

ABB MEASUREMENT & ANALYTICS | DATA SHEET | DS/AAM631-EN REV. D

AAM631

Aztec 600 ISE ammonia analyzer



Measurement made easy

Reliable on-line monitoring of ammonia

Reliable ammonia measurement

- continuous measurement using ISE technology
- automatic 2-point calibration
- temperature-controlled flow cell

Easy to operate

- familiar Windows™ menu system
- built-in context-sensitive help
- data trending and analysis

Easy to maintain

- up to 3 months unattended operation using EcoMode
- simple-to-perform annual service
- helpful maintenance diagnostics screens

Improved reporting

- audit and alarm logs
- onboard data logging
- in-built SD® card reader for secure archiving

Full communications

- web- and ftp-enabled for easy data file access, remote viewing and configuration
- email capability
- optional PROFIBUS® DP V1.0

The Aztec 600 colorimetric range

The Aztec 600 analyzers from ABB are a range of compact, yet reliable, online ion-selective (ISE) and colorimetric analyzers designed for monitoring the key parameters in water treatment.

They combine Aztec's unique fluid handling system with the latest electronics platform (featuring Windows menu-driven software), to create a range of analyzers that provide accurate, reliable measurement, that are simple-to-operate and maintain.

The following parameters are available in the Aztec 600 range:

Colorimetric:

- aluminium
- ammonia
- color
- iron
- manganese
- phosphate

ISE:

- ammonia
- fluoride



Figure 1 Aztec 600 Colorimetric analyzer (left) and Aztec 600 ISE analyzer (right)

Aztec 600 ISE ammonia analyzer

The AAM631 ammonia analyzer uses a robust gas sensing ammonia electrode to provide accurate and reliable continuous on-line analysis of ammonia levels in waters up to 1,000 ppm NH_3 .

Measurement results are updated every 2 seconds to the large, full color graphical display where process trends can be viewed locally. With the AAM631's EcoMode engaged, buffer usage is minimized allowing up to 3 months continuous operation from a set of reagents.

Users of this system also benefit from the AAM631's low maintenance requirements, ease-of-use, auto-calibration and proven chemistry methodology.

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

Applications

Typical applications for the AAM631 include:

- monitoring of ammonia levels in source waters for intake protection for drinking water treatment plants
- monitoring of ammonia levels in final drinking water for chloramination schemes
- monitoring of ammonia levels in industrial effluents
- monitoring of ammonia levels in municipal wastewaters
- monitoring of ammonia levels in river water

Ammonia in water

Ammonia is considered one of the most significant pollutants in the aquatic environment not only because of its highly toxic nature and prevalence in surface waters, but also because many effluents have to be treated extensively to prevent the concentrations of ammonia in surface waters being unacceptably high.

Ammonia can enter the aquatic environment via direct means such as municipal effluent discharges, industrial processes and agricultural run-off, and indirect means such as nitrogen fixation and the excretion of nitrogenous wastes from animals.

The term ammonia refers to 2 chemical species that are in equilibrium in water (NH_3 , un-ionized and NH_{4+} , ionized). The ratio of these species in a given aqueous solution is dependent on both pH and temperature.

The toxicity to ammonia is attributable primarily to the un-ionized form (NH_3).

Although ammonia in drinking water is not considered of immediate health relevance, it has been shown to compromise disinfection efficiency, result in nitrite formation in distribution systems, cause the failure of filters for the removal of manganese, and cause taste and odor problems.

User benefits of online ammonia monitoring using the AAM631

The Aztec 600 solution

Given the toxic nature of ammonia to fish and aquatic organisms, even in very low concentrations, the removal of ammonia from both municipal and industrial effluents must be controlled accurately and monitored carefully to ensure that locally set prescribed operational criteria is adhered to. The AAM631 provides a continuous measurement of the total ammonia concentration that is the sum of the gas NH_3 and the cation NH_{4+} – this is commonly expressed as total ammonia-nitrogen (TAN).

