ODS specialist in Samplers & Analytical Systems

brochure

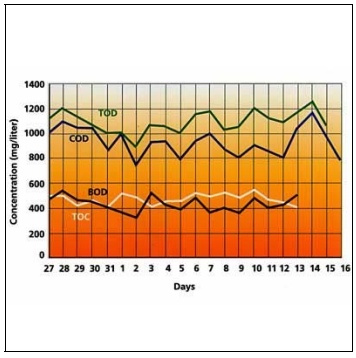
On-line TOD-analyser for waste water, Model Quick-COD-o

General description:
This TOD-analyser, model Quick-COD-o of LAR Process Analysers AG, offers the ability to measure oxygen demand quickly on-line. It can be considers as an alternative procedure for the BOD_5 and COD-$_{dichromate}$ tests which are often specified in the site discharge content. This TOD-analyser is designed and suitable for use in an industrial area and operates reliable even under the most demanding circumstances. Whilst the BOD_5 test takes 5 days and the COD-$_{dichromate}$ test takes 2 to 3 hours, the Total Oxygen Demand analysis only takes 3 minutes. The TOD-measurement include the oxygen demand of non-carbonaceous components e.g. organic nitrogen, ammonia, amines, etc.

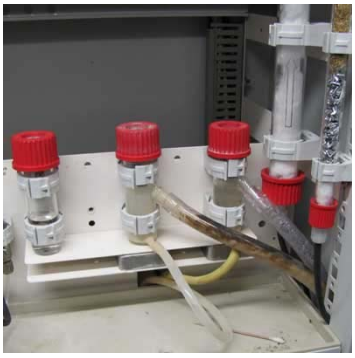
Principle of operation
By use of a permeation box, a fixed concentration of oxygen is introduced into a nitrogen carrier gas. This N_2/O_2 mixture flows through a reactor. Then this carrier gas flows to an oxygen sensor (ZiO_2) where the oxygen base line is measured. Model Quick-COD-o uses a patented injection system. A precise volume of waste water is injected into the thermal oxidation reactor. An electrical oven maintains the reactor at a temperature of 1200 ºC. No catalyst is used. At this high temperature all compounds in the sample will be fully oxidised (100% recovery). Oxygen in the process is being consumed. The oxygen decrease in the carrier gas is directly proportional to the sample oxygen demand. The analyser processor measures the oxygen sensor change and converts the signal to ppm oxygen demand (mg -O_2/litre). The peak area calculation method that is used, results in an excellent repeatability and long term stability. Furthermore the advantage of using the 1200 ºC. thermal oxidation technique is: no memory effects, a rapid response to big concentration changes and a fast analysis cycle time of 3 minutes. An other advantage is that carry over effects are very low meaning that this analyser is very suitable for 2-stream, multi-stream and multi range applications. This analyser operated via a full programmable robot that controls the functions and positions of the robust injection needle. Only a few parts are in contact with the waste water: sample inlet tube, sample overflow vessel, sample outlet tube and an optional sample pump. After every waste water injection, the injection needle is flushed with rinse water. This all results in a minimum of maintenance. The injection volume is fully programmable from 10 to 400 micro litre making the analyser very suitable for many applications from 100 to 100.000 mg -O_2/litre. ODS delivered many Quick-COD-o analysers to a variety of industries. They are used for process water and process control, influent monitoring, spill detection, billing and shock load monitoring. This TOD-analyser measures fast and accurate and it uses no chemicals.

Other models or combinations available are:
- Quick-TC: Total Carbon
- Quick-TOC: Total Organic Carbon
- Quick-TN: Total Nitrogen
- Or any combination of these sum parameters e.g. TOC/TOD, TOC/COD, TOC/TN, TC/TN, TC/TOD etc.

The Quick-COD-o -analyser uses an advanced injection technique by use of a robot and thermal combustion at 1200 degrees Celsius



BOD, COD and TOD methods are all based on oxygen demand



Its very easy to observe how the robot is doing the job

ODS offers service contracts

Easy installation of a Quick-COD-o No chemicals are needed

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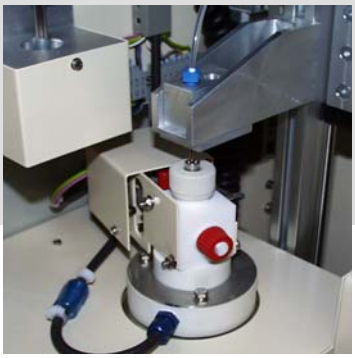
Features of the Quick-COD-o Total Oxygen Demand analyser (TOD-analyser)

