JUMO tecLine ClO_2 and O_3

Sensors for chlorine dioxide (ClO_2) and ozone (O_3), digital or analog

Brief description

These membrane-covered, amperometric sensors are used to measure the concentration of chlorine dioxide or ozone in aqueous solutions.

The sensor for chlorine dioxide can be used to measure chlorine dioxide from chlorite/chlorine and chlorite/hydrochloric acid plants. The sensor for ozone can be used to measure electrolytically generated ozone among other things.

The sensors are not suitable for detecting the absence of chlorine dioxide or ozone.

Depending on the type, the electronics integrated in the sensors provide an analog, temperature-compensated current signal (4 to 20 mA) or a digital Modbus RTU output signal.

The sensors can be connected directly to indicating devices/transmitters/controllers (see "Suitable indicating devices/transmitters/controllers ", page 10). They supply the sensors with voltage and allow for easy calibration of the measuring system.

Type 202634/45... and type 202634/60...

Areas of application

Measurement in...

- Drinking water
- Swimming pool water
- Service water
- Process water
- Cooling water

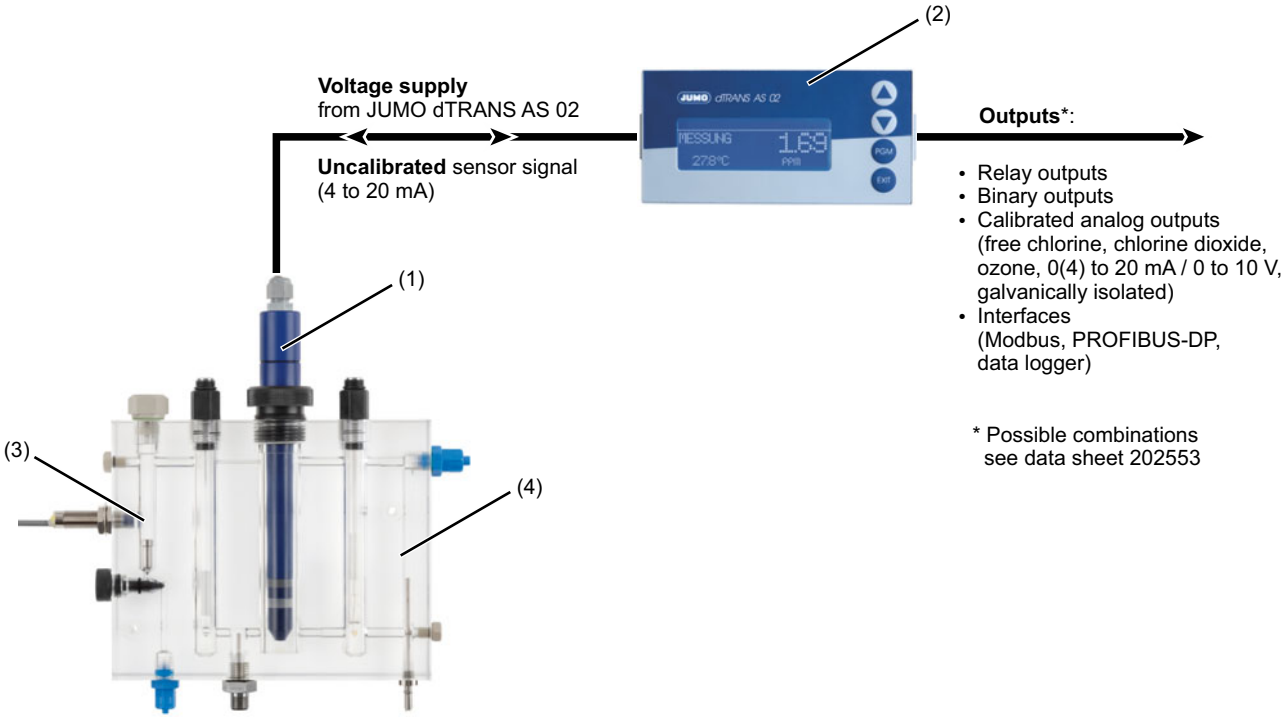
Special features

- 2-electrodes principle
- Easy calibration
- Integrated temperature compensation
- Proven measuring system
- Electrical connection analog or digital