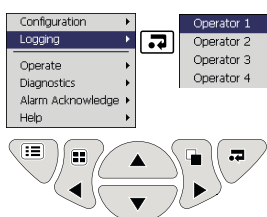
The process alarms from the AAM631 can be linked to an appropriate alarm monitoring system, enabling immediate process decisions to be made to ensure that the ammonia concentration stays within the plant's target operating band. To help operators to verify analyzer performance, the AAM631 features automatic 2-point calibration with separate high and low standard solutions. This provides users with a powerful, accurate and reliable tool for efficient monitoring and control of the wastewater treatment processes/plant to ensure compliance with local discharge consent limits and current legislation.

Overview of Aztec 600 ISE ammonia analyzer

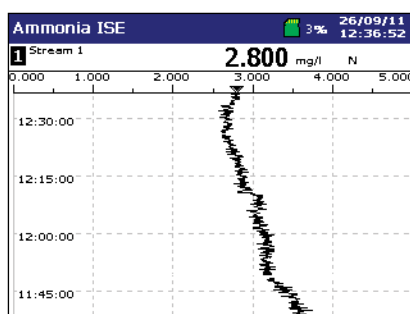
Easy-to-use Windows menu system



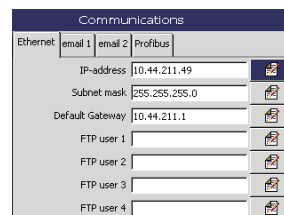
Simple navigation



Graphical results trending



Flexible communications



- Ethernet connectivity
- 6 current outputs
- 10 alarm relays (configurable)
- PROFIBUS DP v1.0
- SD memory card
- Process data trends

Temperature-controlled flow cell for accurate measurement

- Adjusts and stabilizes sample temperature
- Maintains electrodes at constant temperature
- Removes measurement errors caused by temperature fluctuation

Automatic 2-point calibration

- Verifies analyzer's performance
- Fully user-programmable
- Compensates for any electrode drift

Integrated side-sample pot for simple installation

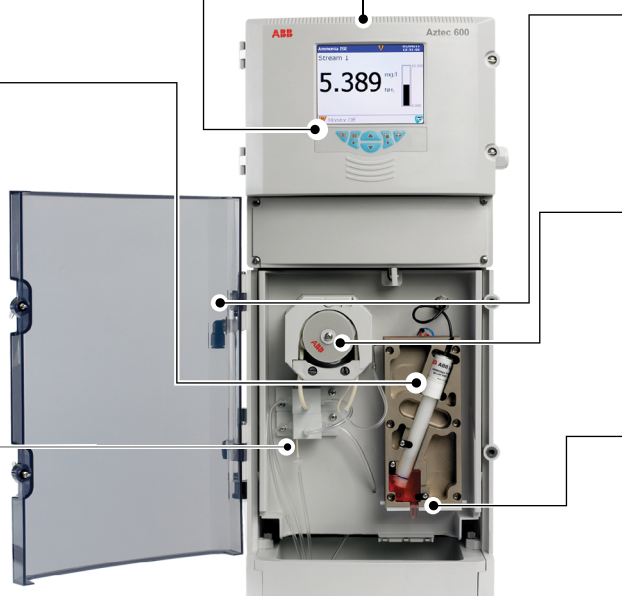
- Magnetic sample flowswitch alarms when sample is not present

Buffered measurement for greater accuracy

- Up to 3 months continuous measurement between routine buffer replacements with EcoMode (refer to "Solution usage" on page 8)

Continuous measurement using ISE technology

- Updated measurement result every 2 seconds
- Robust gas sensing ammonia electrode with visual membrane check feature



Reliable measurement

The AAM631 has been designed for ease-of-use and maintenance simplicity, while offering the benefits of flexible communication and advanced data acquisition.

Measuring principle

The AAM631 measures total ammonia using a robust gas-sensing ammonia probe. The probe contains a glass pH electrode and a robust, long-life reference electrode. The two electrodes are combined into a single assembly and connected as a pH measuring pair through an internal reservoir of filling solution, separated from the sample by a gas-permeable hydrophobic membrane.



Figure 2 Ammonia electrode

To measure the total ammonia-nitrogen (TAN) the AAM631 uses an alkali buffer reagent to raise the sample pH to a value greater than 11 to convert all the ionized ammonium (NH_4^+) to the un-ionized (NH_3) form.