- Measures Total Oxygen Demand including non-carbonaceous oxygen demand;
- It can be considered as an alternative procedure for the BOD_5 and COD-$_{dichromate}$ tests;
- It normally has a good correlation with the existing BOD_5 and COD-$_{dichromate}$ method;
- Ranges available from 100 up to 50.000 ppm mg/litre -O_2 without the use of dilution technique;
- Programmable injection volume offers flexibility in optimising and setting the analyser ranges per analyser stream;
- The thermal oxidation technique at 1200ºC guarantees complete oxidation (100% recovery);
- No sample filtration is needed. Also organic particles will be oxidised completely meaning that “true-TOD” is analysed;
- At 1200ºC. memory effects are minimum resulting in a fast analyser response and a cycle time of 3 minutes;
- Very stable analysing results due to the batch injection technique, auto zero technique and peak area calculation;
- Low reactor salt built up due to the low injection volume method & 1200ºC oxidation;
- Very low carry over effects making the analyser suitable for 2-stream analyser, multi-stream and multi range application
- Low maintenance because of a patented flushing system that cleans the injection needle after every sample injection;
- No chemicals are used;
- It uses a closed injection system. There is no loss of volatile organics (VOC’s or/and POC’s);
- Easy manual or automatic/daily calibration and easy validation due to internal robot selectable calibration vessel;
- Easy analyser inspection due to self diagnostic software and extra diagnostic sensors such as carrier gas inlet and gas outlet flow measurement, relative humidity sensor (option), circuit pressure measurement;
- Big graphical display and alpha numeric keyboard;
- Data presentation and data storage. internal memory and data logger. USB and RS-232 interface;
- Cabinet with a separate dry compartment for all electrical parts and a wet compartment for all analyses parts. Easy access for analyser maintenance;
- The robot in combination with the free programmable software offers unique flexibility. Furthermore the hardware is designed and pre-constructed in such a way that it is easy to change an analyser functionality or measuring principle.

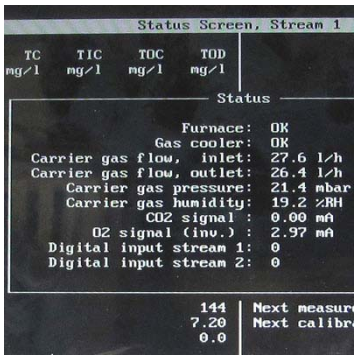
Dry compartment with easy access for service



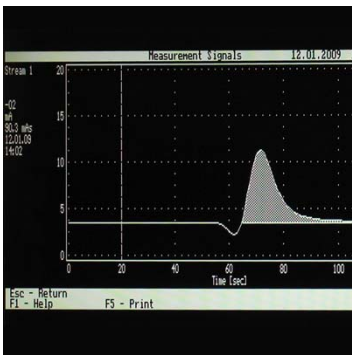
The injection port and robot with injection needle

Fast sample loop with sampler for anti-isokinetic sampling

Measurement of True-TOD
No sample filtration is needed

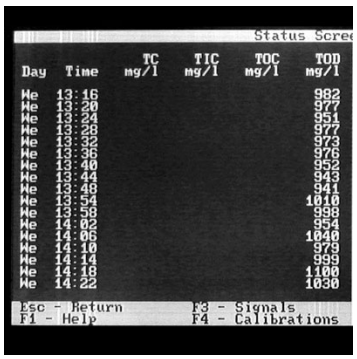


Service menu shows diagnostic information: carrier gas flow etc.



