ABB MEASUREMENT & ANALYTICS | DATA SHEET | DS/ASO550-EN REV. I

Navigator 500

Sodium analyzer





Measurement made easy

Accurate and reliable measurement of sodium in high purity water

Multi-stream measurement capability
- measure up to 3 different sample streams using a single analyzer

Wide measuring range
- covers all power plant applications

Automatic calibration
- minimizes manual intervention and ensures measurement accuracy

Automatic electrode regeneration
- ensures electrode sensitivity when measuring trace sodium levels

'Pumpless' liquid handling section
- reduces maintenance requirements and cost-of-ownership

Comprehensive diagnostics
- provides sensor condition and analyzer status data

Grab sample facility
- enables unattended analysis of manually collected samples

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

The wet-section houses ABB's specially formulated sodium ion responsive electrode and reference electrode that accurately measure the concentration of sodium ions in the water. Up to 3 different sample streams can be measured using a single Navigator 550 sodium wet section.

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 Navigator 500 sodium's low maintenance requirements, ease-of-use, auto-calibration, auto electrode regeneration and proven sensing performance.

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

Navigator 500 transmitter



Sodium
Hydrazine
Dissolved oxygen

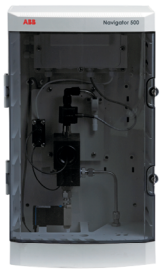
Navigator 550 wet sections



Sodium



Hydrazine



Dissolved oxygen

Figure 1 Navigator 500 family

Applications

Typical applications for the Navigator 500 sodium analyzer include:

Monitoring water treatment plant efficiency and quality

- Sodium measurement, at the outlet of cation and mixed resin exchange beds, provides an early indication of resin exhaustion and treated water quality.

Condensate monitoring at the extraction pump discharge

- As condensers are operated under vacuum, leaks result in the ingress of cooling water into the process water. If the cooling water contains relatively high levels of sodium (as is usually the case), monitoring the sodium content of the process water can provide an early indication of condenser leaks.

Saturated steam in drum boilers

- The monitoring of sodium in the saturated steam between the boiler drum and the superheater detects carryover and, in conjunction with sodium monitoring in the condensate (the sodium balance), can indicate problems caused by sodium deposits on superheated tubes and turbine blades.

Once-through boilers

- Boiler water purity is more stringent in these boilers therefore monitoring sodium levels after the condensate polishing plant, boiler feed and superheated steam, can assist in maintaining water/steam purity within limits.

Sodium monitoring in the water & steam cycle of power plants

The need for accurate monitoring

Sodium is one of the most important parameters to measure in power plant applications and is the cause of many different types of boiler corrosion.

A challenge for power plant operators is that most sodium compounds are water soluble, presenting problems not only in the boiler, but also in the steam supply through carryover.

A particular problem is the formation of sodium hydroxide (NaOH). Sodium hydroxide is formed when concentrations of sodium carbonate used in the feedwater treatment process increase in the boiler as the water evaporates. As it builds up, the sodium carbonate undergoes hydrolysis, forming sodium hydroxide that attacks the iron in the boiler. As the iron dissolves, sodium ferroate is formed. This also undergoes hydrolysis, effectively regenerating the sodium hydroxide levels in the boiler.

The resulting effect of this cycle is the embrittlement of boiler components, including rivets, bends and joints where stresses are greatest.

Further problems are caused where sodium hydroxide is carried over into steam. As the steam condenses, the sodium hydroxide can accumulate in critical components, including the steam turbine, where it can attack the turbine blades.

The Navigator 500 solution

The Navigator 500 sodium provides a continuous measurement of the sodium ion concentration in demineralization plants and in the steam/water cycle of steam-raising plants.

The wide measuring range of the ABB high performance sodium electrode and the choice of reagents available make the Navigator 500 sodium analyzer suitable for all power plant applications. A fully automatic sensor regeneration system is available for ultra low sodium measurement applications to ensure sensor sensitivity.

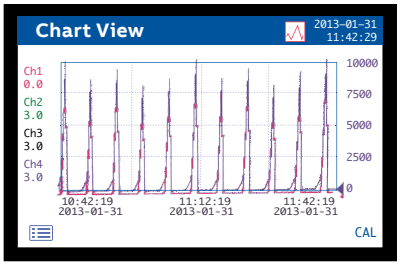
In the multiple stream version, up to 3 different sampling points can be measured by a single wet section, with the measurement results sent digitally to the transmitter. Manually collected samples can also be analyzed utilizing the Navigator 500 sodium's grab sample feature. Measurement accuracy is maintained by the Navigator 500 sodium's fully automatic calibration capability.

