JUMO BlackLine CR 4P

Conductive 4-electrode conductivity sensor
Type 202931



Operating Manual

20293100T90Z001K000

V4.00/EN/00743106/2026-05-18

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1 Introduction

1.1 Safety information

General

This manual contains information that must be observed in the interest of your own safety and to avoid material damage. This information is supported by symbols which are used in this manual as indicated.

Please read this manual before starting up the device. Store this manual in a place that is accessible to all users at all times.

If difficulties occur during startup, please do not intervene in any way that could jeopardize your warranty rights!

Warning symbols



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.

Note symbols



NOTE!

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

1.2 General information regarding the use of the sensor



CAUTION!

Incorrect dosage in the event of sudden failure of sensor

The sudden failure of a sensor may result in a dangerous incorrect dosage.

▶ For this case, take appropriate precautionary measures.



NOTE!

It is not permitted to use conductive conductivity sensors in **highly adhesive**, **oily** or **sticky** media — for these cases we recommend using our **inductive conductivity sensors**.

If you have any doubts, please contact the nearest branch office or the head office.

1 Introduction

1.3 Brief description

The JUMO BlackLine CR 4P acquires the electrolytic conductivity of a measuring liquid according to the conductive four-electrode measuring principle. When combined with a suitable transmitter, precise measurements over a broad measuring range from 1 µS/cm to 300 mS/cm are ensured. A temperature probe which is integrated into the sensor (either Pt100 or Pt1000) simultaneously acquires the temperature of the measuring liquid.

Compared to 2-electrode sensors, this sensor offers a multitude of application-based advantages in the field and in the lab, and can be used both for measuring purified water and for determining ion concentrations in salty, acidic and alkaline media.

The sensor shaft is made from robust PPE blend, and a high-quality, abrasion-resistant special graphite is used for the electrode material. All of the materials used are physiologically safe.

The tried-and-tested design, with a 120-mm insertion length, 12-mm shaft diameter and the standardized Pg 13.5 process connection, enables easy installation in commercially available fittings.

The sensor is also particularly suited for connection to hand-held and laboratory measuring devices.

1.4 Areas of application

Thanks to its broad measuring range of 1 µS/cm to 300 mS/cm, the sensor is ideal for application in general water technology. This means it is possible to reliably measure different levels of conductivity using just a single measuring system, for example for:

- Cleaning and rinsing processes
- Backwashing in the case of ion exchangers
- Inspecting industrial process waters
- Measuring salt concentration levels

Other liquid analysis application areas include environmental technology, horticultural technology and fish breeding.

In all application cases, make sure that you comply with the specifications set out in the "Technical Data" section, and do not use the sensor with highly adhesive, oily or sticky media.



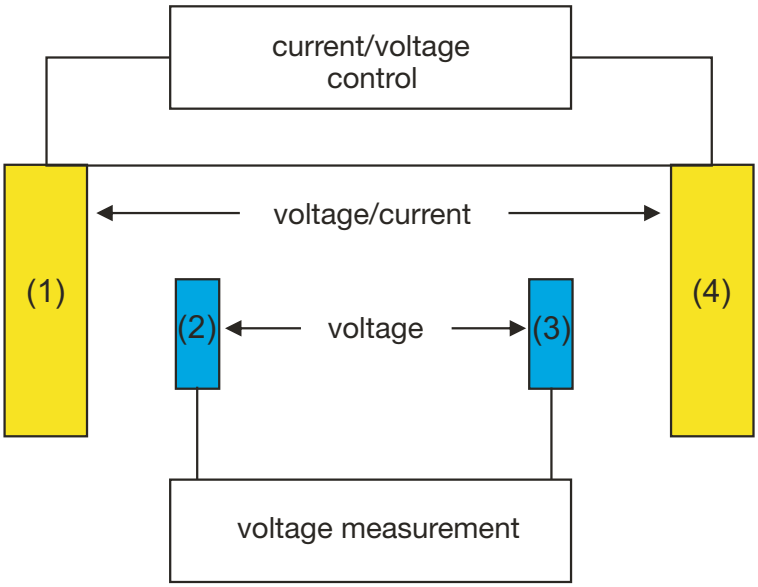
NOTE!

