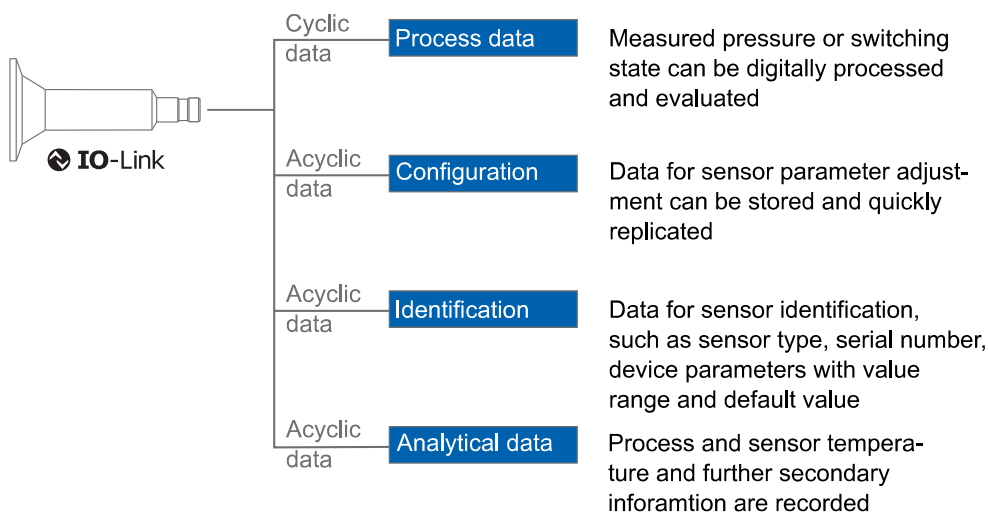
Fig 1 Example of a system architecture using IO-Link

<sup>2</sup> [https://www.baumer.com/de/en/service-support/know-how/technology-highlights/io-link-digitization-begins-with-the-sensor/a/know-how\\_io-link](https://www.baumer.com/de/en/service-support/know-how/technology-highlights/io-link-digitization-begins-with-the-sensor/a/know-how_io-link)

## 4.1 Communication in IO-Link Mode

The communication mode is initiated by the master (PLC) with a standardised command sequence (“wake-up”). After successful completion of the wake-up sequence the IO-link communication starts.

Data is the most important basis for process and product optimisation. With the help of the IO-Link, valuable additional data can be made accessible. Sensor and Master can exchange two different types of data (cyclic and acyclic data). More information can be found *here*<sup>3</sup>.



**Fig 2** Different IO-Link data streams

- Cyclic data (“c”)

Transmitting in real time with minimum cycle time of 2.3ms (reference: IODD from PBMx-M1). They are used for process control in the automation system. These can also be transferred to other ICT systems via IO-Link.

- Acyclic data (“ac”)

Through this data stream, sensors (IO devices) can be parametrised. Additionally this data stream also allows to transmit data for identification and analysis.

## 4.2 IO-Link Device Description (IODD)

One or several IO-Link devices with the same interface have their interface described in a xml based file named IO-Link Device Description (IODD). It contains data about the manufacturer, article number, functionality, software version etc. which can be easily read out and further processed by the automation system. Each device, e.g. each sensor, carrying the unique Device ID, matches one IODD with the same Device ID. The identification data of the sensor also includes device or application descriptions that can be freely assigned by the user. The

<sup>3</sup> [https://www.baumer.com/de/en/.../know-how\\_io-link\\_begriffsbestimmungen](https://www.baumer.com/de/en/.../know-how_io-link_begriffsbestimmungen)

IODD consists of several files: a main file and optional external language files (both in XML format), as well as image files (in PNG format).

### 4.3 Off-Line Parametrisation

The sensor parameter can be adjusted offline via a user interfaces in the PC (via USB Master) or via a Wireless App (via Wireless Master). Therefore the parametrisation can be conducted rather conveniently at the desk and installed without further teach-in.

Even if IO-Link is not implemented in the machine control (PLC), sensors can be operated in SIO mode (switch) and use the advantage of related parametrisation.



## 5 IO-Link Mode (Sensor Specific Information)

### 5.1 Process Data

With the sensor in the IO-Link communication mode, process data is cyclically exchanged between the IO-Link master and the device. Process data is exchanged to and from the sensor (Sensor  $\leftarrow \rightarrow$  Master).

#### *Process Data-Out (Master to Sensor)*

Process Data-Out is sent from the master to the sensor (Sensor  $\leftarrow$  Master) and not implemented for the PBMx-M1.