The ability to add up to 4 single-stream wet sections to one transmitter also enables measurement of samples from different points in the process. This not only offers an economic and compact solution, but enables operators to mix-and-match other parameters within the Navigator 500 range.

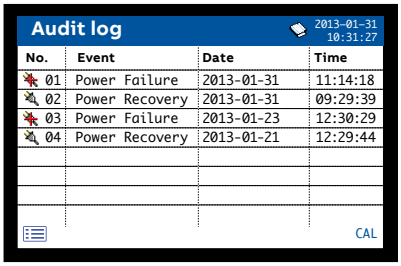
Overview of Navigator 500 sodium analyzer



Transmitter
- Simple navigation and easy-to-use menu system



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



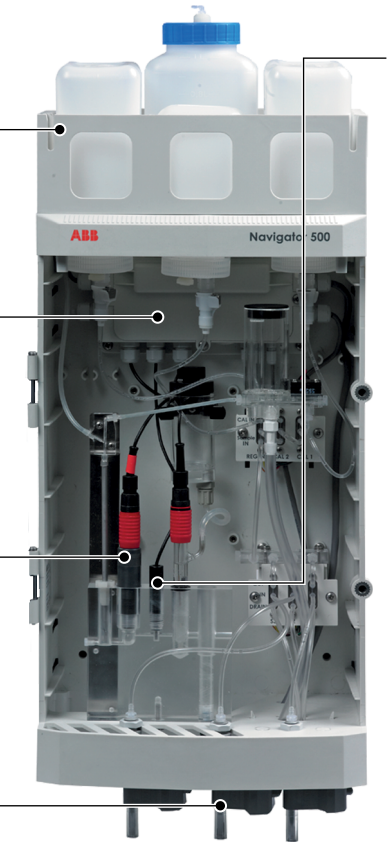
Full audit trail logs
- Diagnostic messages, alarm events, calibration details and system activity are stored in the transmitter audit logs for review

Detachable reagent section
Easy access for reagent replacement

Smart board
Stores sensor calibration data and calculates measurement result

Automatic electrode regeneration
Ensures sensitivity and accuracy for low level sodium measurement

Multi-stream capability
Analyze up to 3 separate sample streams



Continuous sodium measurement using ISE technology
ABB high performance sodium electrode and reference electrode mounted in flow cell with temperature sensor

Grab sample facility
Easily analyze manually collected samples

SD card or USB archiving
Data recorded in the transmitter's internal memory can be archived to a removable SD™ card or USB stick

Flexible communications
A user configurable range of outputs and communication options are available including Ethernet connectivity

Automatic calibration
Verifies analyzer performance

Navigator 540 transmitter



Features and benefits of the Navigator 540 transmitter include:

Connect multiple wet sections to a single transmitter
- Mix-and-match up to 4 different single-stream wet sections in the Navigator 500 range

Plug-and-play capability
- Automatic wet section recognition and configuration

Simple to operate
- Intuitive navigation through the operator menus with ABB's standardized 6-key layout

Password protected security
- Dual access level security, allowing separate user access levels to basic and advanced settings

Navigator 500 sodium wet section



The Navigator 550 sodium wet section has been designed to be used in conjunction with the Navigator 540 transmitter either alone or in combination with other Navigator 550 wet sections.

The Navigator 550 sodium wet section features a detachable reagent section, enabling easy access for reagent replacement.



Accurate and reliable measurement

The Navigator 500 sodium 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 sample enters the analyzer and passes through the sample valve manifold and the calibration valve manifold to the constant head unit that removes the effect of changes in sample pressure and flow rate.

The sample is then delivered to the entrainment T-piece and stainless steel entrainment tube, where an alkaline vapor reagent is added to raise the pH value, before flowing past the sodium and reference electrodes mounted in the flowcell. A temperature sensor, fitted into the flowcell, measures the temperature of the sample. Finally, the sample leaves the flowcell and exits to drain.

The potential developed between the sodium ion-responsive electrode and silver/silver chloride reference electrode is logarithmic with respect to changes in sodium ion concentration.

