# JUMO digiLine pH

Intelligent electronics with digital interface or analog output for pH sensors



Operating Manual

20270510T90Z001K000

V2.00/EN/00621029

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## 1.1 Safety signs

### 1.1.1 Warning symbols



**DANGER!**

This symbol indicates that **personal injury caused by electrical shock** may occur if the respective precautionary measures are not carried out.



**WARNING!**

This symbol in connection with the signal word indicates that **personal injury** may occur if the respective precautionary measures are not carried out.



**CAUTION!**

This symbol in connection with the signal word indicates that **material damage or data loss** will occur if the respective precautionary measures are not taken.



**CAUTION!**

This symbol indicates that **components could be destroyed** by electrostatic discharge (ESD = Electro Static Discharge) if the respective cautionary measures are not taken.

Only use the ESD packages intended for this purpose to return device inserts, assembly groups, or assembly components.



**READ THE DOCUMENTATION!**

This symbol, which is attached to the device, indicates that the associated **documentation for the device** must be **observed**. This is necessary to identify the nature of the potential hazard, and to take measures to prevent it.

### 1.1.2 Note symbols



**NOTE!**

This symbol refers to **important information** about the product, its handling, or additional use.



**REFERENCE!**

This symbol refers to **additional information** in other sections, chapters, or other manuals.



**FURTHER INFORMATION!**

This symbol is used in tables and indicates that **further information** is provided after the table.



**DISPOSAL!**

At the end of its service life, the device and any batteries present do not belong in the trash! Please ensure that they are **disposed of** properly and in an **environmentally friendly** manner.

# 1 Safety information

## 1.2 Intended use

The device described in these instructions is used to measure analytical process variables in liquids in an industrial environment as specified in the technical data. Other uses beyond those defined are not viewed as intended uses.

The device is built according to the relevant standards and directives as well as to the applicable safety regulations. Nevertheless, improper use, incorrect installation or configuration can result is erroneous measurements. Depending on the plant, this may cause unwanted control actions (e. g. overmetering) in the plant. Personal injury and property damage must be prevent through appropriate safety measures and safety devices provided by the customer.

To avoid danger, only use the device:

- for the intended use
- when in good order and condition
- In compliance with these instructions



**WARNING!**

**Error during installation, mounting, or configuration of JUMO sensors with digiLine electronics can disrupt proper execution of the downstream process or cause damage.**

▶ For this reason, it is always necessary to provide safety devices that are independent of the device and to allow settings to be made only by technical personnel.



**CAUTION!**

**JUMO sensors with digiLine electronics must be calibrated correctly to prevent measurement errors.**

## 1.3 Qualification of personnel

This manual contains the necessary information for the intended use of the device described therein.

It is meant for technically qualified individuals who have been specially trained or have the appropriate know-how in the field of automation technology (measurement and control instrumentation).

Understanding and technically correct observance of the safety instructions and warnings contained in this manual are prerequisites for safe mounting, installation, and startup as well as safety during operation of the described device. Only qualified individuals have the required technical knowledge to interpret and put into practice the safety instructions and warnings used in this manual in any given situation.

# 2 Acceptance of goods, storage, and transport

## 2.1 Checking the delivery

- On delivery, ensure that the packaging and its contents are undamaged.
- Check the delivery for completeness against the packing slip and order confirmation.

Proceed as follows if external transport damage is visible:

- Do not accept the delivery or only conditionally.
- Note the extent of damage on the transport documents or on the delivery note of the freight forwarder.
- File a complaint.

## 2.2 Important information about storage and transport

- Store the device in a dry, clean environment. Observe the admissible ambient conditions (see "Technical data" chapter 13.6 "Case", page 50).
- Protect the device from shock during transport. The original packaging offers optimal protection.

## 2.3 Returning goods

If repairs are needed, return the device in clean condition and in its entirety.

Use the original packaging when returning the device.

### 2.3.1 Accompanying letter for repair

Please include the completed accompanying letter for repair when returning goods. Do not forget to state the following:

- Description of the application
- Description of the error that has occurred

The accompanying letter for repair is linked to www.jumo.de on the Internet under the heading Service & Support as follows:

Product Service > Repair Service > Returning Electrodes

### 2.3.2 Decontamination Statement

As a certified company and in compliance with legal requirements, JUMO is required to handle all incoming products that come into contact with liquids in compliance with statutory regulations.

Before returning a device for repair or calibration:

- Remove all adhering residues of the substance measured.
  Pay special attention to grooves for seals and cracks where residues of the material being measured may adhere. This is especially important when the material being measured is a hazardous substance.

In addition to the accompanying repair letter, include the following in the return shipment:

- The completed and signed "Declaration Statement". Only then can the returned device be accepted.
  The decontamination statement can be found on the last page of the above-mentioned accompanying repair letter.
- Special handling instructions, if these are necessary, e.g. a safety data sheet.

### 2.3.3 Protection against electrostatic discharge

(ESD = **e**lectro **s**tatic **d**ischarge)

To prevent damage from ESD, electronic assemblies, or components with a high internal resistance must be handled, packaged, and stored in an environment that protects against ESD. Measures that protect against electrostatic discharge and electric fields are described in DIN EN 61 340-5-1 and DIN EN 61 340-5-2 "Electrostatics – Part 5-2 – Protection of electronic devices from electrostatic phenomena".

If you are returning electronic assemblies or components for repair:

- Pack sensitive components only in an environment providing protection against ESD. Workspaces such as this divert electrostatic charges to ground in a controlled manner and prevent static charges due to friction.
- Use only packaging intended specifically for ESD-sensitive assemblies/components. These must consist of conductive plastics.

Keep in mind that the manufacturer assumes no liability for damage caused by ESD.



**CAUTION!**

**Electrostatic charges occur in non-ESD-protected environments.**

Electrostatic discharges can damage modules or components.

▶ For transport purposes, use only the ESD packaging provided.

## 2.4 Disposal

**Disposing of the device**

**DISPOSAL!**
Devices and/or replaced parts should not be placed in the refuse bin at the end of their service life as they consist of materials that can be recycled by specialist recycling plants.



Dispose of the device and the packaging material in a proper and environmentally friendly manner.

For this purpose, observe the country-specific laws and regulations for waste treatment and disposal.

**Disposing of the packaging material**

The entire packaging material (cardboard packaging, inserts, plastic film, and plastic bags) is fully recyclable.

## 3.1 Introduction

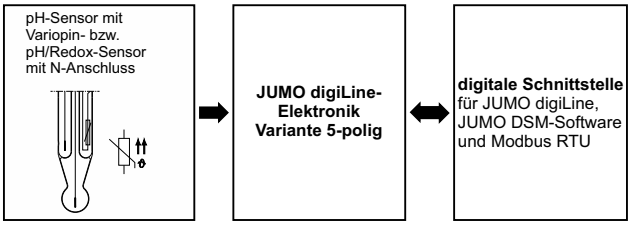
**General information**
JUMO digiLine electronics permit transmission of the measured value from the sensor to the measuring or automation device via digital bus communication or as an analog signal. The digital device version has a 5-pole, the analog version an 8-pole M12 plug connector. The 5-pole digiLine electronics supports plug & play operation on the JUMO AQUIS touch S/P or in Modbus operation on the JUMO mTRON T. Several sensors continuously transmit their measurement data over the bus to a master. As an alternative, the 8-pole device version can also be used. It is designed as a 2-wire transmitter with analog output and transmits measured values in the form of a scalable standard signal (4 to 20 mA). The 8-pole device version features a digital input that can be configured as a switching signal of the analog output value between pH measured value and temperature value as well as a hold signal for the analog output value. Additionally, the digital input for the measurement inputs of the 8-pole device version can be configured as a hold signal.

**Mounting and connecting**
JUMO digiLine electronics is available with N-connection for commercially available pH sensors or with Variopin connection for JUMO sensors with an integrated temperature probe and is simply attached to the sensor and screwed tight. If it is necessary to replace the sensor because of a defect or wear, the transmitter can be unscrewed and used again on the new sensor. The threaded connection between the sensor and transmitter guarantees protection type IP66 and IP67 to prevent malfunctions caused by ingress of moisture. The electrical connection is established easily and quickly by attaching (plug in and screw on) a preassembled bus cable (available from JUMO).

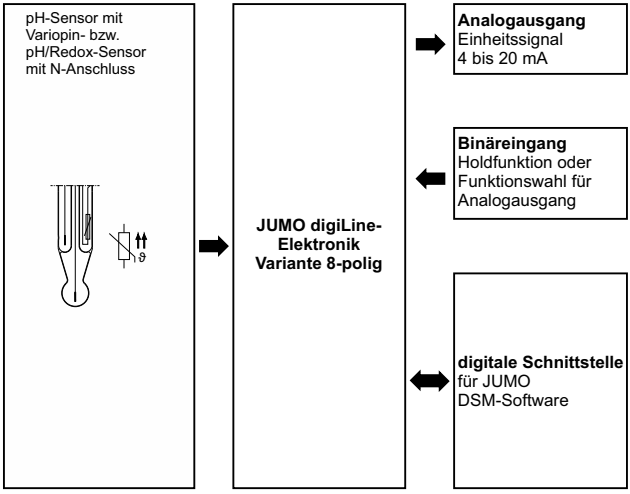
**Configuration, parameterization and calibration**
Normally, the 5-pole JUMO digiLine electronics are configured, parameterized, and calibrated via operation on the JUMO AQUIS touch S/P. The calibration, however, also be conveniently carried out in the laboratory on a PC using the JUMO DSM-Software (**D**igital **S**ensor **M**anagement software). The 8-pole device version is configured, parameterized, and calibrated via the JUMO DSM software. With the USB-RS485 interface (part no.: 00638346), the electronics must be connected to a PC.

