



More than **sensors + automation**

l/min

mV

mg/l

ppm

NTU

μ S/cm

$^{\circ}$ C

mS/cm

pH



Aquaculture

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:

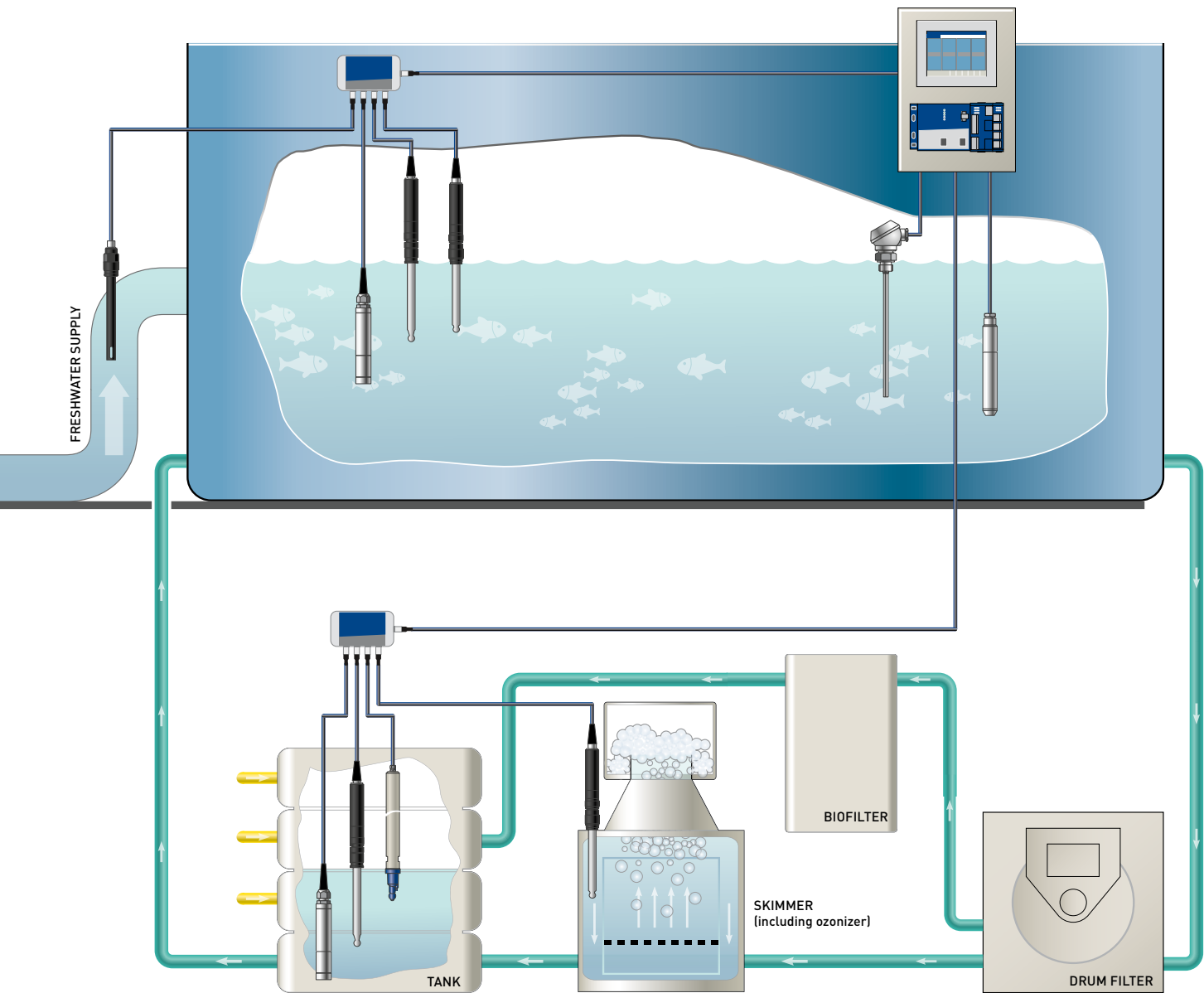
- **Reduced maintenance overheads** – service lives can be extended using integrated salt rings for the JUMO tecLine pH and redox electrodes.
- **Unlimited options** – using JUMO mTRON T it is possible to integrate 62 digiLine sensors in a system to control large plants.
- **Simple and convenient** – JUMO digiLine sensors can be easily and conveniently calibrated using the PC software JUMO DSM (Data Sensor Management) (e.g. in the lab).

