



ORP-1500 REDOX analyser for hydrochloric processes and other extremely corrosive processes with automatic cleaning of the electrodes

## Technical data

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Contents	What is ORP-1500
	Dimension drawings
	Electrical connections
	Specifications



Picture to the left is the PH-1500 analyser after one year of operation in the hydrochloric acid nickel matte leaching process.





## ORP-1500

PH-ORP00 is an automatic on-line REDOX analyser with an advanced system for cleaning of the electrodes. The ORP value of the solution is measured discontinuously. Since the cycle time is very short, the measurement can be used as a continuous measurement. The analyser is a complete working unit for sampling, measuring and cleaning of the electrodes. The analyser has 4-20 mA output, alarm output and a Modbus RTU computer interface.

### Function

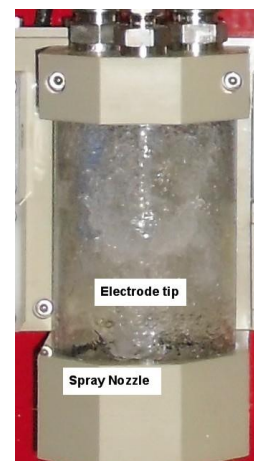
The instrument sucks a sample from the process, to a measuring cell, where the ORP is measured. Then the sample is returned to the process. The instrument then sucks up 4 ml of a suitable **detergent**, for instance acid, from a detergent container. The frequency of washing with detergent is programmable. The dose is measured, and the instrument gives a warning if no detergent (acid) is available. The dose can be adjusted. The electrodes are sprayed with this solution from a powerful spray nozzle underneath, and afterwards the electrodes are sprayed with water from the same nozzle. Then the cycle repeats itself.

### Proven technology

The PH-ORP00 pH analyser is the result of 40 years of experience with design, construction, servicing and sale of pH analysers to the industry. The Norzink/Halland pH analysers have been sold to zinc plants world-wide for 40 years. The first model was developed at the Norzink zinc plant in Odda 1971. In the early 1980's Norzink developed a new model, it was called "SLURpH" this model replaced the first generation and many zinc plants bought this analyser. In 1998 the business was handed over to Halland Instruments AS. In 1999 the third generation of pH analysers were developed, the model PH-13. Hindustan zinc in India bought many analysers for the three new zinc plants they build in 2004, 2006 and 2008. The experiences we got from commissioning and servicing these plants in Rajasthan in India, with ambient temperatures of 50 degrees centigrade, were the reasons to develop a new analyser, the model PH-1300. The ORP-1500 analyser is developed in cooperation with the largest chlorine leaching and electrowinning nickel plant in the world, Glencore Kristiansand Nikkelverk AS.

### Automatic cleaning system for the electrodes

Only clean sensors can provide accurate and reliable measurements. With our system the electrode is kept clean automatically. The instrument has a system for dosing and cleaning the electrodes with an acid or other suitable detergent. To prevent the reference electrode from being poisoned by the process solution we use a flowing type electrode with overpressure. The analyser is equipped with a KCl reservoir with safety valve.





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## Installation

It is easy to install the instrument. Normally no encroachment in the process equipment is needed for taking the sample. The cabinet should be mounted in normal working height for easy access. Mount the instrument close to or on tank, basin or launder. The suction height is maximum 6 meters water column. Generally, we recommend that the suction tube should be less than 10 meters long or as short as practically possible. In the zinc industry we have well-functioning installations that are more than 25 meters long.

The analyser is designed for harsh environments.

The analyser is designed for the harsh environment in chemical industries with high ambient temperatures, acid, dust and gasses. The analyser can be mounted outdoors or indoors. The analyser is designed to tolerate the electrical noise and the fluctuations in the supply voltage which often occurs in the industries.

Designed for extremely corrosive liquids

The analyser is designed for extremely corrosive liquids such as for instance concentrated HCl in the matte leaching stage in a nickel refinery

Unique patented system for cleaning of the wetted parts

Reliable and patented system for sampling. The mechanical unit is kept clean by a unique patented system. The suction circuit; vacuum-pump, valve and connections are cleaned automatically.

