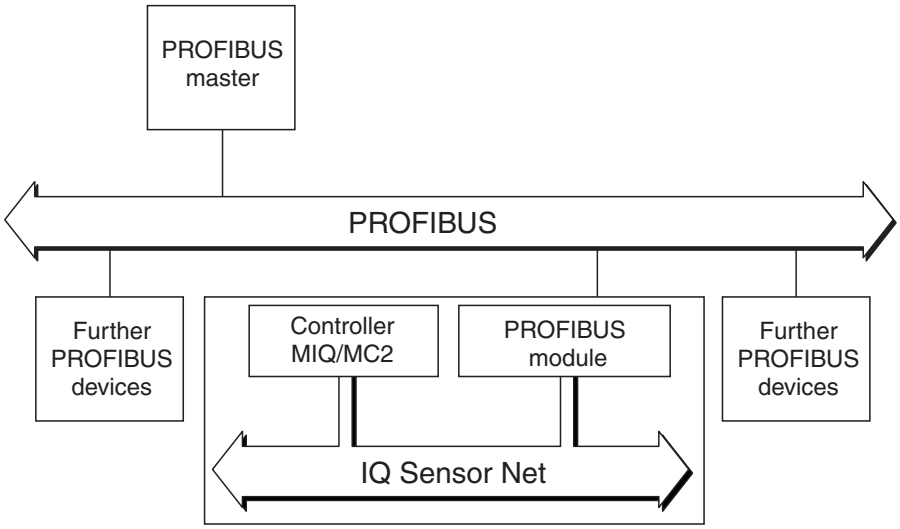
Operating Manual

IQ SENSOR NET
MIQ/2-PR



PROFIBUS connection
for the IQ SENSOR NET
System 2020 XT CONNECT and System 2020 XT USB

ba75974e01 07/2012



The latest version of the present operating manual can be found on the Internet under www.WTW.com.

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1 Overview

1.1 How to use this component operating manual

The present operating manual complements the system operating manual for the **IQ SENSOR NET** System 2020 XT (CONNECT / USB). It contains the description of the -PR option of the MIQ/2-PR module.

File this operating manual directly behind the system operating manual.

Structure of the IQ SENSOR NET operating manual

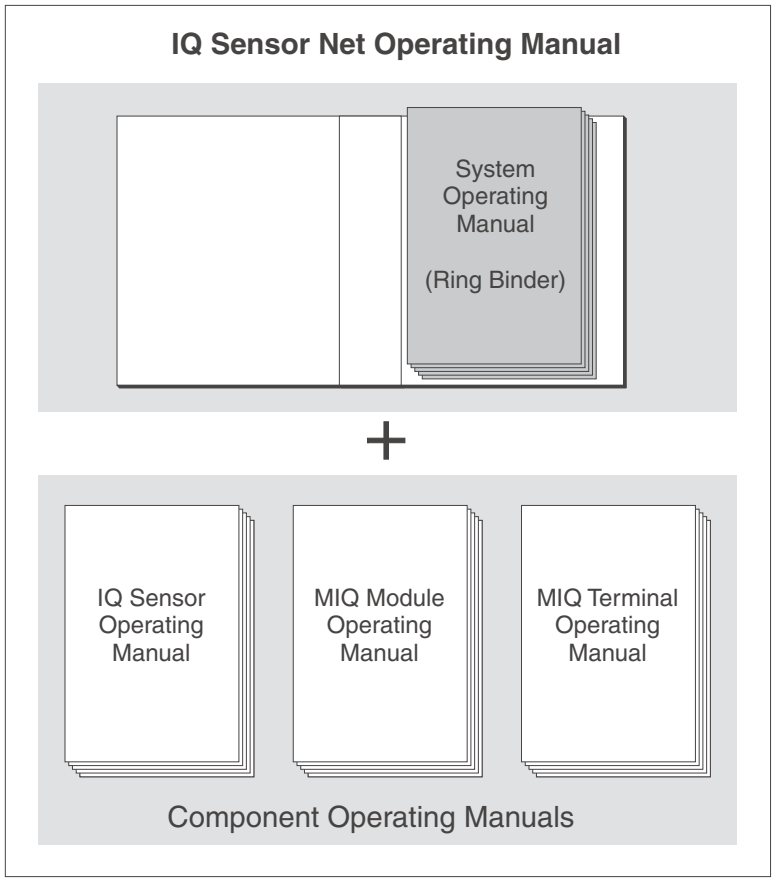


Fig. 1-1 Structure of the IQ SENSOR NET operating manual

The IQ SENSOR NET operating manual has a modular structure like the IQ SENSOR NET system itself. It consists of the system operating manual and the operating manuals of all the components used.