## 3.2 Block diagram

**5-polige Geräteausführung**

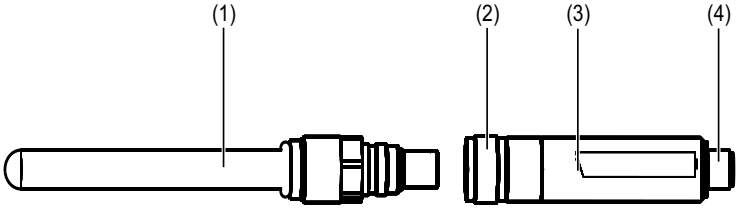



**8-polige Geräteausführung**



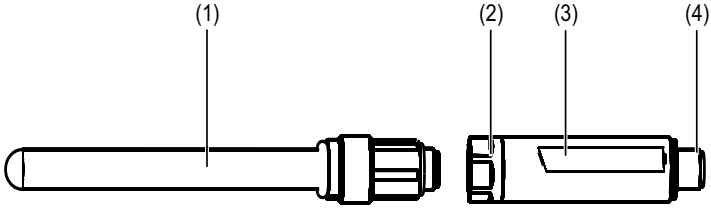
## 3.3 Device setup

**JUMO digiLine electronics with Variopin connection**




(1) Sensor with Variopin connection
(2) Variopin connection of digiLine electronics
(3) JUMO digiLine electronics
(4) M12 plug connector, 5 or 8-pole (see order details)

**JUMO digiLine electronics with N connection**




(1) Sensor with N-connection
(2) N-connection of digiLine electronics
(3) JUMO digiLine electronics
(4) M12 plug connector, 5 or 8-pole (see order details)

# 3 Device Description

## 3.4 Description

**Digital interface**

The digital interface is the heart of the JUMO digiLine electronics. This interface handles communication over the bus by means of the JUMO digiLine protocol. The plug & play support for the JUMO digiLine electronics simplifies sensor startup considerably. After connecting to the JUMO AQUIS touch S/P, the JUMO digiLine electronics are configured automatically and ready for use immediately.
As an alternative to JUMO digiLine operation with plug & play support on the JUMO AQUIS touch S/P, Modbus operation (Modbus-RTU) on the JUMO mTRON T with access to the measured data is also possible. The JUMO digiLine electronics are then configured via the JUMO DSM software.

**analog output**

The device version with an 8-pole M12 plug connector has an analog output for operation as a 2-wire transmitter. The analog output provides the measured value of the temperature input as a freely-scalable unit signal of 4 to 20 mA. With the digital input, the analog signal on sensors with integrated temperature probe can be switched over from the pH measured value to the temperature measured value or a hold function for activating the output of a configurable substitute value. The RS485 interface serves to connect to the PC in order to configure the 8-pole JUMO digiLine electronics using the JUMO DSM software.

**Digital input**

The digital input (available only in the variant with 8-pole M12 plug connector) can be configured for the following functions:

- Activation of hold function for the analog output
- Switching the analog output from pH measured value to temperature measured value
- Activation of hold function for the measurement input signals

**Temperature compensation**

Temperature compensation is handled by the digiLine electronics. When a JUMO pH sensor with integrated temperature probe is used, the digiLine electronics can obtain the temperature compensation directly from the sensor. Alternatively, the compensation temperature can be transmitted from the digiLine master device (JUMO AQUIS touch S/P) or a fixed temperature can be specified in the configuration of the digiLine electronics.

**Calibration**

The calibration of sensors with JUMO digiLine electronics can either be performed in the field on the JUMO AQUIS touch S/P or at a laboratory workstation using the JUMO DSM software. The calibration data are saved in the JUMO digiLine electronics of the sensor. The sensor calibration can therefore be performed ahead of commissioning, so that the sensor with its JUMO digiLine electronics can then simply be mounted on the system. This reduces the plant downtime to a minimum when it becomes necessary to replace the sensor.

**Calibration timer**

The JUMO digiLine electronics has a calibration timer which, after a set calibration interval has lapsed, is able to trigger a reminder for the due sensor calibration on the JUMO AQUIS touch S/P. The calibration interval setting can be edited via the configuration menu of the JUMO AQUIS touch S/P or using the JUMO DSM software. At each sensor calibration, the calibration interval is restarted.

**Calibration logbook**

The JUMO digiLine electronics contain a calibration logbook in which the last 10 calibration operations are saved with the date, time, and calibration values. This logbook provides an overview of the calibration history of the sensor. The calibration logbook can be read-out either at the JUMO AQUIS touch S/P or using the JUMO DSM software on the PC. There is no limit to the number of saved calibration logbook entries for JUMO digiLine electronics in the JUMO DSM software.

**Sensor information**

Numerous data such as type information, operating data, information on measuring point identification etc. are stored in the JUMO digiLine electronics. This information allows clear identification and optimal management of each sensor. All these data can be viewed on the JUMO AQUIS touch S/P or using the JUMO DSM software.

**Sensor monitoring**

To monitor the stress on the sensor from sensor cleaning, counters for autoclaving, CIP, and SIP cycles are incorporated. CIP and SIP cycles are recognized automatically on the basis of the criteria specified in the configuration for sensor monitoring. The autoclaving counter is incremented manually with the JUMO DSM software. The counters for the autoclaving, CIP, and SIP cycles each retain the number of cleaning processes performed. The counter readings can be queried on the JUMO AQUIS touch S/P in order to assess the wear status of the sensor. Upon reaching a configured counter reading, an alarm is signaled on the digiLine master. After a sensor has been replaced, the counters are reset with the JUMO DSM software.

**Sensor stress**

To assess the stress on the sensor from the thermal and chemical environment, the current "sensor stress" is calculated on the basis of the measurement data provided by the sensor. In the JUMO digiLine electronics, an alarm signal for the sensor stress can be configured. When a critical sensor stress level on the master is reached, this signals a sensor stress alarm.

**JUMO Digital Sensor Management Software for the PC**

The JUMO DSM software (DSM stands for **D**igital **S**ensor **M**anagement) can be used to manage, calibrate, and test JUMO digiLine electronics on the PC. It also serves as a configuration tool for JUMO digiLine electronics in the 8-pole device version (2-wire transmitter with analog output). The connection to the PC is achieved via a USB-RS485 interface (part no.: 00655787). The JUMO DSM software adds data from the memory of JUMO digiLine electronics to its sensor database. The sensor database holds calibration logbook entries, histories about replaced sensors and configuration changes to the JUMO digiLine electronics. If the JUMO digiLine electronics are to be mounted to a new sensor, data for the new sensor can be reset via the JUMO DSM software and the information from the old sensor archived on the PC.

# 3 Device Description

## 4.1 Order details

| | (1) | Basic type |
|---|---|---|
| 202705/10 | | JUMO digiLine pH value, temperature |
| 202705/20 | | JUMO digiLine redox |
| 202705/30 | | JUMO digiLine temperature |
| | (2) | Electrical connection input |
| 86 | | Cable socket N |
| 90 | | VP socket |
| | (3) | Output |
| 530 | | RS-485 Modbus |
| 888 | | Actual value output, configurable |

| | (1) | | (2) | | (3) |
|---|---|---|---|---|---|
| **Order code** | | - | | - | |
| **Order example** | 202705/10 | - | 90 | - | 530 |

## 4.2 Accessories

**Accessories**

| Basic type | Part no. |
|---|---|
| JUMO M12 digiLine master connecting cable[a] 5-pole, A-coded, 10 m long | 00638341 |
| JUMO M12-digiLine master connecting cable[a] 5-pole, A-coded 5 m long | 00638337 |
| JUMO M12-digiLine master connecting cable[a] 5-pole, A-coded 1.5 m long | 00638333 |
| JUMO M12 connecting cable 5-pole 15 m | 00638324 |
| JUMO M12 connecting cable 5-pole 10 m | 00638322 |
| JUMO M12 connecting cable 5-pole 5 m | 00638315 |
| JUMO M12 connecting cable 5-pole 1.5 m | 00638313 |
| JUMO M12 connecting cable 5-pole 0.5 m | 00638312 |
| JUMO Y-splitter 5-pole | 00638327 |
| JUMO digiLine hub | 00646871 |
| JUMO power supply unit for JUMO digiLine hub | 00661597 |
| JUMO M12 terminating connector | 00461591 |
| JUMO M12 adapter cable 8-pole socket to 5-pole connector, A-coded | 00638325 |
| M12 cable socket, 8-pole | 00444312 |
| M12 cable socket, 8-pole, shielded | 00486503 |
| digiLine USB-RS485 interface | 00638346 |
| JUMO DSM software (**D**igital **S**ensor **M**anagement) | 00655787 |

[a] For connection to masters with screw or spring-cage terminals; prepare one end of the cable with a 5-pole M12 plug and the other end with ferrules.

