TI01339C/07/EN/04.22-00
71577533
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Technical Information
CA76NA

Analyzer for sodium

Application

The CA76NA analyzer monitors:
- The water/steam circuit in power stations
- The condensate for values that indicate ruptures in the system
- Demineralization systems
- Steam purity
- Cation and mixed bed exchanger

Your benefits

- Reduced operating costs due to low consumption of the DIPA reagent and standard solution
- Automatic three-point calibration, adjustable time interval
- Control and monitoring of the configurable pH value
- Automatic temperature compensation
- Galvanically isolated signal outputs
- Pressure regulator and easy-to-clean preliminary filter per channel
- Optimized investment costs: One analyzer for up to 6 sampling channels
- Additional connection for the measurement of a laboratory sample
- Automatic regeneration of sodium electrode
- Optional PROFIBUS connection

Endress+Hauser
People for Process Automation

Table of contents

Function and system design

Measuring principle

The analyzer measures the concentration of dissolved sodium ions.

Sodium measurement is potentiometric using ion-selective glass electrodes.

An advanced Nernst equation describes in principal the processes at the ion-selective glass membrane:

$$U_i = U_0 + \frac{2.303\ RT}{F} \cdot \log\left(a_{Na^+} + \sum K_{Na^+} \cdot a_x^{1/z_x}\right)$$

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U_i	Measured value in mV
U_0	Standard potential
R	Relative gas constant (8.3143 J/molK)
T	Temperature [K]
F	Faraday constant (26.803 Ah)
a_{Na+}	Activity of Na^+ ions
K_{Na+}	Selectivity coefficient
a_x	Activity of interference ion
z_x	Value of interference ion

The slope of the Nernst equation (2.303RT/F) is known as the **Nernst factor** and has a value of 59.16 mV/px at 25 °C.

The pH electrode has 2 specific functions:
- It serves as the reference point for the sodium electrode.
- It measures the pH value of the sample.

To also be able to measure Na^+ in very low concentrations, the Ag^+ and H^+ activity must be well below the Na^+ concentration to be measured. In this case, the pH value present must be more than 10.8. The device is set to a pH target value of 11.00 as standard to sufficiently safeguard the set pH value.

The pH value of the sample is increased to 11.0 by adding an alkalization reagent, e.g. diisopropylamine.

The sensitivity of the measuring arrangement to interference ions is according to the following rule:

Ag+ >> H+ >> Na+ > >Li+ > K+

Sodium

Sodium measurement is very important in the water/steam circuit of power stations for two reasons:
- Sodium plays a major role in corrosion
- The measurement of sodium enables fast leak detection, e.g. in the condenser or in the event of a ruptured cation or mixed bed filter.

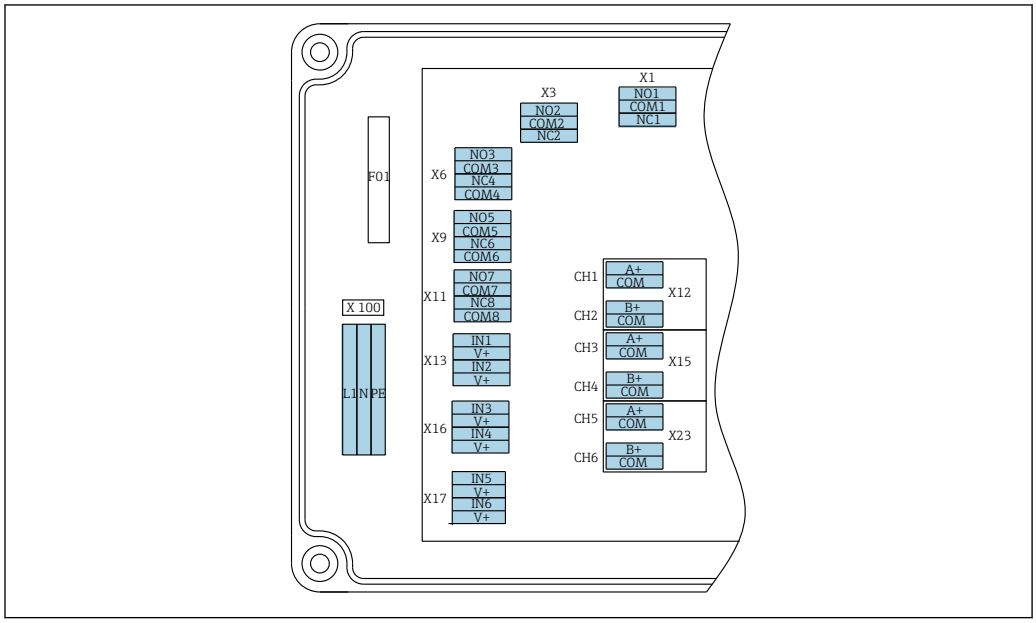
Therefore, more attention is paid to sodium measurement in the revised VGB Guideline (S-006 / S-010).