The space in the ring binder behind the system operating manual is intended for filing the component operating manuals. Please file all component operating manuals here so that all information is quickly available in one location.

1.2 PROFIBUS and IQ SENSOR NET System 2020 XT (CONNECT / USB)

System communication

The functional units of the IQ SENSOR NET are connected with one another via a common line (Fig. 1-2). The line consists of two wires and a shield. It transports digital information between the controller and the other modules. At the same time, the line is used to supply all modules with electrical voltage from a power supply unit. The power supply unit is only required for power supply and is not used in the system communication.

With the -PR option, the MIQ/2-PR module upgrades the system communication by an interface to the PROFIBUS master. Via this interface the data exchange with the PROFIBUS master takes place.

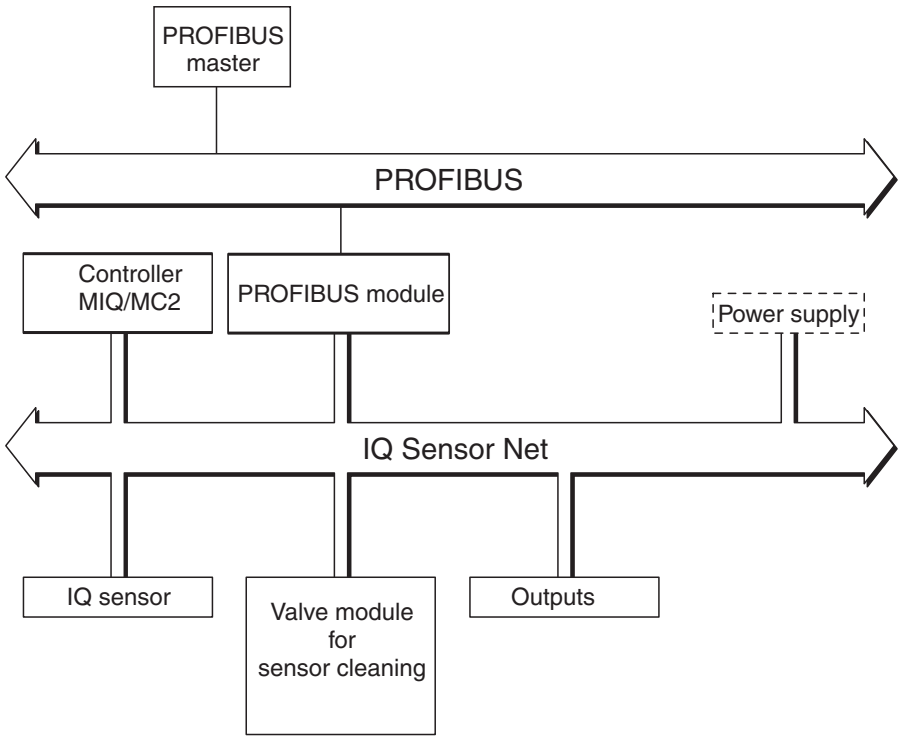


Fig. 1-2 Functional units of the IQ SENSOR NET with connection to the PROFIBUS

Note

All other general information on components, functions and operation of the IQ SENSOR NET System 2020 XT (CONNECT / USB) is given in the system operating manual.

With the A option, the MIQ/2-PR module extends the IQ SENSOR NET system by a fully automatic air pressure compensation for D.O. sensors (see system operating manual).

2 Safety

2.1 Safety information

2.1.1 Safety information in the operating manual

This operating manual provides important information on the safe operation of the product. Read this operating manual thoroughly and make yourself familiar with the product before putting it into operation or working with it. The operating manual must be kept in the vicinity of the product so you can always find the information you need.

Important safety instructions are highlighted in this operating manual. They are indicated by the warning symbol (triangle) in the left column. The signal word (e.g. "CAUTION") indicates the danger level:



WARNING
indicates a possibly dangerous situation that can lead to serious (irreversible) injury or death if the safety instruction is not followed.