Type overview

Type	Description	Technical data
202634/45	ClO_2, output signal of 4 to 20 mA	see "Sensors for chlorine dioxide (ClO_2)", page 4
202634/65	ClO_2, digital interface output signal	
202634/46	ClO_2, output signal 4 to 20 mA, chemical-resistant membrane	see "Sensors for chlorine dioxide (ClO_2) with membranes that are insensitive to chemicals", page 5
202634/66	ClO_2, digital interface output signal, chemical-resistant membrane	
202634/50	O_3, output signal of 4 to 20 mA	see "Sensors for ozone (O_3)", page 6
202634/60	O_3, digital interface output signal	
202634/51	O_3, output signal 4 to 20 mA, chemical-resistant membrane	see "Sensors for ozone (O_3) with membranes that are insensitive to chemicals", page 7
202634/61	O_3, digital interface output signal, chemical-resistant membrane	

Example of the measuring point set-up



Additional indicating devices/controllers: "Suitable indicating devices/transmitters/controllers ", page 10

The following components are required to set up a measuring point for measuring chlorine dioxide or ozone:

(1) Amperometric sensor, membrane-covered (output signal of 4 to 20 mA)
(2) Transmitter/controller (JUMO dTRANS AS 02)
(3) Flow monitor (optional extra, recommended)
(4) Fitting for membrane-covered sensors (JUMO combination fitting 202811/10)

20263400T10Z001K000
Tel : 027-87886630
Fax : 027-87886620
www.maserac.com

Important information

Notes for all types

- Measuring is only possible in a suitable flow fitting (see accessories).
- The flow rate from the measurement medium must be at least 15 cm/s (0.5 l/min) in order for the sensor to work correctly. The minimum inflow can be guaranteed using the JUMO combination fitting or the JUMO individual fitting in connection with the JUMO flow monitor for disinfectant measurands (see accessories).
- For calibration, a test set is required to determine the chlorine dioxide or ozone content using the DPD method; corresponding photo- or colorimetric test sets are commercially available.
- To make sure the sensor works correctly, only one disinfectant should be used at a time.
- More information on the setup and use of amperometric sensors can be found in our brochure "Information on amperometric measurement of free chlorine, chlorine dioxide and ozone in water".

Notes for types 202634/45, /50 and /60

- The measuring water must be visually clean (drinking water or swimming pool water quality) and must not contain surfactants (ingredients consisting of detergents, cleaning agents and disinfectants) due to the hydrophobic membrane of the sensor.

  A pre-filter must also be used, as required.

Notes for types 202634/46, /51 and /61

- These sensors with a chemical and surfactant-resistant membrane can also be used in soiled water that does not have drinking water or swimming pool water quality.

Notes for types 202634/45, /46, /50 and /51 (output signal of 4 to 20 mA)

- The slope of these sensors can vary depending on the manufacture and application by between 65 % and 150 % of the nominal slope. To determine the appropriate measuring range or appropriate sensor, it is therefore recommended that the concentration to be measured be multiplied by a factor of 1.5.

  Example: concentration to be measured 1.6 ppm × factor 1.5 = 2.4 ppm => recommended sensor with measuring range 5 ppm

20263400T10Z001K000
Tel : 027-87886630
Fax : 027-87886620
www.maserac.com

Technical data

Sensors for chlorine dioxide (ClO_2)