# 4 Identifying the device version

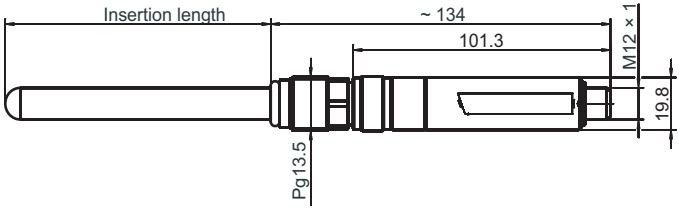
## 5.1 Mounting site and climatic conditions

The installation site should be, as far as possible, free from vibration. Electromagnetic fields, caused by equipment such as motors and transformers, should be avoided. The ambient temperature at the mounting site and the relative humidity must correspond to the technical data. Aggressive gases and vapors have a negative effect on the operating life of the device.

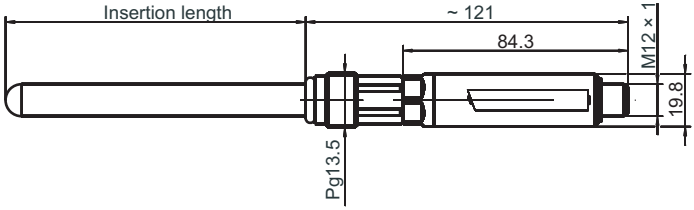
## 5.2 Dimensions

The following dimensioned drawings give the dimensions of sensors with JUMO digiLine electronics. The insertion length varies and depends on the type of sensor to which the digiLine electronics are connected.

**Dimensions of sensor with JUMO digiLine electronics with Variopin connection**



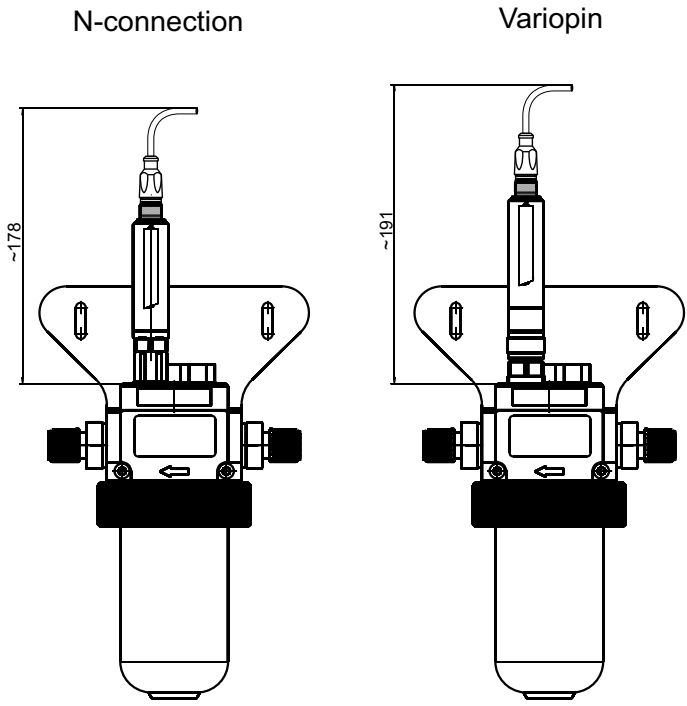

**Dimensions of sensor with JUMO digiLine electronics with N-connection**



## 5.3 Mounting

JUMO digiLine electronics are simply attached to the N or Variopin plug connector of a JUMO sensor and screwed to the sensor using the union nut of the digiLine electronics. The sensor with attached digiLine electronics is mounted on the fitting provided for this purpose. For correct mounting of the sensor, refer to the installation instructions for your fitting. Tighten the union nuts on the M12 cable sockets of the connecting table to a maximum torque of 0.5 Nm.

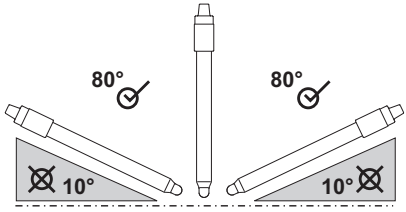
**Installation examples in the flow fittings**



**CAUTION!**

- ORP and pH sensors must be installed as close to vertically as possible! The angle may not exceed 80° from vertical.

**Installation position of ORP and pH sensors**



# 5 Mounting

## 6.1 Installation notes

**CAUTION!**

**Disconnecting the digiLine bus line and/or removing the terminating resistors and terminating connectors during operation will disrupt the digiLine bus**

Possible consequences include bus problems with loss of the sensor values on the bus involved and damage to the associated serial interface on the master.

▶ Before changing the bus cable and disconnecting the bus termination, the master should be switched off.

## 6.2 Connection diagram

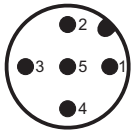
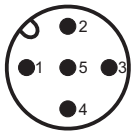
**General information**

The line connections of JUMO sensors with digiLine electronics are, with few exceptions, made using preassembled bus connecting cables. The union nuts on the cable connecting sockets are tightened to a maximum torque of 0.5 Nm. The pin assignment shown here is intended primarily to provide an overview and serve as an aid when troubleshooting.

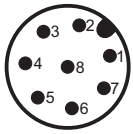
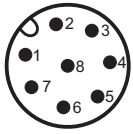
Situations where wiring activities are needed include:

- The connection to the serial interface of a JUMO AQUIS touch S/P or JUMO mTRON T with the JUMO M12-digiLine master connecting cable
  ⇨ chapter 4.2 "Accessories", page 15
- Connection of an 8-pole JUMO digiLine electronics as a 2-wire transmitter; in this case, the customer must provide an 8-pole, A-coded M12 socket with a piece of cable. ⇨ "Variant with 8-pole M12 plug connector, A-coded", page 22

**Variant with 5-pole M12 plug connector, A-coded**

| Pin | Potential | Symbol |
|---|---|---|
| 1 | +5 V (supply to digiLine electronics) | Connector   Socket   |
| 2 | not connected | |
| 3 | GND | |
| 4 | RS485 B (RxD/TxD-) | |
| 5 | RS485 A (RxD/TxD+) | |
| The connection to the serial interface of a master with screw or spring-cage terminals is made with the aid of the JUMO digiLine device connection cable (see Accessories) | | |

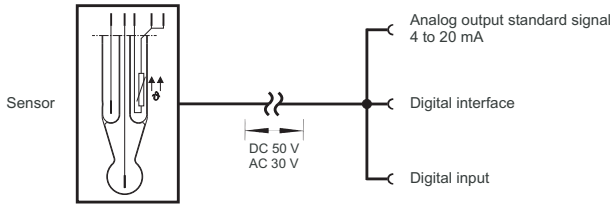
**Variant with 8-pole M12 plug connector, A-coded**

| Pin | Potential | Plug connector symbol |
|---|---|---|
| 1 | +5 V (supplied only when connected to PC)[a] | Connector   |
| 2 | Not used | |
| 3 | GND | |
| 4 | RS485 B (RxD/TxD-) | |
| 5 | RS485 A (RxD/TxD+) | |
| 6 | Digital input for potential-free contact to GND | |
| 7 | Analog output of 4 to 20 mA +[b] | |
| 8 | Analog output of 4 to 20 mA -[b] | |
| For connection as a 2-wire transmitter with a standard signal (4 to 20 mA), a connecting cable with 8-pole M12 cable socket must be provided by the customer. | | Socket   |

[a] The supply of DC 5 V is allowed only when connected to a PC for configuring with the JUMO DSM software, and is provided from the USB-RS485 interface.

[b] In the 2-wire transmitter mode, the transmitter is supplied solely via the current loop (pins 7 and 8). Refer to the appropriate connection examples. The voltage supply for the current loop must be galvanically isolated.

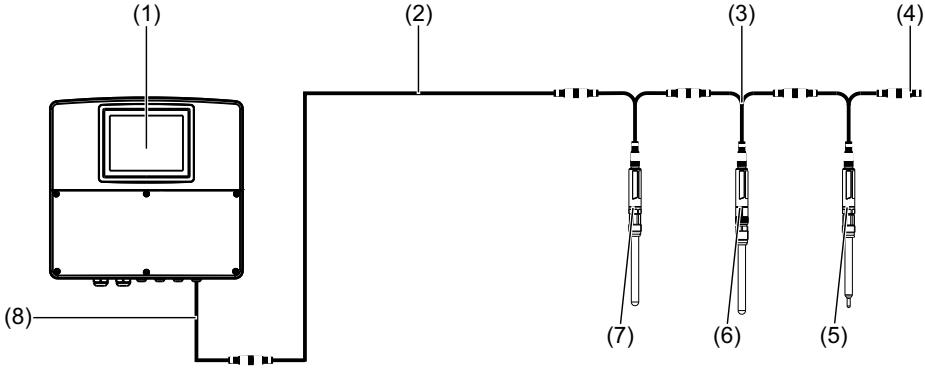
### 6.2.1 Galvanic isolation



### 6.2.2 Connection examples

**JUMO digiLine mode**

The installation example of a neutralization system is displayed. 3 sensors (pH, ORP, and temperature) with JUMO digiLine electronics are connected to a JUMO AQUIS touch S. JUMO Y-splitters are used to attach the connections on the sensors to the JUMO digiLine electronics. Appropriate fittings are available from JUMO for mounting the sensors.