For a measurement without the influence of hydronium ions, the sample is conditioned to a pH value of pH 11 +/- 0.2 pH. The measurement is potentiometric using a special electrode system comprising an Na-sensitive electrode in conjunction with an Ag/AgCl reference electrode:

Ag/AgCl(S) – buffer – Na+-sensitive glass membrane - alkalized measuring solution - diaphragm - KCl electrolyte gel - AgCl(S)/Ag.

Equipment architecture

Terminal diagram without PROFIBUS



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L1	N	PE	NO1	COM1	NC1	NO2	COM2	NC2	A+	COM	B+	COM	A+	COM	B+	COM	A+	COM	B+	COM
X100 Power supply 100 to 240 V AC, 50/60 Hz			X1 Relay 1 Alarm			X3 Relay 2 Warning			X12A 4 to 20 mA Channel 1		X12B 4 to 20 mA Channel 2		X15A 4 to 20 mA Channel 3		X15B 4 to 20 mA Channel 4		X23A 4 to 20 mA Channel 5		X23B 4 to 20 mA Channel 6	

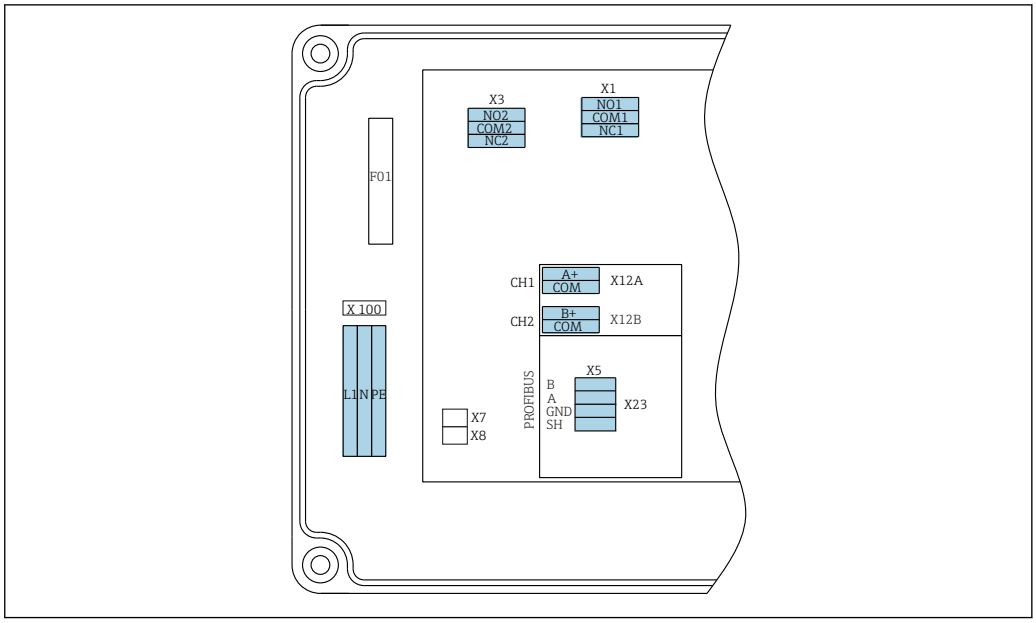
Mains voltage
Multi-range power unit for 100 to 240 V AC

The analyzer is fitted with a fuse, T 1.25 A, for the 215 to 240 V AC voltage level. If the analyzer is operated with 100 to 130 V AC, replace the fuse with the T 2.5 A fuse supplied. The fuse is located in the cover of the electronics unit.