Intelligent system 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 mean that both measuring tasks and control concepts can be implemented independently. 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 digital JUMO probes being directly connected. 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 altogether 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 lorries. However, native fish are also bred on a large scale under optimum climatic conditions in fish hatcheries in such countries as Turkey, Scandinavia, and Australia and 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 where the concentrations would be 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.

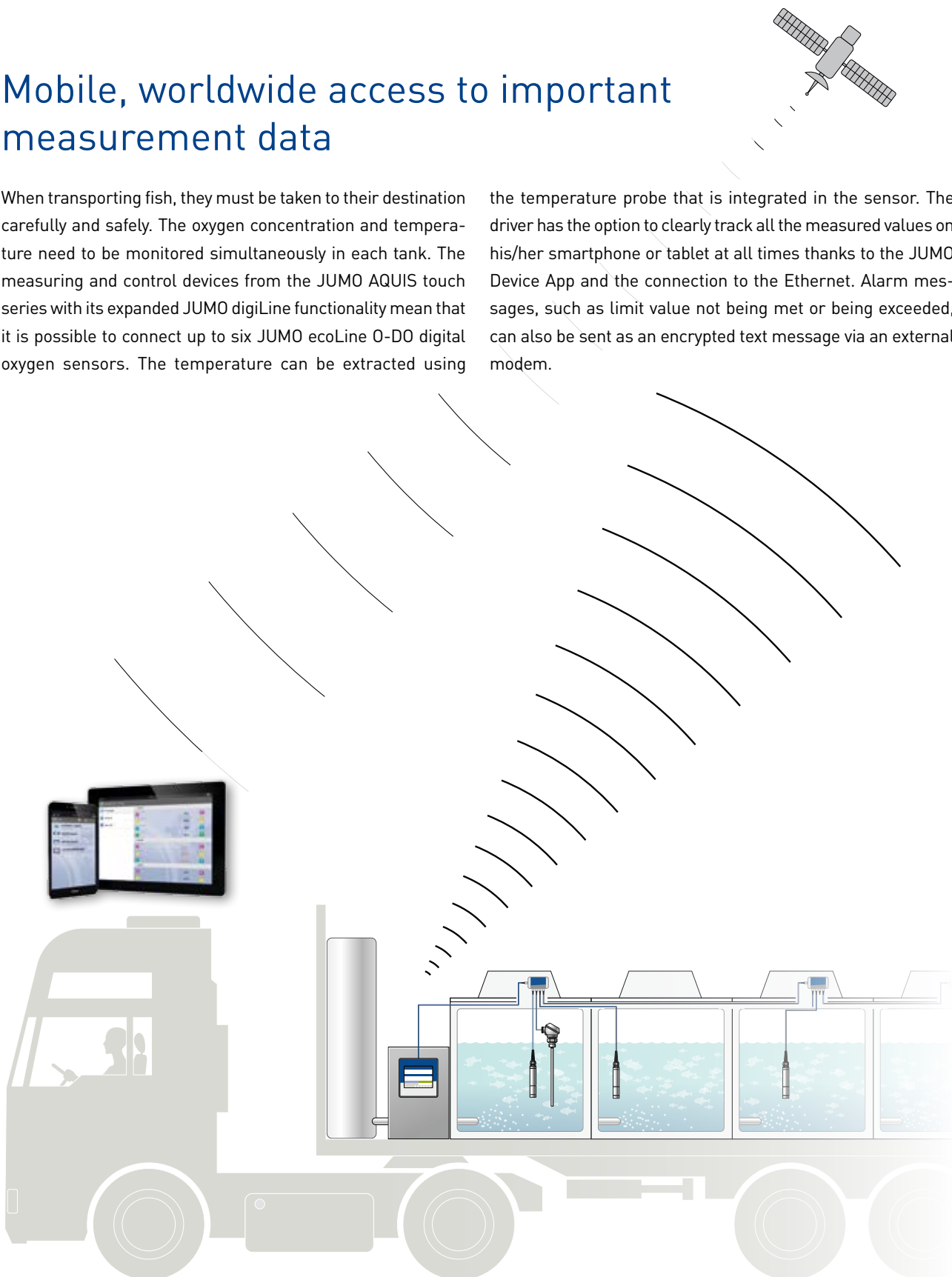
Your benefits in a nutshell:

- **Less wiring and installation overheads** – 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 O-DO, including calibration protocol.
- **Continually updated** – the JUMO Device App means that you always have access to your process data.

Mobile, worldwide access to important measurement data

When transporting fish, they must be taken to their destination carefully and safely. The oxygen concentration and temperature need to be monitored simultaneously in each tank. The measuring and control devices from the JUMO AQUIS touch series with its expanded JUMO digiLine functionality mean that it is possible to connect 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, with an ever-increasing need for space. In Europe mainly trout, salmon, sea bass, and bream are kept in (partially) huge net-enclosure and cage systems.

State-of-the-art technologies and coordinated processes are helping 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 overheads** – 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 electronics mean that analysis inputs and outputs can 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 systems

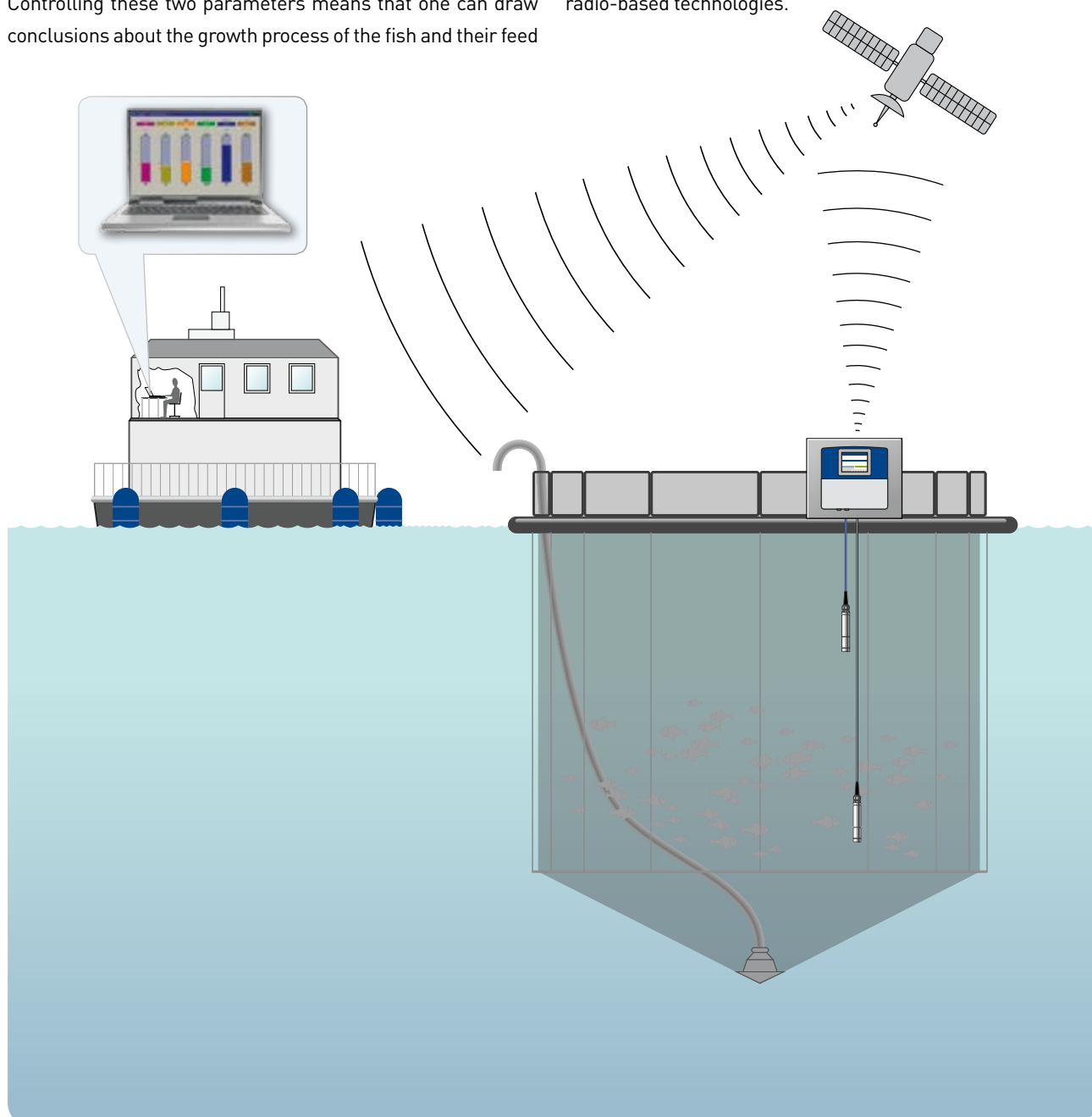
Aqua farms breed thousands of young fish up to the slaughtering stage. Stock success and maximum yield largely depend on the well-being of the animals. A sufficient supply of oxygen is essential and therefore needs to be continuously monitored. The modular measuring and control system JUMO AQUIS touch 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. 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