The signal from the electrode pair and the temperature sensor is connected to the smart board located within the Navigator 500 wet section where the sodium measurement result is calculated. The accurate measurement result is transferred digitally to the Navigator 540 transmitter.

Multi-stream analysis
The Navigator 500 sodium is available in single- or multi-stream configurations. The multi-stream option provides up to 3-stream measuring capability allowing different measuring points to be analyzed within the same wet section.

Automatic calibration
The Navigator 500 sodium features automatic 2-point calibration that verifies the analyzer's performance against standards of a known concentration. The frequency of automatic calibration can be scheduled by the user to occur from daily to monthly intervals. Calibration can also be initiated manually by the operator.

Grab sample facility
The Navigator 500 sodium has the flexibility to allow the analyzer to be used for individual measurements in a grab sample mode. This useful feature only requires manual initiation by the operator allowing samples from different points of the process to be collected and analyzed with minimal effort.

Once initiated, the analyzer stops the sample flow allowing the grab sample to be measured. Once measurement is complete the measurement result is stored with the audit log and the analyzer automatically returns to continuous measurement mode.

Automatic electrode regeneration
The Navigator 500 sodium is available with fully automatic electrode regeneration.

When measuring very low concentrations of sodium continuously over prolonged periods of time, sodium ISEs can become desensitized and unable to respond quickly to changes in sodium concentration.

The Navigator 500 sodium analyzer overcomes this issue by automatically introducing a specially formulated regeneration solution to the sodium electrode that removes the unresponsive layer on the electrode surface resulting in a regenerated layer of ion receptors, effectively 'wakening up' the electrode.

Electrode regeneration can be initiated manually by the user or scheduled automatically before a calibration.