Analog outputs
- X12: current output, channel 1 + 2
- X15: current output, channel 3 + 4
- X23: current output, channel 5 + 6

Digital outputs
- X1: relay, 1 alarm
  - Open contact on error: COM-NO
  - Closed contact on error: COM-NC
- X3: relay 2, warning
  - Open contact on error: COM-NC
  - Closed contact on error: COM-NO

Terminal diagram with PROFIBUS



L1	N	PE	NO1	CO M1	NC1	NO2	CO M2	NC2	A+	CO M	B+	CO M	B	A	GND	SH
X100 Power supply 100 to 240 V AC, 50/60 Hz			X1 Relay 1 Alarm			X3 Relay 2 Warning			X12A 4 to 20 mA Channel 1		X12B 4 to 20 mA Channel 2		PROFIBUS cable (internal)			

Mains voltage
Multi-range power unit for 100 to 240 V AC

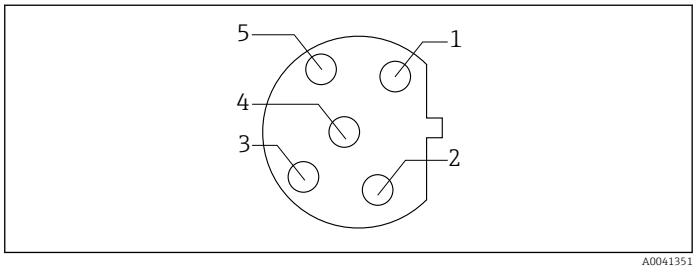
Analog outputs
X12: current output, channel 1 + 2

Digital outputs
- X1: relay 1, alarms
  - Open contact on error: COM-NO
  - Closed contact on error: COM-NC
- X3: relay 2, warnings
  - Open contact on error: COM-NC
  - Closed contact on error: COM-NO

If the CA76NA is the last device in the bus segment, the two jumpers must be set to X7 and X8 on the PROFIBUS interface card to incorporate the terminating resistors. If the analyzer is not the last device in the bus segment, the jumpers must be removed from X7 and X8 on the PROFIBUS interface card.

M12 socket

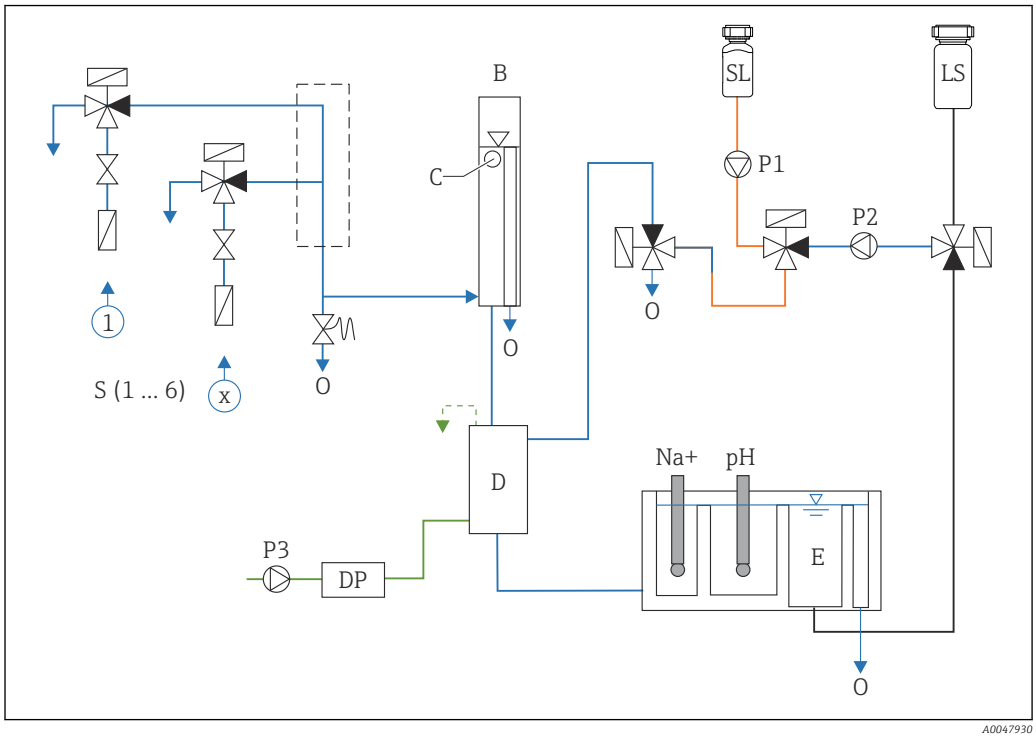
PROFIBUS is connected to an external M12 socket.