Sensor type	202634/45 (output signal of 4 to 20 mA)	202634/65 (Ausgangssignal digitale Schnittstelle)
Area of application	Swimming pool water, drinking water, service water and process water **This must not contain any surfactants**	
Measuring principle	Membrane-covered, amperometric, two-electrode system with integrated electronics	
Membrane type	Hydrophobic PTFE membrane	
Measuring cable connection	2-pin terminal connection (2 × 1 mm^2)	5-pin flange connector, M12
Voltage supply	U_B DC 12 to 30 V (galvanic isolation required)	U_B DC 22.5 to 26 V (galvanically isolated from the sensor)
Electromagnetic compatibility	According to EN 61326-1 emitted interference: Class B interference resistance: industrial requirements	
Output signal	4 to 20 mA	Modbus RTU
Burden/current consumption	≤ (U_B - 7.5 V) ÷ 0.02 A	20 mA
Settling time	Approx 1 h for initial startup	
Inflow speed	Approx. 15 cm/s (entspricht to a flow of approx. 30 l/h when installed in the JUMO flow fitting (part no.: 00392611))	
Measuring ranges[a]	0.05 to 0.5 mg/l (ppm) 0.05 to 2 mg/l (ppm) 0,05 bis 5 mg/l (ppm) 0.05 to 10 mg/l (ppm)	0.05 to 2 mg/l (ppm) 0.05 to 20 mg/l (ppm)
Resolution	0.001 mg/l with measuring range 0.5 mg/l 0.01 mg/l with measuring ranges 2/5/10 mg/l	0.001 mg/l with measuring range 2 mg/l 0.01 mg/l with measuring range 20 mg/l
Slope drift	Approx. < -1 % per month under replicable conditions (25 °C, pH 7.2 in drinking water)	
Response time $_{t90}$	approx. 15 seconds	
Operating temperature	0 to 45 °C Prerequisite: no ice crystals in the measurement medium	
Temperature compensation	Automatic, using integrated temperature probe	
pH value area of application	pH 1 to pH 11	
Zero point adjustment	Not required	
Slope adjustment	On evaluation unit/controller using analytical determination	
Disturbances	Cl_2: recorded with a factor of 0.03 of its measured value O_3: is also measured	
Pressure resistance	p_{abs} max. 2 bar p_{rel} max. 1 bar No pressure fluctuations admissible; pressure-free operation (atmospheric pressure) recommended.	
Materials	Semi-permeable membrane, PVC-U	
Dimensions	Dia. 25 mm, length 220 mm	Dia. 25 mm, length 205 mm
Weight	Approx. 125 g	

Maintenance	
Inspection of the measuring signal	Regularly, at least once a week
Replacement of membrane cap	Once a year (depending on the quality of the water)
Replacement of electrolyte	Every 3 to 6 months
Storage	
Sensor	Can be stored indefinitely in a frost-free and dry place, without electrolyte and between +5 and 40 °C
Membrane cap	Used membrane caps cannot be stored.
Electrolyte	In original bottle, away from sunlight, for at least one year at a temperature between +5 and 35 °C; and for transport between +5 and 50 °C

[a] Other measuring ranges upon request.

20263400T10Z001K000
Tel : 027-87886630
Fax : 027-87886620
www.maserac.com

Sensors for chlorine dioxide (ClO_2) with membranes that are insensitive to chemicals

Sensor type	202634/46 (output signal of 4 to 20 mA)	202634/66 (Ausgangssignal digitale Schnittstelle)
Area of application	All types of water treatment (e.g. bottle washing machine, CIP plant, rinser), seawater **Surfactants are tolerated**	
Measuring principle	Membrane-covered, amperometric, two-electrode system with integrated electronics	
Membrane type	Chemical- and surfactant-resistant membrane	
Measuring cable connection	2-pin terminal connection (2 × 1 mm^2)	5-pin flange connector, M12
Voltage supply	U_B DC 12 to 30 V (galvanic isolation required)	U_B DC 22.5 to 26 V (galvanically isolated from the sensor)
Electromagnetic compatibility	According to EN 61326-1 emitted interference: Class B interference resistance: industrial requirements	
Output signal	4 to 20 mA	Modbus RTU
Burden/current consumption	≤ (U_B - 7.5 V) ÷ 0.02 A	20 mA
Settling time	Approx 1 h for initial startup	
Inflow speed	Approx. 15 cm/s (entspricht to a flow of approx. 30 l/h when installed in the JUMO flow fitting (part no.: 00392611))	
Measuring ranges[a]	0.05 to 2 mg/l (ppm) 0,05 bis 5 mg/l (ppm) 0.05 to 10 mg/l (ppm)	0.05 to 2 mg/l (ppm) 0.05 to 20 mg/l (ppm)
Resolution	0.01 mg/l	0.001 mg/l with measuring range 2 mg/l 0.01 mg/l with measuring range 20 mg/l
Slope drift	Approx. < -1 % per month under replicable conditions (25 °C, pH 7.2 in drinking water)	
Response time t_{90}	Approx. 90 seconds	
Operating temperature	0 to 50 °C Prerequisite: no ice crystals in the measurement medium	
Temperature compensation	Automatic, using integrated temperature probe	
pH value area of application	pH 1 to pH 11	
Zero point adjustment	Not required	
Slope adjustment	On evaluation unit/controller using analytical determination	
Disturbances	Cl_2: not a problem O_3: measured with a sensitivity 25 times higher than ClO_2	
Pressure resistance	p_{abs} max. 2 bar p_{rel} max. 1 bar No pressure fluctuations admissible; pressure-free operation (atmospheric pressure) recommended.	
Materials	PVC-U, stainless steel 1.4571	
Dimensions	Dia. 25 mm, length 220 mm	Dia. 25 mm, length 205 mm
Weight	Approx. 125 g	