CAUTION
indicates a possibly dangerous situation that can lead to slight (reversible) injury if the safety instruction is not followed.

Note
indicates a possibly dangerous situation where goods might be damaged if the actions mentioned are not taken.

2.1.2 Safety signs on the product

Note all labels, information signs and safety symbols on the product. A warning symbol (triangle) without text refers to safety information in this operating manual.

2.1.3 Further documents providing safety information

The following documents provide additional information, which you should observe for your safety when working with the measuring system:

- Operating manuals of other components of the IQ SENSOR NET system (power packs, controller, accessories)
- Safety datasheets of calibration and maintenance equipment (e.g. cleaning solutions).

2.2 Safe operation

2.2.1 Authorized use

Authorized use of the MIQ/2-PR consists of its use as an interface to a PROFIBUS. Only the operation and running of the product according to the instructions and technical specifications given in this operating manual is authorized (see chapter 8 TECHNICAL DATA). Any other use is considered unauthorized.

2.2.2 Requirements for safe operation

Note the following points for safe operation:

- The product may only be operated according to the authorized use specified above.
- The product may only be supplied with power by the energy sources mentioned in this operating manual.
- The product may only be operated under the environmental conditions mentioned in this operating manual.
- The product may not be opened.

2.2.3 Unauthorized use

The product must not be put into operation if:

- it is visibly damaged (e.g. after being transported)
- it was stored under adverse conditions for a lengthy period of time (storing conditions, see chapter 8 TECHNICAL DATA).

2.3 User qualification

Target group

The IQ SENSOR NET system was developed for online analysis. Some maintenance activities, e.g. changing the membrane caps in D.O. sensors, require the safe handling of chemicals. Thus, we assume that the maintenance personnel is familiar with the necessary precautions to take when dealing with chemicals as a result of their professional training and experience.

Special user qualifications

The following installation activities may only be performed by a qualified electrician:

- Connection of the MIQ/PS power supply module to the power line (see MIQ/PS module manual).
- Connection of external, line voltage-carrying circuits to relay contacts (see module manual of the relay output module).



WARNING

A circuit (except for the power supply connections), that is connected to an IQ SENSOR NET component, must not feed any voltages or currents that are not allowed. It has to be made sure that the circuit at any time meets all requirements of a *Limited circuit* or *Limited Power* as well as of *SELV* (Safety Extra Low Voltage). These include the following limiting value specifications:

- **AC voltage: max. 30 V effective / 42.4 V peak**
- **DC voltage: max. 60 V**
- **Current limit: max. 8 A**
- **Power output limitation: max. 150 VA**

3 Interface for the PROFIBUS

The MIQ/2-PR PROFIBUS module enables to connect the IQ SENSOR NET with all the sensors connected to it to the digital connection of a superordinate process control.



Further instructions for the installation and operation of a PROFIBUS network is given on the Internet under www.profibus.com and www.hms-networks.com.

3.1 Scope of delivery

The scope of delivery of the MIQ/2-PR module comprises:

- MIQ/2-PR
- Accessory set, including:
  - 4 x cable glands (clamping range 4.5-10 mm) with seals and blind plugs
  - 4x ISO blind nuts M4 with suitable cheese-head screws and plain washers
  - 2x countersunk screws M3x8 to close the module lid (+ 2 replacement screws)
  - 1 x contact base with fixing screws
- Operating manual.

3.2 PROFIBUS checklist

The following checklist supports you when planning, projecting and installing a PROFIBUS plant with the IQ SENSOR NET. For smooth operation, you should be able to answer all questions with "Yes".

- Is the [bus system] (bus segment) installed without branch lines?
- Was the correct PROFIBUS cable used (cord type A according to EN 50170)?
- Are the poles of the signal lines A line and B line correctly connected at all bus connections?
- Is it guaranteed that there is no short-circuit between A line, B line and cable shielding?
- Is the shielding installed free of interruptions?
- Are the guidelines for shielding and grounding being observed, and doesn't any unallowed potential equalization current flow via the shielding?