1	n.c.
2	A (green)
3	n.c.
4	B (red)
5	n.c.
Housing	Shielding

1 Pin assignment 5-pin, b-coded

Flow diagram



2 *Liquid control unit with measuring unit and supply vessel*

S	*Sample inlet, 1 to 6*	*O*	*Outlet*
B	*Overflow vessel for constant primary pressure*	*SL*	*Standard solution*
C	*Overflow level monitor*	*LS*	*Laboratory sample*
D	*Alkalization vessel*	*P1*	*Dosing pump*
DP	*Diisopropylamine (DIPA)*	*P2*	*Circuit pump*
E	*Supply vessel*	*P3*	*Alkalization pump*

Input

Measured variables	Na [µg/l, ppb]	
Measuring range	CA76NA-**AD	0.1 to 9999 µg/l (ppb) Na
	CA76NA-**AE	0.1 to 200 µg/l (ppb) Na
Types of input	CA76NA-**AD	1 to 6 measuring channels
	CA76NA-**AE	1 measuring channel

Output

Output signal	Depending on version: Up to 6 x 4 to 20 mA

PROFIBUS DP	
Signal encoding	EIA/TIA-485, PROFIBUS DP-compliant acc. to IEC 61158
Data transmission rate	9.6 kbit/s – 12 Mbit/s
Galvanic isolation	Yes
Connectors	M12 socket as per IEC 61072-2-101, 5-pin, b-coded

For version with PROFIBUS DP:
Maximum of two analog outputs for outputting the measured value

Load

Max. 500 Ω

Relay outputs

Relay
- 1 relay for alarms
- 1 relay for warnings

Relay types
Changeover contact

Relay switching capacity

Switching voltage	Load (max.)	Switching cycles (min.)
250 V AC, cosΦ = 0,8 … 1	0,1 A	1.000.000
	0,5 A	200.000
	3 A	300.000
115 V AC, cosΦ = 0,8 … 1	0,1 A	1.000.000
	0,5 A	200.000
	3 A	30.000
24 V DC, L/R = 0 … 15 ms	0,5 A	200.000
	3 A	30.000

Protocol-specific data

Manufacturer ID	11_h
Device type	$1571D_h$
Device database files (GSD files)	www.endress.com/profibus Device Integration Manager DIM
Output values	Status and measured values
Input variables	Remote control: measurement, calibration and regeneration of the analysis function
Supported features	▪ PROFIBUS DP (DP-V0, cyclic data exchange), baud rate: 9.6 kbit/s – 12 Mbit/s ▪ PROFIBUS device address configured via onsite operation or PROFIBUS Service "Set_Slave_Add" ▪ GSD

Power supply

Supply voltage

- 100 to 240 V AC (fuse must be replaced)
- 50 or 60 Hz
- Battery-free parameter backup

The analyzer is fitted with a fuse, T 1.25 A, for the 215 to 240 V AC voltage level. If the analyzer is operated with 100 to 130 V AC, replace the fuse with the T 2.5 A fuse supplied. The fuse is located in the cover of the electronics unit.

Power consumption	40 VA

Performance characteristics

Response time	CA76NA-**AD	
	0.1 to 2000 µg/l (ppb)	180 seconds (95 %) within a calibration interval of 72 hours
	2001 to 9999 µg/l (ppb)	600 seconds (95 %) within a calibration interval of 72 hours
	CA76NA-**AE	< 55 s [1]

1) Response time from sample inflow to display change, T_{90} depending on the stages of the concentration changes, 12 min. max.

