

Ra-BOD[®]

On-line Biological Oxygen Demand



An extended range of on-line analyzers to suit your needs in water treatment, process streams, river monitoring and compliance.

AppliTek

APPLIED TECHNOLOGY.

SINCE 1985.

Ra-BOD[®] On-line Analyzer

Run your treatment plant reliably and efficiently



On-line, rapid BODst measurements

The quantity of oxygen consumed per unit of time and per unit of volume, called the respiration rate, is one of the most important parameters for the biological activity of activated sludge plants. Conventional tests, performed on a diluted sample, at a defined temperature (normally 20°C) and for a standard 5 days period, however, take too much time with results that are difficult to reproduce and of low accuracy.

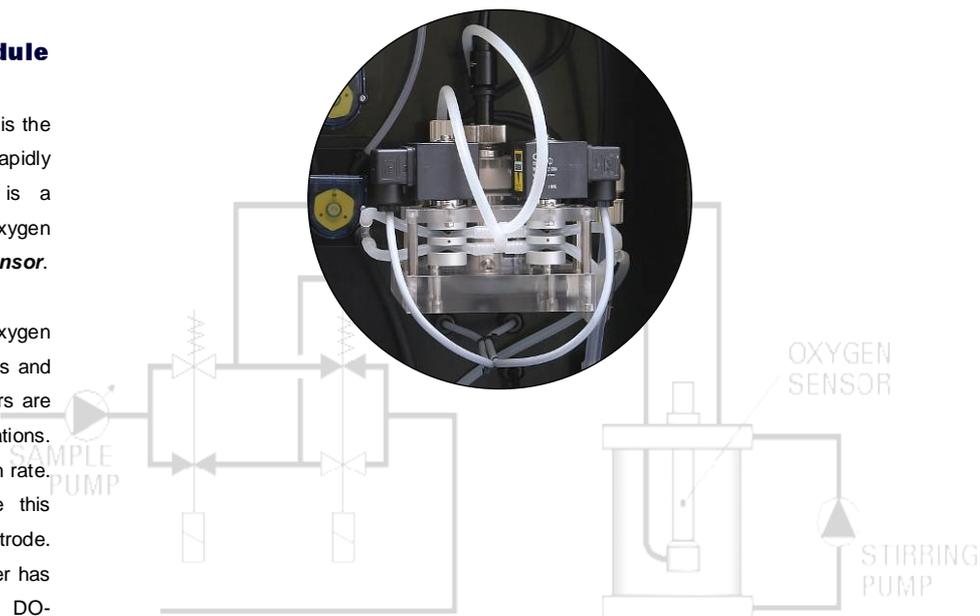
The answer to this need was the development of a unique Respiration Module for analyzer applications, giving birth in return to the Ra-BOD[®] and Ra-TOX[®] AppliTek analyzers.

With a response time of 30 minutes, the Ra-BOD[®] produces rapid and reliable data with operator interventions limited to calibration, enabling its user to achieve control over the treatment process.

The core : the Respiration Module

The heart of the respiration process analyzers is the Respiration Module, designed for quantifying rapidly and reliably respiration. Its basic design is a measurement of the difference between two oxygen concentrations by means of a **single oxygen sensor**.

The disadvantage of designs consisting of two oxygen sensors is that different response characteristics and different aging patterns between the two sensors are recognized as a difference in oxygen concentrations. This might result in a false drift of the respiration rate. The AppliTek respiration analyzers eliminate this problem by using only one single DO-electrode. Moreover, calibration of the Ra-BOD[®] analyzer has been reduced to calibration of the single DO-electrode.





The ergonomic fiberglass housing of the **Ra-BOD**[®] enables quick inspection and easy maintenance of the hardware of the analyzer.



Inside the **Ra-BOD**[®].

The respiration vessel, with standard high precision peristaltic pumps for long-life and reliable operation.

The analyzer samples the sludge waiting in the external aeration vessel.

Respiration technology , built for the plant

Implementing the **Ra-BOD**[®] process analyzer means reduced operational costs, better process performance and higher effluent quality. Typical applications are:

- Overload of the activated sludge as a result of a high supply of readily biodegradable compounds
- Inadequate aeration resulting in less effluent quality or too much aeration, resulting in a high energy bill
- Too high flow of waste sludge, because of which there is too little activated sludge in the installation and the quality of the effluent decreases.
- Too low flow, because of which too much activated sludge remains in the installation and therefore too many oxygen is required

Respiration technology, field-proven

The user-friendly industrial computer inside the analyzer is industrially rugged and controls precisely all operations and functions. A flexible analyzer set-up is available to measure both influent and effluent to assess the treatment efficiency of biodegradable load going into the plant.