...Accurate and reliable measurement

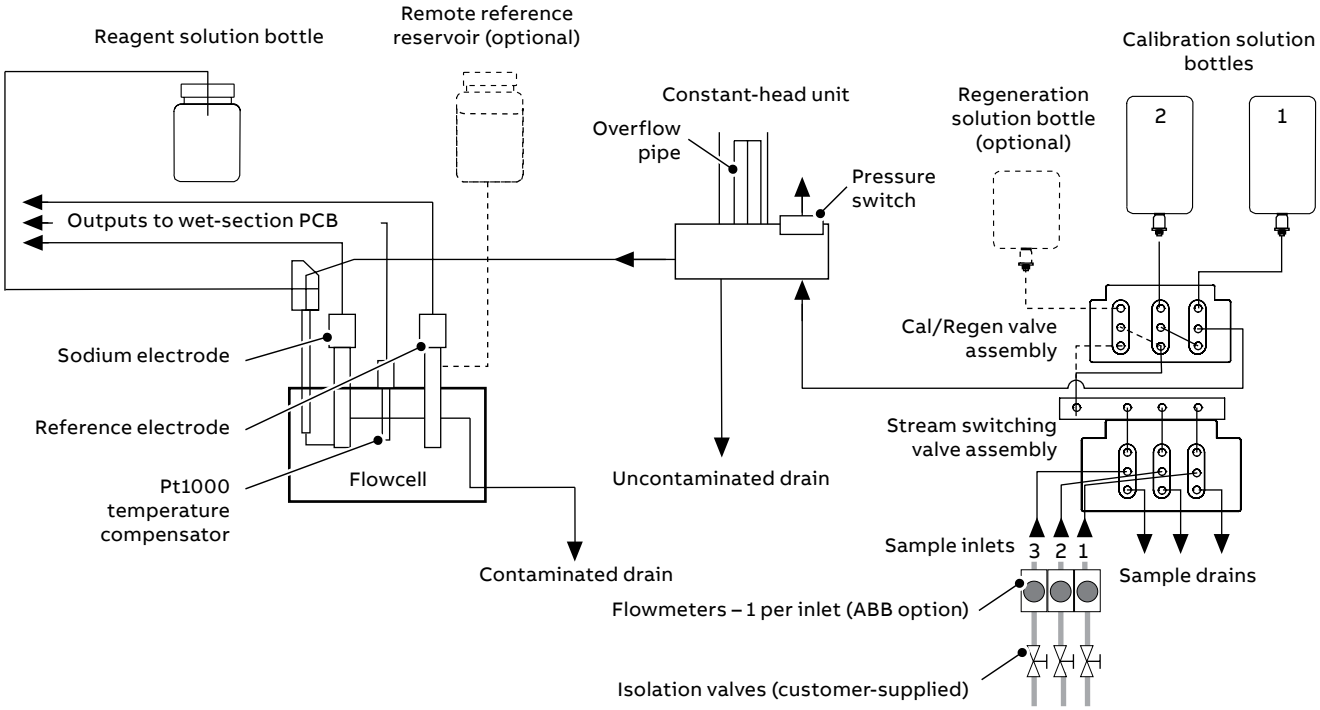


Figure 2 Schematic flow diagram – sodium multi-stream

Specifications – System

Operation

Measuring range
0.01 to 10,000 ppb

Units of measure
ppb, µg/L, µg/kg

Accuracy
±5 % of reading or ±0.1 ppb, whichever is the greater (applies only when sample is within ±5 °C of calibration temperature)

Repeatability
±5 % of reading or ±0.1 ppb, whichever is the greater (applies within a ±5 °C [±9 °F] variation)

Response time
1 to 100 ppb <4 mins;
100 to 1 ppb <4 mins for a 90 % step change

Multi-stream measurement
Sample time programmable between 10 and 60 min

Resolution
0.001 ppb

Temperature compensation
5 to 55 °C (41 to 131 °F) automatic using a Pt1000

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
1.5 bar gauge (21.7 psi) maximum

Sample flow rate
100 to 400 mL/min

Sample connections
¼ in ID flexible tubing to barbed connector

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

Specifications – Wet section

Mechanical data

Protection

IP54

Dimensions

Height:
668 mm (26.30 in), including solution bottles
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)

Electrical

Power supply ranges (supplied by transmitter)

24 V DC max.

Power consumption

8 W max.

Specifications – 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

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
<30 W

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 min. 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 2 A @ 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 V DC (conforms to IEC 61131-2)
Output:
open-collector, 30 V, 100 mA max.
(conforms to IEC 61131-2)

Connectivity/communications

Ethernet (optional)
TCP/IP, HTTP

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

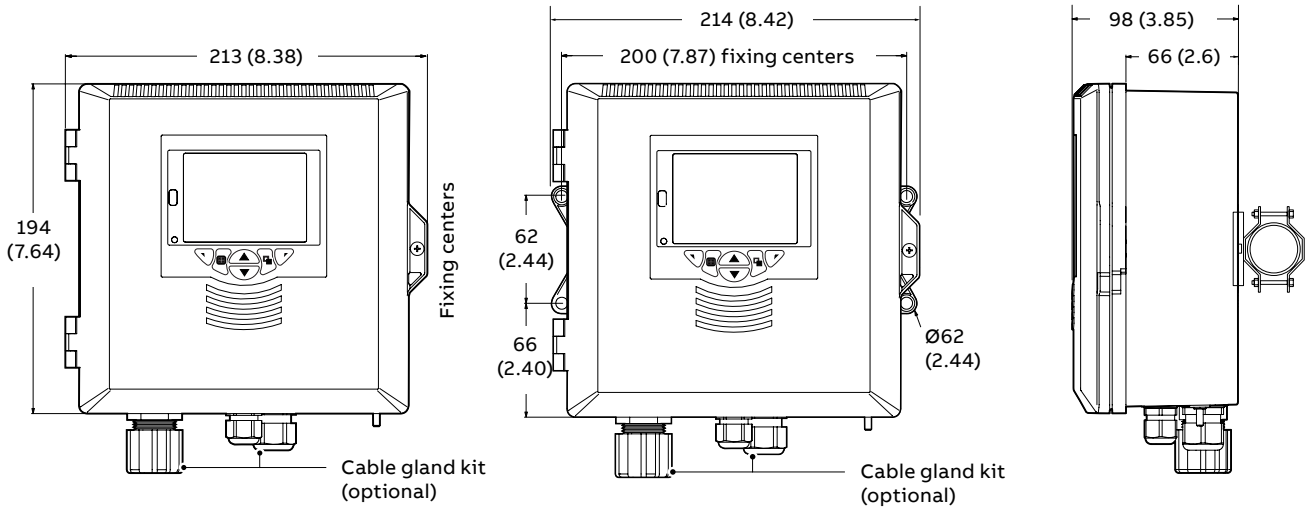
Data transfer
SD card interface/USB stick – Windows®-compatible FAT file system, data and log files in Excel® and DataManager Pro compatible formats

