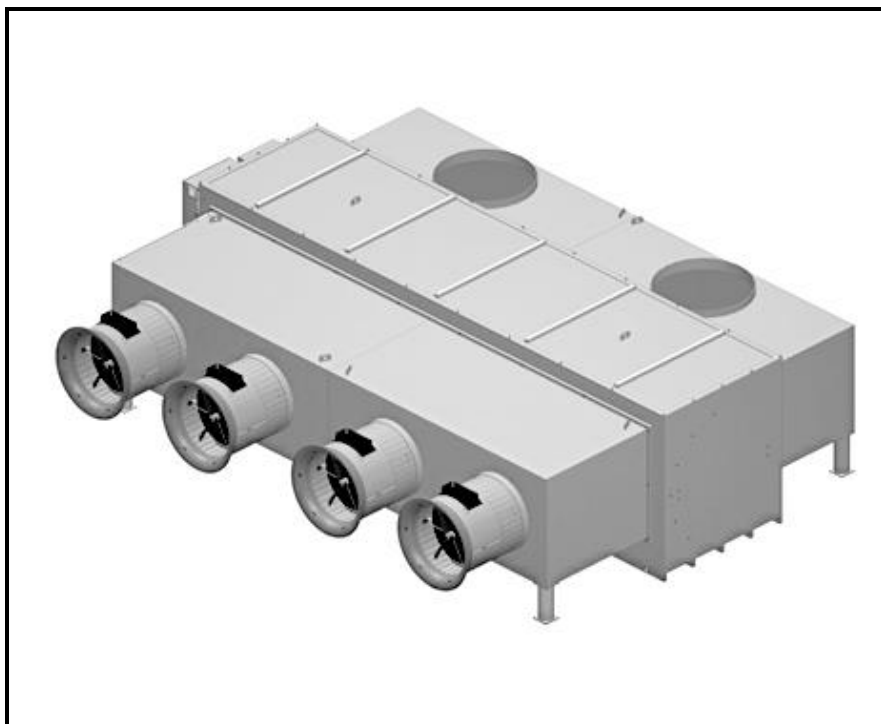


# Operating instructions

Drum washer  
100,000 m<sup>3</sup>/h



**Drum washer Lavamatic XL**

100,000 m<sup>3</sup>/h

9711004E-2722

**REVENTA®**  
a Munters company

## Information page

|                    |                                                                 |
|--------------------|-----------------------------------------------------------------|
| Description        | Drum washer Lavamatic XL                                        |
| Type               | 100,000 m³/h                                                    |
| Manufacturer       | REVENTA GmbH<br>Im Gewerbegebiet 3<br>48612 Horstmar<br>Germany |
| Instruction number | 9711004E-2722                                                   |

Item codes

This document is the translated version.

| Revision index | Modification undertaken | Implemented by | Date       |
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| A              | Correction on page 38   | S.Epping       | 03.08.2023 |

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# 1 Introduction

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## 1.1 Foreword

---

These Operating instructions contain information to ensure the fault-free and safe operation of the system. These Operating instructions must be read carefully by operators and maintenance personnel to guarantee the operational reliability and safe operation of the system.

The Operating instructions are part of the system. They must be retained for the entire service life of the system and passed on to any future owners and operators.

Any modifications or amendments to the system must be recorded in the Operating instructions.

These operating instructions describe the drum washer in its standard design, consisting of a supply air module, a drum module and an exhaust air module.

The system may also comprise multiple drum modules or multiple drum washers may be connected to a livestock shed. A central control module is used to control the entire system.

## 1.2 Definition of terms

---

| Term            | Definition                                                                                         |
|-----------------|----------------------------------------------------------------------------------------------------|
| Check, checking | Comparison with certain states and/or characteristics such as damage, leaks, fill levels and heat. |
| Test, testing   | Comparison with certain values such as the weight, torques, content and temperature.               |

## 1.3 List of abbreviations

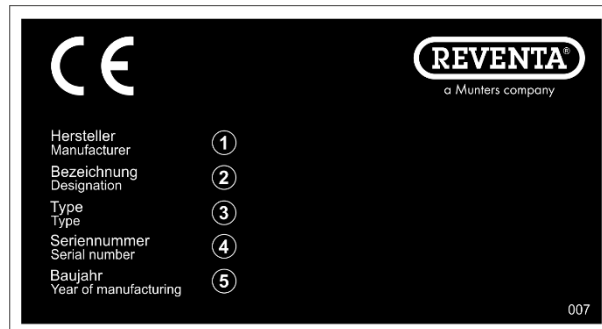
| Abbreviations | Definition                                                                                                                                                                    |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CE            | Communauté européenne<br>European Community                                                                                                                                   |
| DIN           | Deutsches Institut für Normung (German Institute for Standardisation)<br>Technical regulations and technical specifications                                                   |
| EC            | European Community<br>European Union                                                                                                                                          |
| EN            | European Norm<br>Harmonised standard for countries in the EU                                                                                                                  |
| IP            | Ingress protection<br>The abbreviation "IP" and a two-digit reference number indicate the protection rating for the housing.                                                  |
| BGR, BGV      | German accident prevention regulations<br>Health and safety at work directives stipulated by the German Employer's Liability Insurance Associations. Previously known as UVV. |
| Imp           | Litres per impulse<br>Indicates how many litres are conveyed per impulse.                                                                                                     |
| ppm           | Part(s) per million<br>One millionth, $1 \text{ ppm} = 1 \times 10^{-6}$ .                                                                                                    |