The use of sludge from the plant itself as a reference for measurements of short term BOD has some considerable advantages:

- Same temperature as in the treatment plant
- Same pH as in the treatment plant
- Direct respirometric measurement; no mathematic determination

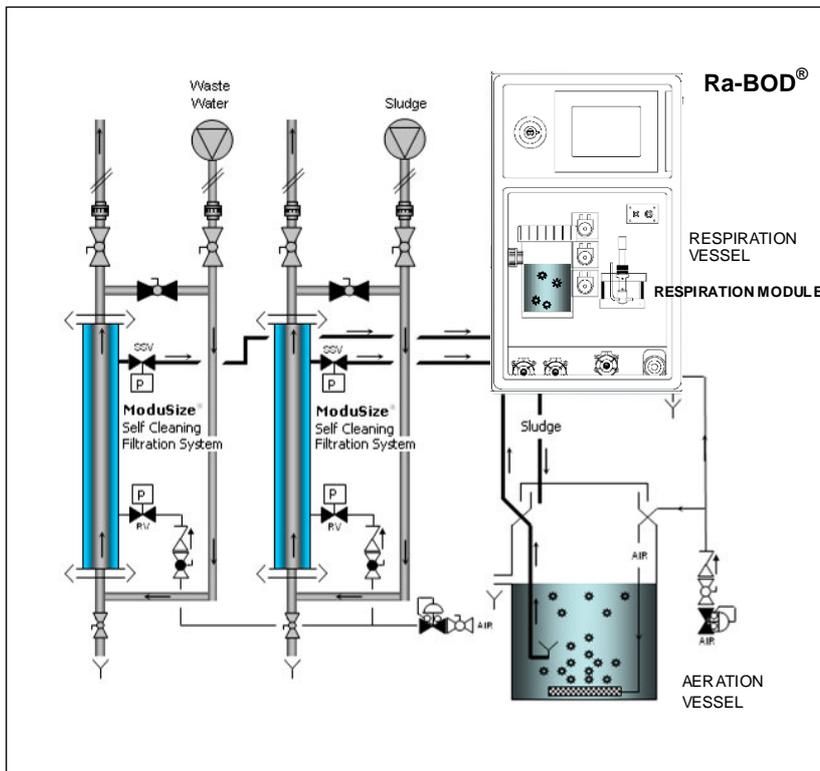
Plant Control by Continuous Measurements on Influent and Effluent

General operation principle

Waste water compounds that can be biodegraded by activated sludge, can be divided into nitrifiable nitrogen and biodegradable organic compounds. The Ra-BOD[®] batch measurement of the short term BOD (BOD_{st}) is based upon continuous monitoring of the respiration rate of activated sludge, fed with the waste water.

The aeration vessel (outside the analyzer) is kept filled automatically with activated sludge. The analyzer samples a fixed volume of sludge to the respiration vessel. Next to the single oxygen sensor concept, a specific, unique procedure is used to measure the oxygen concentration of the sample in the Respiration Module. Each measurement is in fact a two-way flow. After a fixed time (30 seconds), the flow through the Module is reversed. The difference in oxygen concentration leads to the respiration rate (mg O₂/l.h.).

The measurement is kept on-line by continuously refreshing the sludge inside the aeration vessel, representing at all times the aerobic circumstances of the treatment plant.



Typical set-up of the complete Ra-BOD[®] analyzer system.

Appropriate self-cleaning filtration units which will pump sludge and waste water in a fast loop to the aeration vessel.

Left: ModuSize[®] self-cleaning filtration system, typically 2 mm rating; mounted on Trespa[™] board.



Communication features



The touch screen can remotely be taken over by an external PC.



Analysis results are backed up by the solid state data logger (up to 10000 results).



A history of the results can be shown in a chronological data table and exported.

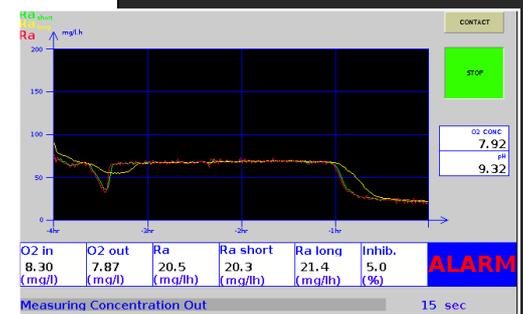
User interface and data communication

The user-friendly industrial computer inside the Ra-BOD[®] controls all operations and functions of the analyzer, with several communication options. Standard 4-20 mA communication outputs serve as easy interfacing for process control.