#### *Process Data-In (Sensor to Master)*

Process Data-In is sent from the sensor to the master (Sensor  $\rightarrow$  Master).

**Tab 2** IO-Link Process Data Input

IO-Link Process Data Input	
23...8	7...0
Pressure	Pressure Factor

The Process Data Input is a 24 bit data stream.

- Bit 0 ... 7: Pressure Factor

Value is the exponent to the power of ten, applicable to the value of the Measurement Data Channel (MDC). Example for the value of MDC equal to 9.81 bar (the basic unit is Pa):

Process Value is 981

Unit is Pascal (Pa)

Scale is 3 (binary 11)

$981 * 10^3 = 981000 \text{ Pa}$  (equal to 9.81 bar)

- Bit 8 ... 23: Pressure

In above example it is a value of 981 (binary 1111010101).

## 6 Function Description

### Note

This chapter contains initial information about the different parameter (index and sub-index) while any further details as e.g. the data type have to be taken from the related IODD.

**Tab 3** Index 2, System Command

Index	Sub-ind.	Access	Min.	Max.	Default	Meaning
2	0	WO	0	255	-	See IOL-Interface-Spec_10002_V112_Jul13.pdf <sup>4</sup> , chapter B2.2, for further information. A noteworthy system command is "Restore factory settings", for this write 130 to the index. <i>Note:</i> A factory reset of the sensor activates the default parameters as programmed in the factory. All parameters changed by the user will be lost.

### 6.1 Device Access Locks

This function is in accordance to the IO-Link Interface and System Specification, Version 1.1.2, July 2013, 10.002, chapter B.2.4 [5].

**Tab 4** Index 12, Device Access Locks

Index	Sub-ind.	Access	Min.	Max.	Default	Meaning
12	0	RW	-	-	0	Device Access Locks (Only Data Storage Locks is in use)

**Tab 5** Available Device Access Locks possibilities

Availability	Bit	Category	Definition
Not available	0	Parameter (write) access (optional)	0: unlocked (default) 1: locked
Available	1	Data Storage (mandatory if the Device supports Data Storage)	0: unlocked (default) 1: locked (see Note)
Not available	2	Local parameterisation (optional)	0: unlocked (default) 1: locked
Not available	3	Local user interface (optional)	0: unlocked (default) 1: locked
	4 ... 15	Reserved	

Note: The Master reads the parameter State\_Property/State of Data Storage prior to any actions<sup>6</sup>.

<sup>4</sup> IOL-Interface-Spec\_10002\_V112\_Jul13.pdf

<sup>5</sup> IOL-Interface-Spec\_10002\_V112\_Jul13.pdf

<sup>6</sup> See table B.10 in the IO-Link Interface and System Specification

## 6.2 Product Information

Different information about the vendor Baumer and the product PBMX are stored on the device as such.

**Tab 6** Index 16 ... 23, Product Information

Index	Sub-ind.	Access	Min.	Max.	Default	Meaning
16	0	RO	-	-	Baumer Electric AG	Vendor Name
17	0	RO	-	-	<i>www.baumer.com</i>	Vendor Text
18	0	RO	-	-	PBMx-x.xxxxx.M1xx.xxxxxx.xxx	Product Name
19	0	RO	-	-	PBMx-x.xxxxx.M1	Product ID
20	0	RO	-	-	Pressure Sensor	Product Text
21	0	RO	-	-	12 Zeros (0)	Serial Number
22	0	RO	-	-	01.00.00	Hardware Version
23	0	RO	-	-	01.00.00	Firmware Version

## 6.3 Tags

The different tags are enabling the sensor user to identify in the PBMx within its system in an easy way. The three elements application specific, function, and location tag are available. Following example shall illustrate how they can be used:

- Application specific tag: 100321 (example of a measuring location identification number)

**Tab 7** Index 24 ... 26, Tags

Index	Sub-ind.	Access	Min.	Max.	Default	Meaning
24	0	RW	-	-	32 Stars (*)	Application Specific Tag

## 6.4 Pressure

Main pressure measurement value in Pascal (Pa) after calculating with pressure factor. Filtering is not available.

## 6.5 Process Temperature

- This temperature is measured directly on the PBMx-M1 process pressure cell.
- The temperature is given in degree Celsius (°C).
- This temperature is an indication and not highly accurate. Furthermore it suites for slow changing medium temperatures only.

**Tab 8** Index 214, Process Temperature

Index	Sub-ind.	Access	Min.	Max.	Default	Meaning
214	1	RO	-	-	-	Current Process Temperature [°C]

## 7 Appendix

### 7.1 Tables

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