Measurement made easy
Accurate and reliable measurement of dissolved oxygen in high purity water

Monitors both low and high dissolved oxygen concentrations
• suitable for measurement during two-shifting and
• baseload operations on power stations

Automatic calibration
• minimizes manual intervention and protects
• sensor during calibration

Fast response
• reacts quickly to rapid changes in plant conditions

Thermal protection
• protects sensor in the event of cooling water failure

Disposable sensor
• minimizes down time and avoids the need for skilled personnel to carry out sensor refurbishment

Comprehensive diagnostics
• provides sensor condition and analyzer status data

Connect multiple wet-sections to a single transmitter
• reduces footprint and installation costs
The Navigator 500 range

The Navigator 500 range of analyzers from ABB are designed for high purity water treatment applications and power cycle chemistry monitoring.

The analysis and signal conditioning is conducted within the Navigator 550’s advanced wet-section that houses the sensing technology. The accurate measurement result is transmitted digitally to the Navigator 540 transmitter.

The Navigator 540 universal transmitter enables connection of up to 4 different Navigator 550 wet-sections and is available with optional features such as SD card data retrieval and graphical trending, as well as additional outputs and communication options.

The following parameters are available in the Navigator 500 range:

**Navigator 500**
- Dissolved Oxygen
- Sodium
- Hydrazine

**Navigator 500 dissolved oxygen analyzer**

The Navigator 500 dissolved oxygen analyzer provides continuous monitoring and control of power station boiler feed water / steam condensate.

The wet-section houses ABB’s maintenance-free electrochemical cell that accurately measures the amount of dissolved oxygen in the water.

Measurement results are updated digitally to the Navigator 540 transmitter where process trends of up to 4 separate wet-sections can be viewed locally on the color display. Users of this system also benefit from the analyzer’s low maintenance requirements, ease-of-use, auto-calibration and proven sensing performance.

Process data, together with the content of alarm and audit logs within the transmitter, can be saved to a removable media for record keeping and analysis using ABB’s DataManager Pro data analysis software.
Applications

Typical applications for the Navigator 500 dissolved oxygen analyzer include:

- Protection against corrosion caused by excessive dissolved oxygen concentrations
- Deaerator efficiency indication
- Hydrazine dosing efficiency indication

Low level dissolved oxygen on boiler plant

The need for accurate monitoring

Accurate measurement of dissolved oxygen is essential for efficient, cost-effective operation of boiler plant. In its dissolved form, oxygen is highly corrosive to most metals, especially the mild steel used for boiler tubes. The presence of even small quantities of dissolved oxygen in boiler water can severely impair a boiler’s operation, causing corrosion of its vital components and significantly reducing its working life.

To minimize damage caused by corrosion, it is therefore necessary to reduce dissolved oxygen to the lowest possible level, typically in the order of seven parts per billion or less. In some applications, particularly those operating once-through boilers, it is preferable to add oxygen to the boiler feedwater, causing a layer of soft haematite to form on the boiler tubes. Hydrazine is then added that reacts with the haematite, converting it to a hard layer of magnetite that protects the tubes from further corrosion.

Monitoring should be carried out wherever there is a risk of oxygen ingress into the boiler feedwater. An effective system monitors dissolved oxygen at key points including the extraction pump discharge, the deaerator inlet and outlet and the economizer or boiler inlet.

The Navigator 500 solution

The significant variations in oxygen levels during the load cycle of a plant, combined with the different levels required for different boiler chemistry regimes, require an analyzer that offers a fast response across both high- and low-level dissolved oxygen concentrations.

The Navigator 500 dissolved oxygen analyzer uses a galvanic-type sensor to accurately measure dissolved oxygen levels in process feed water. Accurate and reliable, it requires no maintenance and can measure dissolved oxygen concentrations up to 20 ppm.

Featuring a separate wet-section and transmitter, the Navigator 500 dissolved oxygen analyzer gives users the option of adding up to 4 wet-sections to one transmitter, enabling measurement of samples from different points in the boiler feedwater line. This feature also allows users to mix-and-match different sensor types from the Navigator 550 range of hydrazine and sodium wet-sections.
Overview of Navigator 500 dissolved oxygen analyzer

Transmitter
- Simple navigation and easy-to-use menu system
- Full audit trail logs
- SD card or USB archiving
- Graphical trending
- Password protected security
- Connect up to 4 wet-sections in the Navigator 500 range

Graphical trending
- Measurement trends of each connected wet-section can be easily and clearly viewed locally on the graphical color display

Full audit trail logs
- Diagnostic messages, alarm events, calibration details and system activity are stored in the transmitter audit logs for review
**Accurate and reliable measurement**
The Navigator 500 dissolved oxygen analyzer has been designed for ease-of-use and maintenance simplicity, while offering the benefits of flexible communication and advanced data acquisition.