Maintenance	
Inspection of the measuring signal	Regularly, at least once a week
Replacement of membrane cap	Once a year (depending on the quality of the water)
Replacement of electrolyte	Every 3 to 6 months
Storage	
Sensor	Can be stored indefinitely in a frost-free and dry place, without electrolyte and between +5 and 40 °C
Membrane cap	Used membrane caps cannot be stored.
Electrolyte	In original bottle, away from sunlight, for at least one year at a temperature between +5 and 35 °C; and for transport between +5 and 50 °C

[a] Other measuring ranges upon request.

20263400T10Z001K000
Tel : 027-87886630
Fax : 027-87886620
www.maserac.com

Sensors for ozone (O_3)

Sensor type	202634/50 (output signal of 4 to 20 mA)	202634/60 (digital interface output signal)
Area of application	Swimming pool water, drinking water, service water and process water **This must not contain any surfactants**	
Measuring principle	Membrane-covered, amperometric, two-electrode system with integrated electronics	
Membrane type	Hydrophobic PTFE membrane	
Measuring cable connection	2-pin terminal connection (2 × 1 mm^2)	5-pin flange connector, M12
Voltage supply	U_B DC 12 to 30 V (galvanic isolation required)	U_B DC 22.5 to 26 V (galvanically isolated from the sensor)
Electromagnetic compatibility	According to EN 61326-1 emitted interference: Class B interference resistance: industrial requirements	
Output signal	4 to 20 mA	Modbus RTU
Burden/current consumption	≤ (U_B - 7.5 V) ÷ 0.02 A	20 mA
Settling time	Approx. 2 h for initial startup	
Inflow speed	Approx. 15 cm/s (entspricht to a flow of approx. 30 l/h when installed in the JUMO flow fitting (part no.: 00392611))	
Measuring ranges[a]	0.05 to 0.5 mg/l (ppm) 0.05 to 2 mg/l (ppm) 0.05 to 10 mg/l (ppm) 0.05 to 20 mg/l (ppm)	0.05 to 2 mg/l (ppm) 0.05 to 10 mg/l (ppm)
Resolution	0.001 mg/l with measuring range 0.5 mg/l 0.01 mg/l with measuring range 2/10/20 mg/l	0.001 mg/l with measuring range 2 mg/l 0.01 mg/l with measuring range 10 mg/l
Slope drift	Approx. < -1 % per month under replicable conditions (25 °C, pH 7.2 in drinking water)	
Response time t_{90}	approx. 15 seconds	
Operating temperature	0 to 45 °C (prerequisite: no ice crystals in the measurement medium)	
Temperature compensation	Automatic, using integrated temperature probe	
Zero point adjustment	Not required	
Slope adjustment	On evaluation unit/controller using analytical determination	
pH value area of application	pH 2 to pH 11	
Disturbances	Cl_2: is recorded with a factor of 0.03 of its measured value ClO_2: is recorded with the factor of 0.7 of its measured value	
Pressure resistance	p_{abs} max. 2 bar p_{rel} max. 1 bar No pressure fluctuations admissible; pressure-free operation (atmospheric pressure) recommended.	
Materials	Semi-permeable membrane, PVC-U	
Dimensions	Dia. 25 mm, length 220 mm	Dia. 25 mm, length 205 mm
Weight	Approx. 125 g	