As sample flows past the probe membrane, the partial pressures of the ammonia gas in the sample on one side of the membrane and the filling solution on the other equalize, transferring the NH_3 gas across the membrane. At equal pressure, the concentration of ammonia in the thin film of filling solution between the probe membrane and the pH-sensitive glass electrode membrane equals that in the sample.

The resultant change in the pH value of the internal filling solution is measured by the pH electrode pair, creating an output potential related to the ammonia concentration in the sample. Like most ion-selective electrodes, the ammonia probe produces a logarithmic output in respect to the measured concentration.

One of the key benefits of this particular electrode design is that the outer body is translucent so that the internal filling solution can be viewed easily whilst in operation. If the gas-permeable membrane is damaged, allowing alkaline solution to leak, the filling solution changes color from yellow to blue so that it can be seen and replaced easily.

Temperature-controlled flow cell

It is important to control both sample and electrode temperature as any variation affects the electrode potential, resulting in significant measurement errors.

The Aztec 600 ISE ammonia electrode is housed in a fully enclosed temperature-controlled cell that adjusts and stabilizes the temperature of the sample before it is introduced to the electrode. This ensures that a constant temperature is maintained during both calibration and measurement.



Figure 3 Electrode in temperature-controlled flow cell

Automatic calibration

The Aztec 600 ISE range features automatic 2-point calibration that verifies the analyzer's performance against standards of a known concentration. Calibration frequency can be programmed by the user to occur either weekly or up to 4 times per day.

Measurement technique

A single peristaltic pump caters for all fluid and chemical handling. This draws sample from the process in through the analyzer side sample pot. The sample is then combined with the buffer reagent.

The buffer reagent is used to raise the sample pH to convert all the ionized ammonium (NH_4^+) to the un-ionized (NH_3) form. The conditioned sample is passed through a temperature block to stabilize the temperature and provide further mixing before being presented to the ammonia probe.

The output of the electrode is converted (by the analyzer) to indicate the ammonia concentration in ppm, mg/l, ppb or $\mu\text{g/l}$. The measured ammonia concentration can be expressed as NH_3 , $\text{NH}_3\text{-N}$ or NH_4 .

Finally, the sample flows to waste.

During automatic calibration, the sample supply is isolated and the calibration standards are presented to the electrode by sequencing of the high and low solenoid valves.

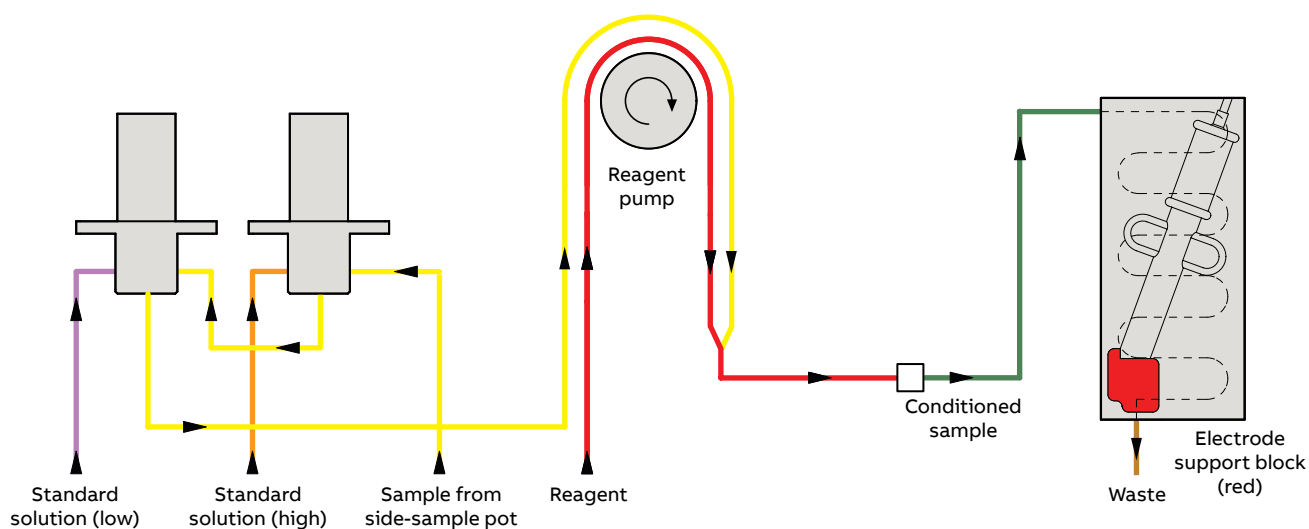


Figure 4 Schematic flow diagram

...Reliable measurement

Simple to operate

The powerful and user-friendly, Windows® menu-driven software enables users to operate the analyzer with the minimum amount of training.