The standard 10" touch screen can remotely be taken over by means of VNC software. The single O₂ sensor concept of the analyzer enables you to do a quick calibration. Our Application Department will gladly advice on the necessary service intervals.

Snapshots of the Ra-BOD[®] touch screen.

Standard On Screen History displays analysis results both graphically and numerically, backed up by the solid state data logger. The touch screen can remotely be taken over by means of VNC software, enabling all settings and operations from a remote PC.



The industrial computer has a solid state data logger. Records of the last 10,000 results can be visualized again and copied through the sealed USB port. A history of the analysis results can be shown in a chronological data table and exported.

ALARM HISTORY

Date and Time	O2in	O2out	Ra	Sh	La	Lo	pH
Wed Feb 14 10:46:22 2007	17.8	17.6	6.5	6.1	6.2	7.8	7.8
Wed Feb 14 10:47:22 2007	17.8	17.6	6.1	6.2	6.2	7.8	7.8
Wed Feb 14 10:48:22 2007	17.8	17.6	7.0	6.2	6.2	7.8	7.8
Wed Feb 14 10:49:22 2007	17.8	17.6	6.7	6.2	6.2	7.8	7.8
Wed Feb 14 10:50:22 2007	17.8	17.6	6.4	6.5	6.2	7.8	7.8
Wed Feb 14 10:51:22 2007	17.8	17.6	6.7	6.5	6.2	7.8	7.8
Wed Feb 14 10:52:22 2007	17.8	17.6	6.5	6.5	6.2	7.8	7.8
Wed Feb 14 10:53:22 2007	17.8	17.6	6.5	6.5	6.2	7.8	7.8
Wed Feb 14 10:54:22 2007	17.8	17.6	6.5	6.5	6.2	7.8	7.8
Wed Feb 14 10:55:22 2007	17.8	17.6	6.7	6.6	6.1	7.8	7.8
Wed Feb 14 10:56:22 2007	17.8	17.6	7.6	6.6	6.1	7.8	7.8
Wed Feb 14 10:57:22 2007	17.8	17.6	6.6	6.3	6.1	7.8	7.8
Wed Feb 14 10:58:22 2007	17.8	17.6	6.6	6.3	6.1	7.8	7.8
Wed Feb 14 10:59:22 2007	17.8	17.6	7.4	6.3	6.1	7.8	7.8
Wed Feb 14 11:00:22 2007	17.8	17.6	6.5	6.3	6.1	7.8	7.8
Wed Feb 14 11:01:22 2007	17.8	17.6	6.5	6.3	6.1	7.8	7.8
Wed Feb 14 11:02:22 2007	17.8	17.6	6.5	6.3	6.1	7.8	7.8
Wed Feb 14 11:03:22 2007	17.8	17.6	6.5	6.2	6.1	7.8	7.8
Wed Feb 14 11:04:22 2007	17.8	17.6	6.5	6.2	6.1	7.8	7.8
Wed Feb 14 11:05:22 2007	17.8	17.6	6.5	6.2	6.1	7.8	7.8
Wed Feb 14 11:06:22 2007	17.8	17.6	6.5	6.2	6.1	7.8	7.8
Wed Feb 14 11:07:22 2007	17.8	17.6	6.5	6.2	6.1	7.8	7.8
Wed Feb 14 11:08:22 2007	17.8	17.6	6.5	6.2	6.1	7.8	7.8
Wed Feb 14 11:09:22 2007	17.8	17.6	6.5	6.2	6.1	7.8	7.8
Wed Feb 14 11:10:22 2007	17.8	17.6	6.5	6.2	6.1	7.8	7.8
Wed Feb 14 11:11:22 2007	17.8	17.6	6.5	6.2	6.1	7.8	7.8
Wed Feb 14 11:12:22 2007	17.8	17.6	6.5	6.2	6.1	7.8	7.8
Wed Feb 14 11:13:22 2007	17.8	17.6	6.5	6.2	6.1	7.8	7.8
Wed Feb 14 11:14:22 2007	17.8	17.6	6.5	6.2	6.1	7.8	7.8
Wed Feb 14 11:15:22 2007	17.8	17.6	6.5	6.2	6.1	7.8	7.8
Wed Feb 14 11:16:22 2007	17.8	17.6	6.5	6.2	6.1	7.8	7.8
Wed Feb 14 11:17:22 2007	17.8	17.6	6.5	6.2	6.1	7.8	7.8
Wed Feb 14 11:18:22 2007	17.8	17.6	6.5	6.2	6.1	7.8	7.8
Wed Feb 14 11:19:22 2007	17.8	17.6	6.5	6.2	6.1	7.8	7.8
Wed Feb 14 11:20:22 2007	17.8	17.6	6.5	6.2	6.1	7.8	7.8

Calibration of the O₂ sensor is done with the sensor mounted in the calibration shaft, which is supplied with the process analyzer. A separate calibration screen guides the user through the procedure. If the oxygen value is stable, simply press the Accept button on the screen.

