Anton Paar

Instruction Manual and Safety Information

# Alcolyzer Module 1001 Beer
# Alcolyzer Module 3001 Beer
# Alcolyzer Module 3001 Wine
# Alcolyzer Module 3001 Sake
# Alcolyzer Module 3001 Spirits
# Alcolyzer Module 3001

Find out more

**www.anton-paar.com**

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# 1 Safety instructions

**Read the documentation**

- Read the documentation before using the product.
- Follow all hints and instructions in the documentation to ensure the correct use and safe functioning of the product.

## 1.1 General safety instructions

**General**

- The documentation is a part of the product. Keep it for the complete working life of the product and make it easily accessible to all persons involved with the product. If you receive any additions or revisions from Anton Paar, these must be treated as part of the documentation.

**Liability**

- This document does not claim to address all safety issues associated with the use of the product and samples. It is your responsibility to establish health and safety practices and to determine the applicability of regulatory limitations.
- Anton Paar only warrants the safe and proper functioning of the product if no modifications are made to mechanics, electronics, or software.
- Use the product only for the purpose described in the documentation. Anton Paar is not liable for damages caused by incorrect use of the product.
- The results delivered by the product depend on the correct function of the product and various other factors. We recommend that you have experts check the results (i.e., perform plausibility testing) before taking consequential actions based on the results.

**General precautions**

- Observe and adhere to your national safety regulations regarding the handling of all substances associated with your measurements (e.g. use safety goggles, gloves, respiratory protection, etc.).
- Check the wetted parts of the product for chemical resistance to all samples and cleaning liquids.
- Take measures that spilled liquids cannot get into plug connections or venting slots of electrical appliances.

**Installation**

- The installation procedure shall only be carried out by authorized personnel who are familiar with the installation instructions.
- Use only accessories, consumables, or spare parts supplied or approved by Anton Paar.

**Using the product**

- Ensure that all operators have been trained beforehand to use the product safely and correctly.
- Ensure that the product is sufficiently supervised during operation.
- In case of damage or malfunction, stop operating the product. Do not operate the product under conditions that could result in damage to goods or injuries or loss of life.

**Precautions for flammable samples and cleaning agents**

- Keep potential sources of ignition, like sparks or open flames, at a safe distance from the product.
- Store only the minimum required amount of sample, cleaning liquids, and other hazardous materials near the product.
- Do not spill sample/cleaning liquids or leave their containers uncovered. Immediately remove spilled sample/cleaning liquids.
- Ensure that the setup location is sufficiently ventilated. The environment of the product must be kept free from flammable gases and vapors.
- Provide fire-extinguishing equipment.

**Operation in areas with risk of explosion**

- The product is **not** explosion-proof and therefore must not be operated in areas with risk of explosion.

**Transportation**

- Empty the measuring cell and all hoses before you move or lift the measuring module.

**Service and repairs**

- Service and repair procedures may be carried out only by authorized persons or by Anton Paar.

**Disposal**

- Concerning the disposal of the product, observe the legal requirements in your country. Contact your Anton Paar representative for further questions.

## 1.2 Conventions for safety messages and typography

**Conventions for safety messages**

The following conventions for safety messages are used in this document:

**WARNING**

**Description of risk**

Warning indicates a hazardous situation which, if not avoided, **could** result in death or serious injury.

**CAUTION**

**Description of risk**

Caution indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

**NOTICE**

**Description of risk**

Notice indicates a situation which, if not avoided, could result in damage to property.

**TIP:** *Tip gives extra information about the situation at hand.*

### Typographical conventions

The following typographical conventions are used in this instruction manual:

| Convention | Description |
|---|---|
| *Names for physical buttons*<br>*Labels for tabs, buttons etc. in the software* | The names and labels are written in *italic*. |
| *Menu Level 1 > Menu Level 2* | Menu paths are written in *italic*. The menu levels are connected using a closing angle bracket. |

# 2 Overview

Alcolyzer 3001/1001 determines the alcohol content of beer and other alcoholic beverages by a patented NIR analysis method.

All Alcolyzer 3001/1001 models are controlled and supplied with power by the master instrument over the CAN bus.

Depending on the sample, different models of Alcolyzer 3001/1001 are available, refer to below table.

**Alcolyzer 3001** is a modular instrument, which can be integrated in Anton Paar measurement systems that use a DMA 5002 or a DMA 6002 as the master instrument. (A DMA 4002 can be the master instrument with Alcolyzer 3001 Wine or Alcolyzer 3001 Sake.)

The **Alcolyzer 3001 model** is a universal, full-range module, which offers all measuring products that are separately available on the other, more specialized modules.

**Alcolyzer 1001 Beer** is a modular instrument, which can be integrated in Anton Paar measurement systems that use a DMA 4002 as the master instrument only.

**Alcolyzer 3001**, **Alcolyzer 3001/1001 Beer**, and **Alcolyzer 3001 Spirits** are optionally available with an integrated **color measurement device**. The color value (measuring range from 0 EBC to 120 EBC / 0 ASBC to 60.96 ASBC) is determined by the measurement of light absorption (light of a wavelength of 430 nm).

Optionally, the Alcolyzer 3001/1001 modules can be combined with other Anton Paar measuring modules and a sample changer (Xsample).

**Table 1:** Measuring ranges of Alcolyzer 3001/1001 models

| Model | Samples | Measuring range(s) | Optional color measurement |
|---|---|---|---|
| **Alcolyzer 1001 Beer** | all kinds of beers and beer mixed drinks | 0–12 % v/v | yes |
| **Alcolyzer 3001 Beer** | all kinds of beers and beer mixed drinks, hard seltzer, cider, molasses, wash, kombucha | 0–12 % v/v | yes |
| **Alcolyzer 3001 Wine** | wine, sparkling wine, cider, sake, hard seltzer | 0–20 % v/v | no |
| **Alcolyzer 3001 Sake** | wine, sparkling wine, cider, sake, hard seltzer | 0–20 % v/v | no |
| **Alcolyzer 3001 Spirits** | whisky, cognac, vodka, gin, rum, tequila, clear liqueurs, sucrose-based liqueurs[a], RTDs[b] (e.g. whisky cola) | 0–65 % v/v | yes |
| **Alcolyzer 3001** | all kinds of beers and beer mixed drinks, hard seltzer, cider, molasses, wash, kombucha, wine, sparkling wine, cider, sake, hard seltzer, whisky, cognac, vodka, gin, rum, tequila, clear liqueurs, sucrose-based liqueurs[a], RTDs[b] (e.g. whisky cola) | 0–65 % v/v | yes |