Use in combination with a suitable transmitter/controller, e.g. JUMO AQUIS 500 CR according to data sheet 202565 or JUMO dTRANS CR 02 according to data sheet 202552 or JUMO AQUIS touch S/P according to data sheet 202580/81 or JUMO digiLine CR ST10 according to data sheet 202762.

1.5 Special features

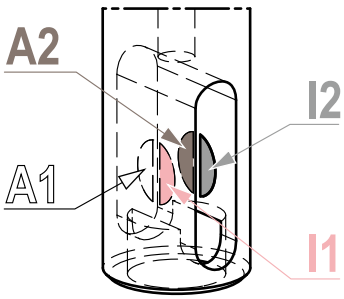
- Wide measuring range
- Suitable for both low and high conductivity
- Reliable and precise measurements
- Reduced sensitivity to pollutants
- No measurement uncertainty resulting from polarization effects
- For universal use

1.6 Functions



The measuring sensors have two pairs of electrodes. The transmitter applies alternating current at the outer pair of electrodes. A voltage is released at the inner electrodes - subject to the conductivity of the measuring material. The transmitter acquires the voltage and uses it to calculate the electrolytic conductivity value. Functionally, excitation and measurement are kept separate. This has some advantages compared to 2-electrode measuring sensors, as the effects of polarization recede into the background. To a large extent, incoming resistances are automatically compensated. Measurement errors as a result of contamination or deposits, are reduced.

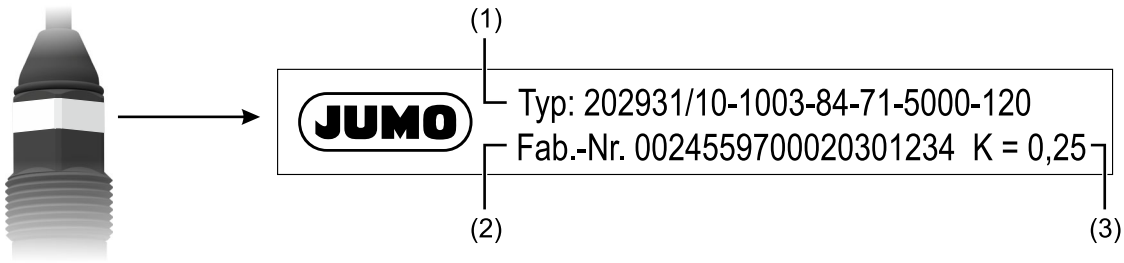
1.7 Arrangement of the electrodes in the sensor measuring insert

Figure	Label	Function
	A2	Outer electrode 2
	I2	Inner electrode 2
	A1	Outer electrode 1
	I1	Inner electrode 1

2 Identifying the device version

2.1 Nameplate

On the sensor



(1) **Sensor type (type)**
Compare the specifications on the nameplate with your order documents. The supplied sensor version can be identified using the order code specified under "order details".

(2) **Fabrication number (Fab. no.)**
The fabrication number provides information such as the production date (year and week). These are represented by the numbers in positions 12 to 15 (from left).

In the example shown above, the sensor was produced in 20**20**, in week **30**.

(3) **Cell constant K**
This is where the nominal cell constant of the sensor is specified.

2.2 Order details

	(1)	**Basic type**
202931		JUMO BlackLine CR 4P – Conductive 4-electrode conductivity sensor
	(2)	**Basic type extension**
10		With internal temperature probe
	(3)	**Measuring insert**
1001		1 × Pt100 in three-wire circuit (available for connection 70)
1003		1 × Pt1000 in two-wire circuit (available for connection 71)
1006		1 × Pt1000 in three-wire circuit (available for connection 70)
	(4)	**Electrode material**
84		Special graphite
	(5)	**Connection**
71		Screw head Pg 13.5 (S8), black, can be rotated
70		Screw head Pg 13.5 with M12 connector, can be rotated
	(6)	**Cable length**
0		Without cable (for connection 70)
5000		5000 mm
	(7)	**Insertion length**
120.0		120 mm