Pumpflow Calibration

Initial Flow	Initial Pump	Initial Volume	Last Flow	Enter New Flow
0.0	0.0	0.00	0.0	0.0
Actual spm :				0.00

Oxygen Sensor Calibration

Put Oxygen Sensor in Calibration Shaft If value is stable (102%): Accept

Temperature (°C)	% Saturation	Correction Factor
22.27	1.82	2.54

pH control

Setpoint:	8.00	pH-4 Buffer	<input checked="" type="checkbox"/>
Hysteresis:	0.20	pH-7 Buffer	<input checked="" type="checkbox"/>
Prop. Band:	7.00	pH:	8.04
Min. puls:	2	Analog Signal:	5161
Period:	20000.0		

Ra-COMBO®

The Respiration Module used in Off-line Applications



A smart platform for many purposes

Respiration measurements in a convenient, smart platform designed for desktop operation.

Being considerably smaller and lighter than the on-line configuration, the Laboratory Ra-COMBO® is truly a cost-effective solution for research ends, simulation or for off-line BOD_{ST} and/or toxicity measurements at universities and corporate laboratories (e.g. of tank cleaning companies).

Designed for Testing and Simulation.

The essence of respiration measurements

However marked as a laboratory analyzer, the Ra-COMBO® will perform automatic measurements on the biological activity of the sludge. The only difference, besides the easy handling, is that the sampling is done by hand. Temperature and pH inside the respiration / aeration vessel are controlled automatically by the analyzer's industrial computer. Its analytical properties are identical to those of the on-line analyzer design.

The Ra-COMBO® platform for genuine BOD_{ST} and toxicity measurements, with easy handling and low maintenance.



Technical Data

Ra-BOD® GENERAL SPECIFICATIONS

Parameters	Biological Oxygen Demand
Operating principle	Respirometry using activated sludge
Electrical output	Programmable, analog 4 -20 mA, max. 500 Ohm
Alarms	Programmable (result + malfunctioning), potential free contact
Display	LCD color touchscreen, 320 x 240 pixels, backlit
Operating temperature	10° - 30°C (range 4°C)
Validation	With standard solution
Protection rating	IP 55 (per DIN 40050)
Certification	Certified to CE conformity
Enclosure dimensions	100 cm (39") x 60 cm (24") x 55 cm (22") (H x W x D)
Total weight	65 kg (143 lbs.) Process analyzer 40 kg (107 lbs) Laboratory analyzer

Ra-BOD® ANALYTICAL PROPERTIES

Detection method	Respirometric measurement by means of DO probe
Measuring range (BOD)	20 – 100000 mg O ₂ /l
Detection limit (respiration rate)	Better than 5 mg O ₂ /l.h
Precision (respiration rate)	Better than 5% full scale
Response time	Typically 30 minutes
Reagents	Not applicable

Ra-BOD® UTILITIES

Power	230 VAC / 115 VAC, 50/60 Hz
Instrument air	For respiration vessel; min. 4 bar
Waste water	For aeration vessel
Sludge	For aeration vessel

Ra-BOD® OPTIONS

pH sensor	For controlling pH inside aeration vessel
ModuSize®	Self-cleaning filtration system
ModuPlex®	Stream selector (inside analyzer)
RaWeb®	Internet-enabled control & diagnosis software (via www)
Communication outputs	RS232, MODBUS, Ethernet

Water Quality Monitoring

AppliTek develops and manufactures an own range of on-line analyzers for water analysis applications. The incorporated technology benefits from a large experience in wet-chemical techniques since 1985, combined with powerful interfaces, high quality components and ergonomic design.

Applications include:

- Compliance monitoring
- Water treatment control
- River water monitoring
- Assessment of low-level organic contaminations & toxicity

AppliTek manufactures also several types of self-cleaning filtration systems for preconditioning the liquid samples in order to guarantee continuous operation and reliable analysis data.

The *Single Source Responsibility Program* is our quality approach not only assuring quality of the individual analyzers, but giving the option to choose for a turnkey solution. In that case AppliTek manufactures your monitoring station, completed with filtration systems, data communication and utilities.



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