Reference conditions	Sample pH 7, 25 °C (77 °F), 1 bar (14.5 psi)

Maximum measured error	CA76NA-**AD	
	0.1 to 2000 µg/l (ppb)	2 % of measured value; ±2 µg/l (ppb) (under reference conditions)
	2001 to 9999 µg/l (ppb)	5 % of measured value; ±5 µg/l (ppb) (under reference conditions)
	CA76NA-**AE	
	0.1 to 40 µg/l (ppb)	2 µg/l (ppb)
	> 40 µg/l (ppb)	5 % of measured value

Repeatability	CA76NA-**AD	
	0.1 to 2000 µg/l (ppb)	±2 % of display value; ±2 µg/l (ppb) (under reference conditions)
	2001 to 9999 µg/l (ppb)	±5 % of display value; ±5 µg/l (ppb) (under reference conditions)
	CA76NA-**AE	Max. ±4 % of measured value or ±1 µg/l (ppb) (under reference conditions, for the same sample matrix)

Reagent consumption [1]	CA76NA-**AD	Typically 0.5 l (16.9 fl oz) per month at 25 °C (77 °F)
	CA76NA-**AE	Maximum 0.2 l (6.76 fl oz) per day at < 30 °C (86 °F) and alkalinization to pH 11

Sample conditioning	CA76NA-**AD	pH 3.5 to 11 (unbuffered)
	CA76NA-**AE	pH 2 to 4 (alkalinity: based on pH 2 acidified with HCl and buffered with 225 ppm $CaCO_3$)

Environment

Ambient temperature range	5 to 45 °C (41 to 113 °F)

Storage temperature	0 to 50 °C (32 to 122 °F)

Alkalization reagent and electrodes

Store the alkalization reagent and electrodes at temperatures above +5 °C (41 °F).

1) The consumption of the DIPA reagent is heavily dependent on the pH value and temperature of the medium.

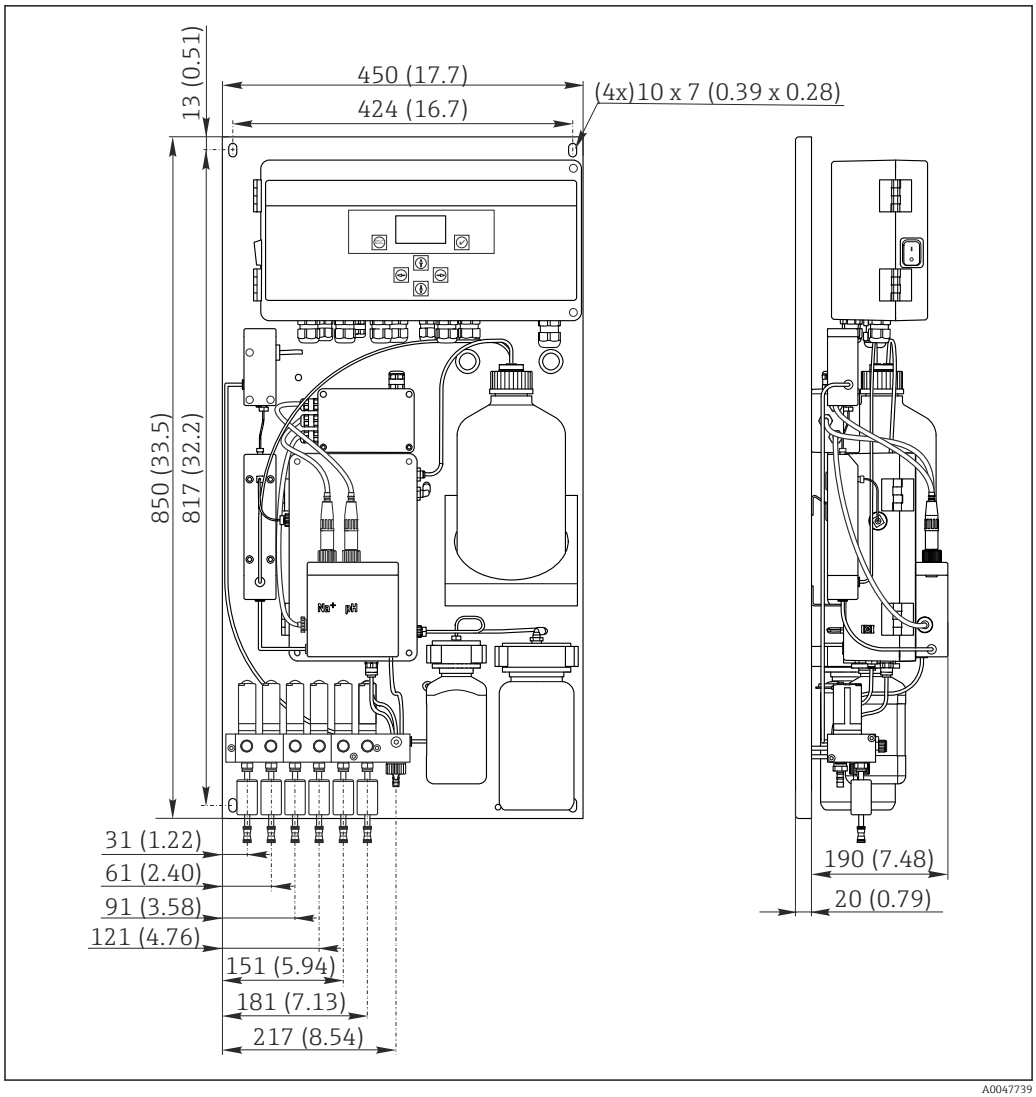
Humidity	30 … 95 %
Degree of protection	IP54 complete panel assembly IP65 electronics unit
Electromagnetic compatibility	Interference emission and interference immunity as per EN 61326-1:2013, Class A for Industry
Electrical safety	According to EN/IEC 61010-1:2010, Class I equipment Low voltage: overvoltage category II For installations up to 2000 m (6500 ft) above MSL
Pollution degree	The product is suitable for pollution degree 2. Pollution degree 1 applies within the electronics unit.