[a] *only in combination with an MCP 100/150 polarimeter*

[b] *only available in pressurized systems. Specifications can be found in the respective manual*

## 2.1 Intended use of the instrument

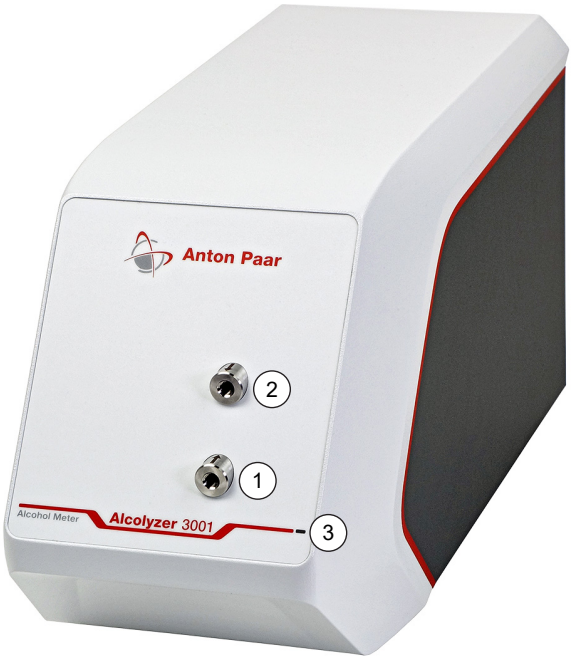
Alcolyzer 3001/1001 is capable of measuring the alcohol content of alcoholic beverages. Measuring ranges of the alcohol content for all available models are given in Table 1 [▶ 5].

### Restrictions and exclusions

- Do not leave beverage samples longer than necessary in the measuring cell because the sugar content will leave residues on the inner surface of the glass cuvette.
- Do not fill a sample if you do not know which cleaning liquid removes this sample.
- Do not fill and test liquids that attack the instrument's materials.
- Do not use hydrofluoric acid as a cleaning agent as it attacks the glass of the measuring cell.
- Do not fill substances that may harden inside the measuring cell.
- Do not mix substances inside the measuring cell if these substances may react chemically.

## 2.2 Functional components

Front and right side




Rear

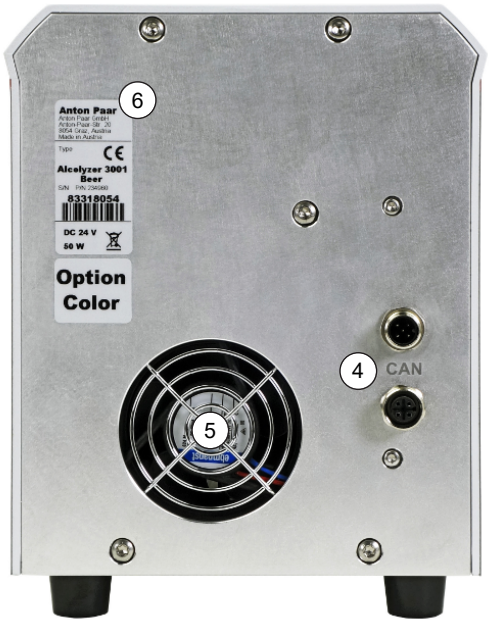



***Fig. 1:*** *Views of Alcolyzer 3001 (Alcolyzer 1001 with equivalent design)*

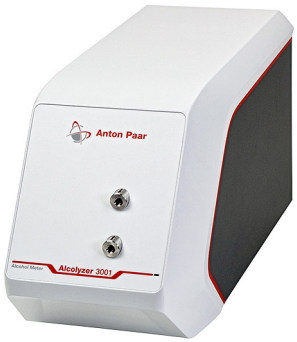
*1 Sample inlet*
*2 Sample outlet*
*3 Power LED*
*4 CAN interfaces*
*5 Fan*
*6 Type plate (P/N = mat. no.)*

# 3 Supplied parts

The product was tested and packed carefully before shipment. However, damage may occur during transport.

– Keep the packaging material (box, foam piece, transport protection) for possible returns and further questions from the transport and insurance company.
– Check the delivery for completeness by comparing the supplied parts to those noted in the table(s) below.
– If a part is missing, contact your Anton Paar representative.
– If a part is damaged, contact the transport company and your Anton Paar representative.

**Table 2:** Supplied parts

| | Qty. | Description | Mat. No. |
|---|---|---|---|
|  | 1 | Alcolyzer 3001 Beer or<br>Alcolyzer 3001 Wine or<br>Alcolyzer 3001 Spirits or<br>Alcolyzer 3001 Sake or<br>Alcolyzer 3001 or<br>Alcolyzer 1001 Beer | 234960<br>234961<br>234962<br>234963<br>234964<br>234965 |
| | 1 | Option Color 430 nm<br>(if applicable, indicated on the type plate) | 90684 |
| | 1 | Instruction Manual and Safety Information English Alcolyzer 3001/1001 | 241649 |
| | 1 | Instruction Manual and Safety Information English Alcoholic Beverages Measurement Systems | 242964 |
| | 1 | Accessory kit Alcolyzer 1001/3001 | 241650 |
| | | containing: | |
|  | 2 | CAN cable with ferrite sleeve 0.6 m | 241440 |
|  | 1 | CAN/Devicenet terminating resistor 5-poles | 83999 |
|  | 2 m | Hose 1.6x3.2 Tygon | 67540 |
|  | 4 | UNF filling adapter fitting black | 159945 |
|  | 2 | Tube d=2.1 D=2.4 L=20 1.4571 | 67982 |

# 4 Installation

## 4.1 Installation requirements

- The setup location and surroundings should meet the requirements of a typical laboratory.
- The setup location and surroundings must meet the minimum requirements specified under “Operating conditions” in the technical data, refer to Appendix A.2 [▶ 17].
- Observe the safety instructions in Section 1.1 [▶ 4].
- For information specific to the operation in a measurement system, refer to the manual of your measurement system.
- The latest software version must be installed on the master instrument of the measurement system.
  (Refer to the documentation of the master instrument for detailed information on software maintenance.)

**IMPORTANT:** *High humidity or a measuring temperature that is significantly below the ambient temperature may lead to condensation in the measuring cell. Care for appropriate measuring conditions.*

**The right place**

**NOTICE**

**No spray water protection at the rear**

Consider that the rear of the instrument is not protected against spray water, whereas the front, top, and sides are.

To ensure temperature stability and trouble-free measurement, do **not** position your instrument:

- next to a heating facility,
- in a drafty place (e.g. near an air conditioning, ventilation system, or an open window),
- in direct sunlight.