Automatic cleaning system for the electrodes

Only a clean ORP sensor can provide accurate and reliable measurements. With our system the electrodes are kept clean automatically. The spray nozzle is spraying the electrodes from below and cleans the sensor surface mechanically. The instrument has a system for dosing and cleaning of the electrodes with an acid to prevent build-up of physical or chemical coating. The analyser is designed for using cold or hot water for spraying of the electrodes. To prevent the reference electrode from being poisoned by the process solution we use a flowing type of reference electrode with overpressure. The analyser is equipped with a KCl reservoir for the reference electrode.



Regular sensor cleaning ensures:

- Increased process safety due to accurate, reliable measurement
- Defined and consistent product quality
- A greater reproducibility of measurements for better process control
- Replacement/maintenance costs savings due to an extended lifetime of electrode



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The analyser is designed for measuring the ORP of slurries with very high temperatures

The analyser is designed for measuring the pH of solutions with high temperatures, up to 100 degrees centigrade, high solid content and high ionic strength.

## Modes of operation

- Normal: The instrument is running continuously.
- For batch processes: A Modbus start command or a 24 volt signal starts the analysers and the analyser runs continuously until a stop command or a 0 volt signal is received, then the current cycle is finished, and the analyser stops.
- Fixed intervals; the instrument executes one cycle for instance every 10 minutes.

## Industries

- Nickel chlorine leaching industry
- Electroplating industry
- Gold chlorine leaching industry
- Molybdenum chlorine leaching industry

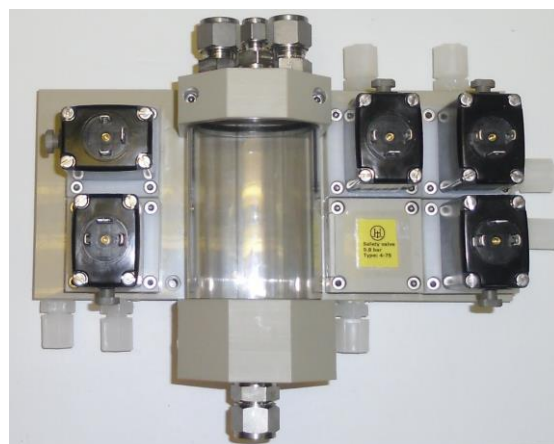


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The analyser is design for easy maintenance

No special skills are needed for the maintenance and the calibration of the instrument. The analyser has one mechanical unit, all the valves and the mechanical components, except the air pressure regulators and the ejector, are mounted on a manifold with the same type of O-ring sealing as used on hydraulic manifolds. The advantage is that the valves and the other components can be replaced for repair without disconnecting any tube fittings. It is also very fast and easy to replace the complete unit for instance for preventive maintenance after a lengthy period of operation. The internal tubing is made of high quality plastic materials, Teflon tubing and Kynar (pvdf) fittings.

The analyser has one proprietary electronic unit with one electronic circuit board. This advanced design eliminates many possible causes for errors, since the alternative is a much more complicated design with a PLC, advanced pH transmitter, electronics for dosing acid, level control, user communication unit and wiring. It is easy to replace the unit if needed.



The mechanical unit



The electronic unit

Summary: Advantages and earnings

- Automatic cleaning of the electrodes by spraying the electrodes from below cleans the sensor surface mechanically and cleaning with chemicals prevents build-up of physical or chemical coating. This results in stable measurements.
- Cleaning of the electrode gives long electrode life. And the electrode is only in contact with the solution in a limited time, the measurement cycle, which also gives long electrode life. The low consumption of electrodes does, in many cases, the procurement of the instrument cost saving.
- Very high short-term and long-term accuracy. This makes accurate process control possible.
- Very long life-time of the electrodes, many months or even years even in very difficult solutions for ORP measurement. It is not possible to get high long-term accuracy without long electrode life. The low consumption of electrodes by it selves does, in many cases, the procurement of the instrument cost saving.
- The electrode system is designed in such a way that the reference electrode can never be poisoned.



