



More than **sensors + automation**

l/min

mV

mg/l

ppm

NTU

$\mu\text{s/cm}$

$^{\circ}\text{C}$

ms/cm

pH



Aquaculture Technology

Innovative solutions for your success



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Dear Reader,

All over the world more and more fish and crustaceans are being bred on commercial farms in aquacultures: in ponds, breeding tanks, net enclosures, and net cages. Among the different species of fish, freshwater fish such as carp or tilapia as well as sea fish such as salmon, bream, halibut, or tuna are particularly well suited for breeding of this kind. Aquaculture is currently the fastest growing sector in food production.

System manufacturers or operators know how complicated and challenging fish breeding in aquacultures is. The water quality is the decisive factor which depends on reliable processes and accurate measurement technology. Here, JUMO is at your side as a reliable partner.

We are happy to help you with any issues regarding the measurement and control of oxygen, temperature, pH level and redox value, conductivity, ozone concentration, pressure, filling level, flow, and other measurement parameters.

JUMO stands for years of experience and has been a leading manufacturer of measurement and control technology made in Germany for more than 65 years.

Contact us and tell us your process conditions and requirements. We will be happy to advise and offer you individual solutions that are tailored to your needs.

PS: Detailed information about our products can be found using the given type/product group number at www.jumo.net.



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Closed recirculation systems

Fish and other animal populations are held in breeding tanks and holding ponds under controlled conditions outside of their natural environments in closed recirculation systems. Aquaculture systems consist of a combination of breeding tanks and filter systems often connected in series in which the used and dirty water is recycled and returned to the tank. Water is pumped through the system while oxygen is constantly supplied. It then passes the mechanical and biological cleaning stage with subsequent disinfection by means of UV radiation or ozone. The oxygen content, temperature, pH level, redox value, and conductivity must be checked and adjusted before the water is fed back to the cycle again. The individual procedures and process steps need to be precisely coordinated to prevent the animals from experiencing any kind of stress or illness. Complete acquisition of process data is essential. JUMO provides measuring and control systems for water treatment, including data reporting for monitoring subprocesses as well as complete automation and control units for entire plant systems.