Peak area measurement with auto zero technique

A big graphical screen; 2-stream, effluent and influent



One month of data is stored and is accessible via screen and USB

ODS
klöckner & co multi metal distribution

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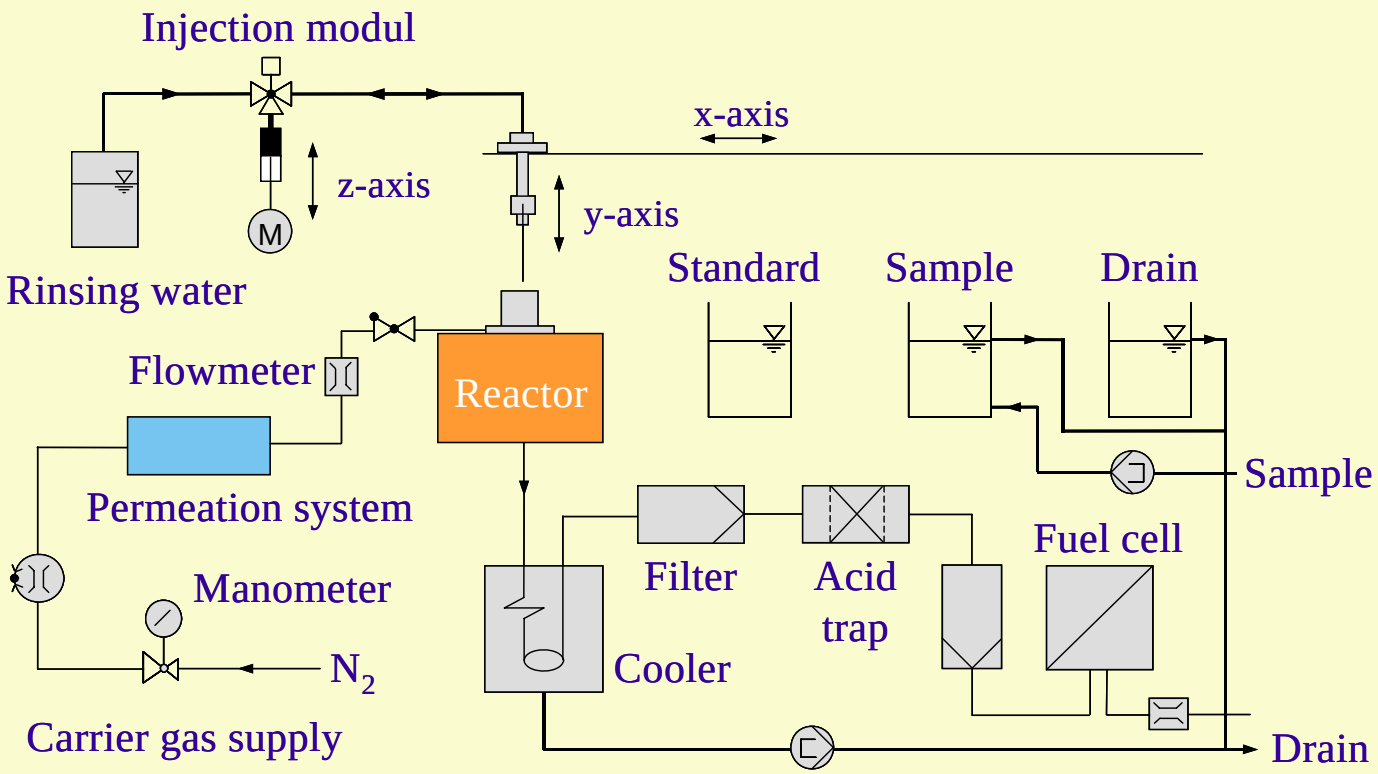

Total Oxygen Demand principle:

A nitrogen carrier gas flows through a temperature controlled permeation box where a known constant amount of oxygen is added. This nitrogen oxygen mixture flows through the high temperature reactor (1200 °C.). Then the carrier gas flows through a gas/sample cooler and a gas scrubber The dry and clean carrier gas then flows through the O_2-sensor. Prior to injection the O_2-sensor measures the base line O_2-value.

The robot controls the needle position and sample suction syringe. The needle is positioned into the sample overflow vessel and is filled preciously with a programmed fresh sample volume.

Then the robot positions the needle into the injection inlet port. A needle sensor detects the needle and opens the inlet cock valve. Then the needle is positioned deep into the 1200 °C. reaction tube and a precise volume of sample is injected.
The sample is quantitatively oxidized, which consumes part of the oxygen content in the carrier gas. The oxygen depletion correlates directly to the oxygen demand of the sample. The method includes the oxygen demand by non-carbonaceous compounds.

$(n_1)\ (C_xH_yN_z) + \mathbf{(n_2)\ O_2} \rightarrow (n_3)\ CO_2 + (n_4)\ H_2O + (n_5)\ NO$ + rest

Via peak area calculation the amount of O_2-depletion is determined. By comparing the outcome to wet calibrations, the Total Oxygen Demand concentration in the waste water is calculated.

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Nitrogen:
The Quick-COD-o analyser uses nitrogen gas. This nitrogen gas flow through a so called permeation box and then enters the analyser. In the permeation box oxygen permeates into the nitrogen resulting in a stable oxygen base line. The Quick-COD-o needs a nitrogen gas flow of about 20 normal litres per hour.

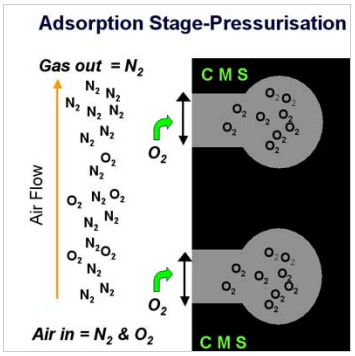
Some industries have a nitrogen pipe network.