	(1)		(2)		(3)		(4)		(5)		(6)		(7)
Order code		/		-		-		-		-		-	
Order example	202931	/	10	-	1003	-	84	-	71	-	5000	-	120

2.3 Accessories

Article	Part no.
Connecting cable for 4-electrode conductivity sensors M12 female connector, 8-pin (metal), to ferrules Length 5 m	00528699
Connecting cable for 4-electrode conductivity sensors M12 female connector, 8-pin (metal), to ferrules Length 10 m	00528700
Connecting cable for 4-electrode conductivity sensors to JUMO AQUIS touch S/P M12 female connector, 8-pin (metal), to ferrules, extended connection lines for Pt1000 Length 5 m	00502027
Connecting cable for 4-electrode conductivity sensors to JUMO AQUIS touch S/P M12 female connector, 8-pin (metal), to ferrules, extended connection lines for Pt1000 Length 10 m	00502029
Connecting cable for 4-electrode conductivity sensors to JUMO digiLine CR ST10, M12 female connector, 8-pin (plastic) to M12 female connector, 8-pin (plastic), Length 1.5 m	00759427
Connecting cable for 4-electrode conductivity sensors to JUMO digiLine CR ST10, M12 female connector, 8-pin (plastic) to M12 female connector, 8-pin (plastic), Length 5 m	00759428
Connecting cable for 4-electrode conductivity sensors to JUMO digiLine CR ST10, M12 female connector, 8-pin (plastic) to M12 female connector, 8-pin (plastic), Length 10 m	00759431

3 Mounting

3.1 General information

Mounting site

- Ensure that the device is easily accessible for calibration later on.
- Make sure that the sensor is mounted securely and with minimum exposure to vibration.
- Ensure that the operating conditions (temperature, pressure, chemical constitution of the medium, etc.) do not cause damage to the sensor.
- Do not make any mechanical alterations to the sensor (e.g. by shortening it, boring into it, grinding it).

Installation position

The conductivity sensor can be mounted in any position. But it is essential to make sure that the sensor electrodes are fully immersed in the measurng material.

Incident flow

No incident flow is required to make the conductivity sensor work, but is recommended for fast, stable measurement values and to prevent the accumulation of deposits. Structural measures must be taken to prevent flow separation or gas bubbles in the measuring material.

Insertion length

The insertion length of the conductivity sensor must be coordinated with the installation situation.

3.2 Installation suggestions

The sensor can be installed in the following JUMO fittings:

- Flow fittings (product group 202810)
- Combination fitting (product group 202811)
- Immersion fittings (product group 202820)
- Retractable fittings[1] (product group 202822)
- Process immersion fitting[1] (product group 202821)
- Process fittings[1] (Product group 202825/202831)

When installing the sensor, please follow the instructions in the operating manual supplied with the fitting.

NOTE!

When using in the fittings, please observe the permissible limits for the sensor with respect to process pressure and the temperature of the medium.

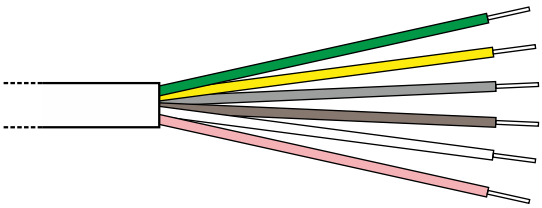
[1] The electrodes of the sensor are located on the inside of the measuring insert (see chapter 1.7 „Arrangement of the electrodes in the sensor measuring insert“). After installing the sensor in the fitting, it is recommended that you turn the sensor in a manner that ensures that the medium flows through the measuring insert. This will ensure a fast, reliable measuring process.