## 4.2 Installing Alcolyzer 3001/1001

Install the module as described in the instruction manual of your measurement system. Information and instructions given there:

- where to place the module,
- which adapters to use,
- how to connect the hoses,
- how to connect the cables.

**WARNING**

**Risk of electric shock**

Connect only voltages that comply with PELV (protective extra-low voltage) according to EN 61140 or with SELV (safety extra-low voltage) according to EN 60950 to any of the electrical interface connectors of the instrument.

**Mounting the filling adapters (if applicable)**

**NOTE:** *When PTFE hoses are used for connecting the module, no filling adapters are needed.*

Before mounting the hoses, you need to mount the filling adapters at the sample inlet and sample outlet (1 and 2,Fig. 1 [▶ 6]) of Alcolyzer 3001/1001:

- Screw in the adapters finger-tight (no tool required).

**IMPORTANT:** *The supplied filling adapters cannot be used for all measurement systems. Use the correct adapters as specified in the manual of your measurement system.*

**WARNING**

**Risk of leakage due to improper filling adapters**

If you operate the module in a pressurized system, mount the pressure-resistant filling adapters included in the connection kit of the system.

# 5 Operation

The measuring module is powered and controlled by the master instrument of the measurement system.

- Switching on the master instrument, also switches on a connected Alcolyzer 3001/1001.
- All settings and procedures for the module are controlled from the menu of the master instrument.

# 6 Instrument settings

**IMPORTANT:** *The instrument settings will be used for all Alcolyzer 3001/1001 adjustments.*

*For measurements and checks, temperature and table settings from the products are used.*

## 6.1 Condensation-proof mode

Select condensation-proof mode if you are facing condensation problems due to highly humid conditions. This will set the actual measuring temperature of the instrument to 25 °C, also refer to Section 7.4 [▶ 10].

1. Select *Settings* in the menu, then under *Modules* select your alcohol module.

2. Tap in the action box and switch *Condensation-proof mode* to *Yes* in order to activate it, switch it to *No* in order to deactivate it.
3. Tap *Save*.

**IMPORTANT:** *After you have changed the condensation-proof mode, wait for at least 1.5 h before you continue with adjustments, checks, or measurements.*

*Changing the condensation-proof mode requires a new alcohol zero and concentration adjustment (including an alcohol multipoint adjustment if applicable).*

## 6.2 Ethanol table

An ethanol table defines the relation between the ethanol concentration and the density of a binary water/ethanol mixture.

Select one of the predefined tables or provide a user-defined table or a polynomial function. By default the ethanol table is set to *EtOH OIML (% v/v)*.

The selection of an ethanol table affects

- the alcohol concentration adjustment of the Alcolyzer 3001/1001 module,
- calculated quantities with the alcohol content as an input parameter, refer to Appendix B [▸ 18].

### Selecting a specific ethanol table

1. Select *Settings* in the menu, then under *Modules* select your alcohol module.
2. Tap in the action box and select an ethanol table from the drop-down box.
3. Tap *Save*.
   - For 20 °C usually *OIML ITS-90* or *OIML* are used.
   - For 15 °C *Shusei-Do 1000 Points* can be used.

**IMPORTANT:** *Depending on the measurement temperature (20 °C or 15 °C) the right alcohol table has to be used.*

### User-defined ethanol table

Instead of selecting a predefined ethanol table:

1. Select *User-defined table*, then tap *Edit table*.
2. Import a table of data pairs:
   ethanol concentration [% v/v]; true density
   (example: 0.18;0.99795)
   - each data pair in a separate line
   - data values of a pair separated by a semicolon
   - up to 1000 data pairs

**TIP:** *You can export a table template and edit it.*

**TIP:** *The larger the number of data pairs and the higher the accuracy of the data pairs, the higher the accuracy of the results that you can obtain.*

**TIP:** *Table data will be interpolated but not extrapolated. This means that the data pairs should cover the whole range of values that you want to measure.*

### User-defined polynomial function

Instead of selecting a predefined ethanol table:

1. Select *User-defined polynomial function*.
2. Specify the two sets of coefficients A0 to A4 and B0 to B4 for the required two polynomials (eq. 1 and eq. 2):

$$c = A0 + A1 \cdot \rho + A2 \cdot \rho^2 + A3 \cdot \rho^3 + A4 \cdot \rho^4$$

c.....ethanol concentration [% v/v]
ρ.....true density = input
Ai.....coefficients to be determined

***Fig. 2:*** *eq. 1*

$$\rho = B0 + B1 \cdot c + B2 \cdot c^2 + B3 \cdot c^3 + B4 \cdot c^4$$

ρ.....true density
c.....ethanol concentration [% v/v] = input
Bi.....coefficients to be determined

***Fig. 3:*** *eq. 2*

The function in eq. 2 is the inverse of the function in eq. 1.

## 6.3 Temperature mode

The selected temperature mode (15 °C or 20 °C) determines for which temperature all results of the measurement system will be shown.

**IMPORTANT:** *Make sure that temperature and table settings match the instrument settings of the Alcolyzer, refer to Section 6 [▸ 8].*

**TIP:** *If condensation-proof mode has been activated, refer to Section 6.1 [▸ 8], measurements of the instrument will be performed at 25 °C (77 °F), and results recalculated according to the selected temperature mode.*

**IMPORTANT:** *With an Alcolyzer 3001/1001 in the measurement system, you cannot set the measuring temperature using the header control on the master instrument.*

- After a temperature change between measurements, perform an equilibration measurement.

# 7 Measurement settings

The following measurement parameters are available if an Alcolyzer 3001/1001 is included in your measurement system.

## 7.1 Measurement product

The measurement products are based on specific mathematical models established with reference analysis.

Each measurement product has an intended use.

The availability of products depends on your measurement system. For a detailed description refer to the documentation of your measurement system.

## 7.2 Alcohol offset

If you see a deviation between the alcohol content determined by Alcolyzer 3001/1001 and your reference value (e.g. alcohol content determined with the distillation method), you can define an offset to compensate for the deviation.

The offset can be in the range from –10 % v/v to +10 % v/v.

**IMPORTANT:** *An offset is only applied for alcohol contents ≥ 0.5 % v/v. For offsets for beverages with lower alcohol content a custom quantity has to be created. How to create a custom quantity is described in the IMSI of the DMA density meters.*

## 7.3 Temperature mode

The selected temperature mode (15 °C or 20 °C) determines for which temperature all results of the measurement system will be shown.