- Is the maximum cable length (per bus segment) observed for the corresponding baud rate?
- Do all devices support the required baud rate?
- With 12 Mbit/s transmission rate only: Are the bus plugs suitable for this baud rate?
- Are exactly two terminators switched on at the ends of the [bus system] (bus segment)?
- Are the terminators supplied with voltage so the following applies: $U_{B\ line} - U_{A\ line} > + 500$ mV?
- Do all devices have individual bus addresses?
- After changing the bus address, have the devices been restarted (switched off and on again)?
  Note: The IQ SENSOR NET does not have to be restarted.
- Do the addresses projected in the master correspond to the actual addresses? Are all addresses less than or equal to the parameter HSA and less than 126 (HSA = Highest Station Address)?
- Is the currently valid GSD being used? If you are in doubt, download it from the Internet.
- Have admissible bus parameters been set only? If you are in doubt set them to default values.
- Is it guaranteed that the PROFIBUS master has consistent access to the 16 byte sensor data structure?

  Note for Siemens PLC with programming language STEP7:
  The following commands have to be used for consistent access:
  - SFC15 (for writing)
  - SFC14 (for reading)
- After commissioning:
  Do all devices signal error-free behavior?
  (IQ SENSOR NET: status "Online" in the measured value and status display).

3.3 Connecting the PROFIBUS cable

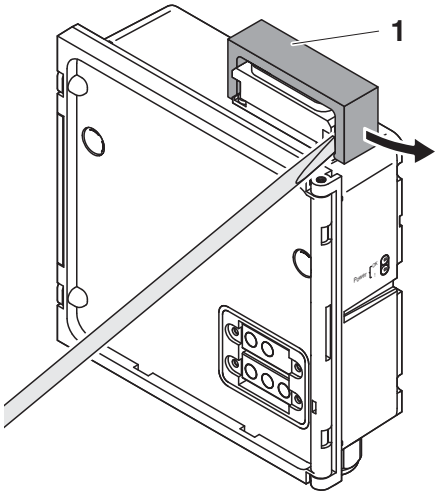
The PROFIBUS cable is connected to the IQ SENSOR NET using a 9-pin D-SUB connector on the top of the housing. As connector on the cable side, we exclusively recommend one of the following two connectors.

Manufacturer: Phoenix Contact GmbH & Co. KG
Flachsmarkt 8
32825 Blomberg
Germany
http://www.phoenixcontact.com

Types: VS-09-PROFB-SC
(Phoenix article no. 1654549, with screwed contacts, available from WTW under the order no. 902 888)

or: VS-09-PROFB-SP
(Phoenix article no. 1654345, with spring contacts)

To remove the blind plug, lift the safety bracket with a suitable screw driver at both clamps on the left and right side (see Fig. 3-1).



1 Safety bracket

Fig. 3-1 Removing the safety bracket

Note

To prevent the enclosure of the IQ SENSOR NET from being penetrated by water the following must be observed:

- *Use connectors recommended by WTW only.*
- *When the connector is removed, the connection socket of the IQ SENSOR NET must be closed with the blind plug and secured with the safety bracket.*

Use PROFIBUS cables according to EN 50170, cord type A.

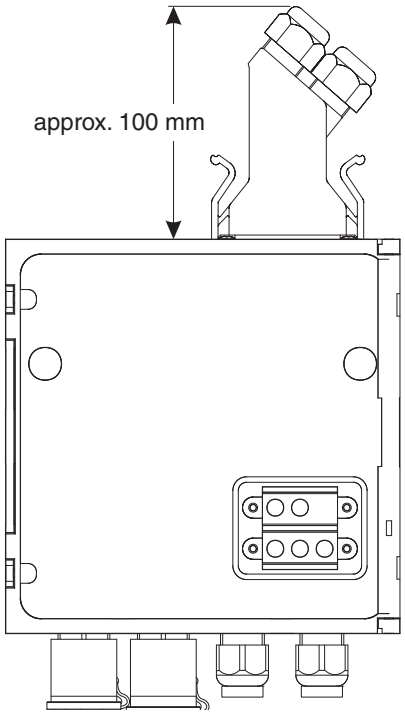


Fig. 3-2 IQ SENSOR NET with Phoenix connector

Pin assignment of the connector

Pin	Color*	Name	Function
1			-
2			-
3	Red	B line	Positive RxD/TxD according to RS 485 specification
4		RTS	Request To Send
5		GND BUS	Reference potential for data lines and terminating resistors
6		+5 V BUS	Supply voltage for terminating resistors
7			-
8	Green	A line	Negative RxD/TxD according to RS 485 specification
9			-