4.1 Installation notes

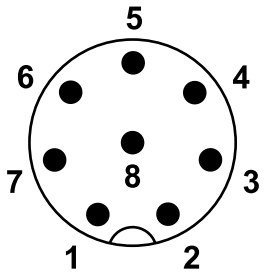
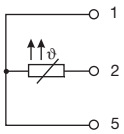
- Route input, output, and supply lines separately and not parallel to one another
- To connect the conductivity sensor, use the CR 4P-cable (see "Accessories") if possible; do not run the connecting cable close to current-carrying components or cables
- Implement the cables continuously (not via terminal blocks or similar)
- Do not connect any additional loads to the supply terminals of the sensor
- Follow the instructions regarding the electrical connection in the operating manual for the transmitter used
- Make sure that you always use safety devices that are independent of the device, and ensure that only qualified personnel configure the settings. In addition to incorrect installation, incorrectly set values on the transmitter can impair the performance of the downstream process or cause damage

4.2 Connection diagram

Connection 71 with fixed cable, 6 × 0.14 mm, shielded

Figure	Wire color	Function
	Green	Pt1000
	Yellow	Pt1000
	Gray	Inner electrode 2
	Brown	Outer electrode 2
	White	Outer electrode 1
	Pink	Inner electrode 1

Connection 70 with M12 connector, 8-pole, A-coded

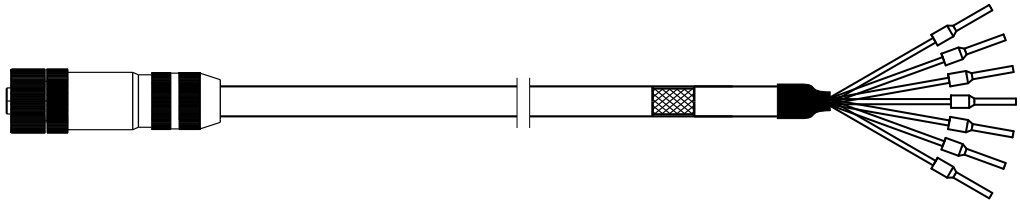
Figure	PIN	Function	
	1	Pt100/Pt1000	
	2	Pt100/Pt1000	
	5	Pt100/Pt1000 three-wire circuit	
	3	Inner electrode 2	
	4	Outer electrode 2	
	6	Outer electrode 1	
	7	Inner electrode 1	
	8	not used	

4 Electrical connection

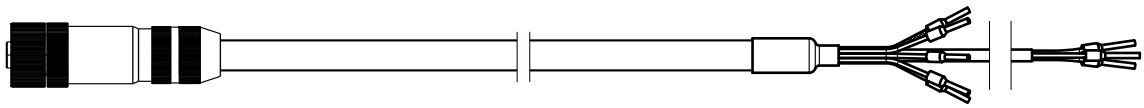
4.3 Connection to transmitters/controllers

To connect the sensor, use only the cables provided for this purpose:

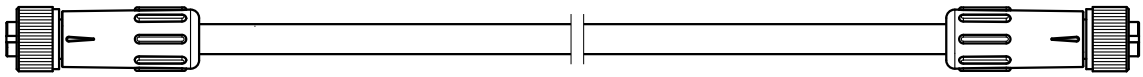
Device	Suitable connecting cable
JUMO AQUIS 500 CR	M12 female connector, 8-pin (metal), to ferrules
JUMO dTRANS CR 02	



Device	Suitable connecting cable
JUMO AQUIS touch S/P	M12 female connector, 8-pin (metal), to ferrules, extended connection wires for Pt1000



Device	Suitable connecting cable
JUMO digiLine CR ST10	M12 female connector, 8-pin (plastic) to M12 female connector, 8-pin (plastic)



Blue connector = transmitter connection side; black connector = sensor connection side.

Further information on the connecting cables	Technical data ⇨chapter 8.2 "Connecting cable with wire ends (accessories)", Page 17
	Order details ⇨chapter 2.3 "Accessories", Page 9

NOTE!

You will find the necessary information for connecting the sensor in the corresponding operating manuals of the devices.