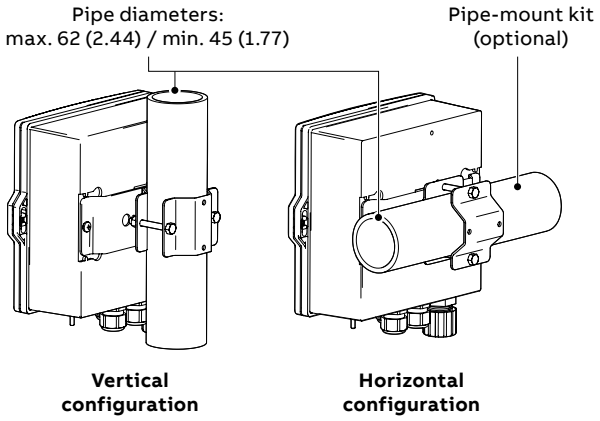
*Audit Log and Alarm Log data are stored in the same log file.

Overall dimensions

Transmitter

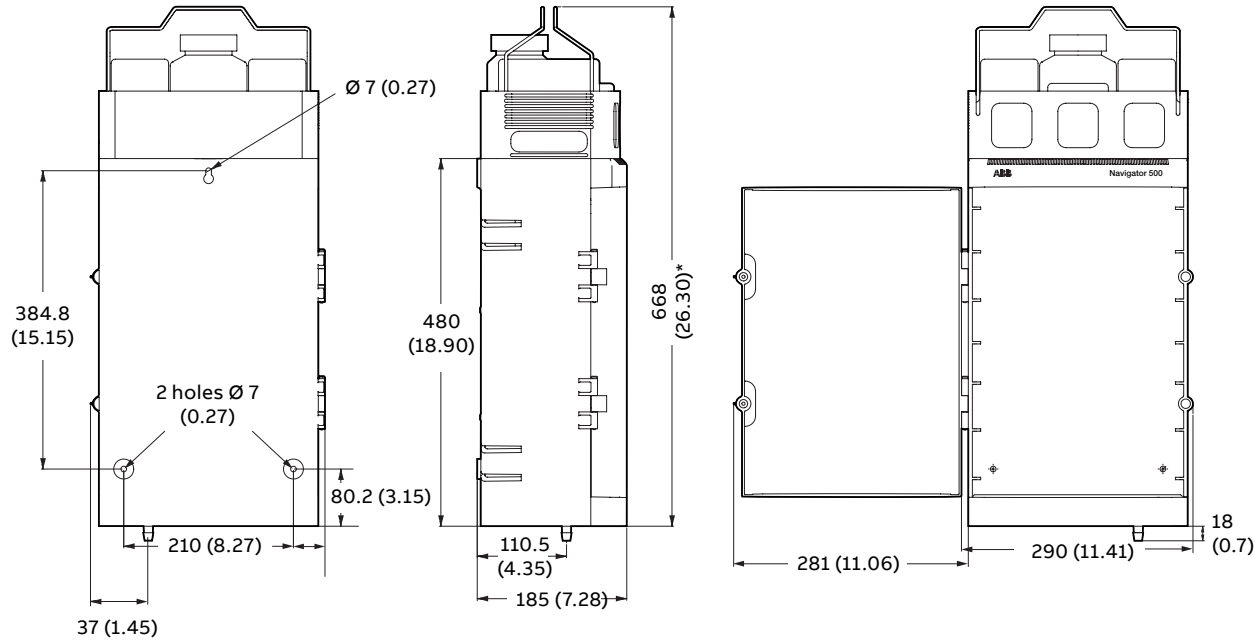
Dimensions in mm (in)