**IMPORTANT:** *Make sure that temperature and table settings match the instrument settings of the Alcolyzer, refer to Section 6 [▸ 8].*

**TIP:** *If condensation-proof mode has been activated, refer to Section 6.1 [▸ 8], measurements of the instrument will be performed at 25 °C (77 °F), and results recalculated according to the selected temperature mode.*

**IMPORTANT:** *With an Alcolyzer 3001/1001 in the measurement system, you cannot set the measuring temperature using the header control on the master instrument.*

– After a temperature change between measurements, perform an equilibration measurement.

## 7.4 Ethanol table

The ethanol table can be set as an instrument setting and as a measurement setting (e.g. when you define a product). For a detailed description, refer to Section 6.2 [▸ 9].

– For 20 °C usually *OIML ITS-90* or *OIML* are used.
– For 15 °C *Shusei-Do 1000 Points* can be used.

**IMPORTANT:** *Depending on the measurement temperature (20 °C or 15 °C) the right alcohol table has to be used.*

# 8 Performing measurements and checks

You will find information on checks of the entire measurement system and on how to perform measurements in the documentation of your measurement system.

# 9 Performing adjustments

With an adjustment, a sample of exactly known measurement properties (standard) is measured, and the instrument constants are adjusted in a way that the instrument delivers the known correct results.

## 9.1 Adjusting the Alcolyzer 3001/1001 modules

The available types of alcohol concentration adjustment depend on your instrument model, refer to below table.

**Table 3:** Available types of alcohol concentration adjustment

| Model | Low | High[a] | Multi-point |
|---|---|---|---|
| Alcolyzer 1001 Beer | • | | |
| Alcolyzer 3001 | • | • | • |
| Alcolyzer 3001 Beer | • | | |
| Alcolyzer 3001 Wine | • | | |
| Alcolyzer 3001 Sake | • | | |
| Alcolyzer 3001 Spirits | | • | • |

[a] *After you have performed a multipoint adjustment, high concentration adjustments will use it as baseline.*

**When to perform adjustments**

Always perform a check measurement with the clean measurement system before performing an adjustment. (Checks are described in the manual of your measurement system.)

– Perform an **alcohol zero adjustment**, refer to Section 9.1.1 [▸ 11] if a water check has failed and corrective actions have not helped.
– Perform an **alcohol concentration adjustment**, refer to Section 9.1.2 [▸ 11]
  – if a known concentration check has failed and corrective actions have not helped;
  – after changing the temperature mode.
– Perform an **alcohol multipoint adjustment**, refer to Section 9.1.3 [▸ 12], only if you need to analyze samples with different alcohol contents, known concentration checks at the boundaries of the spirits concentration range (35 % v/v and 65 % v/v) have failed and corrective actions have not helped (alcohol range exceeding a span of 10 % v/v).
  No new alcohol zero adjustment is required.

  **Repeat** the alcohol multipoint adjustment:
  – after you have switched on or off condensation-proof mode (see section 6.1);
  – if monthly checks at both ends of your alcohol range show deviations > 0.1 % v/v;

– at least once per year.

**Before the adjustment**

Before the adjustment the system has to be turned on for at least one hour. However, after transport full stabilization may even take up to one day. The ambient temperature has to be stable within a maximal variation of ±3 °C (±5.4 °F).

## 9.1.1 Alcohol zero adjustment

**IMPORTANT:** *Before you start the adjustment, make sure that the measuring cells are clean.*

1. Prepare freshly degassed ultra-pure water for filling:
   a. Boil ultra-pure water for several minutes to remove dissolved gas.
   b. Fill up a clean glass flask with the freshly degassed ultra-pure water, and cover it.
   c. Wait until the water has cooled down to approx. 20 ±3 °C (68 ±5.4 °F).
   d. Pour the water into a container suited for filling with your filling device (see documentation of the filling device).
2. Select *Adjustments* in the menu, then select *Zero alcohol*.
3. Follow the instructions on the screen.
   The adjustment routine is carried out, and the results are shown.
4. Apply or reject the adjustment.
   The signal level compared to factory adjustment decreases mainly due to coating of the measuring cell.
   – If the level goes below 80 %, clean the measuring cell thoroughly and repeat the alcohol zero adjustment.

## 9.1.2 Alcohol concentration adjustment

**IMPORTANT:** *Always perform an alcohol zero adjustment before alcohol concentration adjustments.*

**IMPORTANT:** *All water/ethanol solutions have to be prepared at least 12 hours before use. This period starts again if you perform small corrections like adding water or ethanol to a solution.*

**IMPORTANT:** *Use only freshly degassed ultra-pure water, refer to Section 9.1.1 [▶ 11] and high-proof ethanol without denaturant for the water/ethanol solutions.*

**IMPORTANT:** *Before you start the adjustment, make sure that the measuring cells are clean.*

1. Prepare the water/ethanol solutions for your instrument model with defined concentrations in the range given in the below table.

**Table 4:** Recommended alcohol concentration ranges for the alcohol low/high concentration adjustment

| Application | Low | High |
|---|---|---|
| **Alcolyzer 3001:** | | |
| Low concentrations | 8–15 % v/v | – |
| High concentrations | – | 40 % v/v[a] |
| Beer | 8–12 % v/v | – |
| Wine | 8–15 % v/v | – |
| Sake | 8–15 % v/v | – |
| Spirits, liqueurs | – | 40 % v/v[a] |
| RTDs | 10-30 % v/v | |

[a] *In PBA systems the alcohol content of adjustment solutions must stay below 30 % v/v.*

As a guideline, mix the volumes given in the table below to get 1 L solution of the specified ethanol concentration.

| Ethanol concentration | Volume ethanol 96 % | Volume water |
|---|---|---|
| 10 % v/v | 104 mL | fill up to 1 L |
| 40 % v/v | 417 mL | |

**IMPORTANT:** *Always determine the accurate concentration (±1 % v/v) by density measurement with the master instrument at the required temperature and using the correct alcohol table.*

   a. Mix the volumes of water and ethanol in a flask. Shake gently.
   b. Cover the flasks and leave the solutions for 12 hours at 20 ±3 °C (68 ±5.4 °F).
   Before filling the solutions must be free of gas bubbles (e.g. use an ultrasonic bath).
   c. Pour the solutions into containers suited for filling with your filling device (refer to the documentation of the filling device).