(1) JUMO AQUIS touch S with RS485 bus terminator in the device

(2) JUMO M12 connecting cable, 5-pole and A-coded;
the required total line length between master and sensors can be achieved by combining several M12 connecting cables. When planning the line lengths, heed the information regarding cable planning in the Annex of the operating manual for the JUMO AQUIS touch S/P.

(3) JUMO Y-splitter, 5-pole with 2× M12 cable sockets and 1× M12 connector, each of which is A-coded

(4) JUMO M12 terminating connector, 5-pole for bus termination

(5) JUMO compensation thermometer with 5-pole JUMO digiLine electronics
Order example: Compensation thermometer 201085/89-1005-21-120 with
JUMO digiLine-T: 202705/30/86-530

(6) JUMO pH sensor with 5-pole JUMO digiLine electronics
Order example: pH sensor 201021/10/12-04-22-120/000 with
JUMO digiLine pH: 202705/10/86-530

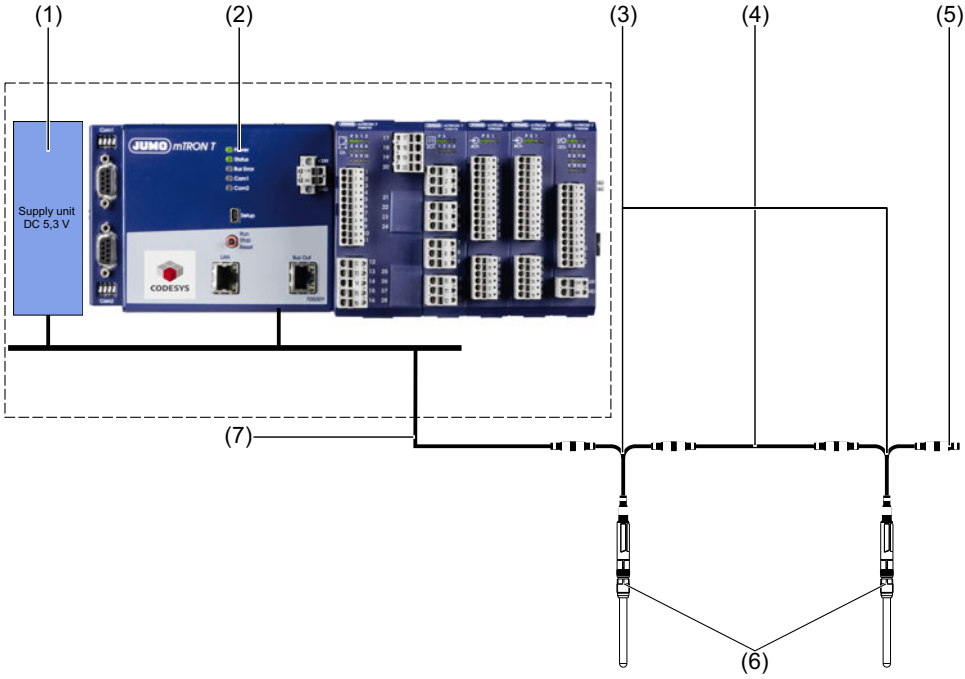
(7) JUMO redox sensor with 5-pole JUMO digiLine electronics
Order example: redox sensor 201026/10/22-04-22-120 with
JUMO digiLine-ORP: 202705/20/86-530

(8) JUMO digiLine master connecting cable with exposed wire ends at one end for connection to devices with screw or spring-cage terminals (see Accessories); connection is described in the operating manual of the JUMO AQUIS touch S/P.

# 6 Electrical connection

**Modbus mode**

The figure shows the connection of 2 sensors with JUMO digiLine electronics with 5-pole M12 plug connection on a JUMO mTRON T as the Modbus master. Up to 31 digital sensors per RS485 interface can be integrated. Optionally, a JUMO mTRON T central processing unit can be equipped with up to 2 RS485 interfaces (see order data for JUMO mTRON T).




(1) Stabilized power supply unit with DC 5.3 V output for feeding the digital sensors

(2) JUMO mTRON T central processing unit with activated PLC function and RS422/485 Modbus RTU (see order data for JUMO mTRON T)

(3) JUMO Y-splitter, 5-pole with 2× M12 cable sockets and 1× M12 connector, each of which is A-coded

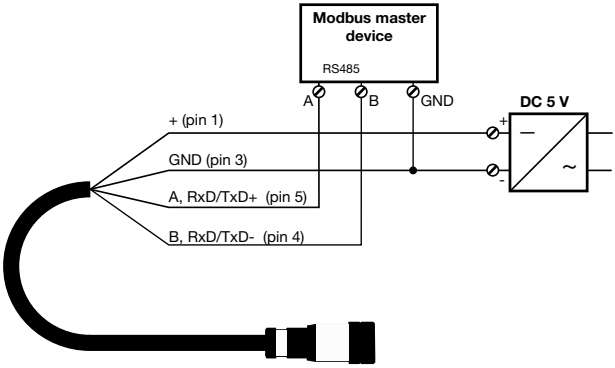
(4) JUMO M12 connecting cable, 5-pole and A-coded

(5) JUMO M12 terminating connector, 5-pole for bus termination

(6) JUMO sensors with 5-pole JUMO digiLine electronics

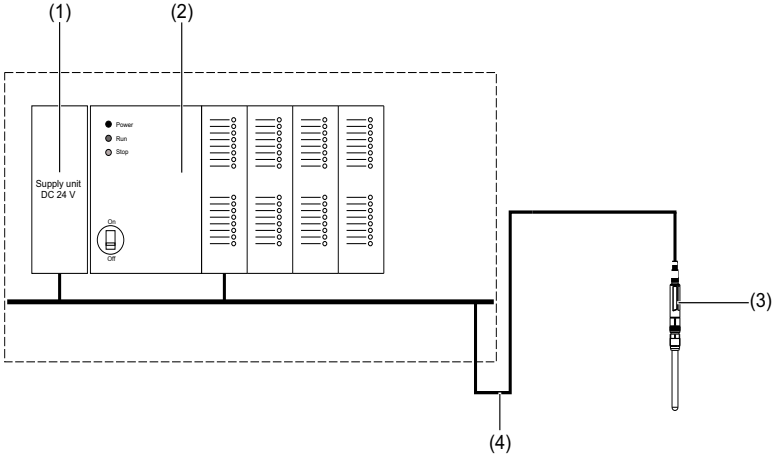
(7) JUMO digiLine master connecting cable with open wire ends at one end for connection to devices with screw or spring-cage terminals (see Accessories); for connection to the Modbus system, refer to the wiring diagram in the following.

**Wiring diagram for Modbus mode**



**8-pole version for operation with 2-wire transmitter (standard signal 4 to 20 mA)**

The figure shows the connection of 1 sensor with JUMO digiLine electronics with 8-pole M12 plug connector on a measuring or automation device as 2-wire transmitter with standard signal of 4 to 20 mA. In addition a potential-free contact, in the receiving automation device, which controls activation of the hold function or selection of the function of the analog output via the digital input on the JUMO digiLine electronics. In this way, it is possible to toggle the measured value, e. g. with a PLC. The 8-pole device version is intended primarily for use as a 2-wire transmitter with standard signal of 4 to 20 mA.



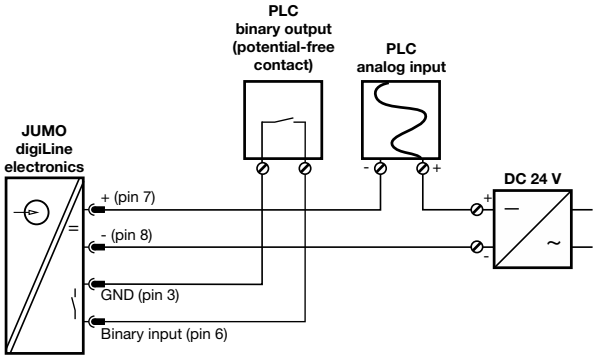

(1) Stabilized power supply unit with DC 24 V output to supply the automation system and the current loop (standard signal of 4 to 20 mA) and the JUMO digiLine electronics

(2) Measuring or automation device with analog input for the standard signal of 4 to 20 mA and control contact for toggling the measured value in the JUMO digiLine electronics of the sensor; the current loop for the standard signal must be supplied with an output voltage of DC 12 to 30 V by a stabilized power supply unit.