**Measuring principle**
The Navigator 500 dissolved oxygen analyzer uses a disposable galvanic cell in a custom-designed flow cell. Sample flow is adjusted easily by a flow regulating needle valve and monitored by an optional flowmeter. A temperature sensor, fitted in the flowcell, measures the temperature of the sample.

The signal from the dissolved oxygen sensor and the temperature sensor is passed to the smart board located within the Navigator 550 wet-section. The smart board accurately calculates the dissolved oxygen measurement result and transfers it digitally to the Navigator 540 transmitter.

**Maintenance-free disposable sensor**
ABB dissolved oxygen sensors are maintenance-free and long lasting. Their encapsulated design removes the requirement for time-consuming maintenance such as membrane changes or electrolyte replenishment. The easy replacement procedure for the maintenance-free DO sensor just takes seconds, saving further valuable time and cost.

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**Simple automatic calibration**
The Navigator 500 dissolved oxygen analyzer features automatic calibration that verifies the analyzer’s performance and calculates sensor efficiency. During calibration the sample is diverted, exposing the dissolved oxygen sensor to air.

Once the calibration routine is complete, sensor efficiency is calculated and displayed, providing the user with a valuable indication of sensor life.

The frequency of automatic calibration can be scheduled by the user to occur from daily to bi-monthly intervals. Calibration can also be initiated manually by the operator.
Flow during normal operation

Flow during calibration or thermal overload condition

Figure 3 Flow conditions
**Specification – system**

**Operation**
- Measuring range: 0 to 20,000 ppb
- Units of measure: ppb, µg/l, µg/kg
- Accuracy: ±5 % of reading or ±1 ppb, whichever is the greater
- Repeatability: ±3 % of reading or ±1 ppb, whichever is the greater
- Response time: 1 minute for a 90 % step change
- Resolution: 0.1 ppb
- Temperature compensation: 5 to 55 °C (41 to 131 °F) automatic using a Pt1000
- Salinity correction: Preset within the range 0 to 80 ppt
- Barometric pressure correction: Preset within the range 500 to 800 mm Hg
- AutoCal frequency: Programmable from 1 to 7 days or 1 to 8 weeks
- Sample temperature: 5 to 55 °C (41 to 131 °F)
- Sample pressure: 2 bar gauge (29 psi) maximum
- Sample flow rate: 100 to 300 ml/min
- Sample connections: 1/4 in. or 6 mm OD pipe (stainless steel recommended)

**Environmental data**
- Ambient operating temperature: 0 to 55 °C (32 to 131 °F)
- Ambient operating humidity: Up to 95 % RH non-condensing
- Storage temperature: –20 to 70 °C (–4 to 158 °F) without sensor
  0 to 55 °C (41 to 131 °F) with sensor

**Approvals, certification and safety**
- Safety approval: cULus
- CE mark: Covers EMC & LV Directives (including latest version EN 61010)
- General safety: EN61010-1
  - Pollution category 2
  - Insulation category 2

**EMC**
- Emissions & immunity: Meets requirements of IEC61326 for an industrial environment and domestic emissions

**Maintenance**
- Periodic calibration: User-defined

**Specification – wet-section**

**Mechanical data**
- Protection: IP54
- Dimensions – ADS550
  - Height: 480 mm (18.90 in)
  - Width: 290 mm (11.41 in) – door shut
  - Depth: 185 mm (7.28 in) door closed – minimum (excluding fixing brackets)
  - Weight: 4.5 kg (10 lb)
- Dimensions – ADS551
  - Height: 194 mm (7.64 in.) minimum – excluding glands
  - Width: 214 mm (8.42 in.) – excluding glands
  - Depth: 98 mm (3.85 in.) door closed; minimum – excluding fixing brackets
  - Weight: 1.5 kg (3.3 lb)

**Electrical**
- Power supply ranges (supplied by transmitter): 24 V DC max.
- Power consumption: 8 W max.
**Specification – transmitter**