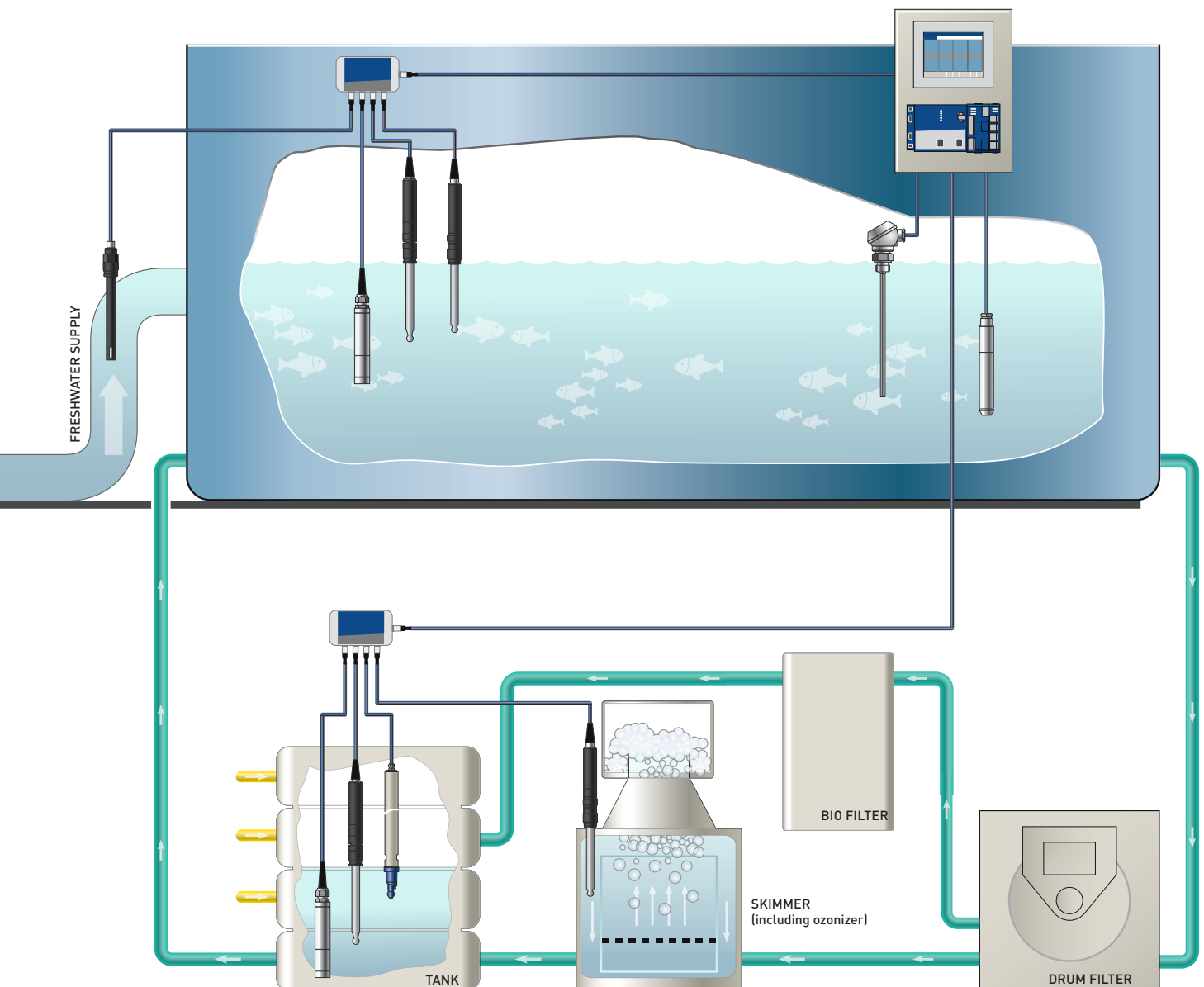
Your benefits in a nutshell

- **Reduced maintenance costs** – service lives can be extended through the integrated salt rings of the JUMO tecLine pH and redox electrodes.
- **Unlimited options** – using JUMO mTRON T, 62 JUMO digiLine sensors can be integrated in a system to control large plants.
- **Simple and convenient** – JUMO digiLine sensors can be easily and conveniently calibrated using the PC software JUMO DSM (Digital Sensor Management) in such locations as a lab.

Intelligent systems for controlled breeding on land

As a central unit, the JUMO mTRON T automation system allows complete process control as well as monitoring of closed recirculation systems. The individual system modules allow measuring tasks as well as control concepts to be implemented independently from one another. In combination with the bus-compatible connection system JUMO digiLine, JUMO mTRON T can even perform measuring tasks in the fish tanks as well as in the entire water cycle

of aquaculture systems thanks to the direct connection of digital JUMO probes. Oxygen consumption and temperature, but also parameters essential to the water quality such as pH value and salt content, can therefore be acquired in one system and are directly available for additional control processes. It is possible to integrate up to 62 digital sensors in the bus system with JUMO mTRON T for liquid analysis.





Live fish transport

The transport of live fish usually involves young fish that are transferred to the intended destination for further breeding. It is possible to breed fish worldwide thanks to the technical possibilities available for keeping fish outside of their natural habitat. Non-native young fish in the larval stage are therefore sometimes first transported from overseas via air freight and then taken to closed breeding stations in trucks. However, native fish are also bred on a large scale under optimum climatic conditions in fish hatcheries in such regions as Turkey, Scandinavia, and Australia. These fish are then transported to aqua farms for continued growth up to slaughtering. An optimum oxygen supply and stable temperature conditions are essential for the fish to survive during transport. Metabolic products must not accumulate in quantities that are harmful to the animals. Permanent monitoring of the water quality in the transport tanks is therefore essential. JUMO would be happy to help you with reliable measuring and control systems for various tasks.