Process

Sample temperature range	+10 to +40 °C (+50 to +104 °F)	
Supply pressure	1.0 to 5.0 bar (14.5 to 72.5 psi)	
pH value of sample	CA76NA-**AD	pH 3.5 to 11 (unbuffered)
	CA76NA-**AE	pH 2 to 4 (alkalinity: based on pH 2 acidified with HCl and buffered with 225 ppm $CaCO_3$)
Sample flow rate	10 to 15 l/h (2.64 to 3.96 gal/hr)	
Sample supply	▪ 1 to 6 input channels with pressure regulator (regulates pressure to approx. 0.8 bar (11.6 psi)) ▪ additional lab sample ▪ pH regulation to pH 11	

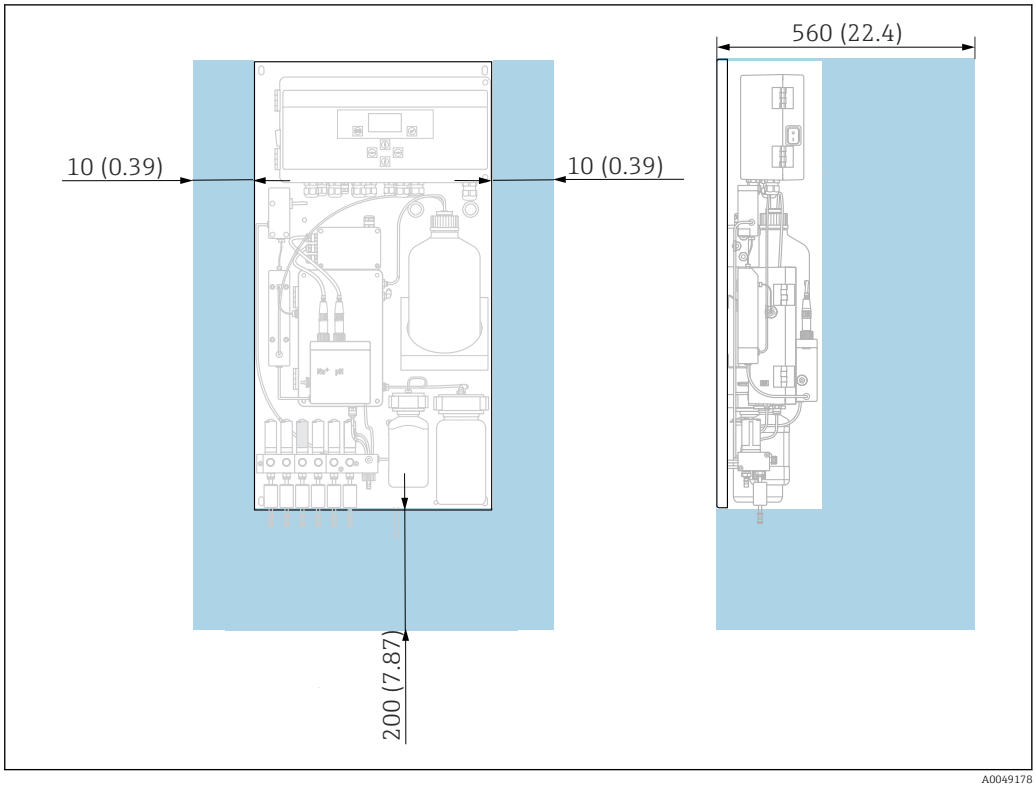
Mechanical construction

Dimensions	The mounting materials required to secure the device to the wall (screws, wall plugs) are not supplied. ► Provide mounting materials on site.



3 Analyzer CA76NA. Unit of measurement mm (in)

Spacing requirements when mounting



4 *Analyzer CA76NA, spacing requirements in mm (in)*

► Observe the required distances when mounting.

Weight

Approx. 23 kg (50.7 lbs)

Hose specification

Medium inlet
- Externally toleranced PE or PTFE hose with outer diameter of 6 mm on quick-release coupling
- Hose minimum length: 200 mm (7.87 in)

Medium outlet
- Sample conditioning unit outlet: hose measuring 6 x 4 mm
- Overflow vessel outlet, hose measuring 6 x 4 mm
- General outlet: hose measuring 11 x 8 mm
- Overflow valve outlet, 8 x 6 mm

Certificates and approvals

Current certificates and approvals that are available for the product can be selected via the Product Configurator at www.endress.com:

1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Configuration**.

Ordering information

Product page

www.endress.com/ca76na

Product Configurator

1. **Configure**: Click this button on the product page.
2. Select **Extended selection**.
   ↳ The Configurator opens in a separate window.
3. Configure the device according to your requirements by selecting the desired option for each feature.
   ↳ In this way, you receive a valid and complete order code for the device.
4. **Apply**: Add the configured product to the shopping cart.

For many products, you also have the option of downloading CAD or 2D drawings of the selected product version.

5. **Show details**: Open this tab for the product in the shopping cart.