**TIP:** *Improve measurement performance by adjusting the instrument at an alcohol concentration close to that of your samples.*

2. Select *Adjustments* in the menu, then select the appropriate adjustment: *Low concentration alcohol* or *High concentration alcohol*.
3. Follow the instructions on the screen.
4. When asked to select measurement products (low concentration adjustment):
   With **Alcolyzer 3001**, the instrument can be adjusted for both *Beer & Wine* products (recommended selection).
   The selection has an influence on the wavelengths used.
5. When asked for the ethanol concentration of your adjustment medium:
   The input field is preset with the value determined via density measurement (by the master instrument).
   – If you know the exact concentration, you may enter it instead of the shown value.

– If the shown value is completely off the mark, this may be due to a filling error. In this case repeat the adjustment.

6. Tap *Confirm*.
7. When the adjustment results are shown, apply or reject the adjustment.

### 9.1.3 Alcohol multipoint adjustment

**IMPORTANT:** *All binary solutions have to be prepared at least 12 hours before use. This period starts again if you perform small corrections like adding water or ethanol to a solution.*

**IMPORTANT:** *Use only freshly degassed ultra-pure water, refer to Section 9.1.1 [▶ 11] and high-proof ethanol without denaturant for the water/ethanol solutions.*

**IMPORTANT:** *Before you start the adjustment, make sure that the measuring cells are clean.*

1. Prepare water/ethanol solutions with defined concentrations as given in the below table (±1 % v/v).

**Table 5:** Alcohol concentrations of adjustment solutions

| Solution | Recommended concentration |
|---|---|
| Solution 1 | ultra-pure water |
| Solution 2 | 18 % v/v |
| Solution 3 | 45 % v/v |
| Solution 4 | 55 % v/v |
| Solution 5 | 64 % v/v |

As a guideline, mix the volumes given in the table below to get 1 L solution of the specified ethanol concentration.

| Ethanol concentration | Volume ethanol 96 % | Volume water |
|---|---|---|
| 18 % v/v | 188 mL | fill up to 1 L |
| 45 % v/v | 469 mL | |
| 55 % v/v | 573 mL | |
| 64 % v/v | 666 mL | |

**IMPORTANT:** *Always determine the accurate concentration (±1 % v/v) by density measurement with the master instrument at the required temperature and using the correct alcohol table.*

a. Mix the volumes of water and ethanol in a flask. Shake gently.
b. Cover the flasks and leave the solutions for 12 hours at 20 ±3 °C (68 ±5.4 °F).
Before filling the solutions must be free of gas bubbles (e.g. use an ultrasonic bath).
c. Pour the solutions into containers suited for filling with your filling device (refer to the documentation of the filling device).

2. Select *Adjustments* in the menu, then select *Multipoint alcohol*.
3. Follow the instructions on the screen.
4. When asked for the ethanol concentration of your adjustment medium:
The input field is preset with the value determined via density measurement (by the master instrument).
– If you know the exact concentration, you may enter it instead of the shown value.
– If the shown value is completely off the mark, this may be due to a filling error. In this case repeat the adjustment.
5. Tap *Confirm*.
6. When the adjustment results are shown, apply or reject the adjustment.

## 9.2 Adjusting Option Color 430 nm

The light source for the color measurement undergoes a continuous aging process resulting in a drift of the color value measured. A drift of up to 0.5 EBC (0.25 ASBC) per week can be considered normal.

We recommend to check the zero color value daily with a water check (refer to the documentation of your measurement system).

**When to perform adjustments**

– Perform a **color zero adjustment** if a water check has failed and corrective actions have not helped.
– It is sufficient to perform a **color concentration adjustment** once a year.

### 9.2.1 Color zero adjustment

**IMPORTANT:** *Before you start the adjustment, make sure that the measuring cells are clean.*

**Adjustment medium:** freshly degassed ultra-pure water

1. Select *Adjustments* in the menu, then select *Zero color*.
2. Follow the instructions on the screen.
The adjustment routine is carried out, and the results are shown.
3. Apply or reject the adjustment.
The signal level compared to factory adjustment decreases by-and-by due to aging of the LED as well as coating of the measuring cell.
– If the level goes below 80 %, clean the measuring cell thoroughly and repeat the color zero adjustment.
– If the level stays low, aging of the LED is the cause. However, you need not worry as long as adjustments are carried out successfully.
– If you don't get successful adjustments anymore, contact your local Anton Paar representative.

### 9.2.2 Color concentration adjustment

**IMPORTANT:** *Always perform a color zero adjustment before a color concentration adjustment.*

**Adjustment medium:** color standard (tartrazine) with a color value between 1.00 EBC and 60.00 EBC (between 0.50 ASBC and 30.48 ASBC), preferably at approx. 50.00 EBC (25.40 ASBC)

**TIP:** *Use the color adjustment set, mat. no. 12627 (shelf life of the tartrazine color standards and water standards: three months).*

1. Select *Adjustments* in the menu, then select *Concentration color*.
2. Follow the instructions on the screen.
3. When asked for the concentration of your adjustment medium, enter the color value of the color standard according to the appropriate scale (*unit*). The input field is preset with the value determined by Option Color 430 nm.
4. Tap *Confirm*.
5. When the adjustment results are shown, apply or reject the adjustment.

# 10 Upkeep and cleaning

– Alcolyzer 3001/1001 requires periodical upkeep to ensure error-free operation as well as reliable and accurate measuring results.
– To ensure a constant and high accuracy of your measurements, employ a regular and effective cleaning routine, and store the instrument under the recommended conditions.
– Reorder consumables from Anton Paar.
– If the repeatability of your color measurements is not satisfactory anymore, even after a thorough cleaning, the light source for the color measurement may have come to the end of its life. In this case contact your Anton Paar representative.

**Table 6:** Regular upkeep routines

| What | When | Refer to |
|---|---|---|
| Regular system cleaning | Refer to the manual of your measurement system | |
| Regular system checks | Refer to the manual of your measurement system | |
| Color concentration adjustment | once a year | Section 9.2.2 [▶ 12] |
| Exchange hoses<br>(same material, same length) | – every 2 years<br>– immediately if heavily colored | manual of measurement system |

## 10.1 Cleaning the measuring cell

The measuring module is installed as part of a measurement system and therefore cleaned by applying the cleaning routines of the measurement system. For information on the cleaning routines, refer to the manual of your measurement system.

## 10.2 Cleaning the housing of the measuring module

**WARNING**

**Risk of fire and explosion**

Ethanol is a highly flammable liquid.

a) Strictly follow all safety instructions regarding the use of flammable liquids, refer to Section 1.1 [▶ 4].

To clean the housing of the module, use a soft tissue wetted with ethanol or warm water. If necessary, a mild cleaning agent (pH < 10) can be added to the water.

## 10.3 Storing and transporting the measuring module

**WARNING**

**Risk of fire and explosion**

Ethanol is a highly flammable liquid.