Others have to use gas bottle stations. Nowadays gas cinders are offered with a built-in-purifier. A gas bottle with a volume of 50 litres can contain, at a filling pressure of maximum 200 bar, 10000 normal litres of nitrogen. It will be empty after a period of maximum 20,8 days. Normally the end user place bottle stations with automatic gas cylinder change over regulators. Sometimes the bottles are replaced with a bunch at a time.

These bottles should be kept outside the analyser shelter under a roof and free accessible for personal and trucks for reloading. Also safety is important. The nitrogen should not leak into an analyser house. It is recommended to use a flow restriction integrated into the carrier gas piping to the analyser and use an O_2-gas detector in the shelter as well.

Using a nitrogen generator in combination with the Quick-COD-o offers great features. Its principle is based on Pressure Swing Absorption. The time from start up till pure gas conditions is about 8 to 12 hours. The end purity is < 10 ppm O_2 at 18,7 normal litres/hour. The nitrogen generator is quit big (but gas bottles are also big). The biggest advantage is that it is a safe devise. It's maximum output is simply too low. It can be used continuously. Nevertheless, the needed instrument air quality and pressure is of great importance.

A stand alone nitrogen generator



It's principle is based on Pressure Swing Absorption

Hardware / analyser cabinet

The Quick-COD-o analyser is built in a rugged steel coated cabinet. It has two separate compartments with next features:

- Dry compartment (back) for the power supply, electronics, PCB's and microprocessor board, a big graphical display, membrane switch board.
- Wet compartment (front) for the robot, sample vessel, sample magnetic stirrer, injection system, reactor and heater, peristaltic pumps, cooler.
- Both compartments are easy accessible for maintenance.
- Suitable for wall, frame or strut mounting.
- Ex p cabinets for ATEX zone 2 or Atex zone 1 are available.

ODS project with walk in shelter and fast sample loop

Projects

ODS offers also a system integration package consisting of know how and additional equipment and complete analyser packages: :

- Waste water pump system,
- Fast sample loop with anti-isokenetic sampling point,
- Utilities such as zero air supplies
- Complete walk in shelter

We offer:

- Engineering;
- A Factory Acceptance Test and Site Acceptance Test
- Documentation package, drawings and manuals
- Installation and commissioning & start-up and training

ODS analyser shelter

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Total Oxygen Demand Analyser, model Quick-COD-o Specifications	
Type	Model Quick-COD-o
Manufacturer	LAR Process Analysers AG, Germany, Berlin
Analytical Method:	Determination of the oxygen demand via thermal combustion of the sample at 1200 degrees Celsius and the measurement of the amount of oxygen depletion in the with oxygen enriched nitrogen carrier gas.
Use	Stationary On-line
Typical applications	Influent of a WWTP, spill detection, process water monitoring and control, billing, shock load detection etc.
Ranges (milligram/litre -O_2.)	50 - 500 up to 3.000 - 100.000 (to be specified)
Repeatability, CV (% of measured value, 25 to 100% of scale)	< +/- 3
Reproducibility (%)	< +/- 2; drift: < 10 mg/litre -O_2 per year due to auto zero technique
Cycle time (minutes)	Minimum 3
Type of detector	O_2-sensor, zirconium
Sample requirements: • Pressure (bar) • Flow (ml/min.) • Salt; as NaCl (gram/litre) • Temperature maximum • Organic Particles (micrometer)	 • Slight overpressure; 0,05 tot 0,2 • Internal overflow sample vessel (no sample pump) 50 tot 500; with sample pump: 30 ml/min. during programmable sample pump time. • Up to 15 gram; only at TOD-ranges > 1000 mg -O_2/litre • 60 • Maximum 2000; typical 1000 (“soft” organic particles)
Sample conditioning: • Filtration • Fast sample loop	 • No, not needed. • Yes, preferable. • We advise to use the anti-isokinetic sampling technique to separate big particles with high mass.
Analyser Cabinet • Type • Door • Dimensions; outside; h x b x d (mm) • IP class • Area	 • Steel, coated, grey, dry and wet compartment, two sets of hinges • Door: with Securit window • 1860 x 600 x 500 (plus glands, mounting brackets etc.) • IP 44 (to be mounted inside in a factory or analyser walk in shelter) • Non hazardous (optional ATEX Ex p Zone 2 or ATEX Ex p Zone 1)
Housing Permeation Box • Type • Material • Dimensions; outside; h x b x d (mm) • IP class • Area	 • Wall mount, with front door • Steel, coated, grey, door • 500 x 500 x 300 • IP 44 (to be mounted inside in a factory or analyser walk in shelter) • Non hazardous; optional ODS special: ATEX certified; consult ODS.
Preferable space needed for mounting the analyser, connecting inlets and outlets, maintaining and operating the analyser	• Floor: 1100 mm x 1100 mm (W x D) • Wall: 2000 mm x 1100 mm (H x W)
Weight (kg):	• 120
Ambient conditions: • Temperature; (°C.); Relative Humidity (%)	 • Non freezing to +40; max. 95% (non condensing)
Power; • Voltage / Frequency (V, Hz) • Fuse (A) • Power Dissipation, during start-up, typical (VA/ Watt)	 • 230 / 50; (optional 110 / 60) • 16 • 1100, 800
Carrier gas requirements: • Quality • Consumption (normal litres per hour) • Pressure (barg)	 • Nitrogen, high purity (grade 5.0 / 99,999 % N_2 / < 10 ppm O_2 and C_xH_y; required grade depends on TOD-analyser range) • Typical 20, maximum 28; 1 each cylinder with 50 litres of compressed (200 bar) nitrogen per week. • 3,5
Chemicals; consumption	• Not needed.
Rinse water (litre/week)	1 or 2; depends on cycle time
Certified	CE
Electrical cables	Via Glands; top of cabinet
Signals: • Analogue outputs • Relays / alarms • Serial RS232	 • 2 each, 4-20 mA; isolated, active, max 500 ohm; free programmable • 4 each; contact closure; free programmable; fail safe • Can be used for serial data readout, a printer, auto sampler
Materials; wetted parts (sample)	Inlet tube (nylon), overflow vessel, (quartz glass), drain tube (PVC); injection needle (stainless steel 316); reactor (ceramic); pump tube (Marprene or Viton)