5.1 General information

Depending on production, the cell constants of commercial conductivity sensors are subject to a certain level of dispersion. When a more accurate measurement is required, the sensor, measuring line and transmitter have to be coordinated. This coordination is achieved through calibration.

To achieve optimum accuracy, we recommend performing the calibration in the same conductivity range in which the measurement will be conducted.

Furthermore, the cell constant of a conductivity sensor can change through ageing and, in particular, through dirtying of the electrodes (coatings).

That is why it is necessary to clean the sensor and calibrate the transmitter on the conductivity sensor at regular intervals. The frequency of this depends on the measurement medium and the operating conditions.

NOTE!

Before conducting the calibration, make sure that the sensor is clean and in perfect working condition.

5.2 Settings on the transmitter/controller

NOTE!

For the calibration, it is essential that you observe the operating manual of the transmitter/controller used (e.g. JUMO AQUIS 500 CR, JUMO dTRANS CR 02, JUMO AQUIS touch S/P or JUMO digiLine CR with separate sensor).

At least the following settings are required:

- Cell type (connection type): 4-electrode or 4-wire
- Nominal cell constant: 0.5[1] cm^{-1}

Reference solutions

A reference solution is used to calibrate the relative cell constant.

The conductivity of commercial potassium chloride reference solutions include e.g.:

Potassium chloride concentration	Conductivity at 20 °C	Conductivity at 25 °C
$C_{(KCl)}$ = 0.01 mol/l	1278 µS/cm	1413 µS/cm
$C_{(KCl)}$ = 0.1 mol/l	12.2 mS/cm	12.9 mS/cm
$C_{(KCl)}$ = 3 mol/l	275 mS/cm	298 mS/cm

To ensure the measurement is as accurate as possible, the reference solution chosen must be close to the setpoint of the conductivity measurement when in operation.

When performing the calibration, proceed as instructed in the operating manual for the transmitter/controller used.

[1] Value for AQUIS 500 CR and dTRANS CR 02; for AQUIS touch and digiLine CR the value 0.25 can be entered manually for this sensor.

6 Maintenance

6.1 Cleaning

The electrodes of the conductive conductivity sensor come into direct contact with the measurement medium. **Therefore, make sure they are cleaned on a regular basis, depending on the soiling tendency of the measurement medium.**

For cleaning, you can use all suitable, common household cleaning chemicals.
Avoid using abrasive cleaning agents.
Ensure that the measuring electrodes do not suffer any mechanical damage.

Cleaning the electrodes in an **ultrasonic bath** is also good for removing various deposits.

When cleaning, proceed as follows:

- Wipe off minor dirt with a soft, preferably lint-free cloth
- Wash off stubborn dirt and greasy or oily deposits with warm soapy water and a soft brush; you can also use ethanol to clean the sensor, if necessary
- For calciferous coatings or precipitated metal hydroxides or metal oxides, use diluted hydrochloric acid (3 % by weight) to dissolve the dirt
- **After cleaning, always rinse the sensor with water.**



NOTE!

It is not permitted to use conductive conductivity sensors in highly adhesive, oily or sticky media — for these cases we recommend using our inductive conductivity sensors.

7 Troubleshooting

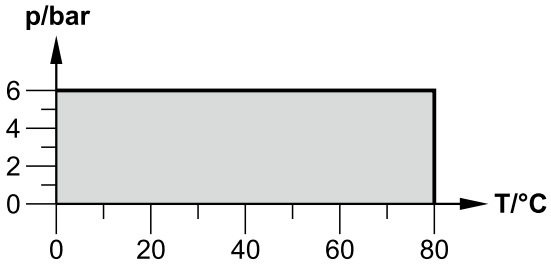
When troubleshooting, all of the components of the conductivity measuring chain must always be taken into account. As well as the conductivity sensor, also check the transmitter and the connecting cable used.