JUMO tecLine HD

Combination electrodes for acquiring pH and redox values

- Robust electrodes for demanding applications
- JUMO digiLine electronics with digital interface, optionally with an analog output
- Simple calibration on the PC using the software program JUMO DSM
- The electronics can continue to be used when exchanging the sensor after wear



Type 404393

JUMO MAERA S29 SW

Level probe for continuous level measurement

- Measuring ranges: 100 mbar to 10 bar (1 mWS to 100 mWS)
- Medium temperature: 0 to 50 °C
- Piezoresistive silicon sensor
- Accuracy: 0.3 % MSP (linearity)
- Highly resistant to chemicals due to titanium version
- Ship approval according to GL



Types 202924, 202922

JUMO tecline CR and JUMO BlackLine CR

Conductive two-electrodes conductivity sensors

- Two-electrodes principle
- For measuring ranges from 0.05 $\mu\text{S}/\text{cm}$ to 5,000 mS/cm
- Wide selection of process connections
- Version with small shaft diameter available (for 202924/20 version)



Type 202943

JUMO ecoLine Ci

Inductive conductivity and temperature sensor

- Practically maintenance-free conductivity measurement
- Various process connection variants
- Fast-response temperature sensor
- Suitable for conductivity measurement with higher salt contents
- Possible to use in open channels and containers thanks to the immersion version



Types 202613, 202670

JUMO ecoLine O-DO and JUMO ecoLine NTU

Optical sensors for dissolved oxygen (DO) and turbidity

- Low operating costs due to reduced maintenance work
- Greater calibration intervals due to lower drift behavior
- Versatile application options due to wide measuring range
- Secure measured value transmission even over long distances
- Simple on-site startup thanks to pre-calibrated sensor



Types 202565, 202551

JUMO AQUIS 500 and JUMO dTRANS 02

Single-channel and two-channel transmitter/controller

- Plain language operation, multilingual
- Graphic display with backlight
- Easy-to-assemble plug-in terminal strip
- Setup program features easy-to-use programming and system documentation



Types 202580, 202581

JUMO AQUIS touch S/P

Modular multichannel measuring devices for liquid analysis

- Up to four analog and six digital sensors can be connected in any combination
- Up to 15 additional measuring signals possible
- Interfaces: USB host, USB device, Modbus, PROFIBUS DP, and Ethernet
- Intuitive operation via touchscreen



Type 705000

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) via RS485 interface
- Ethernet interface with integrated web server
- PLC according to IEC 61 131-3 (CODESYS V3.5)
- Creation of customer-specific process screens



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