(3) JUMO sensor with 8-pole JUMO digiLine electronics

(4) Customer-provided connecting cable with 8-pole M12 cable socket for connecting to the JUMO digiLine electronics; for the connector assignment, refer to the wiring diagram in the following.

**Wiring diagram for 2-wire transmitter mode**



# 6 Electrical connection

### General information

Startup of the JUMO sensor with digiLine electronics in the 3 possible versions is described below:

- Sensor with digiLine electronics on a JUMO AQUIS touch S/P
- Sensor with digiLine electronics on a Modbus master
- Sensor with digiLine electronics as 2-wire transmitter for a standard signal of 4 to 20 mA



**CAUTION!**

**The electrical characteristics of analysis sensors are dependent upon numerous factors, e.g. aging and wear.**

For accurate measurements, analysis sensors must be calibrated.

▶ In the course of startup, it is necessary to ensure that the sensor was calibrated correctly. This can be done either during startup or also in advance on a PC with the JUMO DSM software.
⇨ chapter 11 "Calibrate", page 45



**WARNING!**

**Error during installation, mounting, or configuration of sensors with digiLine electronics can disrupt proper execution of the downstream process or cause damage.**

▶ For this reason, it is always necessary to provide safety devices that are independent of the device and to allow settings to be made only by technical personnel.

### Startup on a JUMO AQUIS touch S/P

The startup of JUMO sensors with digiLine electronics on a JUMO AQUIS touch S/P is largely automatic thanks to plug & play support. Newly connected digiLine electronics, however, must be assigned a device function by the user. The startup procedure consists essentially of the following stations:

- **Sensor Scan:** The first step involves searching for newly connected sensors with digiLine electronics. This is initiated either by a device restart or manual starting of the sensor scan by the user.
- **Sensor Link:** Known sensors with digiLine electronics are then assigned to the desired input functions of the JUMO AQUIS touch S/P by the user.

  Status after a successful Sensor Link step: NotInstalled

  Status after a failed Sensor Link step: NoLink
- **Sensor Install:** The JUMO AQUIS touch S/P synchronizes configuration data with the digiLine electronics and puts them into service.

  Status after a successful Sensor Install step: LinkActive
- **Sensor Transfer:** The digiLine electronics have been set up successfully and put into service

The exact procedure for performing startup is described in detail in the operating manual and installation instructions for the JUMO AQUIS touch S/P.

# 7 Startup

**Startup with a JUMO mTRON T as the Modbus master**

A JUMO mTRON T has no plug & play mechanisms. The settings of the digital interface to the digiLine electronics must be made prior to connection with the JUMO DSM software in accordance with the interface settings of the Modbus master.

- **Device address:** The user assigns to the digiLine electronics a device address that identifies it uniquely in the Modbus system. Duplicate device addresses are not allowed in a Modbus system; otherwise, malfunctions result.
- **Baud rate:** The baud rate must match that of the Modbus master.
- **Data Format:** The data format (data bits - stop bits - parity) must match the settings on the Modbus master.
- **Minimum Response Time:** The minimum response time provides an intentional response delay for the digiLine electronics in order to solve timing problems in the bus communication with slow Modbus masters. This setting can be changed if necessary.

The JUMO digiLine electronics are then configured on the PC via the JUMO DSM software. It is also possible, with write access to configuration parameters in the Modbus address table, to change the configuration parameters of the digiLine electronics. A detailed description of how to use the Modbus protocol can be found in the interface description.
⇨ JUMO DSM software operating manual
⇨ Modbus interface description B 202705.2.0

When correctly wired and configured, the JUMO digiLine electronics start operating immediately after the measuring or automation device to which it was connected is put into service.

**Startup as a 2-wire transmitter**

When correctly wired and configured, the JUMO digiLine electronics start operating immediately after the measuring or automation device is put into service and deliver the measured value as an analog standard signal (4 to 20 mA). Configuration takes place on the PC with the JUMO DSM software.
⇨ JUMO DSM software operating manual

## 7.1 Functional test

**Functional check on the PC**

The JUMO DSM software enables a sensor with JUMO digiLine electronics to be checked for proper operation. The software provides the ability to display current measured values on a PC.

⇨ JUMO DSM software operating manual

**Functional check on a JUMO AQUIS touch S/P**

On a JUMO AQUIS touch S/P, a JUMO sensor with digiLine electronics is displayed as "linked" as soon as it has been recognized correctly and set up. Further information can be found in the operating manual and installation instructions of the JUMO AQUIS touch S/P.

**Faults during operation in the JUMO digiLine or Modbus mode**

In the event of bus faults in JUMO digiLine or Modbus systems, check the following items:

- All plug-in and terminal connections in the bus must be made correctly and be tight. As long as bus communication in general is not disrupted (e.g. as the result of disconnected or short-circuited bus cables or missing terminating resistors), JUMO digiLine electronics which have been disconnected from the bus can be identified within the "Reference table" for the device software of the the JUMO AQUIS touch S/P. Further information in this regard can be found in the operating manual of the respective device.
- The ends of bus cables with line topology must have terminating resistors or terminating connectors (part no. 00461591). Stub lines do not require termination.
- The bus must be supplied correctly with DC 5 V (cf. chapter 6.2 "Connection diagram", page 21).

**Faults during operation in the 2-wire transmitter mode**

If faults occur during operation of 8-pole JUMO digiLine electronics a 2-wire transmitter, check the following items:

- All plug-in and terminal connections must be made correctly and be tight.
- The maximum load resistance for the current loop must not be exceeded.
  ⇨ chapter 13.3 "Analog output of 4 to 20 mA (only with M12 plug connector, 8-pole)", page 50
- The digiLine electronics must be supplied correctly with DC 12 TO 30 V (cf. chapter 6.2 "Connection diagram", page 21).

# 8 Troubleshooting in the event of faults

## 9.1 General Information

The JUMO digiLine electronics saves sensor information. The information saved includes sensor type, manufacturer, measuring point and operating conditions. These data can be viewed on the JUMO AQUIS touch S/P or using the JUMO DSM software.



**CAUTION!**

**An incorrect setting of the sensor type in the configuration of the digiLine electronics results in the "Sensor information" not matching the sensor actually used.**

The pre-alarms and alarms for extreme conditions are then based on the wrong limit values.

▶ When configuring the digiLine electronics, ensure correct selection of the electrode!

## 9.2 Sensor details

The sensor details provide an overview of sensor characteristics and settings. No data can be edited here.

| Data point | Explanation |
|---|---|
| Manufacturer | Article information on the sensor mounted on the digiLine electronics is entered in these fields by the manufacturer during production. The data are displayed in the JUMO DSM software. In the Modbus mode, these data can also be retrieved for viewing only. The user can refer to these data when reordering. |
| Customer order number | |
| VK job number | |
| Part number | |
| Customer type | |
| Order code | |
| Customer item number | |
| Customer number | |
| Serial number | |
| Hardware address | |
| Date of manufacture | |
| Sensor type | These fields hold data on the sensor type currently in use. The type of sensor being used is selected in the configuration. The data are used for startup in the digiLine mode. They are used by the JUMO AQUIS touch S/P for identifying and "linking" JUMO sensors with digiLine electronics. In the Modbus mode, these data can also be retrieved for viewing only. Here, they serve only to provide information. |
| Sensor subtype | |
| Active pH component | |
| Diaphragm | |
| Connection | |
| Insertion length | |
| Measuring range start | |
| Measuring range end | |
| Pressure | |
| Minimum temperature | |
| Maximum temperature | |
| Approval | |

| Data point | Explanation |
|---|---|
| TAG number | The "TAG number" identifies the measuring point with a unique ID assigned by the user. With the aid of the "TAG number", digiLine electronics can be assigned to a designated digital sensor input of a specific digiLine master. When "TAG check" is activated in the digiLine master, matching of the sensor's "TAG number" and the digital sensor input is checked by the JUMO AQUIS touch S/P. If there is no match, the digiLine electronics are not linked to the master. The "TAG number" of the digiLine electronics can be edited only with the JUMO DSM software. |
| Description | Text field for a description of the measuring point. The description can be edited only with the JUMO DSM software. |
| Sensor origin | The "Sensor origin" is assigned to the transmitter by the digiLine master to which the digiLine electronics were last connected and provides information about the device on which the digiLine electronics were last connected. |

## 9.3 Process values

The operating data includes signals such as alarms, measured values and sensor monitoring data. The status of sensor operation can be viewed with the JUMO DSM software or on the JUMO AQUIS touch S/P.