Error	Possible cause	Remedy
Measured value too high or too low	Conductivity sensor dirty	Clean conductivity sensor
Transmitter does not show conductivity (e.g. display "0")	Line breakage or incorrect electrical connection	Check electrical connection
	Sensor in air (not immersed in medium)	Check installation location of sensor
		Medium present?
Conductivity displayed on transmitter too high or too low	Electrical connection of sensor not correct: Poles reversed or incorrect "right – left" allocation	Check electrical connection
Transmitter does not display temperature	Line breakage or incorrect electrical connection	Check electrical connection
Display value unstable, fluctuates	Malfunction due to incorrect/insufficiently shielded connecting cable	Use connecting cable for 4-electrode conductivity sensors for connection
	Malfunction due to gas bubbles	Check line connection and cable routing
		Check the installation location and installation position of the sensor

You can also check whether the conductivity sensor has suffered a short circuit or has internal contact problems, see chapter 1.7 "Arrangement of the electrodes in the sensor measuring insert", Page 7, and chapter 4.2 "Connection diagram", Page 11.
For this you need a continuity tester (e.g. the diode tester of a multimeter).

8 Technical data

8.1 Sensor

Measuring principle for conductivity	Conductive, 4-electrode measurement
Cell constant	K = 0.25 ± 5 %[a]
Typical measuring range[b]	1 µS/cm to 300 ms/cm
Temperature sensor	Either Pt100 or Pt1000 (both at least class A)
Response time t_{90}[c]	< 96 s
Process connection	Screw connection Pg 13.5
Materials[d]	
Screw head system	PPS
Sensor body	PPE + PS
Electrodes	Special graphite
Admissible temperature of medium	-5 to +80 °C
Admissible process pressure	6 bar at 80 °C 
Protection type[e]	IP65 and IP67
Electrical connection	Either securely connected cable, 5 m long, with tin-plated wire ends, or M12 connector

[a] The manufacturing-related deviation of the sensor can be equalized on the transmitter. The measuring accuracy of the overall conductivity measurement is determined by the transmitter used. Therefore, it is not possible to make a general assertion as to the accuracy of the measuring system.

[b] The measuring range also depends on the transmitter being used.

[c] DIN EN 60751.

[d] Please also refer to the dimensional drawings for the sensors.

[e] Valid for the electrical connection when connected.

8.2 Connecting cable with wire ends (accessories)

Connecting cables for JUMO AQUIS 500 CR, JUMO dTRANS CR 02, and JUMO AQUIS touch S/P

M12 female connector	Metal, 8-pin
Cable diameter	7 ±0.3 mm
Stranded wire cross section	0.25 mm^2 each
Cable material	PU, blue
Ambient temperature	-30 to +80 °C
Cable length	5 m or 10 m

Connecting cables forJUMO digiLine CR ST10

M12 female connectors	Plastic, 8-pin, connection side of transmitter colored blue
Cable diameter	7 ±0.3 mm
Cable material	PU, blue
Ambient temperature	-30 to +80 °C
Cable length	1.5 m, 5 m or 10 m

9 China RoHS

						
产品组别 Product group: 202931	产品中有害物质的名称及含量 China EEP Hazardous Substances Information					
部件名称 Component Name						
	铅 （Pb）	汞 （Hg）	镉 （Cd）	六价铬 （Cr(VI)）	多溴联苯 （PBB）	多溴二苯醚 （PBDE）
外壳 Housing (Gehäuse)	○	○	○	○	○	○
过程连接 Process connection (Prozessanschluss)	X	○	○	○	○	○
螺母 Nuts (Mutter)	○	○	○	○	○	○
螺栓 Screw (Schraube)	○	○	○	○	○	○

本表格依据SJ/T 11364的规定编制。
This table is prepared in accordance with the provisions SJ/T 11364.
○：表示该有害物质在该部件所有均质材料中的含量均在GB/T 26572规定的限量要求以下。
Indicate the hazardous substances in all homogeneous materials' for the part is below the limit of the GB/T 26572.

×：表示该有害物质至少在该部件的某一均质材料中的含量超出GB/T 26572规定的限量要求。
Indicate the hazardous substances in at least one homogeneous materials' of the part is exceeded the limit of the GB/T 26572.

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