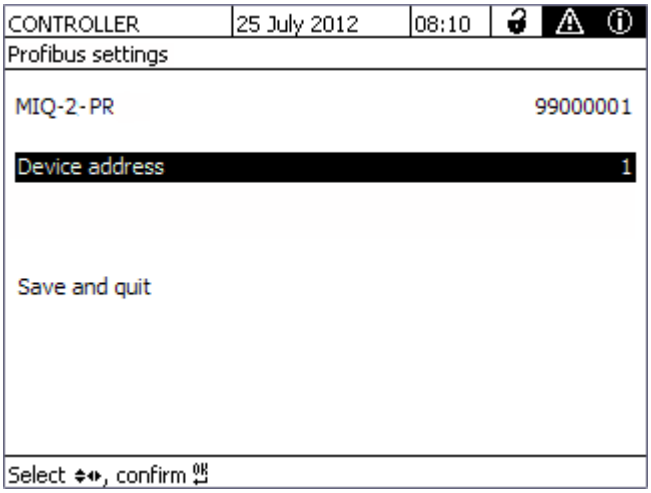
* Wire colors when using a standard PROFIBUS cable.

Please observe the operating manual of the connector.

3.4 Setting the PROFIBUS address

Proceeding: Setting the PROFIBUS address on the IQ SENSOR NET

1	Using **<S>**, open the *Settings* menu.
2	Press **<▲▼◀▶>** and **<OK>** to select and confirm the menu item, *Settings bus interfaces*.
3	Press **<▲▼◀▶>** and **<OK>** to select and confirm the bus interface.



4	Edit the setting table.

To accept all settings, you have to highlight the *Save and quit* menu item at the lower end of the setting table and to confirm with **<OK>**. If you exit the setting table via **<M>**, **<ESC>**/*Quit* or the *Quit* menu item, all changes are ignored.

3.5 GSD file

The GSD file contains all necessary information on the Profibus module and is required by the configuration program of the Profibus master.

The current GSD file is provided on the Internet under www.WTW.com.

3.6 Transmitted sensor data

3.6.1 Overview

Course of the data transmission

The basis for data transmission between the PROFIBUS master and IQ SENSOR NET is formed by the unique assignment of a sensor to its sensor number (Sxx) in the IQ SENSOR NET system. The sensor numbers are assigned by the system in the order in which the sensors are recognized by the system.

The sensor number (Sxx) is the identification for a sensor. The sensor number is always transmitted in the first byte of the output and input data. Thus the PROFIBUS master can clearly query data of individual sensors.

The data is transferred in two steps:

- The Profibus master transmits the request to the IQ SENSOR NET to supply data for the sensor with a certain sensor number.
- The IQ SENSOR NET checks whether the requested sensor number is present and returns the data for the sensor with the respective sensor number to the PROFIBUS master.