Maintenance	
Inspection of the measuring signal	Regularly, at least once a week
Replacement of membrane cap	Once a year (depending on the quality of the water)
Replacement of electrolyte	Every 3 to 6 months
Storage	
Sensor	Can be stored indefinitely in a frost-free and dry place, without electrolyte and between +5 and 40 °C
Membrane cap	Used membrane caps cannot be stored.
Electrolyte	In original bottle, away from sunlight, for at least one year at a temperature between +5 and 35 °C; and for transport between +5 and 50 °C

[a] Other measuring ranges upon request.

20263400T10Z001K000
Tel : 027-87886630
Fax : 027-87886620
www.maserac.com

Sensors for ozone (O_3) with membranes that are insensitive to chemicals

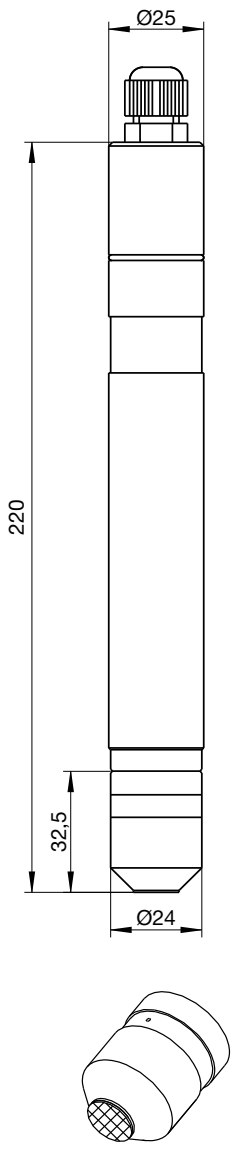
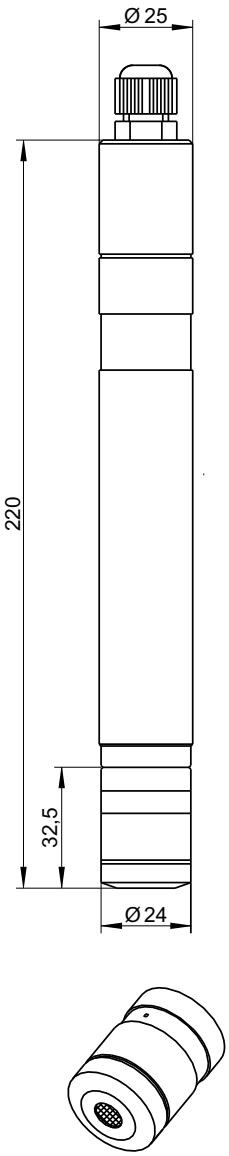
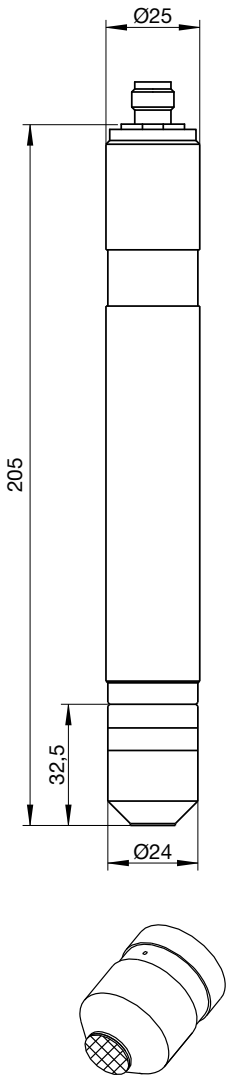
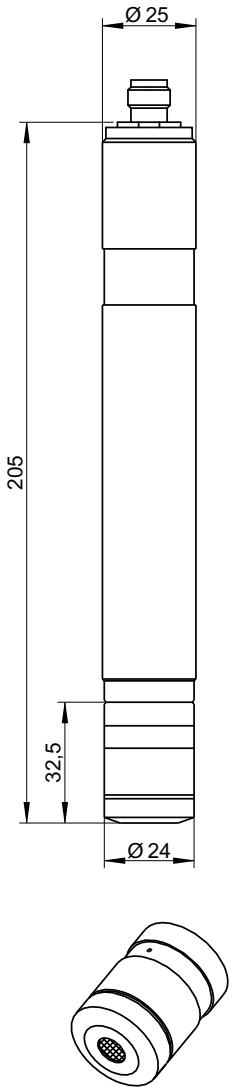
Sensor type	202634/51 (output signal of 4 to 20 mA)	202634/61 (digital interface output signal)
Area of application	All types of water treatment (e.g. bottle washing machine, CIP plant, rinser), seawater **Surfactants are tolerated**	
Measuring principle	Membrane-covered, amperometric, two-electrode system with integrated electronics	
Membrane type	Chemical- and surfactant-resistant membrane	
Measuring cable connection	2-pin terminal connection (2 × 1 mm^2)	5-pin flange connector, M12
Voltage supply	U_B DC 12 to 30 V (galvanic isolation required)	U_B DC 22.5 to 26 V (galvanically isolated from the sensor)
Electromagnetic compatibility	According to EN 61326-1 emitted interference: Class B interference resistance: industrial requirements	
Output signal	4 to 20 mA	Modbus RTU
Burden/current consumption	≤ (U_B - 7.5 V) ÷ 0.02 A	20 mA
Settling time	Approx 1 h for initial startup	
Inflow speed	Approx. 15 cm/s (entspricht to a flow of approx. 30 l/h when installed in the JUMO flow fitting (part no.: 00392611))	
Measuring ranges[a]	0.05 to 2 mg/l (ppm) 0.05 to 10 mg/l (ppm)	0.05 to 2 mg/l (ppm) 0.05 to 10 mg/l (ppm)
Resolution	0.01 mg/l	0.001 mg/l with measuring range 2 mg/l 0.01 mg/l with measuring range 10 mg/l
Response time t_{90}	Approx. 50 seconds	
Operating temperature	0 to 45 °C (prerequisite: no ice crystals in the measurement medium)	
Temperature compensation	Automatic, using integrated temperature probe temperature changes < 5 °C per hour	
Zero point adjustment	Not required	
Slope adjustment	On evaluation unit/controller using analytical determination	
pH value area of application	pH 2 to pH 11	
Disturbances	Cl_2: negligible ClO_2: leads to an increase in the measured value by 6 %	
Pressure resistance	p_{abs} max. 2 bar p_{rel} max. 1 bar No pressure fluctuations admissible; pressure-free operation (atmospheric pressure) recommended.	
Materials	PVC-U, stainless steel 1.4571	
Dimensions	Dia. 25 mm, length 220 mm	Dia. 25 mm, length 205 mm
Weight	Approx. 125 g	