The comprehensive range of menu screens is simple-to-access using the six membrane keys.

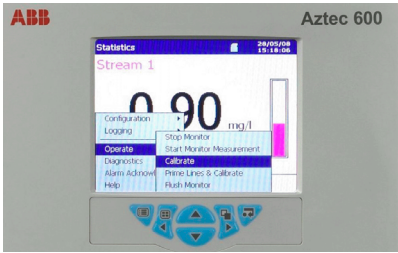


Figure 5 Windows-based interface

These menus include data logging and graphical trending screens, operation command screens, full setup configuration screens and a range of self-diagnostics (including full calibration and operating status screens).

Historical logs provide operators with access to alarm data and audit trail data. Process data and historical logs are archived securely to a removable SD card.

All information is displayed clearly on the easy-to-read 145 mm (5.7 in) color LCD display and is available in a range of languages.

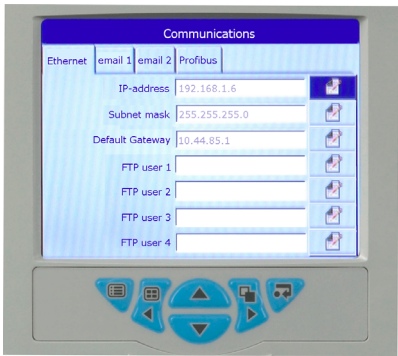


Figure 6 Communications window

Simple to maintain

The Aztec 600 ISE range is designed to be as maintenance-free as possible. The inherent product design and auto-calibrating features reduce the amount of maintenance required for external cleaning of sample lines, changing of reagents and probe membrane and annual servicing.

Service schedule

Period	Schedule*
12 monthly	Replace pump capstans and sample tubing
24 monthly	Replace pump capstans and monitor tubing

*Periodic replacement of probe membrane and electrode filling solution is application specific.

All parts are provided in convenient maintenance kits.

Solution usage

The analyzer features an EcoMode function that reduces the amount of buffer and sample drawn into the analyzer during measurement by approximately one third when compared to the standard operating speed. EcoMode enables 3 months' continuous measurement between routine buffer replacements in addition to a reduction in the analyzer waste generated. EcoMode can be activated or deactivated by the user.

Solution	Average consumption
Calibration standards	2.5 L (0.66 galUS) every 60 days*
Buffer	10 L (2.64 galUS) every 2 to 3 months

*Based on a daily calibration

Flexible communications

Ethernet-ready

The AAM631 provides 10 BaseT Ethernet communications via a standard RJ45 connector and uses industry-standard protocols TCP/IP, FTP and HTTP. The use of standard protocols enables easy connection into existing PC networks.

Data file access via FTP (file transfer protocol)

The AAM631 features FTP server functionality. The FTP server in the analyzer is used to access its file system from a remote station on a network. This requires an FTP client on the host PC. Both MS-DOS® and Microsoft® Internet Explorer version 5.5 or later can be used as an FTP client.

- Using a standard web-browser or other FTP client, data files contained within the analyzer's memory or memory card can be accessed remotely and transferred to a PC or network drive.
- Four individual FTP users' names and passwords can be programmed into the AAM631. An access level can be configured for each user.
- All FTP log-on activity is recorded in the audit log of the analyzer.
- Using ABB's data file transfer scheduler program, data files from multiple analyzers can be backed-up automatically to a PC or network drive for long-term storage, ensuring the security of valuable process data and minimizing operator intervention.