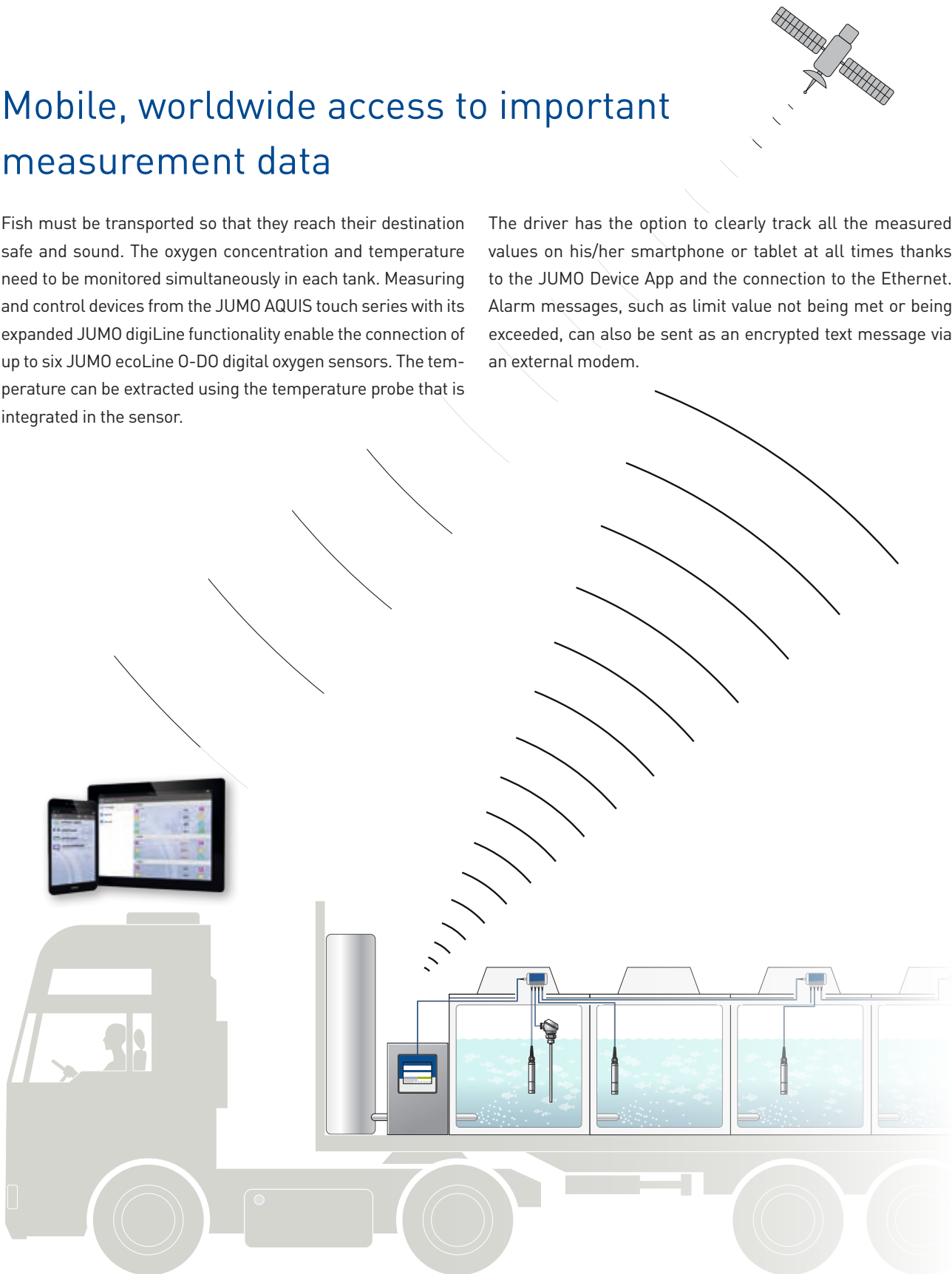
Your benefits in a nutshell

- **Reduced wiring and installation work** – thanks to the JUMO digiLine functionality, you only need a master cable for the communication between sensors and transmitters.
- **Immediately ready for use** – with the precalibrated oxygen sensor JUMO ecoLine 0-DO, including calibration protocol.
- **Continually updated** – the JUMO Device App allows constant access to your process data.

Mobile, worldwide access to important measurement data

Fish must be transported so that they reach their destination safe and sound. The oxygen concentration and temperature need to be monitored simultaneously in each tank. Measuring and control devices from the JUMO AQUIS touch series with its expanded JUMO digiLine functionality enable the connection of up to six JUMO ecoLine O-DO digital oxygen sensors. The temperature can be extracted using the temperature probe that is integrated in the sensor.

The driver has the option to clearly track all the measured values on his/her smartphone or tablet at all times thanks to the JUMO Device App and the connection to the Ethernet. Alarm messages, such as limit value not being met or being exceeded, can also be sent as an encrypted text message via an external modem.





Net-enclosure systems

The breeding of saltwater fish has developed into a major industry over recent years. Aqua farms have been set up along stretches of coastline across the world. The result is an ever-increasing need for space. In Europe mainly trout, salmon, sea bass, and bream are kept in net-enclosure and cage systems that can be very large in size. State-of-the-art technologies and coordinated processes help to make managing such systems more and more efficient. Reliable measuring and process systems that are tailored to the needs of the system operators are essential here. JUMO offers innovative sensor and device technologies for the required measuring tasks and the monitoring of aqua farms. Reliable data communication between sensors and the measuring device, tamper-proof recording of measuring and process data, as well as the forwarding of data to higher level control systems or mobile devices are possible thanks to the integration of various modern interfaces.