| Data point | Explanation |
|---|---|
| Uncomp. actual value | Raw value from pH sensor in mV without consideration of the effect of temperature |
| Compensated actual value | pH measured value with the effect of temperature removed |
| Compensation temperature Interface | Temperature value received via the interface<br>This value is used for temperature compensation when the setting "Via interface" was selected in the parameter "Compensation signal" in the configuration.<br>**digiLine Mode:** The compensation temperature is transmitted from the digiLine master.<br>**Modbus Mode:** The user must ensure that the "Compensation temperature interface" is updated cyclically by the Modbus master (JUMO mTRON T). The Modbus functionality is explained in detail in the separate Modbus description. |
| pH alarm signal | In the event of a fault during the pH measurement (e. g. as the result of a measuring range violation or compensation error), this alarm is triggered and generates a corresponding signal on the JUMO AQUIS touch S/P. It can also be queried by a Modbus master (JUMO mTRON T). |
| Temperature<br>Resistance value | **only on pH sensors with integrated temperature probe (Variopin plug connector):**<br>Current measured value from the integrated temperature probe |
| Temperature alarm signal | In the event of a fault during the temperature measurement (e. g. as the result of a measuring range violation or compensation error), this alarm is triggered and generates a corresponding signal on the JUMO AQUIS touch S/P. It can also be queried by a Modbus master (JUMO mTRON T). |
| Sensor stress | The "Sensor stress" value reflects the current level of stress on the sensor from high temperatures and acidic or alkaline pH values. When specified limit values are reached, the following sensor stress alarm conditions are signaled on the digiLine master:<br>• Pre-alarm for sensor stress above sensor stress level 3<br>• Alarm for sensor stress above sensor stress level 7 |
| Sensor stress pre-alarm state | This pre-alarm is generated at a sensor stress level greater than 3. |

| Data point | Explanation |
|---|---|
| Sensor stress alarm state | In addition to the "Sensor stress pre-alarm", this alarm is triggered at a sensor stress level greater than 7 and generates a corresponding signal on the JUMO AQUIS touch S/P. It can also be queried by a Modbus master (JUMO mTRON T). |
| CIP counter | Number of previous CIP cycles identified as having exceeded the CIP temperature<br>The CIP temperature is set in the configuration data.<br>⇨ chapter 10 "Configuration", page 39 |
| SIP counter | Number of previous CIP cycles identified as having exceeded the SIP temperature<br>The SIP temperature is set in the configuration data.<br>⇨ chapter 10 "Configuration", page 39 |
| Autoclaving counter | Number of previous autoclaving cycles<br>The autoclaving counter must be incremented manually with the JUMO DSM software. |
| CIP/SIP/autoclaving pre-alarm signal | On reaching the maximum number of CIP, SIP, or autoclaving cycles set for this pre-alarm signal, this pre-alarm is triggered and generates a corresponding signal on the JUMO AQUIS touch S/P. It can also be queried by a Modbus master (JUMO mTRON T).<br>The maximum number of CIP/SIP/autoclaving cycles for this pre-alarm is set in the configuration data.⇨ chapter 10 "Configuration", page 39 |
| CIP/SIP/autoclaving alarm signal | On reaching the maximum number of CIP, SIP, or autoclaving cycles set for this alarm signal, this alarm is triggered and generates a corresponding signal on the JUMO AQUIS touch S/P. It can also be queried by a Modbus master (JUMO mTRON T).<br>The maximum number of CIP/SIP/autoclaving cycles for this alarm is set in the configuration data.⇨ chapter 10 "Configuration", page 39 |

# 9 Sensor information

## 9.4 Operating data

| Data point | Explanation |
|---|---|
| Operating hours counter | The operating hours counter records the total operating time of the digiLine electronics to the second. It cannot be configured or reset. |
| Sensor replacement counter | The sensor replacement counter records how often the electrode of the sensor was replaced. It provides a history on the PC of archived sensor information and calibration logbook entries for every sensor with which the digiLine electronics were operated. The sensor replacement counter is incremented by the JUMO DSM software.<br>⇨ JUMO DSM software operating manual |
| Initial startup date | Date of the initial startup on a JUMO AQUIS touch S/P |
| Operating hours counter reading at initial startup | Operating hours counter reading at startup on a digiLine master |
| **Drag indicator for temperature** | |
| Lowest temperature value | Data on the highest or lowest temperature values that occurred in the course of operation to date<br>The measured temperature value is obtained from the signal source set in the configuration data as the "Temperature compensation signal".<br>After a sensor on the digiLine electronics with the sensor replacement function has been replaced, the drag indicator data are reset with the JUMO DSM software.<br>⇨ JUMO DSM software operating manual |
| Highest temperature value | |
| Time of lowest temperature value | |
| Time of highest temperature value | |
| Operating hours counter reading at lowest temperature | |
| Operating hours counter reading at highest temperature value | |
| **Extreme conditions** | |
| Total time below the minimum temperature | Total time violating the admissible min./max. values of temperature and pH value<br>The min./max. values of temperature and pH value depend on the active pH component used in the sensor and are stored in the "Sensor information". |
| Total time above the maximum temperature | |
| Total time below the minimum pH value | |
| Total time above the maximum pH value | |
| Number of times below the minimum temperature | Number of times above or below the admissible min./max. values of temperature and pH value<br>The min./max. values of temperature and pH value depend on the electrode used and are stored in the "Sensor information". |
| Number of times above maximum temperature | |
| Number of times below minimum pH value | |
| Number of times above maximum pH value | |

## 9.5 Calibration data

| Data point | Explanation |
|---|---|
| Remaining running time on calibration timer | Elapsed time on calibration timer<br>When this time has elapsed, the calibration alarm is triggered to signal that a calibration is due. |
| Calibration alarm | The calibration alarm is triggered when the time set on the calibration timer has elapsed and generates a corresponding signal on the JUMO AQUIS touch S/P. It can also be queried by a Modbus master (JUMO mTRON T). |
| pH zero point | The pH zero point is established by the calibration. |
| pH slope | The pH slope is established by the calibration. |

# 9 Sensor information

## 10.1 General Information

The configuration of sensors with digiLine electronics can either be performed on a JUMO AQUIS touch S/P or on a PC using the JUMO DSM software. Further information can be found in the operating manual and installation instructions of the JUMO AQUIS touch S/P and/or the JUMO DSM software.

The tables in this chapter explain all of the configuration parameters of the JUMO digiLine electronics.

## 10.2 Important information



**CAUTION!**

**Incorrect configurations can cause sensor malfunctions.**

The consequence may be erroneous measured values.

▶ Prior to startup, check all information in the configuration.

## 10.3 Input

### 10.3.1 pH input

| Configuration item | Selection/setting option | Explanation |
|---|---|---|
| Filter time constant | 0.0 to 25.0 s | Optimization of measured value updating<br>The larger the value of the filter time constant, the slower is the change in measured value at the output. |
| Compensation signal | Fixed value<br>Via interface<br>Temperature input | Selects the source for the compensation temperature<br>**Fixed value:** Compensation with a fixed temperature value that is entered in the configuration item "Compensation temperature".<br>**Via interface:** Compensation temperature is transmitted from the master over digiLine. The source for the compensation temperature is set in the digiLine settings of the master.<br>**Temperature input:** The integrated temperature probe of the pH sensor supplies the compensation temperature. |
| Compensation temperature | -25 to +150 °C | Constant compensation temperature value<br>If the configuration item **"Compensation signal"** is set to **"Fixed value"**, this value is used for temperature compensation of the pH value. |
| digital input function | Inactive<br>Hold | **only for 8-pole variant:**<br>Activates the hold function of the digital input<br>The hold function freezes the measured value (e. g. during maintenance work). The hold function is On-active (the measured value is held when contact between digital input and GND is closed). |

## 10.4 Analog output

| Configuration item | Selection/setting option | Explanation |
|---|---|---|
| Signal | 4 to 20 mA<br>20 to 4 mA | Type of analog output signal |
| digital input function | Inactive<br>Hold<br>Toggle | Selects the function of the digital input for the analog output<br>**Inactive:** No function<br>**Hold:** The hold function freezes the analog output value (e. g. during maintenance work). The hold function is On-active (the measured value is held when contact between digital input and GND is closed).<br>**Toggle:** On sensors with an integrated temperature probe, toggles between pH value and measured temperature value as an analog signal on the basis of the binary signal. For pH and temperature value at the output, the respectively configured substitute values and scaling also apply when toggling.<br>Toggling options:<br>• Digital input contact closed = Temperature value as analog signal<br>• Digital input contact open = pH measured value as analog signal |
| Substitute value for pH | 3.6 to 22 mA | Specifies an analog value that the output assumes at hold, at calibration or in case of a fault |
| Scale start for pH | -2.00 | pH value that corresponds to the lower limit of the standard signal range generated (4 mA) |
| Scale end for pH | 16.00 | pH value that corresponds to the upper limit of the standard signal range generated (20 mA) |
| Response at hold | low (4 mA)<br>high (20 mA)<br>Frozen<br>Replacement value | Selects the response of the analog output value at hold |
| Response in case of a fault | low (4 mA)<br>high (20 mA)<br>Namur low (3.6 mA)<br>Namur high (22 mA)<br>Frozen<br>Replacement value | Selects the response of the analog output in case of a fault (e. g. overrange) |
| Response during calibration | Moving<br>Frozen<br>Replacement value | Selects the response of the analog output value during calibration |
| Substitute value for temperature | 3.6 to 22 mA | Specifies an analog value that the output assumes at hold, at calibration or in case of a fault |
| Scale start for temperature | -20 to +150 °C | Temperature value that corresponds to the lower limit of the standard signal range generated (4 mA) |
| Scale end for temperature | -20 to +150 °C | Temperature value that corresponds to the upper limit of the standard signal range generated (20 mA) |

## 10.5 Sensor

| Configuration item | Selection/setting option | Explanation |
|---|---|---|
| Electrode part no. | Selection list | The sensor to which the digiLine electronics are connected must be selected here. In addition, some of the technical data for the selected electrode are displayed: type of active pH component, diaphragm, and electrode connection as well as information on the insertion length, approval, measuring range, maximum operating pressure and operating temperature limit values. |
| Calibration interval | 0 to 9999 days | Time from one calibration to the next. The time at which a calibration is due is indicated by the calibration alarm on the device. Furthermore, the calibration alarm can be queried via the Modbus. |

## 10.6 Sensor monitoring



**NOTE!**

Sensor monitoring requires plant-specific empirical values for the sensor stress caused by process conditions. Configure the sensor monitoring parameters on the basis of these empirical values.