Maintenance	
Inspection of the measuring signal	Regularly, at least once a week
Replacement of membrane cap	Once a year (depending on the quality of the water)
Replacement of electrolyte	Every 3 to 6 months
Storage	
Sensor	Can be stored indefinitely in a frost-free and dry place, without electrolyte and between +5 and 40 °C
Membrane cap	Used membrane caps cannot be stored.
Electrolyte	In original bottle, away from sunlight, for at least one year at a temperature between +5 and 35 °C; and for transport between +5 and 50 °C

[a] Other measuring ranges upon request.

20263400T10Z001K000
Tel : 027-87886630
Fax : 027-87886620
www.maserac.com

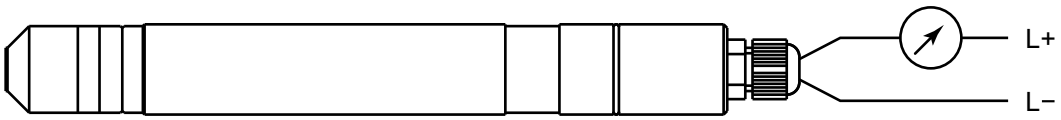
Dimensions

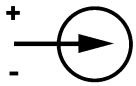
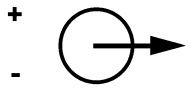
Types 202634/45 and /50	Types 202634/46 and /51	Types 202634/60 and /65	Types 202634/61 and /66
			