Wet section

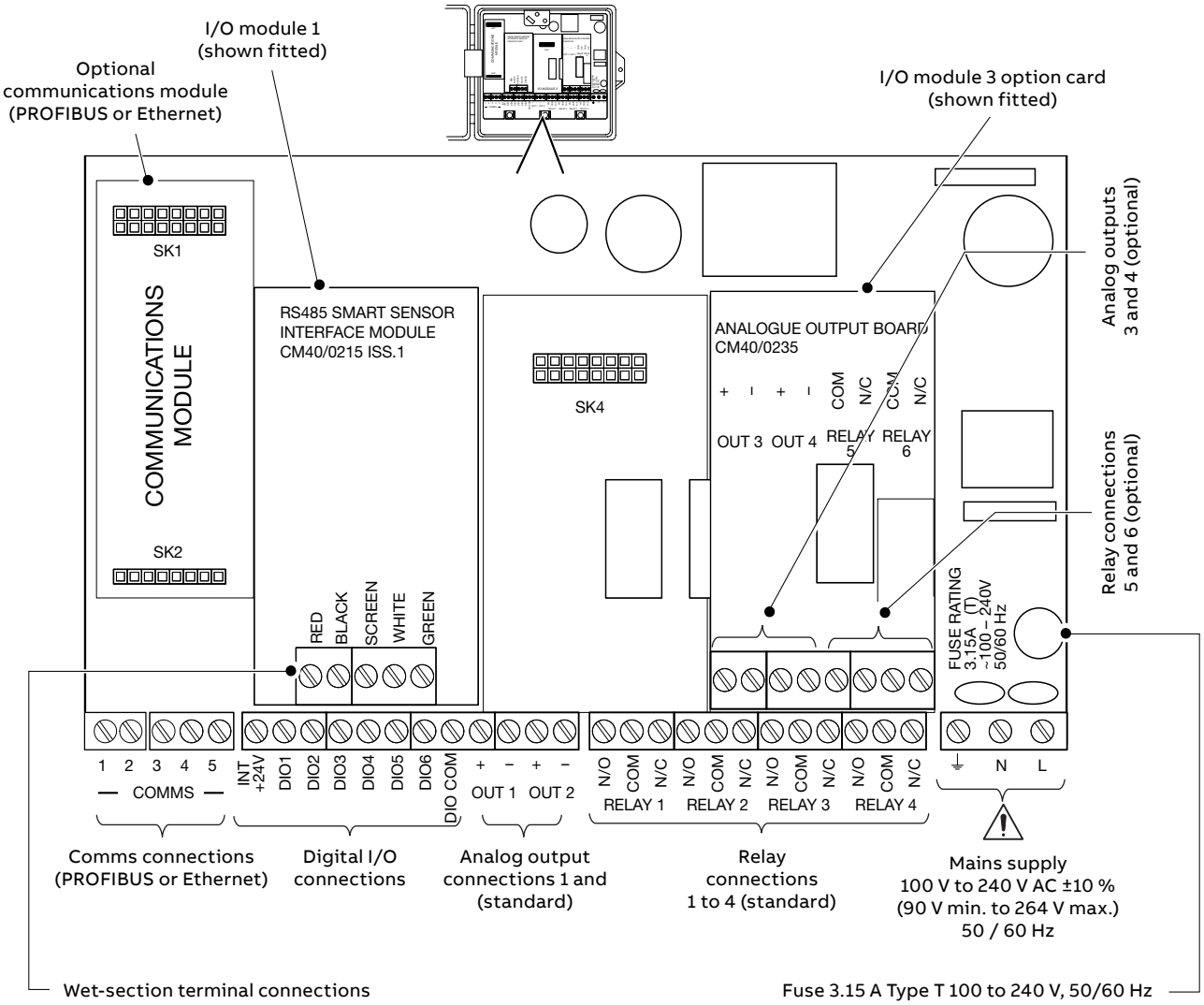
Dimensions in mm (in)



*When installing, allow a further 60 mm (2.36 in) min. to remove the bottle carrier assembly, or 135 mm (5.31 in) min. to remove the calibration solution bottle from the carrier.

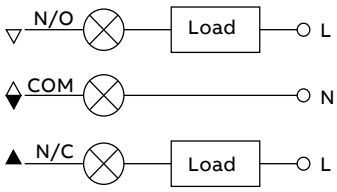
Electrical connections

Transmitter

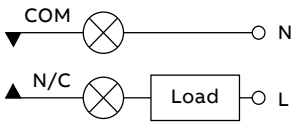


Digital I/O, relays and analog output

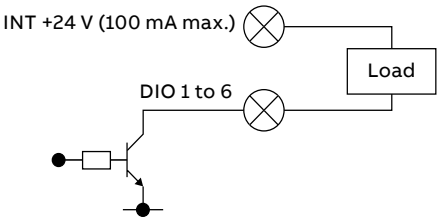
Relays (1 to 4)