### Operation

**Display**
89 mm (3.5 in) color 1/4 VGA TFT, liquid crystal display (LCD) with built-in backlight and brightness / contrast adjustment

**Language**
English, German, French, Italian, Spanish

**Keypad**
6 tactile membrane keys: Group select / left cursor, view select / right cursor, menu key, up, down, enter key

**No of inputs**
Up to 4 single-stream or 1 multi-stream wet-section

### Mechanical data

**Protection**
IP66 / NEMA 4X

**Dimensions**
- Height: 194 mm (7.64 in) minimum (excluding glands)
- Width: 214 mm (8.42 in) – excluding glands
- Depth: 98 mm (3.85 in) door closed – minimum (excluding fixing brackets)
- Weight: 1.5 kg (3.3 lb)

**Materials of construction**
Glass-filled polycarbonate

### Security

**Password protection**
Calibrate and Advanced – user-assigned

**Service level access** – factory-set

### Electrical

**Power supply ranges**
100 to 240 V AC max., 50 / 60 Hz ±10 %
(90 to 264 V AC, 45/65 Hz)

**Power consumption**
<30W

**Terminal connections rating**
AWG 26 to 16 (0.14 to 1.5 mm2)

### Analog outputs

- 2 standard
- 2 optional
- Galvanically isolated from the rest of the circuitry, 500 V for 1 minute. Range-programmable source and range 0 to 22 mA, maximum load 750 W @ 20 mA

### Relay outputs

- 4 standard
- 2 optional
- Fully-programmable. Contacts rated at 2A @ 110 / 240 V. Standard relays are changeover. Optional relays are normally closed (N/C).

### Digital inputs / outputs

- 6 standard, user-programmable as input or output
- Minimum input pulse duration: 125 ms
- Input: volt-free or 24 VDC (conforms to IEC 61131-2)
- Output: open-collector, 30 V, 100 mA max. (conforms to IEC 61131-2)

### Connectivity / communications

- **Ethernet**
- **Profibus DP**
- **Modbus**
  - RTU, RS485, 2-wire/4-wire

### Data logging

**Storage**
- Measurement value storage (programmable sample rate)
- Audit Log*, Alarms Log*, Calibration log, Diagnostics log, Configuration changes

**Chart view**
- On local display

**Historical review**
- Of data

**Data transfer**
- SD card interface / USB stick – Windows-compatible FAT file system, data and log files in Excel and DataManager Pro compatible formats

*Audit Log and Alarm Log data are stored in the same log file.
Overall dimensions

Transmitter
Dimensions in mm (in.)
Wet-section – ADS550
Dimensions in mm (in.)

Wet-section – ADS551
Dimensions in mm (in.)
Electrical connections

Transmitter

- Optional communications module (PROFIBUS or Ethernet)
- Analog outputs 3 and 4 (optional)
- Relay connections 5 and 6 (optional)
- Analog output connections 1 and 2 (standard)
- Relay connections 1 to 4 (standard)
- Digital I/O connections
- Comms connections (PROFIBUS or Ethernet)
- Wet-section terminal connections

Fuse 3.15 A Type T 100 to 240 V, 50/60 Hz

Mains supply 100 V to 240 V AC ±10 %
(90 V min. to 264 V max.) 50 / 60 Hz
Digital I/O, relays and analog output

Relays (1 to 4)

Relays (5 and 6)

Digital output

Analog outputs (1 to 4)

Digital input (24 volt)

Digital input (voltage-free)

Wet-section – ADS550
(applicable only to multiple wet-section systems)

Additional serial cable connections to multiple wet-sections
- Red – R (24 V)
- Black – B (0 V)
- Green – G (Data +ve)
- White – W (Data –ve)
- Screen – SCR

Wet-section – ADS551

Additional serial cable connections to multiple wet-sections
- White – W (Data –ve)
- Green – G (Data +ve)
- Screen – SCR
- Black – B (0 V)
- Red – R (24 V)
## Ordering Information

**Wet-section – ADS550**

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*Commissioning instructions are supplied with each transmitter. Comprehensive operating instructions are available as a free download from [www.abb.com](http://www.abb.com) or printed copies can be ordered as additional items.*
**Wet-section – ADS551**

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*Comprehensive operating instructions are available as a free download from [www.abb.com](http://www.abb.com) or printed copies can be ordered as additional items.*
## Ordering information

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Notes