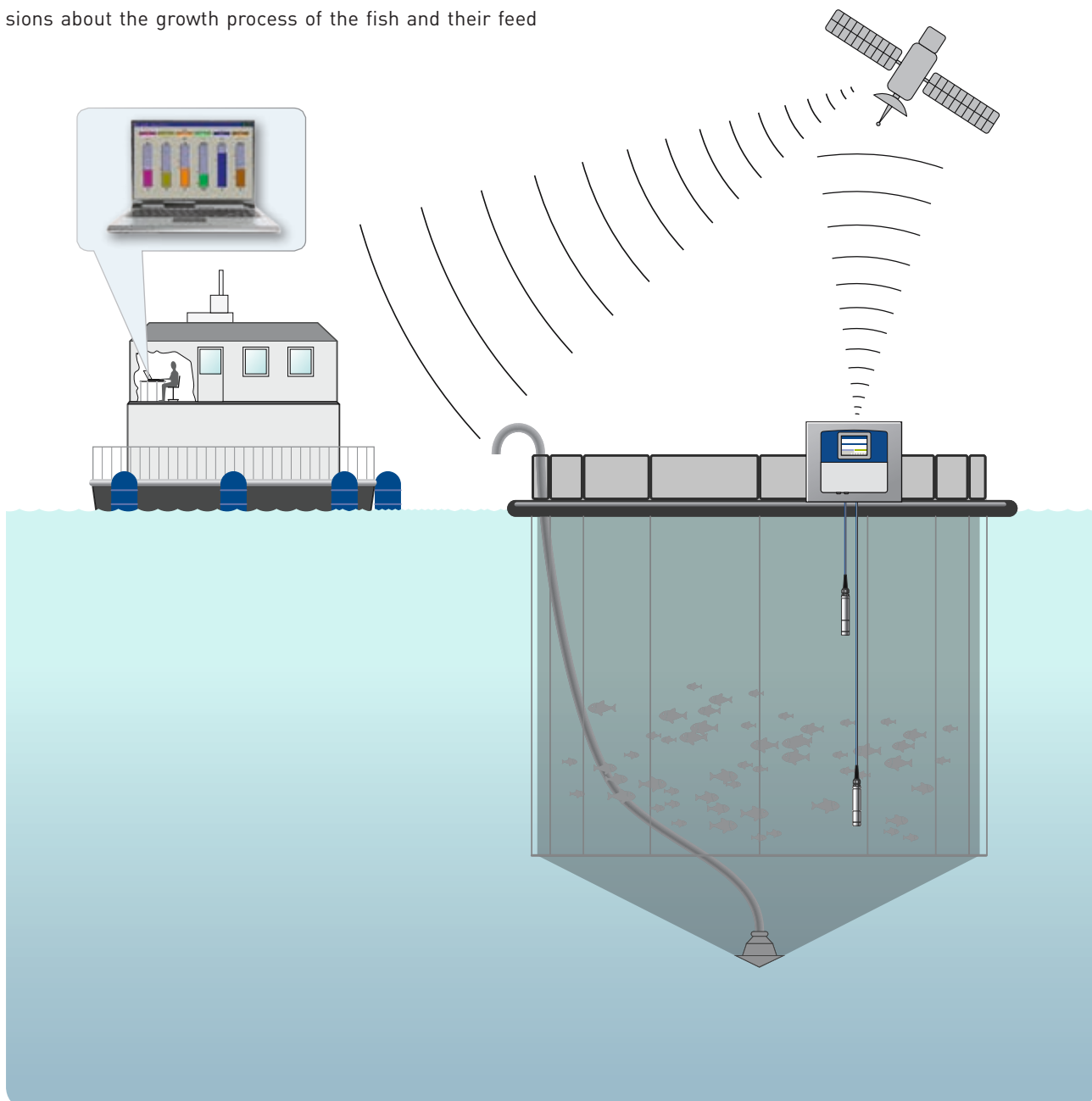
Your benefits in a nutshell

- **Less maintenance costs** – the modern LED technology in the JUMO ecoLine O-DO increases the service life of the membrane and reduces the calibration intervals.
- **Versatility** – JUMO digiLine electronic components allow analysis inputs and outputs to be loaded according to the individual measuring requirements.
- **Everything at a glance** – the recording function in the JUMO AQUIS touch records data in a tamper-proof manner and transfers this data to the control system.