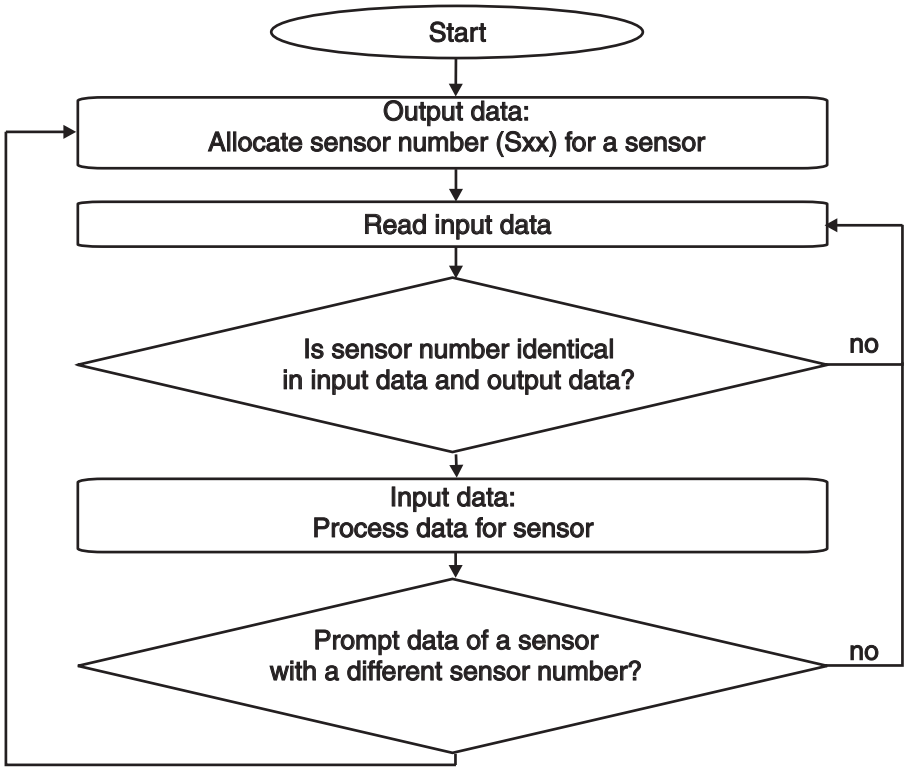


Fig. 3-3 Course of the data transmission in the PROFIBUS master

Transmitted sensor data

The following data for a sensor is transmitted to the PROFIBUS master as a consistent data block:

- Sensor number (Sxx)
- Sensor status
- Sensor model
- Status info of sensors
- Measuring mode
- Measured value status (main and secondary measured value)
- Main measured value
- Secondary measured value

The transmitted data of all IQ SENSOR NET sensors is given in the WTW document, "IQ SENSOR NET sensors: encoded data for field bus communication" (ba75560de). It is constantly updated with the appearance of new sensors and changes to the sensor software (insofar as they affect the transferred sensor data). The latest version is available on the Internet, in the download area for operating manuals. Use the search function for the download and search for "ba75560de".

Before further processing check the sent data for agreement of the requested and sent sensor number (Sxx).

3.6.2 Sensor administration under PROFIBUS

Preparation of the IQ SENSOR NET for communication with the PROFIBUS may require, e.g. the following:

- Creating an IQ SENSOR NET system with specific assignment of sensor numbers to sensors
- Creating several IQ SENSOR NET systems with the identical assignment of sensor numbers to sensors
- Changing the order of the sensors in an already installed system

Creating the assignment of sensor numbers

You want to install an IQ SENSOR NET system and, at the same time, to create a specific sequence of sensor number assignments to the sensors.

1	Carry out a system start without any sensors (see system operating manual).
2	Connect the sensors to the system in the required order. With each sensor wait until the system has recognized the sensor.

Changing the assignment of sensor numbers

You want to change the assignment of sensor numbers to the sensors in an already running IQ SENSOR NET system.

1	Unplug all sensors from the IQ SENSOR NET.

When the inactive datasets are deleted, all settings for the sensors are deleted as well.

2	Delete all inactive datasets in the list of sensors (see System operating manual, chapter *Deleting inactive datasets of sensors*).
3	Connect the sensors to the system in the required order. For each sensor, wait until the sensor is recognized by the system (see System operating manual, chapter Installation).

Creating the identical assignment of sensor numbers in several systems

You want to install several identical IQ SENSOR NET systems and, at the same time, to create the same sequence of sensor number assignments to the sensors in all systems.

1	Carry out a system start without any sensors (see System operating manual, chapter Installation).
2	Connect the sensors to the system in the required order. For each sensor, wait until the sensor is recognized by the system (see System operating manual, chapter Installation).
3	Repeat steps 1 and 2 for all other systems and, while doing so, keep to exactly the same order when connecting the sensors.

3.6.3 Output data

(1 byte - from the PROFIBUS master to the IQ SENSOR NET)

Address	Information	Bit
Offset 0h	Sensor number (Sxx) in the IQ SENSOR NET (Int8)	Bit 7-0

3.6.4 Input data

(16 bytes - from the IQ SENSOR NET to the PROFIBUS master)

Address	Information	Bit
Offset 0h	Sensor number (Sxx) (Int 8)	Bit 7-0
Offset 1h	Sensor status (Int8)	Bit 7-0
Offset 2h	Sensor model (Int16)	Bits 15-8
Offset 3h		Bit 7-0
Offset 4h	Status info (Int16)	Bits 15-8
Offset 5h		Bit 7-0
Offset 6h	Measuring mode (Int8)	Bit 7-0
Offset 7h	Measured value status (Int8) Main measured value bits 7-4 Secondary measured value bits 3-0	Bit 7-0
Offset 8h	Main measured value (IEEE-754 floating point, 32-bit)	Bits 31-24
Offset 9h		Bits 23-16
Offset Ah		Bits 15-8
Offset Bh		Bit 7-0
Offset Ch	Secondary measured value (IEEE-754 floating point, 32-bit)	Bits 31-24
Offset Dh		Bits 23-16
Offset Eh		Bits 15-8
Offset Fh		Bit 7-0

3.6.5 Data formats

Measured values

The data for the main and secondary measured values are transmitted in the IEE-754 standard 32-bit floating point format.