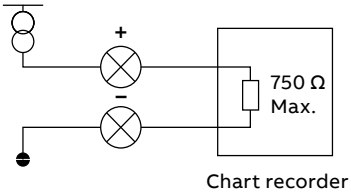
Relays (5 and 6)



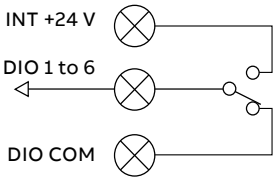
Digital output



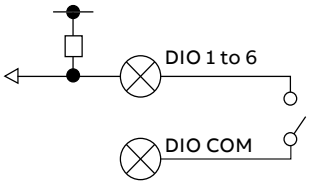
Analog outputs (1 to 4)



Digital input (24 volt)

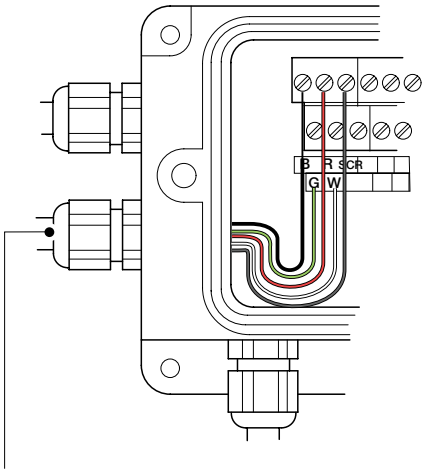


Digital input (voltage-free)



Wet-section

(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

Ordering Information

Wet section

Navigator 500 dissolved SODIUM analyzer	**ASO550/**	**X**	**X**	**X**	**X**	**XX**	**XX**	**XX**	**XX**	**XXX**	**XX**	**XX**
Build revision												
Reserved		A										
Measurement range												
Standard (0.01 TO 10,000 ppb)			1									
Enclosure type												
Wall				W								
Number of streams												
Single stream					1							
Triple stream					3							
Sensor type												
Standard (non reservoir-fed)						S1						
Reservoir-fed junction						S2						
Without sensor – standard						Y0						
Without sensor – reservoir						Y1						
Process connection type												
6 mm fitting							A1					
¼ in fitting							B1					
Optional ordering codes Add 1 or more of the following codes after the standard ordering information to select any additional options.												
Sample measurement options												
Sample flow measurement								S1				
Additional functions												
Automatic electrode regeneration									N3			
Signal cable length and type (supplied without signal cable as standard)												
1.5 m (approx. 5 ft) cable, terminal connection										SC1		
5 m (approx. 15 ft) cable, terminal connection										SC2		
10 m (approx. 30 ft) cable, terminal connection										SC3		
20 m (approx. 60 ft) cable, terminal connection										SC4		
Test certificate												
Test certificate											CD	
Documentation language* (supplied in English as standard)												
English												M5

*Commissioning instructions are supplied with each transmitter.
Comprehensive operating instructions are available as a free download from www.abb.com or printed copies can be ordered as additional items.

Transmitter

Navigator 540 transmitter	**AWT540/**	**X**	**X**	**X**	**X**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**
Build revision														
Reserved		A												
Enclosure type														
Wall mount			1											
Display type														
Color (standard)				A										
Power supply														
90 to 260 V AC, 50 to 60 Hz					1									
Channel 1														
Digital, wired sensor connection						B1								
Without						Y0								
Reserved							Y0							
Reserved								Y0						
Output signal														
Without									Y0					
Additional output card (2 current outputs + 2 relays)									Y2					
Ethernet									E1					
PROFIBUS DPV1									D1					
Data storage														
Without										Y0				
SD card function										D1				
USB function										D8				
Optional ordering codes Add 1 or more of the following codes after the standard ordering information to select any additional options.														
Accessories														
Panel mount kit											A2			
Test certificate														
Test certificate												CD		
Documentation language * (supplied in English as standard)														
English													M5	
Cable entry options														
Metric gland pack (9 glands)														U1

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Comprehensive operating instructions are available as a free download from www.abb.com or printed copies can be ordered as additional items.

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ABB Measurement & Analytics

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www.abb.com/contacts

For more product information, visit:
abb.com/measurement

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