## 1.4 Orientation references

|              |                                                                                                   |
|--------------|---------------------------------------------------------------------------------------------------|
| <b>Front</b> | The "front" refers to the side where the drum washer is fitted to the shed exhaust air discharge. |
| <b>Rear</b>  | The "rear" is the opposite side to the front.                                                     |
| <b>Right</b> | The "right" side is on the right as seen from the front.                                          |
| <b>Left</b>  | The "left" side is on the left as seen from the front.                                            |

## 1.5 Type plate

The type plate position is shown on the labelling plan (see appendix).



|   |                      |   |                    |
|---|----------------------|---|--------------------|
| 1 | Manufacturer         | 2 | System designation |
| 3 | Type                 | 4 | Serial number      |
| 5 | Year of construction |   |                    |

## 1.6 Requirements for the qualification of the personnel

This applies to all personnel irrespective of the employment relationship or company affiliation. Qualification of the groups of persons must comply with the national workplace safety legislation.

### Definition of technical qualifications

| Term                          | Definition                                                                                                                                                                                                                                                                    |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Authorised specialist         | Having received instruction from the manufacturer, the authorized service provider or from a company assigned by the manufacturer.                                                                                                                                            |
| Specialist                    | Is professionally trained, experienced and instructed and also has knowledge of the relevant standards, requirements, accident prevention regulations and operating conditions. Is authorized to carry out the required operations and can both detect and avoid any dangers. |
| Trained and instructed person | Instructs on tasks and on potential dangers due to inappropriate conduct. If necessary, trained on-the-job and instructed about protective equipment and safeguards.                                                                                                          |

### Definition of the target group and allocation of the tasks and qualification:

| Target group           | Definition                                                                                                                                                                                                                                            | Qualification                 |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| Operator               | In-depth knowledge of the subject, specific circumstances and the resulting dangers. Responsible for compliance with the technical guidelines and implementation of the required protective equipment and safeguards by the persons appointed by him. | Specialist                    |
| Qualified personnel    | Carry out work and mounting steps in keeping with their qualification e.g. installing gas, electrical equipment and electronic components and handling chemical substances.                                                                           | Specialist                    |
| Assembly personnel     | Are trained in handling and operating the required tools. Carry out work under the direction and supervision of a qualified person, e.g. preliminary work, straightforward mounting work with consideration given to the required safeguards.         | Trained and instructed person |
| Authorized specialists | Carry out work for which they have received specific instructions, e.g. mounting work, commissioning.                                                                                                                                                 | Authorised specialist         |

## 1.7 Notes for reading the Operating instructions

Facts that have previously been explained are only repeated if necessary for safety purposes.

Figures in these instructions are designed to provide a basic understanding and may deviate from the actual design.

## 1.8 Time limits

The expected useful life of the machine is 10 years. Observe the specified maintenance intervals.

## 2 Safety

### 2.1 General information and illustrations

|                                                                                     |                |                                                                                                                                                               |
|-------------------------------------------------------------------------------------|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <b>DANGER</b>  | <b>Brief description of the hazard</b><br>Extremely dangerous situation which will lead to death or serious injury if the safety instruction is not observed. |
|    | <b>WARNING</b> | <b>Brief description of the hazard</b><br>Dangerous situation which can lead to death or serious injury if the safety instruction is not observed.            |
|    | <b>CAUTION</b> | <b>Brief description of the hazard</b><br>Dangerous situation which will lead to slight injury if the safety instruction is not observed.                     |
|  | <b>NOTE</b>    | <b>Brief description of additional information</b><br>Indicates actions which can cause material damage or offers additional information.                     |

## 2.2 Safety symbols

### 2.2.1 Warning symbols

Points on the system and its components are labelled with symbols where there is or could be a threat to life and physical well-being for the system operator and/or third parties while they undertake work activities.