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- The electrodes are in controlled pressure conditions. The electrodes are protected against mechanical strains - no risk of broken electrodes.
- Other systems require calibration daily or even several times daily to provide high accuracy. Our analyser gives high accuracy even with weeks' or even months' interval between calibrations.
- It is fast and easy to calibrate the analyser, there is no sample head which must be dismantled for calibration. No special skills are needed for the calibration and maintenance of the instrument and it is only necessary to stop the analyser few minutes for calibration. It is also fast and easy to replace the electrodes.
- Easy to operate, logical menu structure. Easy-to-use one- or two point-calibration procedures with ORP buffer solutions or millivolt source. It is also very easy to change the times, for instance for emptying, spraying and measuring, and to set the measurement range etc.
- The analyser can use a wide selection of chemicals in addition to water spraying for cleaning of the electrodes.
- It is easy to install the instrument; normally no encroachment in the process equipment is required. The instrument can be mounted where it is easy to access it for calibration and maintenance.
- Reliable and patented system for sampling. Suction circuit; vacuum-pump, valves and connections are cleaned automatically.
- Most reliable, infrequent error with the analyser, very low-maintenance. Uncomplicated mechanical design, with few parts, gives reliable operation and little maintenance. It is designed in such a way that it is easy to carry out the maintenance and it is designed in such a way that it is easy to carry out the maintenance.
- The built-in Modbus RTU interface makes it very straightforward to communicate with a process control computer or PLC. The ORP measurement, the temperature, the step number in operation and the error warnings are available over the Modbus line.
- It is possible to start and stop the analyser via the Modbus line.
- Sophisticated intelligent monitoring; of measured value and electrode response. The instrument gives warning with the alarm relay and message on the Modbus line if the electrode response is abnormal or if the measurement is abnormal. These functions can be switched off if they are not needed.
- The analyser is designed for the harsh environment in the industry with high temperatures, acid, dust and gasses. The analyser is designed to tolerate electrical noise and fluctuations in the supply voltage.



## Electrical connections

RK1 terminal No.	Description
26	4-20 mA output, +10-24 volts for feeding the mA loop.
12	4-20 mA output, return 4-20 mA, connect load from here to 0 (-10-24V)
9/23	+ for RS485/MODBUS or 0 VDC for start stop
10/24	- for RS485/MODBUS
11/25	Screen RS485/MODBUS Cable or 24 CDC for start stop
8	Alarm signal output +, normal operation +24 VDC, alarm 0 VDC. Wire terminals 8/22 to alarm relay or galvanic isolated digital input on process control computer or warning system.
22	Alarm signal output - (0 VDC)
3	Digital input for remote start/stop signal. Wire terminals 3/17 to external contact for remote start/stop (relay contact or switch).
17	Digital input for remote start/stop signal
RK3 terminal No.	
1	230 VAC
2	230 VAC
3	Earth, preferably local earth

The pH measurement, the temperature, the step number in operation and the warnings are available over the Modbus line.



Electronic unit



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## Specifications

Water pressure.....	3-7 bar.
Air pressure.....	4-7 bar
Detergent consumption, adjustable .....	4-10 ml/wash
The acid washing frequency is programmable	
Suction height .....	6 meter water column.
ORP range.....	-1500 to +1500
Temperature.....	0-100 °C.
Accuracy, transmitter.....	0.1 mV
Power supply.....	110, 115 or 230 volt AC.
Power consumption.....	35 Watt.
Internal tubing.....	Teflon .
Electronic enclosure.....	IP 65.
Cabinet (GRP with glass window).....	IP 65.
Outer dimensions.....	747x536x300 mm.
Weight ca.....	27.5 kg.

### *Outputs:*

4-20 mA loop powered, maximum load 950  $\Omega$  at 24V dc, linearity and offset error max 0.1 %.  
Alarm signal: 24 VDC, 0.5 A. RS485 (Modbus RTU) computer interface (1 start bit, 8 data bits, 2 stop bits, 9600 baud). All outputs are galvanic isolated from the measuring circuits and from each other.

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