**Sensor monitoring 1**

| Configuration item | Selection/setting option | Explanation |
|---|---|---|
| CIP/SIP/autoclaving alarm | Inactive<br>Active | Activates/deactivates the CIP/SIP and autoclaving alarm<br>on reaching the maximum number of CIP/SIP or autoclaving cycles |
| Maximum number of autoclaving cycles | 0 to 999 | Specifies the number of autoclaving cycles at which the autoclaving alarm is triggered on the master[a] |
| pH weighting (acidic) | 0 to 10 | Factor for determining the effect of acidic pH values on the sensor stress level |
| pH weighting (alkaline) | 0 to 10 | Factor for determining the effect of alkaline pH values on the sensor stress level |
| Temperature weighting | 0 to 10 | Factor for determining the effect of the temperature on the sensor stress level |
| Sensor stress alarm | Inactive<br>Active | Activates/deactivates the sensor stress alarm<br>The "Sensor stress" value reflects the current level of stress on the sensor from high temperatures and acidic or alkaline pH values. When specified limit values are reached, the following sensor stress alarm conditions are signaled on the digiLine master:<br>• Pre-alarm for sensor stress above sensor stress level 3<br>• Alarm for sensor stress above sensor stress level 7 |
| CIP temperature | -20 to +150 °C | Temperature thresholds for identifying CIP/SIP cycles<br>If the CIP/SIP cycle takes place above one of these values during the set duration of a CIP/SIP cycle, the values identify a successfully completed CIP/SIP cycle and the CIP or SIP counter is incremented. The respective counter is reset only after the value has dropped below the CIP/SIP temperature. |
| SIP temperature | | |

| Configuration item | Selection/setting option | Explanation |
|---|---|---|
| CIP cycle duration | 0 to 9999 s | Duration of a CIP/SIP cycle |
| SIP cycle duration | | |
| Maximum number of CIP cycles | 0 to 999 | Specifies the number of CIP/SIP cycles at which the CIP/SIP/autoclaving alarm is triggered on the master[b] |
| Maximum number of SIP cycles | | |

[a] The autoclaving counter is not incremented automatically, since the sensor is removed from the process for this purpose. The autoclaving counter must be incremented manually with the JUMO DSM software. After a sensor has been replaced and the digiLine electronics have been transferred to the new sensor, the counters are reset with the JUMO DSM software.

[b] The counters for CIP and SIP cycles are automatically incremented by the digiLine electronics each time a CIP or SIP process is recognized on the basis of the configured CIP/SIP temperatures and duration of the CIP/SIP cycle.

**Sensor monitoring 2**

| Configuration item | Selection/setting option | Explanation |
|---|---|---|
| **Limit values for duration** | | |
| Pre-alarm for duration at lower temperature | 0 to 99999 min | Adjustable alarm thresholds for the total accumulated duration of limit value violations |
| Pre-alarm for duration at upper temperature | | The duration of upper/lower limit violations of sensor type-dependent limit values is totaled. As soon as the value set here is reached, the respective pre-alarm or alarm value is set to 1 in the digiLine electronics. Alarm thresholds are only active when they are set to values greater than 0. When the value is 0, no alarm is generated. |
| Pre-alarm for duration at lower pH value | | |
| Pre-alarm for duration at upper pH value | | |
| Alarm for duration at lower temperature | | The alarm values are recorded by the JUMO AQUIS touch S/P. Signaling on the master takes place in accordance with its configuration. Please read the operating manual for the master for more information in this regard. |
| Alarm for duration at upper temperature | | |
| Alarm for duration at lower pH value | | The pH and temperature limit values are set at the factory and based on the physical characteristics of the respective sensor type. |
| Alarm for duration at upper pH value | | ⇨ chapter 9.2 "Sensor details", page 33 |
| **Limit value for number** | | |
| Pre-alarm for number of lower temperature violations | 0 to 99999 | Adjustable alarm thresholds for the total number of limit value violations |
| Pre-alarm for number of upper temperature violations | | The number of upper/lower limit violations of sensor type-dependent limit values is totaled. As soon as the value set here is reached, the respective pre-alarm or alarm value is set to 1 in the digiLine electronics. Alarm thresholds are only active when they are set to values greater than 0. When the value is 0, no alarm is generated. |
| Pre-alarm for number of lower pH value violations | | |
| Pre-alarm for number of upper pH value violations | | The alarm values are recorded by the JUMO AQUIS touch S/P. Signaling on the master takes place in accordance with its configuration. Please read the operating manual for the master for more information in this regard. |
| Alarm for number of lower temperature violations | | |
| Alarm for number of upper temperature violations | | The pH and temperature limit values are set at the factory and based on the physical characteristics of the respective sensor type. |
| Alarm for number of lower pH value violations | | ⇨ chapter 9.2 "Sensor details", page 33 |
| Alarm for number of upper pH value violations | | |

## 10.7 Measuring point info

| Configuration item | Selection/setting option | Explanation |
|---|---|---|
| Tag number | up to 19 text characters (UTF8) | Name of the measuring point at which the sensor is used |
| Description | up to 63 text characters (UTF8) | Space for information, comments and notes about the measuring point |

## 10.8 Digital interface



**NOTE!**

The settings for the digital interface are obtained automatically in the digiLine mode and may then no longer be changed.

Make sure that the interface settings are not changed inadvertently with the JUMO DSM software. For operation on the JUMO mTRON T, the settings must be made in advance with the JUMO DSM software.

| Configuration item | Selection/setting option | Explanation |
|---|---|---|
| Baud rate | 9600<br>19200<br>38400 | Transmission speed (symbol rate) of the RS485 interface |
| Data format | 8 - 1 - no parity<br>8 - 2 - no parity<br>8 - 1 - odd parity<br>8 - 1 - even parity | Transmission format of the RS485 interface |
| Floating-point format | Standard<br>IEEE754_LITTLE<br>IEEE754_BIG | Selectable transmission format for float values (floating-point numbers) |
| Hardware address | - | non-configurable, permanently assigned address of the digiLine electronics for unique identification (required for plug & play) |
| Device address | 1 to 247 | Bus user identification for the digiLine electronics |
| Min. response time | 0 to 500 ms | Minimum time from receipt of a query to sending of the response<br>This parameter is used to adjust the response speed of the digiLine electronics to slower bus users. |

**General information**

The actual electrical characteristics of analysis sensors always deviate somewhat from the nominal specifications. The reasons for this include:

- Like every measuring instrument, analysis sensors always have a certain uncertainty of measurement that results from manufacturing tolerances.
- During use, analysis sensors are exposed to chemical processes. Deposits and wear phenomena caused by these processes result in changes of the electrical characteristics of sensors.

To optimize the accuracy of measurements, analysis sensors must be calibrated. Calibrations are required:

- when a sensor is replaced
- regularly at time intervals that must be specified by the user
- if implausible measured values are displayed
- if process conditions change, e. g. as the result of equipment modification

Calibration timers can be configured to provide a regular reminder of when calibrations are due.
⇨ chapter 10.5 "Sensor", page 41

Each successfully completed calibration is recorded in the calibration logbook.
⇨ "Calibration logbook", page 46

The calibration of pH electrodes is based on measurements in buffer solutions with a defined pH-value. Since pH value measurement of liquids is temperature-dependent, the temperature of the buffer solution must be sensed in order to compensate for its effect on the result of the measurement.

**Calibration methods for pH sensors**

**Zero-point calibration**
This calibration method is used to determine the pH zero point on the measurement characteristic curve. The slope is retained. A buffer solution with a defined pH value is needed as a reference.

**Two-point calibration**
By measuring 2 different buffer solutions with defined pH values, the pH zero point and pH slope of the measuring chain are established. The pH values of the buffer solutions must be at least 2 pH apart. This calibration method is recommended for most applications.

# 11 Calibrate

**Calibrating JUMO sensors with digiLine electronics**

JUMO sensors with digiLine electronics can be calibrated on the PC or on the JUMO AQUIS touch S/P using the JUMO DSM software. The calibration values are calculated in the digiLine electronics of the sensor. The calculated calibration values and the data in the calibration logbook are saved in the digiLine electronics following successful calibration.