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Mounting: • Wall • Hardware	 • Solid, horizontal, e.g. concrete • 4 expender bolts; M8 (part of the delivery)
Extra diagnostic sensors: • Thermal Mass Flow, carrier gas inlet • Thermal mass Flow; carrier gas outlet • Relative Humidity sensor; after condensate cooler Option: Pressure sensor; reactor pressure and pressure pulse	Measures status of: • Carrier gas consumption, blocking of the oven outlet • Leakage in the gas circuit; differential inlet/outlet carrier gas flow • Checks good operation of cooler, checks sample injection via delta RH • Blocking of the reactor output or gas circuit; checks sample injection via dP
Data and program settings: download/upload:	• USB connection; internally; for service only. • Data transfer of 24-hour data profiles
Service menu: • Service • Calibrate • Status; tests • Test run • Setting of alarm parameters • Observe measured values of sensors	 • Flush injection system or sample lines, Furnace on/off, Condensate pump on/off • Manual validate or calibrate, daily automatic calibration • Relays, signal outputs, oven, cooler etc. • Check settings and fine-tune robot positions. • Pressure, delta P, carrier gas flow balancing and limits, R.H. limits etc. • O_2-detector signal, graphical curve, carrier gas inlet and outlet etc.
Warranty (year)	1 year after delivery; wearing parts and consumables excluded
Documentation: Manuals, drawings, spare part listing	• User manual available in the English language; drawings, schematics included. • Technical training manuals on request
Maintenance and routine service: • Calibration • Cleaning of sample system • Inject-port • Outlet reactor • Pump tubes, condensate pump and sample pump • Scrubbers; aerosol and halogens	(depends on application and local conditions) • 1x per 2 weeks • 1x per month / clean applications: 1x per 2 month • 1x per month / O-ring replacement • Depends on salt content and injection volume; 1x per 6 month; 1x per month • 4x per year; replacement of pump tubes • 2x to 4x per year; replace content (quartz wool, brass and zinc)
Options	
Options: • 2-stream; 2x sample streams • Special cabinet for corrosive environment • ATEX Zone 2 or Zone 1; special cabinet • TN; total nitrogen analyses	 • Includes: overflow vessel + stirrer, 2x 4-20 mA; sample & hold; software • Stainless Steel; hermetically closed, integrated air-to-air heat exchanger & fan • Type LAR; Ex p Günheimer; with integrated air-to-air heat exchanger • Via thermal combustion to NO-gas measured by an electrochemical NO-cell
Options and utilities (outside the analyser): • Multi stream (> 6 streams) • Sample pump, sample loop, sample probe • Nitrogen Generator	 • consult ODS • ODS delivers complete analyser packages • Makes nitrogen out of compressed instrument air; low maintenance. Outlet <10 ppm O_2

Specifications are subject to change by manufacturer or ODS without notice due to modifications or improvements *revision: 2012-02*

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