Tel : 027-87886630
Fax : 027-87886620
www.maserac.com

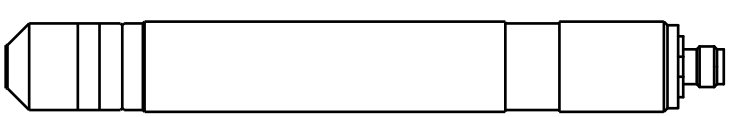
Electrical connection

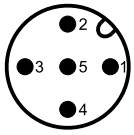
Types 202634/45, /46, /50 and /51



Function		Screw terminals
Voltage supply DC 12 to 30 V		1 L+ 2 L-
Two-wire output of 4 to 20 mA, load-independent current of 4 to 20 mA in voltage supply		1 L+ 2 L-

Types 202634/60, /61, /65 and /66





Function	Pin on M12 flange connector
not connected	1
+24 V voltage supply from transmitter/controller	2
GND	3
RS 485 B (RxD/TxD-)	4
RS 485 A (RxD/TxD+)	5

20263400T10Z001K000
Tel : 027-87886630
Fax : 027-87886620
www.maserac.com

Accessories

Combination fitting type 202811/10

The combination fitting is intended to hold several electrochemical sensors. It is typically used for disinfection monitoring of drinking and swimming pool water as well as slightly polluted process and cooling water. Thanks to its compact design, the fitting allows for the space-saving consolidation of several sensors and is usually operated in a bypass or downstream of a tap in the main line. The sensors are easily visible through the fitting's crystal-clear design and can be visually inspected for pollutants. In the maximum version, 2 sensors with Pg13.5 thread (for example for pH value and redox), 1 membrane-covered sensor Ø 25 mm for disinfectant monitoring and one temperature probe with thread M14 x 1.5 can be installed. Furthermore, the inflow of the measuring water contains flow monitoring with an inductive proximity switch for monitoring the inflow of the membrane-covered sensor. A ground pin can also be installed to discharge any electrostatic charges.	

Flow monitor type 202811/20

The flow monitor is integrated in the measuring water supply, in line with the disinfection sensor, and monitors the required minimum flow speed to the sensor. It consists of a flow unit, a needle valve insert for flow control, and an inductive proximity sensor, the contact of which can control a binary input of a controller (for example JUMO AQUIS 500 AS/RS). If the inflow is too low, the controller is moved to the "HOLD" status. This helps to avoid incorrect dosages.	

Flow fitting type 202811/30

The flow fitting is intended to hold an individual membrane-covered sensor. The fitting is generally mounted in the bypass and, thanks to its special design type, provides the correct inflow for the sensor. The flow monitor type 202811/20 is recommended as an extension for monitoring the minimum inflow speed of a sensor. The standard ground rod of the fitting enables the discharge of undesired electrical and electrostatic voltage potentials, which occur in complex plants and can distort the measured values.	

Suitable indicating devices/transmitters/controllers

Type	Features	Suitable sensors
JUMO AQUIS 500 AS	Single-channel (4 to 20 mA) indicating device/controller, additional temperature input, binary input, up to two analog and switching outputs	Types 202634/45, /46, /50 and /51 (output signal of 4 to 20 mA)
JUMO AQUIS 500 RS	Single-channel (Modbus RTU) indicating device/controller, additional temperature input, binary input, up to two analog and switching outputs	Types 202634/60, /61, /65 and /66 (digital interface)
JUMO dTRANS AS 02	Modular multichannel transmitter/controller for standard signals, PROFIBUS-DP, RS422/485, data logger using optional boards	Types 202634/45, /46, /50 and /51 (output signal of 4 to 20 mA)
JUMO AQUIS touch S/P	Modular multichannel measuring devices for liquid analysis with integrated controller and paperless recorder, USB host, USB device, Modbus, PROFIBUS-DP and Ethernet using optional boards	All types 202634[a]

[a] Types with digital interface (202634/60, /61, /65 and /66) in development.

