

$$Q = A \times v$$

pH

°C

TDS

$$D = v \hat{=} t/2$$

NTU

# THE ORAKEL SYSTEM

Intelligent flow and water  
quality monitoring

  
DETECTRONIC

## ONE SYSTEM, MULTIPLE APPLICATIONS

The ORAKEL System is the ultimate water flow and water quality measuring product range.

Created as a modular system, a wide range of sensors can be added to measure various water characteristics, for a truly bespoke and cost-effective solution.

Capable of measuring a range of water characteristics, the control unit connects up to 4 sensors as standard but is expandable up to 16 sensors.

Optional comms packages allow Profibus, Modbus ASCII, Modbus RTU, Modbus TCP, 4-20mA analogue outputs and relays for alarms and control.

Equipped with a colour display screen, readings can be taken directly from the control unit or downloaded from the internal data logger. An optional modem allows for remote communication capabilities.

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## MULTIPLE MEASUREMENTS

### Flow:

- Radar open channel
- Closed pipe time of flight clamp-on
- Area velocity open channels and partially filled pipes
- Level monitoring of flumes and weirs

### Water Quality Analytics:

- Wastewater
- Groundwater
- Drinking Water
- Water Treatment
- Cooling Water
- Finished products
- Process water

### PID Control:

- Chemical dosing
- Temperature control
- Pump control



## APPLICATIONS

The ORAKEL System can be used in a wide range of applications including:

- Treatment plant influent and effluent
- Industrial effluent
- Process control
- Water quality analysis
- Billing verification
- Environmental protection
- Leak detection
- Compliance monitoring

**KEY  
FEATURES**

**ONE SYSTEM,  
MULTIPLE SENSORS**

- One system to programme and maintain

**DATA COLLECTION  
ALL IN ONE PLACE**

- Flexible and modular system set up
- Multiple parameter combinations

**COMMUNICATION OPTIONS**

- Profibus
- Modbus ASCII, Modbus RTU, Modbus TCP
- 4-20mA analogue outputs and relays for alarms and control
  - 2G/3G/4G modem
- Online portal access for remote management

**EASY  
CONFIGURATION**

- Comprehensive database of pipe, fluids and lining materials to choose from

**SMART SENSORS**

- Reliable and accurate
  - Rugged
- Customise for your application and add up to 16 sensors

**INTUITIVE DISPLAY**

- Real time trends
- Check sensor health with diagnostics
- View status of sensors – alarm and warnings

**CONTROL OPTIONS**

- Analogue outputs
  - Relay outputs
  - Band control
  - Inverter control
- Flow proportional control
  - PID Control
- Real time clock control

## ADVANCED CONTROLS



### Relays

Relays are used to control external equipment such as dosing pumps and solenoid valves. The ORAKEL Controller supports multiple control protocols including pulse frequency (number of contacts within a time period), pulse width (time between contacts within a time period) and contact (on/off).

For applications where precise dosing control is not needed, it is possible to use band control which is essentially an on/off control mechanism. If a signal moves outside of a pre-determined range, a relay is triggered. That turns on a dosing pump, which adds chemicals into the system to return the signal to within the desired band.

### PID Control

PID controllers can manipulate process variables such as temperature, flow, pressure, pH levels etc. making it ideal for dosing. It works by reading the sensor signal. It then subtracts the measurement from a desired setpoint to determine an

error. The error is then acted upon by the three (Proportional, Integral & Derivative) terms simultaneously. For example after setting the desired pH setting from 5.5 to 9.5 pH, the controller measures the pH value of the solution and automatically adds pH adjustment (acid or alkaline) to change the liquid's pH to the selected level.

### Flow Proportional Control Dosing Control

PID ensures optimum dosing, eliminating chemical wastage and overdosing whilst ensuring the required levels are always achieved. Sometimes performance is measured by applying a step function as the setpoint variable and then measuring the response of the process variable. For example if the desired setpoint is pH7 and the liquid's pH level is moving further away, PID will trigger the pump, proportional to the error to increase the acid or alkaline. The controller will measure the time it takes for the pH level to increase to the setpoint. It will also measure any overshoot of the desired



pH level and the settling time taken to return levels to the desired levels.

### Real Time Clock Control

Real time clock control allows a relay output to be controlled based on the internal clock of the controller. An example of an application for real time clock control would be to activate a dump valve on a water recirculation system at a certain time. The controller could be setup to activate the relay every 6 hours for a predetermined time which would allow the water to be drained and then automatically made up to give the required dilution.

### Auto Flush Control

Using autoflush helps to extend the life of a sensor. After a predetermined time, the sample drains away and is flushed with clean water. Because the water flushes the whole of the sensor housing, it helps to prevent the build up of solids.