   ↳ The link to the CAD drawing is displayed. If selected, the 3D display format is displayed along with the option to download various formats.

Scope of delivery

The scope of delivery comprises:
- 1 analyzer
- 1 print version of the Brief Operating Instructions in the language ordered

The sodium electrode, pH electrode, standard solution and alkalization reagent are not included in the delivery for the analyzer.

Before commissioning the analyzer, order the sodium electrode, pH electrode and standard solution as a "starter kit" accessory.

Purchase alkalization reagent separately (recommended: diisopropylamine (DIPA), > 99.0 % (GC), in a bottle made from a solid material, e.g. glass.

Accessories

The following are the most important accessories available at the time this documentation was issued.

► For accessories not listed here, please contact your Service or Sales Center.

Device-specific accessories

Starter kit

Due to customs regulations, check with your local Sales Center regarding availability.

The sodium electrode, pH electrode and standard solution are not included in the delivery for the analyzer.

Before commissioning the analyzer, order the sodium electrode, pH electrode and standard solution as a "starter kit" accessory.

- pH electrode
- Sodium electrode
- Standard solution

Order No. 71358762

Electrode kit

- Sodium electrode
- pH electrode

Order No. 71371663

PROFIBUS upgrade kit for CA76NA

Analyzers with software version V2.13 or higher can be upgraded to PROFIBUS.

PROFIBUS DP upgrade

Order No. 71439722

Sodium electrode for CA76NA

Sodium electrode

Order No. 71358110

pH electrode for CA76NA

pH electrode

Order No. 71358111

Consumables for CA76NA

Alkalization reagent

Purchase alkalization reagent separately (recommended: diisopropylamine (DIPA), > 99.0 % (GC), in a bottle made from a solid material, e.g. glass).

Sodium standard solution

Standard solution 5100 µg/l (ppb) Na, 500 ml (16.9 fl.oz)
Order No. 71358761

Other accessories

Threaded adapter for alkalization bottle GL45 IG / S40 AG
Order No. 71358132

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