– Make sure that all hose connections are tight before you fill ethanol.

**IMPORTANT:** *Do not use denatured ethanol. The denaturing agent may stick to the surface of the measuring cell and cause measuring errors in subsequent measurements.*

### Storing for short periods

1. To preserve the module for short periods without transportation (e.g. over the weekend, max. two weeks), clean the measuring cell according to the cleaning procedure at the end of the day (refer to the documentation of your measurement system).
2. Then fill ultra-pure water into the measuring cell and leave it filled up until the next measurement.

**Storing for long periods or for transportation**

1. To preserve the module for longer periods or for transportation, clean the measuring cell thoroughly according to the weekly cleaning procedure (refer to the documentation of your measurement system).
2. Use highly concentrated ethanol as the last rinsing agent and dry the measuring cell afterwards with the internal air pump of the master instrument.

# 11 Maintenance and repair

## 11.1 Maintenance performed by an authorized Anton Paar representative

The product does not require a periodic maintenance by an authorized Anton Paar representative to retain warranty coverage.

However, optional services are available from your local Anton Paar representative upon request.

**Following parts are generally excluded from the warranty (wear and tear parts)**

- syringes
- hoses
- adapters, connectors, fittings
- pump diaphragms
- filters
- O-rings, seals, gaskets
- cables
- fuses
- batteries
- desiccants
- protection foils and covers

All parts damaged in consequence of a fall of the product are generally excluded from the warranty as well.

## 11.2 Repair performed by an authorized Anton Paar representative

In case your product needs repair, contact your local Anton Paar representative, who will take care of the necessary steps. If your product needs to be returned, request an RMA (Return Material Authorization Number). It must not be sent without the RMA and the filled “Safety Declaration for Instrument Repairs”. Please make sure it is cleaned before return.

**TIP:** *Find the contact data of your local Anton Paar representative on the Anton Paar website (https://www.anton-paar.com) under “Contact”.*

**IMPORTANT:** *Do not return products that are contaminated by radioactive materials, infectious agents or other substances that cause health hazards.*

# Appendix A Technical data

## Appendix A.1 Specifications

| | Alcolyzer 1001 Beer | Alcolyzer 3001 Beer |
|---|---|---|
| **Alcohol** | | |
| Measuring range | 0 % v/v to 12 % v/v | |
| Repeatability s.d. | 0.05 % v/v | 0.01 % v/v |
| Accuracy | ±0.1% v/v to distillation[a] | |
| **Color** (optional) | | |
| Measuring range | 0 EBC to 120 EBC (0 ASBC to 60.96 ASBC) | |
| Repeatability s.d. | 0.1 EBC (0.05 ASBC) | |
| **Temperature** | | |
| Measuring temperature | 15 °C, 20 °C, or 25 °C (59 °F, 68 °F, or 77 °F) | |
| Repeatability s.d. | 0.01 °C (0.018 °F) | |
| **Maximal operating pressure** | 8 bar (116 psi) relative pressure | |
| **Measuring time** | approx. 60 seconds | |
| **Sample volume** | approx. 5 mL | |

[a] *For beer with an alcohol content lower than 0.5 % v/v an accuracy of ±0.1 % v/v against distillation and ±0.04 % v/v against GC can be expected. Reference analysis is recommended for offset determination.*

| | Alcolyzer 3001 Wine | Alcolyzer 3001 Sake |
|---|---|---|
| **Alcohol** | | |
| Measuring range | 0 % v/v to 20 % v/v | |
| Repeatability s.d. | 0.01 % v/v | |
| Accuracy | ±0.1% v/v to distillation[a] | |
| **Color** (optional) | | |
| Measuring range | 0 EBC to 120 EBC (0 ASBC to 60.96 ASBC) | |
| Repeatability s.d. | 0.1 EBC (0.05 ASBC) | |
| **Temperature** | | |
| Measuring temperature | 15 °C, 20 °C, or 25 °C (59 °F, 68 °F, or 77 °F) | |
| Repeatability s.d. | 0.01 °C (0.018 °F) | |
| **Maximal operating pressure** | 8 bar (116 psi) relative pressure | |
| **Measuring time** | approx. 60 seconds | |
| **Sample volume** | approx. 5 mL | |

[a] *For wine with an alcohol content lower than 1 % v/v, the expected accuracy against GC is ≤ ± 0.15. Reference analysis is recommended for offset determination.*

| | Alcolyzer 3001 Spirits | Alcolyzer 3001 |
|---|---|---|
| **Alcohol** | | |
| Measuring range | 0 % v/v to 65 % v/v | |
| Repeatability s.d. | 0.01 % v/v | |
| Accuracy | ±0.1% v/v to distillation | - |
| **Color** (optional) | | |
| Measuring range | 0 EBC to 120 EBC (0 ASBC to 60.96 ASBC) | |

| | | |
|---|---|---|
| Repeatability s.d. | 0.1 EBC (0.05 ASBC) | |
| **Temperature** | | |
| Measuring temperature | 15 °C, 20 °C, or 25 °C (59 °F, 68 °F, or 77 °F) | |
| Repeatability s.d. | 0.01 °C (0.018 °F) | |
| **Maximal operating pressure** | ambient pressure | 8 bar (116 psi) relative pressure |
| **Measuring time** | approx. 60 seconds | |
| **Sample volume** | approx. 5 mL | |

## Appendix A.2 Instrument data and operating conditions

| | |
|---|---|
| **Temperature control** | built-in solid state thermostat (Peltier) |
| **Environmental conditions** (EN 61010) | indoor use only |
| **Ambient temperature** | 15 °C to 32 °C (59 °F to 89.6 °F) |
| Air humidity | non-condensing<br>20 °C: < 90 % relative humidity<br>25 °C: < 60 % relative humidity<br>30 °C: < 45 % relative humidity |
| Altitude | max. 3000 m (9800 ft) |
| **Pollution degree** | 2 |
| **Interfaces** | 2 x CAN Bus |
| **Power supply** | DC 24 V via the master instrument |
| **Power consumption** | 50 W |
| **Dimensions** (L x W x H) | 366 mm x 156 mm x 201 mm (14.4 in x 6.1 in x 7.9 in) |
| **Weight** | 8.4 kg (18.5 lbs) |

## Appendix A.3 Wetted parts

The following materials are in contact with the samples and cleaning agents:

| **Material** | **Part** |
|---|---|
| EPDM (ethylene propylene diene monomer) | sensor system |
| Glass | sensor system |
| NBR (nitrile butadiene rubber) | internal connectors |
| PFAN (poly (α-fluoro acrylonitrile)) | internal tubing |
| PTFE (polytetrafluoroethylene) | filling nozzle fitting |
| Silicone | hose |
| Stainless steel (1.4404, 1.4301) | sensor system, internal connectors |
| Tygon | hose |

# Appendix B Calculations / Output quantities

All calculations are valid for 20 °C.