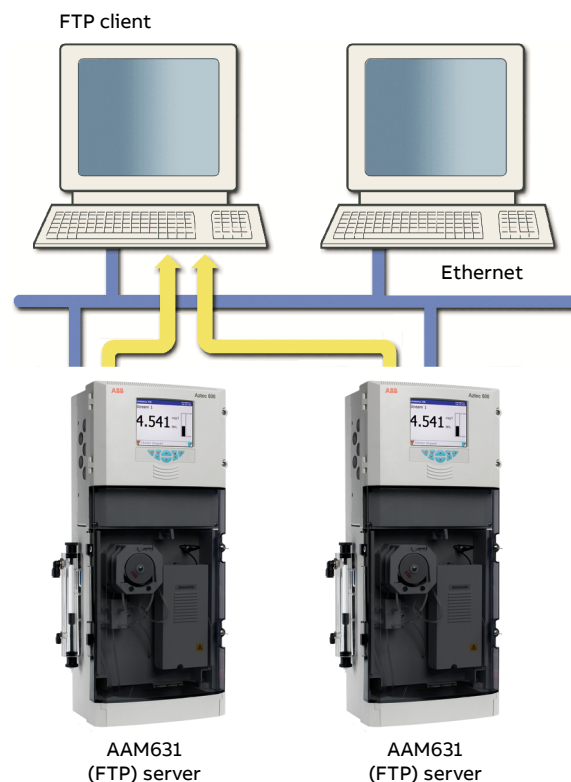
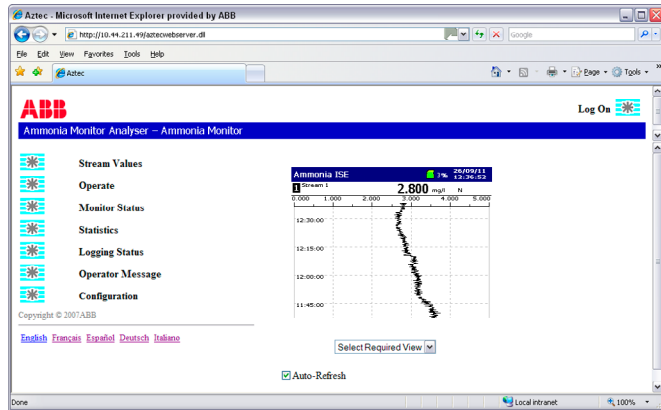


Figure 7 Aztec 600 FTP server

...Flexible communications

Embedded web server

The AAM 631 has an embedded web-server that provides access to web pages created within the analyzer. The use of HTTP (Hypertext Transfer Protocol) enables standard web browsers to view these pages.



- Accessible through the web pages are the current display of the analyzer, detailed information on stream values, reagent and solution levels, measurement status and other key information.
- The audit and alarm logs stored in the analyzer's internal buffer memory can be viewed on the web pages.
- Operator messages can be entered via the web server, enabling comments to be logged to the analyzer.
- The web pages and the information they contain are refreshed regularly, enabling them to be used as a supervision tool.
- The analyzer's configuration can be selected from an existing configuration in the internal memory or a new configuration file transferred to the instrument via FTP.
- The analyzer's real-time clock can be set via the web server. Alternatively, the clocks of multiple analyzers can be synchronized using ABB's File Transfer Scheduler software.

Email notification

Via the AAM631's built-in SMTP client, the analyzer is able to email notification of important events. Emails triggered from alarms or other critical events can be sent to multiple recipients. The analyzer can also be programmed to email reports of the current measurement status or other parameters at specific times during the day.

PROFIBUS

The AAM631 can be equipped with PROFIBUS DP V1.0 to enable full communications and control integration with distributed control systems.

Specifications

Measurement

Units

NH₃
NH₃-N
NH₄

Range

0.050 to 1000 ppm NH₃

Measurement principle

Gas-sensing ammonia probe

Measurement mode

Continuous

Measurement performance

Accuracy¹

- $\pm 5\%$ of reading² or ± 0.02 ppm for 0.05 to 500 ppm NH₃ (whichever is the greater)
- $\pm 7.5\%$ of reading² for 500 to 1000 ppm NH₃

Repeatability

$\pm 2\%$ of reading³ or ± 0.02 ppm (whichever is the greater)

Response time

- Normal operating mode: T90 typically 5 minutes
- EcoMode: T90 typically <7.5 minutes

Resolution

0 to 10 ppm:	0.001 ppm
10 to 100 ppm:	0.01 ppm
100 to 1000 ppm:	0.1 ppm

Calibration

Two-point, automatic calibration, with the option of manual initiation. The interval between automatic calibrations is selectable manually from four times a day to once per week.