### Built-in Parameters

Built-in fluid parameters allow calculation to compensate for sound speed, density, viscosity, specific heat capacity and temperature (if temperature is known from optional temperature probe) as required.

### Flexible Measurement

Liquid can be measured in m<sup>3</sup>, USgal, mg, cf, bbl and Imp bbl. All measured values can be selected as flow rate per second, minute, hour or day and are automatically totalised.

### On-Board Flow Calculation

The pulse output can be used for flow proportional sampling. This is useful where auto sampling is required and is an alternative to time proportional sampling. It is especially useful where the flow of water varies for instance during shifts and cleaning processes. Flow proportional sampling offers a more accurate view of the composite sample, since samples taking is dictated by the flow of water.

## WATER FLOW

**Detectronic specialise in developing ultrasonic level and flow meters. Ultrasonic flow meters work using the principle of transmitting a pulse out from the sensor and measuring the time it takes to return.**

### Non Contact Flow Meter

An ideal solution for monitoring rivers, irrigation canals, and sewage systems, the ORAKEL Non Contact Flow Meter uses radar technology to capture flow data with a high level of accuracy. An ATEX version is available.

The sensors are installed above the surface of the water meaning that no routine cleaning is needed and the sensors are not susceptible to ragging or fouling.

The flow meter is also suitable for various mass flow metering applications in processing plants, industrial plants and, due to its operation without moving parts and robust mechanical design, is ideal for the measurement of flammable fluids and harsh chemical applications.

### Time of Flight Flow Meter

Ideal for monitoring a closed pipe and virtually any liquid including all types of water, oils, petrochemicals and alcohol. The time of flight flow meter sends ultrasonic waves both upstream and downstream through the pipe to determine the flow rate.

The transducers clamp onto the exterior of the pipe, meaning there is no need to shutdown or cut into the pipe.

### Submerged Area Velocity Flow Meter

Installed within the open channel, the sensor simultaneously uses ultrasonic waves to measure the velocity of the liquid flow and pressure sensing technology to establish depth.

Pre-configured dimensions of the pipe or channel are used to determine the overall volume of flow.

Due to its robust construction and ATEX certification, the ORAKEL Submerged AV Flow meter can be used in open channels, combined sewers and storm sewer pipes. It is designed to measure volumetric flow of raw sewage, industrial effluents and storm waters.

### Level Measurement for Flumes and Weirs

The flow in an open channel can be calculated by measuring the liquid level up stream of a standard weir or flume. It is often used to measure rainwater and stormwater, sewer monitoring, industrial wastewater and the flow measurement of rivers and levels.

An ATEX certified non-contact ultrasonic transmitter is placed above the water. It emits a pulse which then reflects back from the surface of the water, providing accurate level measurement that is non-intrusive and low maintenance.



## WATER QUALITY

Sensors are available for a range of water quality parameters. Being a modular system, users can simply select the sensors they need for a particular location.

## SENSORS

Parameter	Range	Resolution	Temp	Lifespan
Chlorine	0.01-2mg	0.01ppm	0 - <45°C	15 years
pH	0-14pH		0 - 100°C	3 years
Dissolved Oxygen	0-50mg/l	0.01mg/l	>0 - 50°C	>5 years
ORP	-1999 to 1999mV			3 years
Turbidity	0.01 - 1000 NTU	0.001 NTU	-20°C - +85°C	>5 years
Suspended Solids	Up to 500mg/l, 4000NTU	Up to 0.00001g/L	0 - 50°C	>5 years
Conductivity	0-1000 µS/cm 500-2,000,000 µS/cm		70°C 105°C	5 years
Peracetic Acid	0-5000mg/l	0.1ppm	0 - 45°C	15 years
UV254	0-100% UVT 0-6.5 UVA	0.1% UVT 0.001 UVA		Lamp life 2 years
Oil on water	Up to 8m above surface	0.1µm oil thickness	-25°C - +60°C	Lamp life 5 years

### Chlorine Sensors

Membrane devices which are insensitive to changing pH, use no reagents, are extremely stable and have reduced maintenance, minimising whole life costs.

#### Typical applications:

Disinfection dosing control  
Drinking water  
Swimming pools

#### Key benefits:

Long lifetime  
Low maintenance required - annually

### Conductivity Sensors

Measures conductivity from 0 to 2,000,000 µS/cm. They are suitable for measuring the online conductivity of any aqueous solution.

#### Typical applications:

Industrial effluent  
TDS monitoring  
Salinity monitoring

#### Key benefits:

Resistant to corrosion for long service life  
Can be mounted inline, in a pipe 'T' fitting or submerged in a tank



#### Dissolved Oxygen Sensors

Optical luminescent devices which are extremely resistant to abrasion, extremely stable, and have greatly reduced maintenance and whole life costs.