**ADF (% w/v) = apparent degree of fermentation in % based on % w/v [for beer products]**

$$ADF_{w/v} = \frac{p_{w/v} - Ea_{w/v}}{p_{w/v}} \cdot 100$$

**ADF (% w/w) = apparent degree of fermentation in % based on % w/w [for beer products]**

$$ADF_{w/w} = \frac{p_{w/w} - Ea_{w/w}}{p_{w/w}} \cdot 100$$

**Alcohol (% v/v) = alcohol content in percent by volume [for beer / wine / sake / spirits products]**

Alcohol (% v/v) is calculated using a specific function of the absorption intensity of the NIR line of alcohol. The result is valid for the indicated temperature and can be calculated for 15 °C (60 °F), 20 °C (68 °F), or 25 °C (77 °F).

**Alcohol (% w/w) = alcohol content in percent by weight [for beer / wine / sake / spirits products]**

Since percent by weight is independent of temperature, alcohol (% w/w) is valid for any temperature.

$$alcohol_{w/w} = \frac{alcohol_{w/w} \cdot \rho_{100\% alcohol}}{\rho_{sample}}$$

$$\rho_{100\%\ alcohol} = 0.78924\ g/cm^3$$

**Alcohol-ASBC (% w/w) = alcohol content according to the ASBC regulations [for beer products]**

$$alcohol\text{-}ASBC = \frac{alcohol_{v/v} \cdot \rho_{100\% alcohol}}{\rho_{sample}}$$

**Alcohol-IUPAC (% w/w) = alcohol content according to the IUPAC regulations [for beer products]**

$$alcohol\text{-}IUPAC = \frac{alcohol_{v/v} \cdot \rho_{100\% alcohol}}{\rho_{sample}}$$

**Calories (kcal/100 mL) = kcal/100 mL [for beer products]**

$$kcal/100\ mL = \left(3.5 \cdot Er_{w/w} + 7 \cdot alcohol_{w/w}\right) \cdot alcohol_{sample}$$

**Calories (kcal/12 oz) = kcal/12 oz [for beer products]**

$$kcal/12\ oz = \left(6.9 \cdot alcohol_{w/w} + 4 \cdot (Er_{w/w} - 0.11)\right) \cdot SG_{sample} \cdot 3.55$$

**Calories (kcal/kg) = kcal/kg [for beer products]**

$$kcal/kg = \left(3.5 \cdot Er_{w/w} + 7 \cdot alcohol_{w/w}\right) \cdot 10$$

**Calories (kJ/100 mL) = kJ/100 mL [for beer products]**

$$kJ/100\ mL = \left(15 \cdot Er_{w/w} + 29 \cdot alcohol_{w/w}\right) \cdot \rho_{sample}$$

**Calories wine = kcal/100 mL [for wine products]**

$$calories\ wine = 5.445756 \cdot alcohol_{\%v/v} + 0.4 \cdot E\ total_{w/v}$$

**Calories (Steiner) (kcal/kg) = kcal/kg according to the Steiner formula [for beer products; not with Alcolyzer 1001 Beer]**

$$kJ/kg\ (Steiner) = p_{w/w} + 36.4$$

**DL = degrees lost [for beer products; not with Alcolyzer 1001 Beer]**

$$DL = \sum_{n=0}^{10} A_n \cdot SI^n$$

| | | | | | |
|---|---|---|---|---|---|
| A0 = | 0.0080 | | | | |
| A1 = | 4.30003 | | A6 = | –2.59916898 | E–3 |
| A2 = | –2.048839 | E–1 | A7 = | 2.374003555 | E–4 |
| A3 = | 1.8090493 | E–1 | A8 = | –1.301128748 | E–5 |
| A4 = | –7.3330484 | E–2 | A9 = | 3.9162206 | E–7 |
| A5 = | 1.7587605 | E–2 | A10 = | –4.9735684 | E–9 |

**Ea (app. extract) (% w/v) = apparent extract in % w/v [for beer products; not with Alcolyzer 1001 Beer]**

The apparent extract in percent of weight of solution in the total volume of solution is determined by[1]:

$$Ea_{w/v} = Ea_{w/w} \cdot SG20/04$$

**Ea (app. extract) (% w/w) = apparent extract in % w/w [for beer products]**

The apparent extract in % w/w is calculated from the sample density using the Plato table.

**EG (extract gravity) = extract gravity [for beer products; not with Alcolyzer 1001 Beer]**

$$EG = (SG_{extract} - 1) \cdot 1000$$

**E JPN (Japanese extract) (g/100 mL) = Japanese extract in g/100 mL [for beer / wine / sake / spirits products; not with Alcolyzer 1001 Beer]**

$$Ejap = \frac{density_{sample\ 15\,°C} - density_{alcohol}}{0.9991} \cdot 260$$

[1] SG20/04 = $\rho_{extract\ (20\ °C)}$ / $\rho_{water\ (4\ °C)}$; $\rho_{water\ (4\ °C)}$ = 0.999972 g/cm$^3$

The density (alcohol) is calculated from the inverse Shusei-do table. Only valid and available for 15 °C.

**Er (real extract) (% w/w) = real extract in % w/w [for beer products]**

The real extract in % w/w is calculated from the extract density determined by the Tabarié formula[2] using the Plato table.

**Er (real extract) (g/100 mL) = real extract in % w/v [for beer products; not with Alcolyzer 1001 Beer]**

The real extract in percent of weight of solution in the total volume of solution is determined by[1]:

$$Er_{w/v} = Er_{w/w} \cdot SG20/04$$

**E total (% w/v) = total extract in % w/v [g/L] [for wine / sake products]**

$$E\ total_{w/v} = E\ total_{w/w} \cdot \rho_{extract} \cdot 10$$

**E total (% w/w) = total extract in % w/w [for wine / sake products]**

Total extract in % w/w is calculated from the density of extract using a polynomial function.

The density of extract is calculated using the Tabarié formula[2].

The density of alcohol is calculated from the measured alcohol content (% v/v) using a polynomial function.