Environmental data

Ambient operating temperature:

5 to 40 °C (41 to 104 °F)

Ambient operating humidity:

Up to 95 % RH non-condensing

Sample temperature:

1 to 40 °C (33.8 to 104 °F)

Sample flow:

Continuous, 200 to 500 mL/min

Sample pressure:

5 psi maximum

Sample limitations:

Samples containing particles 100 µm (0.004 in) in diameter or larger may require pre-filtration.

Maintenance

Routine service interval:

12 months

Display

Color, TFT, liquid crystal display (LCD) with built-in backlight and brightness adjustment

Diagonal display area:

- 145 mm (5.7 in)
- 76,800 pixel display*

* A small percentage of the display pixels may be either constantly active or inactive.

Max. percentage of inoperative pixels <0.01 %.

Dedicated operator keys

- Group select/left cursor
- View select/right cursor
- Menu key
- Up/increment key
- Down/decrement key
- Enter key

Mechanical data

Ingress protection

IP31**

Sample connections

Inlet:

- 6 mm OD × ¼ in BSP push-fit elbow

Outlet:

- 10 mm OD × ¾ in BSP push-fit elbow

Dimensions

Height:

653 mm (25.7 in)

Width:

366 mm (14.4 in) max.

Depth:

- 183 mm (7.2 in) door closed
- 430 mm (16.9 in) door open

Weight:

15 kg (33 lb)

Materials of construction

Electronics enclosure:

- 10 % glass-loaded polycarbonate

Main enclosure:

- Noryl®

Lower tray:

- 20 % glass-loaded polypropylene

Door:

- Acrylic

Electrical

Power supply ranges

- 100 to 240 V max. AC 50/60 Hz $\pm 10\%$ (90 to 264 V AC, 45/65 Hz)
- 18 to 36 V DC (optional)

Power consumption

- 75 W max. – AC
- 100 W max. – DC

** Not evaluated for UL or CB

¹ Maximum measured error across full measurement range.

² Testing based on IEC 61298 Parts 1-4 : Edition 2.0 2008-10.

³ Testing based on BS ISO 15839 : 2003.

...Specifications

Analog outputs

Six isolated current outputs, fully assignable and programmable over a 0 to 20 mA range (up to 22 mA if required)

Alarms/relay outputs

One per unit:

- Stop relay
- Attention relay
- Failure relay
- Calibrate relay

Six per unit:

- Fully user-assignable alarm relays

Rating

Voltage:

- 250 V AC
- 30 V DC

Current:

- 5 A AC
- 5 A DC

Loading (non-inductive):

- 1,250 VA
- 150 W

Connectivity/communications

Ethernet connection

Web server with ftp for real-time monitoring, configuration, data file access and email capability

Communications

PROFIBUS DP V1.0 (optional)

Data handling, storage and display

Security

Multilevel security:

- Operator and configuration password or security switch

Storage

Removable Secure Digital (SD) card

Trend analysis

Local and remote

Data transfer

SD card or FTP

Approvals, certification and safety

Safety approval

cULus

CE mark

Covers EMC & LV directives (including latest version EN 61010)