Remote monitoring of aqua farms with a systematic approach

Aqua farms breed thousands of young fish up to the slaughtering stage. Stock success and maximum yield largely depend on the well-being of the animals. A sufficient supply of oxygen is essential and therefore needs to be continuously monitored. The modular measuring and control system JUMO AQUIS touch S, in conjunction with the optical oxygen sensor JUMO ecoLine O-DO, provides continuous and reliable measuring data in real time. The temperature can also be extracted via the sensor's digital interface. Controlling these two parameters means that one can draw conclusions about the growth process of the fish and their feed

utilization. Based on this data the feed quantities and times can be optimized and tailored to the needs of the fish populations. Additional sensors can be connected to the JUMO AQUIS touch S and the environmental conditions inside and outside the individual cages can be acquired by determining such measurands as the pH value, conductivity, or turbidity. Simple data control via the control system or mobile devices is possible thanks to the implementation of Internet-based interfaces in JUMO AQUIS touch S or thanks to the connection of radio-based technologies.



Product highlights at a glance



digiLine

Types 201021, 201022,
201026, 201027

JUMO tecLine HD

Digital or analog pH and redox combination electrodes

- Robust electrodes for demanding applications
- JUMO digiLine electronic components are available with digital interface or analog output
- Simple and convenient calibration on the PC with the JUMO DSM software
- The electronic components can continue to be used when exchanging the sensor after wear



Types 202922, 202924
202943

JUMO BlackLine CR, JUMO tecLine CR, and JUMO ecoLine Ci

Conductive and inductive conductivity sensors

- Conductive sensors for measuring ranges < 10 mS/cm
- Robust and compact design types
- Wide selection of process connections
- Inductive sensors for measurements of high salt concentrations
- Measuring range from 0 to 2000 mS/cm
- With fast-response temperature sensor



Type 404393

JUMO MAERA S29 SW

Level probe for continuous level measurement

- Highly resistant to chemicals due to titanium
- Measuring range already as of 100 mbar relative pressure
- Accuracy: 0.3 % MSP (linearity)
- Proven piezoresistive silicon sensor

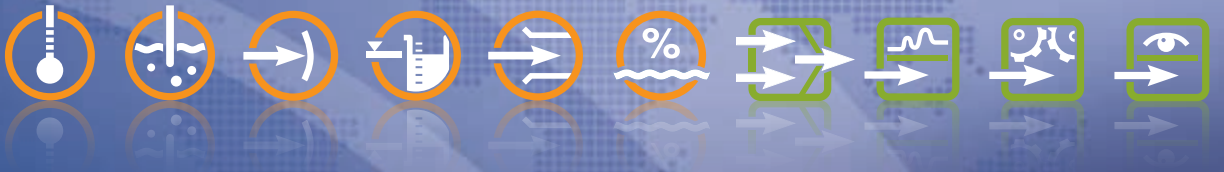


Types 401012, 401021, 401050

JUMO MIDAS C18 SW, JUMO MIDAS S07 MA, and JUMO MIDAS DP10

Pressure and differential pressure transmitters

- Measuring range up to 100 bar relative pressure
- Different versions available (e.g. for seawater)
- Different differential pressure areas selectable up to 16 bar
- Various process connections



JUMO ecoLine O-DO and JUMO ecoLine NTU

Optical sensor for dissolved oxygen (O-DO) and turbidity

- Versatile application options
- Secure measured value transmission
- Simple startup
- Low operating costs

Types 202613, 202670



JUMO AQUIS 500 and JUMO dTRANS 02

1 channel and 2 channel transmitter/controller

- Available as wall device and panel mounted device
- Multilingual plain text operation
- Easy-to-use programming
- Plant documentation through setup program
- For the measurement of pH and redox value, conductivity, oxygen, turbidity, and disinfection

Types 202551, 202565



JUMO AQUIS touch S/P

Modular multichannel measuring devices for liquid analysis

- Up to four analog and six digital sensors can be combined as needed
- Up to 15 additional measuring signals possible
- Interfaces: USB host, USB device, Modbus, PROFIBUS DP, Ethernet including web server, PROFINET (type 202581)
- Intuitive operation via touchscreen
- Display of the measured values on smartphone or tablet with JUMO Device App

Types 202580, 202581



JUMO mTRON T

Measuring, control, and automation system

- Process mapping for up to 30 input/output modules
- Individual solution concepts thanks to the modular setup
- Connection of up to 62 digital sensors for liquid analysis (digiLine pH/ORP/T, ecoLine O-DO/NTU, and disinfection measurands) via RS485 interface
- Ethernet interface with integrated web server
- PLC according to IEC 61131-3 (CODESYS V3.5)
- Creation of customer-specific process screens

Type 705000



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