The procedure for calibrating on the master is described in the operating manual and installation instructions of the JUMO AQUIS touch S/P.

The procedure for calibrating with a PC is described in the operating manual of the JUMO DSM software.

**Calibration logbook**

The calibration logbook is saved in the digiLine electronics of the sensor. The last 10 successful calibrations are saved in the calibration logbook. When the JUMO DSM software has successfully connected to the digiLine electronics, the entries of the calibration logbook in digiLine electronics are read out from the JUMO DSM software and saved on the PC. There is no limit to the number of calibration logbook entries that can be saved on the PC. Canceled or failed calibrations (calibrations outside the admissible limits) are not saved in the logbook. Manual changes of calibration values are also documented. The following data are retained in the logbook:

- Date and time
- Calibration values determined or entered
- Reference values used and temperatures of the buffer and test solutions
- Calibration mode (true calibration/manual entry of calibration values)
- Calibration assessment (assessment of the calibration values determined during the true calibration)
- Sensor replacement counter reading (to assign the calibration logbook entries to the individual sensors in the sensor replacement history of the digiLine electronics)

The calibration logbook can be viewed on the JUMO AQUIS touch S/P or on the PC using the JUMO DSM software.

**Evaluation criteria for pH calibration**

| **Calibration value [unit]** | **Invalid** | | | | **Warning** | | **OK** | **Warning** | | | | **Invalid** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Zero point [pH] | ... | < | 5 | ≤ | ... | < | 6 to 8 | < | ... | ≤ | 9 | < ... |
| Slope [%] | ... | < | 75 | ≤ | ... | < | 89.6 to 103.1 | < | ... | ≤ | 110 | < ... |

## 12.1 Sensor replacement

**Replacement of the sensor with retention of the JUMO digiLine electronics**

The sensor can be disconnected from the digiLine electronics by unscrewing it. If the sensor needs to be replaced, the JUMO digiLine electronics can be screwed to a new sensor and re-inserted. The "Sensor replacement function" must be used in this case to reset the corresponding data in the digiLine electronics and increment the "sensor counter".

⇨ JUMO DSM software operating manual

**Replacing, disconnecting, and re-connecting JUMO sensors with digiLine electronics**

The replacement, disconnection, and re-connection of digiLine electronics to a bus system for maintenance purposes can be carried out with the bus master switched off or also during operation. During replacement of digiLine electronics, it has to be put into operation on the digiLine master.

⇨ chapter 7 "Startup", page 29

If a sensor is disconnected from the bus and then reconnected, it resumes service automatically once the master is switched on again. If "sensor information" or "interface configuration" were changed in the sensor prior to reconnection with the JUMO DSM software on the PC, ensure the following:

- In the Modbus mode, ensure that the interface configuration is correct. Otherwise, the sensor will not resume service.
- In the digiLine mode, a change of the "sensor information" requires "linking" the sensor in the JUMO AQUIS touch S/P (cf. chapter 7 "Startup", page 29).

### 12.1.1 Sensor replacement while the digiLine mode is active

**Disconnection and reconnection of JUMO sensors with digiLine electronics while the digiLine mode is active**

If JUMO sensors with digiLine electronics are disconnected from the digiLine bus for cleaning or calibration while the system is operating and then reconnected with no changes to the configuration and sensor information, the JUMO AQUIS touch S/P detects the sensors again and links them automatically. The sensors then resume service automatically.

**Replacement of JUMO sensors with digiLine electronics while the digiLine mode is active**

If **an individual sensor** with digiLine electronics is replaced with a new sensor of the same kind, it is linked automatically and assigned in the JUMO AQUIS touch S/P to the previous function of the removed sensor. When several sensors are being replaced, it is necessary to ensure that multiple sensors are not disconnected from the bus at the same time. If several sensors with digiLine electronics are disconnected from a digiLine bus, the individual replacement sensors might not be linked automatically and a complete startup of each new sensor is required again. It is therefore advisable to replace sensors with digiLine electronics in succession.

***When replacing sensors, proceed as follows :***

1. Disconnect from the bus **one individual** sensor that is being replaced.



**NOTE!**

Ensure that except for the sensor being replaced no additional sensor is disconnected from the bus until the replacement sensor has been connected and put back into service. This could lead to problems with the automatic linking of the new sensors in the JUMO AQUIS touch S/P.

2. Connect the replacement sensor.
3. If the old and replacement sensors are identical in terms of type, the JUMO AQUIS touch S/P can automatically assign the previous function of the old sensor to the replacement sensor and link it automatically.

4. Check on the JUMO AQUIS touch S/P whether the new sensor has been linked and resumed service. The procedure is described in the operating manual and installation instructions of the JUMO AQUIS touch S/P.

When several sensors need to be replaced, follow this procedure for each individual sensor separately.

**NOTE!**

The terms "Linking" and "Sensor scan" mentioned here are steps in the startup of JUMO digiLine electronics. For a more detailed explanation, see chapter 7 "Startup", page 29

### 12.1.2 Sensor replacement while the Modbus mode is active

**Disconnection and reconnection of JUMO sensors with digiLine electronics while the Modbus mode is active**

If JUMO sensors with digiLine electronics are disconnected from the Modbus system for cleaning or calibration while the system is operating and then reconnected, always ensure that the interface configuration was not changed. In contrast to digiLine, Modbus does not support plug & play and cannot configure the interface automatically. It is also necessary to ensure that the user is in possession of all parameters that can be written over the Modbus. The automatic linking and installation available with digiLine do not exist here. A detailed description of the Modbus functionality of JUMO digiLine-electronics can be found in the description of its Modbus (B 202705.2.0).

## 13.1 Digital interface

| | |
|---|---|
| Protocol | digiLine[a] or Modbus RTU[b] |
| Device address | 1 to 247 |
| Data formats[c] | 8 - 1 - no parity<br>8 - 2 - no parity<br>8 - 1 - odd parity<br>8 - 1 - even parity |
| Baud rates | 9600 baud<br>19200 baud<br>38400 baud |
| Minimum response time | 0 to 500 ms |

[a] The digiLine protocol assigns the interface parameters automatically during startup (plug & play).

[b] The Modbus RTU protocol is used to operate the digiLine electronics on a JUMO mTRON T CPU. For operation on a JUMO mTRON T, the interface parameters must be set prior to initial commissioning with the JUMO DSM software.

[c] Specification in useful bit - stop bit - parity format.

## 13.2 pH/ORP/T inputs

| Input | Measuring range | Connection type | Measuring accuracy | Ambient temperature influence |
|---|---|---|---|---|
| Primary measurement input[a] | | | | |
| pH | -2 to 16 pH | | ±0.5 % of MR[b] | 0.3 % / 10 K |
| Redox | -1500 to +1500 mV | | ±0.5 % of MR[b] | 0.3 % / 10 K |
| Temperature measurement input[c] | -20 to 150 °C | Pt1000 in 2-wire electrical circuit | ±0.2 % of MR[b] | ≤ 100 ppm/K |

[a] Measurand depends on basic type extension (see order details)

[b] MR: measuring range span

[c] Temperature input (for temperature compensation) may be used only with JUMO digiLine-pH with VP plug connector and JUMO digiLine-T

# 13 Technical data

## 13.3 Analog output of 4 to 20 mA (only with M12 plug connector, 8-pole)

| | |
|---|---|
| Signal range | 4 to 20 mA |
| Voltage supply | DC 12 to 30 V |
| Maximum load resistance | $R_b = (U_b - 2.5\ V) \div 0.022\ A$[a] |
| Accuracy | 0.25 % |
| Ambient temperature influence | 100 ppm/K |

[a] Rb: Load resistance, Ub: Supply voltage

## 13.4 Digital input (only with M12 plug connector, 8-pole)

| **Signal type** | **Switching thresholds** | |
|---|---|---|
| | **On** | **Off** |
| Potential-free contact | < 100 Ω | > 100 kΩ |

## 13.5 Electrical data

| | |
|---|---|
| Voltage supply[a] | SELV or PELV |
| digiLine mode | DC 4.2 to 5.5 V |
| 2-wire transmitter mode (analog output of 4 to 20 mA) | DC 12 to 30 V |
| Power/current consumption | |
| digiLine mode | 75 mW / 15 mA (at 5 V) |
| 2-wire transmitter mode (analog output of 4 to 20 mA) | 270 mW / 22 mA (at 12 V)<br>530 mW / 22 mA (at 24 V)<br>660 mW / 22 mA (at 30 V) |
| Electromagnetic compatibility (EMC) | DIN EN 61326-1 |
| Interference emission | Class B |
| Interference immunity | Industrial requirements |
| Protection rating | Protection rating III |

[a] The voltage supply for the digiLine bus must be rated as SELV or PELV.

## 13.6 Case

| | |
|---|---|
| Ambient temperature | |
| 5-pole device version (digiLine mode) | -10 to+120 °C |
| 8-pole device version (2-wire transmitter mode) | -10 to +85 °C |
| Storage temperature | -10 to +85 °C |
| Resistance to climatic conditions | Relative humidity < 92% annual average, no condensation |
| Protection type | IP66 and IP67 |

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