20263400T10Z001K000
Tel : 027-87886630
Fax : 027-87886620
www.maserac.com

Order details

	(1)	**Basic type**
202634		JUMO tecLine ClO2 + O3
		Sensors for chlorine dioxide and ozone
	(2)	**Basic type extension**
45		Sensor for chlorine dioxide, output signal 4 to 20 mA
46		Sensor for chlorine dioxide, output signal 4 to 20 mA, insensitive to chemicals and surfactants
50		Sensor for ozone, output signal 4 to 20 mA
51		Sensor for ozone, output signal 4 to 20 mA, insensitive to chemicals and surfactants
60		Sensor for ozone, digital output signal
61		Sensor for ozone, digital output signal, insensitive to chemicals and surfactants
65		Sensor for chlorine dioxide, digital output signal
66		Sensor for chlorine dioxide, digital output signal, insensitive to chemicals and surfactants
	(3)	**Measuring range**
10		0 to 0.5 mg/l (ppm)
20		0 to 2 mg/l (ppm)
25		0 to 5 mg/l (ppm)
35		0 to 10 mg/l (ppm)
37		0 to 20 mg/l (ppm)

	(1)		**(2)**		**(3)**
Order code		/		-	
Order example	202634	/	45	-	20

Important information:

The order code is not modular. When placing orders, if possible please select the items listed under **"Stock versions"**. We must check the technical feasibility of and approve freely chosen combinations of individual code parts.

Scope of delivery

Types 202634/45, /46, /50 and /51	Two-wire sensor, incl. membrane cap, electrolyte, special abrasive paper for cathode cleaning and operating manual
Types 202634/60, /61, /65 and /66	Modbus RTU sensor, incl. membrane cap, electrolyte, special abrasive paper for cathode cleaning and operating manual

Stock versions

(Delivery within 3 working days after receipt of order)

Type	**Part no.**
202634/50-20 (ozone, 4 to 20 mA, 0 to 2 mg/l)	00392202

Tel : 027-87886630
Fax : 027-87886620
www.maserac.com

Accessories

Fittings

Description	Part no.
Combination fitting for mounting several electrochemical sensors[a]	00607325
Individual fitting for mounting a membrane-covered sensor	00392611
Mounting bracket for individual fitting	00455706
Flow monitor for monitoring the minimum inflow[b]	00605507

[a] With integrated flow monitor, mini ball valve included.

[b] For flow monitoring in connection with the individual fitting.

Spare part sets and electrolytes

Description	Part no.
Spare part set for 202634/45, /50, /60 and /65 (1 x membrane cap, fine abrasive paper)	00392331
Spare part set for 202634/46 and /66 (1 x membrane cap, fine abrasive paper)	00409344
Spare part set for 202634/51 and /61 (1 x membrane cap, fine abrasive paper)	00441309
Special electrolyte for 202634/45, /46, /65, and /66 (100 ml)	00392332
Special electrolyte for 202634/50, /51, /60, and /61 (100 ml)	00392333

Connecting cables for sensors with a digital interface

Description	Part no.
1.5 m connecting cable, 5-pin M12 connector, A-coded on the ferrules	00638333
5 m connecting cable, 5-pin M12 connector, A-coded on the ferrules	00638337
10 m connecting cable, 5-pin M12 connector, A-coded on the ferrules	00638341

Suitable transmitters/controllers

Description	Part no.
JUMO AQUIS 500 AS[a], type 202568/20-888-888-888-310-310-23/000 (for further versions, please refer to data sheet 202568) 	00528718
JUMO AQUIS 500 RS[b], type 202569/20-654-888-888-310-310-23/000 (for further versions, please refer to data sheet 202569) 	00602275
JUMO dTRANS AS 02[a], type: 202553/01-8-01-4-0-00-23/000 (fur further versions, please refer to data sheet 202553) 	00550842
JUMO AQUIS touch S/P[c]  	Refer to data sheet 202580/81

[a] For sensors with analog output signal (types 202634/45, /46, /50, and /51).

[b] For sensors with digital output signal (types 202634/60, /61, /65, and /66).

[c] For sensors with analog output signal (types 202634/45, /46, /50 and /51).
For sensors with digital output signal (types 202634/60, /61, /65 and /66) upon request.

20263400T10Z001K000
Tel : 027-87886630
Fax : 027-87886620
www.maserac.com