##### Typical applications:

DAF plants  
Aeration lanes (WWTW)  
Fish Farms

##### Key benefits:

Low maintenance – 36 months  
Low calibration rate – 36 months

#### Oil on Water

A non-contact sensor that detects oil on water in real time. It uses oil's natural fluorescence to detect anything from marine diesel to vegetable oil to jet fuel, and alerts you immediately.

##### Key benefits:

Detects oil thickness as low as 1µm  
5 year lifetime on UV lens

#### ORP

A range of platinum based sensors that measure the online redox potential of

any aqueous solution. The potential tells operators the tendency of the water to oxidise (or reduce) pollutants. Tendency can be seen as a useful measure of the rate of oxidation.

##### Typical applications:

Potable water  
Wastewater  
Pool/spa  
Process water

##### Key benefits:

Longer life – up to 3 years

#### Peracetic Acid

Anywhere you have a requirement to measure residual  $CH_3CO_3H$  is a suitable application for the ORAKEL Peracetic Acid Sensor. It is suitable for all potable, process and salt waters.

##### Typical applications:

Disinfection dosing control  
Water residuals for food processing

##### Key benefits:

Up to 15 years life  
Reduced maintenance – 6 months

#### Particle Counter

A sophisticated range of particle counters with the capability to size and count particles from 2-127 microns.

##### Typical applications:

Filtration process monitoring in dairies  
Rapid gravity filters (RGF)  
Cryptosporidium detection

##### Key benefits:

Sapphire optics for extended life  
Low cost of ownership

#### Suspended Solids

A sophisticated sensor that can monitor turbidity and suspended solids from 2 NTU (1mg/l) to 8% solids in wastewater. Optical technology provides a stable and reliable low-maintenance sensor with no moving parts and no consumables.

##### Key benefits:

12 months between maintenance  
12 months between calibration

#### Turbidity

The turbidity sensor automatically varies the light output so that the turbidity can be

measured independently of background light and electronic drift. It is ISO 7027 compliant and covers a range of 0.01-1000 NTU (0.01-2000mg/l depending on the sample).

##### Key benefits:

Low cost of ownership  
Maintenance free  
Calibration – 3 months

#### UV254

Providing online continuous organics monitoring, utilising a 254nm ultraviolet light source. The amount of light absorbed provides an ongoing indication of Natural Organic Matter (NOM) in a flowing sample and serves as a continuous surrogate measurement for Total Organic Carbon (TOC), as well as other measurements such as Chemical Oxygen Demand (COD) and Biological Oxygen Demand (BOD).

##### Key benefits:

UVA (ultra-violet absorbance) is an excellent surrogate parameter for TOC, BOD, COD and colour.  
UVT (ultra-violet transmission) allows for the calculation of optimal UV dose for disinfection systems, improving efficiency.



## COMMUNICATIONS

The ORAKEL controller offers a full suite of device and remote communications options plus a range of comms packages including Modbus, Profibus, ASCII, Modbus RTU, Modbus TCP and others.

The controller has 8 digital inputs, but is expandable up to 32. Additionally, 4 configurable sensor inputs are available. 4-20mA loop powered, 0-2 VDC, +/- 1200 mV for pH, ORP, or ISEs, PT100, pulse and Modbus. Any unused inputs can be used as Outputs.

The ORAKEL controller holds over 1 million records. Downloadable datalogs are available for almost anything. You can view graphs on the display screen and you can datalog the same parameter at more than one interval.

A human readable service log can be downloaded, providing a history of the instrument including settings and calibrations. Additionally for ease of use, on-screen wiring diagrams can be accessed directly from the controller menu.

With remote monitoring, you get visibility of your data as it is recorded, displayed online in charts. Alarms can be set, warning you by email or SMS when set parameter thresholds are exceeded and enabling you to take appropriate action. The ORAKEL system transmits data via GPRS and includes an optional 2G/3G/4G modem.

## CHOOSING AN ORAKEL SYSTEM

The ORAKEL system is modular and fully configurable. It is capable of a wide range of measurements and control options. To help ensure you get exactly what you need, here is a guide to help specify your ORAKEL System.

Start with the controller

Next, choose your primary measurement  
e.g conductivity or flow

Then, select any other parameters you want to measure, such as chlorine, pH, COD etc.

How are you measuring the liquid?  
Do you need any flow cells or auto flushes?  
If you are adding PID control, you'll need a relay or an analogue output too.  
How many analogue outputs do you need to relay information or control a pump?

Choose any extras such as PID control. Remember that you'll need one per measurement that you want to control

Finally, choose any output communications options you need such as Profibus, Modbus or Remote Access

The Detectronic team are available to discuss your application and can help with your specifications.

Contact the team on **+(44) 1282 449 124** or email **[sales@detectronic.org](mailto:sales@detectronic.org)**





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