General safety

- EN61010-1
- Overvoltage Class II on inputs and outputs
- Pollution category 2

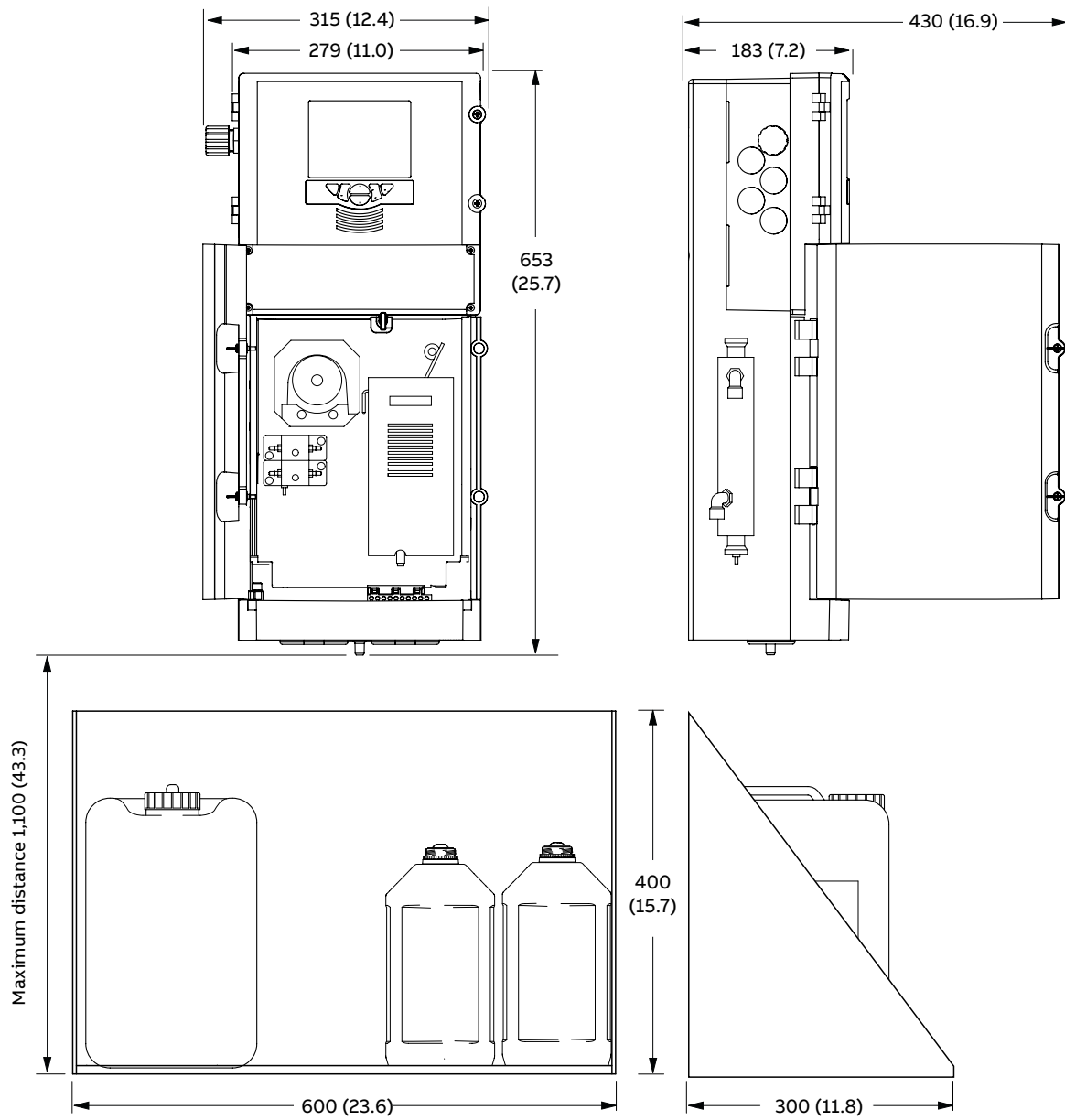
EMC

Emissions & immunity

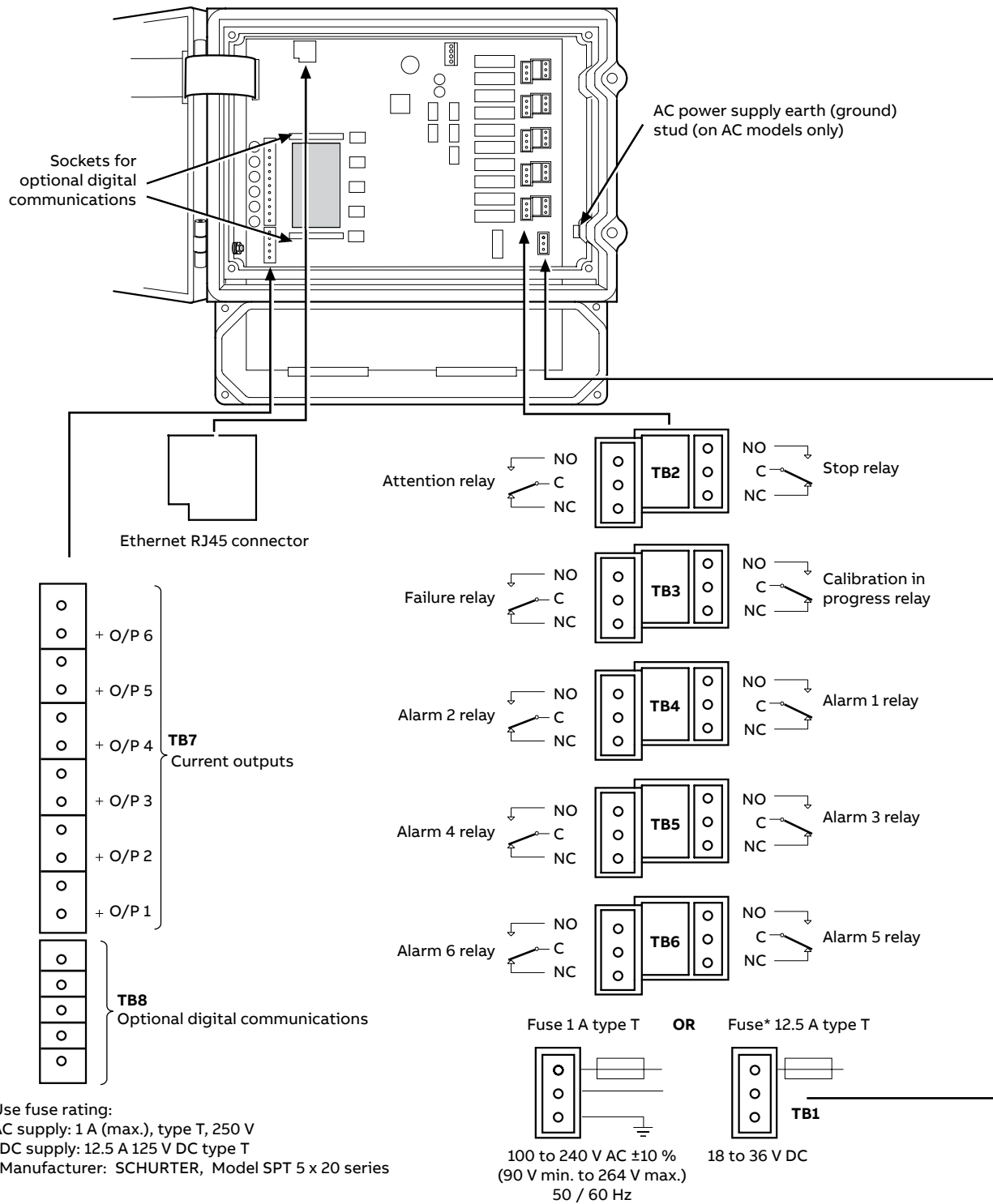
Meets requirements of IEC61326 for an industrial environment

Overall dimensions (shown with optional reagent tray)

All dimensions in mm (in)



Electrical connections



Ordering information

Aztec 600 ISE ammonia analyzer	AAM631/	A1	A1	XX	XX	XX	Options
Measuring range 0.050 to 1,000 ppm NH ₃		A1					
Number of streams Single stream			A1				
Power supply 90 to 264 V AC / 50 to 60 Hz 18 to 36 V DC				A1 A2			
Output signal 4 to 20 mA + Ethernet 4 to 20 mA + Ethernet + PROFIBUS DPV1					A1 D2		
Display language German Italian Spanish French English						A1 A2 A3 A4 A5	

Optional ordering codes

Add 1 or more 2-digit codes after the standard ordering information to select any additional options if required.

Reagent level sensors Calibration standard level sensors	S1
Data storage SD Card	D1
Certificates Calibration certificate	CD
Reagent storage Reagent tray Reagent tray + reagent containers	R1 R2
Maintenance kits Annual maintenance kit	V1
Documentation language German Italian Spanish French English Polish	M1 M2 M3 M4 M5 M9

Sales



Service



Software



Acknowledgements

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- PROFIBUS is a registered trademark of PROFIBUS organization.
- SD is a trademark of SD-3C

Notes



Notes

ABB Measurement & Analytics

For your local ABB contact, visit:
www.abb.com/contacts

For more product information:
www.abb.com/measurements

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