**KMW = Klosterneuburger Mostwaage [for wine / sake products]**

$$°KMW = alcohol_{v/v} \cdot 1.2 + E\ total_{w/v} \cdot 0.075 + 2.5$$

**OG (original gravity) = original gravity according to the standard formula [for beer products; not with Alcolyzer 1001 Beer]**

$$OG = EG + DL$$

**OG-BMP (original gravity) = original gravity according to the BMP formula [for beer products; not with Alcolyzer 1001 Beer]**

$$OG\text{-}BMP = p_{w/w} \cdot\ (3.86098 + p_{w/w} \cdot 0.01435427)$$

**p (original extract) (% w/v) = original extract in % w/v[1] [for beer products; not with Alcolyzer 1001 Beer]**

$$p_{w/v} = p_{w/w} \cdot SG20/04$$

**p (original extract) (% w/w) = original extract in % w/w [for beer products]**

$$p_{w/w} = \frac{(alcohol_{w/w} \cdot 2.0665 + Er_{w/w}) \cdot 100}{100 + alcohol_{w/w} \cdot 1.0665}$$

**PG (present gravity) = present gravity [for beer products; not with Alcolyzer 1001 Beer]**

$$PG = (SG_{sample} - 1) \cdot 1000$$

**Ratio E/A (US) = ratio extract/alcohol [for beer products; not with Alcolyzer 1001 Beer]**

$$ratio\ E/A = \frac{Er_{w/w}}{alcohol_{w/w}}$$

**RDF (real deg. of ferm.) = real degree of fermentation in % [for beer products]**

$$RDF = \frac{alcohol_{w/w} \cdot 2.0665}{alcohol_{w/w} \cdot 2.0665 \cdot Er_{w/w}} \cdot 100$$

**RDF-St (real deg. of ferm.) = real degree of fermentation in % according to the standard formula [for beer products; not with Alcolyzer 1001 Beer]**

$$RDF_{St} = \frac{p_{w/w} \cdot Er_{w/w}}{p_{w/w}} \cdot 100$$

**RDF-US (real deg. of ferm.) = real degree of fermentation in % acc. to the US formula [for beer products; not with Alcolyzer 1001 Beer]**

$$RDF_{US} = \frac{100 \cdot (p_{w/w} - Er_{w/w})}{p_{w/w}} \cdot \frac{1}{1 - 0.005161 \cdot Er_{w/w}}$$

**SG alcohol (spec. gravity) = specific gravity of the alcohol [for beer / wine / sake / spirits products; not with Alcolyzer 1001 Beer]**

$$SG_{alcohol} = \frac{\rho_{alcohol}}{\rho_{water}}$$

The density of alcohol is calculated from the measured alcohol content (% v/v) using a polynomial function.

**SG extract (spec. gravity) = specific gravity of the extract [for beer / wine / sake / spirits products; not with Alcolyzer 1001 Beer]**

$$SG_{extract} = \frac{\rho_{extract}}{\rho_{water}}$$

The extract density is calculated according to the Tabarié formula[2].

[2] Tabarié formula: $\rho_{extract} = \rho_{water} + \rho_{sample} - \rho_{alcohol}$

**SI (spirit indication) = spirit indication**
**[for beer products; not with Alcolyzer 1001 Beer]**

$$SI = (1 - SG_{alcohol}) \cdot 1000$$

**Total Extract [Spirits] = total extract**
**[for spirits products]**

Total extract is calculated from the alcohol concentration and the sample density using a polynomial function.

**Color measurement**
**Conversion from EBC into ASBC**

$$1\ EBC = 0.508\ °ASBC$$

# Appendix C Declarations of conformity



## EU Declaration of Conformity

(original)

Anton Paar

The Manufacturer **Anton Paar GmbH,** Anton-Paar-Str. 20, A-8054 Graz, Austria – Europe hereby declares that the products listed below

| | |
|---|---|
| Product designation: | **ALCOLYZER 3001 BEER**<br>**ALCOLYZER 3001 WINE**<br>**ALCOLYZER 3001 SPIRITS**<br>**ALCOLYZER 3001 SAKE**<br>**ALCOLYZER 3001**<br>**ALCOLYZER 1001 BEER** |
| Model: | **Alcolyzer 3001 Beer**<br>**Alcolyzer 3001 Wine**<br>**Alcolyzer 3001 Spirits**<br>**Aloclyzer 3001 Sake**<br>**Alcolyzer 3001**<br>**Alcolyzer 1001 Beer** |
| Material number: | 234960, 234961, 234962, 234963, 234964, 234965 |

are in conformity with the relevant European Union harmonisation legislation. This declaration of conformity is issued under the sole responsibility of the manufacturer.

**Electromagnetic Compatibility (2014/30/EU, OJ L 96/79 of 29.3.2014)**

Applied standards:

| | |
|---|---|
| ▪ EN 61326-1:2013 | Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements |

**Low Voltage Directive (2014/35/EU, OJ L 96/357 of 29.3.2014)**

Applied standards:

| | |
|---|---|
| ▪ EN 61010-1: 2010 +A1:2019 + A1:2019/AC:2019 | Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements |
| ▪ EN IEC 61010-2-010:2020 | Safety requirements for electrical equipment for measurement, control and laboratory use – Part 2-010: Particular requirements for laboratory equipment for the heating of materials |

**RoHS Directive (2011/65/EU, OJ L 174/88 of 1.7.2011)**

Place and date of issue: Graz, 24.4.2024

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# UK Declaration of Conformity

Anton Paar

The Manufacturer **Anton Paar GmbH,** Anton-Paar-Str. 20, A-8054 Graz, Austria – Europe hereby declares that the products listed below

| | |
|---|---|
| Product designation: | **ALCOLYZER 3001 BEER**<br>**ALCOLYZER 3001 WINE**<br>**ALCOLYZER 3001 SPIRITS**<br>**ALCOLYZER 3001 SAKE**<br>**ALCOLYZER 3001**<br>**ALCOLYZER 1001 BEER** |
| Model: | **Alcolyzer 3001 Beer**<br>**Alcolyzer 3001 Wine**<br>**Alcolyzer 3001 Spirits**<br>**Alcolyzer 3001 Sake**<br>**Alcolyzer 3001**<br>**Alcolyzer 1001 Beer** |
| Material number: | 234960, 234961, 234962, 234963, 234964, 234965 |

are in conformity with all the relevant UK legislation. This declaration of conformity is issued under the sole responsibility of the manufacturer.

**Electrical Equipment (Safety) Regulations 2016, 2016 No. 1101**

**Electromagnetic Compatibility Regulations 2016, 2016 No. 1091**

**Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012, 2012 No. 3032**

complies with the designated standards:

- EN 61010-1:2010 + A1:2019 + A1:2019/AC:2019
- EN IEC 61010-2-010:2020
- EN 61326-1:2013

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