Address	Bit representation	
	MSB* LSB*	
Offset 0h bits 31-24	S E E E E E E E	S = sign (bit 31) E = exponent (bits 30-23) M = mantissa (bits 22-0)
Offset 1h bits 23-16	E M M M M M M M	
Offset 2h bits 15-8	M M M M M M M M	
Offset 3h bits 7-0	M M M M M M M M	

* MSB = Most significant bit, LSB = Least significant bit

If not all of the bits of the exponent are 0, the value is calculated according to:

$$V = -1^{S} \cdot 2^{E-127} \cdot (1 + M_{b22} \cdot 2^{-1} + M_{b21} \cdot 2^{-2} + M_{b20} \cdot 2^{-3} + ... + M_{b0} \cdot 2^{-23})$$

If all of the bits of the exponent are 0, the value is calculated according to:

$$V = -1^{S} \cdot 2^{-126} \cdot (M_{b22} \cdot 2^{-1} + M_{b21} \cdot 2^{-2} + M_{b20} \cdot 2^{-3} + ... + M_{b0} \cdot 2^{-23})$$

A value is 0 if all the bits of both the exponent and the mantissa are 0.

If the measured value is equal to 0, check the measured value status. If the measured value status is not equal to 1, an error has occurred and the measured value is invalid.

Sensor model Status info

The data for the sensor model and status info is transmitted as INT16, i.e. consists of 2 bytes. The assignment is carried out in Motorola format (the higher value byte first).

Address	Bit representation	Information
	MSB LSB	
Offset 0h bits 15-8		High byte
Offset 1h bits 7-0		Low byte

Measured value status

The data for measured value status of the main and secondary measured values are encoded jointly into a single byte. Bits 7-4 encode the status of the main measured value, bits 3-0 encode the status of the secondary measured value.

Other data

All other data always consist of only a single byte (Int8).

4 What to do if ...

Data transmission between the Profibus master and IQ SENSOR NET is faulty

Cause	Remedy
– Incorrect wiring of the PROFIBUS cable on the connector	– Check/change the connections (see section 3.3) – Use checklist according to section 3.2
– Incorrect setting of the address	– Check/change the setting of the address (see section 3.4)
– Incorrect protocol	– Check the version of the GSD file – Adapt the protocol
– MIQ/2-PR module defective	– Return the MIQ/2-PR module to WTW

The PLC does not receive any plausible input data

Cause	Remedy
– Input data and output data are not consistent	– When programming the PLC, define input data and output data as consistent over the entire data length
– The data interpretation of the PLC is not correct	– Observe the data alignment of the PLC data representation. If necessary, exchange the high-order and low-order bytes word by word

5 Technical data

5.1 IQ SENSOR NET component, MIQ/2-PR

General technical data for the IQ SENSOR NET are given in the system operating manual for the System 2020 XT (CONNECT / USB) system.

Electrical data

Nominal voltage	Max. 24 VDC via the IQ SENSOR NET (for details, see chapter TECHNICAL DATA of the IQ SENSOR NET system operating manual).
Power consumption	2,0 W
Protective class	III
Number of MIQ/2-PR in an IQ SENSOR NET system	1

Instrument safety

Applicable norms	– EN 61010-1 – UL 61010-1 – CAN/CSA C22.2#61010-1

Terminal connections

IQ SENSOR NET connections	2 2 additional SENSORNET terminators that can be activated (terminating resistors)
Terminal type	Screw-type terminal strip, accessible by raising the lid
Terminal ranges	Solid wires: 0.2 ... 4.0 mm^2 AWG 24 ... 12 Flexible wires: 0.2 ... 2.5 mm^2
Cable feeds	4 cable glands M16 x 1.5 on the underside of the module

USB connection

USB-A socket for software updates

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