The following symbols can be used:

|                                                                                     |                                                      |                                                                                    |                                                          |
|-------------------------------------------------------------------------------------|------------------------------------------------------|------------------------------------------------------------------------------------|----------------------------------------------------------|
|    | General hazardous area                               |   | Dangerous electrical voltage                             |
|    | Risk of hand injuries                                |   | Risk of crushing                                         |
|    | Danger of being drawn in between moving system parts |   | Warning – hot surfaces                                   |
|    | Warning – suspended loads                            |   | Warning – danger of slipping                             |
|    | Warning – caustic substances                         |   | Warning – toxic substances                               |
|   | Warning – rotating parts                             |  | Risk of tripping and falling! Marking on edges and steps |
|  | Place forklift here                                  |                                                                                    |                                                          |

### 2.2.2 Prohibition signs

Points on the system and its components are labelled with prohibition signs where there is or could be a threat to life and physical well-being for the system operator and/or third parties while they undertake work activities.

The following prohibition signs can be used:

|                                                                                     |                    |                                                                                     |                                |
|-------------------------------------------------------------------------------------|--------------------|-------------------------------------------------------------------------------------|--------------------------------|
|  | No switching       |  | No unauthorised access         |
|  | Climbing forbidden |  | Crane suspension not permitted |

### 2.2.3 Mandatory action signs

Points on the system and its components are labelled with mandatory action signs where there is or could be a threat to life and physical well-being for the system operator and/or third parties while they undertake work activities.

The following mandatory signs can be used:

|                                                                                   |                         |                                                                                   |                             |
|-----------------------------------------------------------------------------------|-------------------------|-----------------------------------------------------------------------------------|-----------------------------|
|  | Wear eye protection     |  | Wear hand protection        |
|  | Wear hearing protection |  | Wear respiratory protection |
|  | Wear foot protection    |  | Wear head protection        |
|  | Wear protective apron   |                                                                                   |                             |

### 2.2.4 First-aid signs

Points on the machine and its components are labelled with first-aid signs where there is or could be a threat to life and physical well-being for the machine operator and/or third parties while they undertake work activities.

The following first-aid signs can be used:

|                                                                                     |                  |                                                                                     |                  |
|-------------------------------------------------------------------------------------|------------------|-------------------------------------------------------------------------------------|------------------|
|  | Eye wash station |  | Emergency shower |
|-------------------------------------------------------------------------------------|------------------|-------------------------------------------------------------------------------------|------------------|

### 2.2.5 First-aid signs

Points on the machine and its components are labelled with symbols where there is or could be a threat to life and physical well-being for the machine operator and/or third parties while they undertake work activities.

The following symbols can be used:



Ensure you are familiar with the contents of the operating instructions before operating the system.

Caution! Sharp edges. Warning of hand injuries.

Caution! Rotating parts.



Ensure you are familiar with the contents of the operating instructions before operating the system.

Caution! Danger of slipping.

Caution! Rotating parts.

Access only with system switched off!

Access not recommended for persons with respiratory problems!



Ensure you are familiar with the contents of the operating instructions before operating the system.

Caution! Dangerous electrical voltage.



Ensure you are familiar with the contents of the operating instructions before operating the system.

No unauthorised access.

Caution! Sharp edges. Warning of hand injuries.

Caution! Rotating parts.

## 2.3 IP protection class

The abbreviation "IP" stands for ingress protection. The abbreviation "IP" and a two-digit reference number indicates the protection class of a housing.

The first digit specifies the degree of protection against accidental contact and the ingress of foreign objects. The second digit specifies the degree of protection against water.

The protection class specified for this system is detailed in the table in the technical data.

| First digit:<br>Protection against foreign objects |                                                                                                                                                    | Second digit:<br>Protection against water |                                                                                            |
|----------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|--------------------------------------------------------------------------------------------|
| 0                                                  | No protection against accidental contact, no protection against foreign objects                                                                    | 0                                         | No protection against water                                                                |
| 1                                                  | Protection against contact with any large surface area with the hand; protection against foreign objects with a diameter of >50 mm.                | 1                                         | Protection against vertically falling drops of water                                       |
| 2                                                  | Protection against contact with fingers; protection against foreign objects with a diameter of >12 mm.                                             | 2                                         | Protection against diagonally falling drops of water (any angle up to 15° to the vertical) |
| 3                                                  | Protection against contact with tools, wires or similar with a diameter of >2.5 mm; protection against foreign objects with a diameter of >2.5 mm. | 3                                         | Protection against drops of water falling from any angle up to 60° to the vertical         |
| 4                                                  | Protection against contact with tools, wires or similar with a diameter of >1 mm; protection against foreign objects with a diameter of >1 mm.     | 4                                         | Protection against splash water from any direction.                                        |
| 5                                                  | Protection against contact. Protection against dust deposits on the interior                                                                       | 5                                         | Protection against water jet (nozzle) from any angle                                       |
| 6                                                  | Full protection against contact; protection against the ingress of dust                                                                            | 6                                         | Protection against temporary flooding                                                      |
|                                                    |                                                                                                                                                    | 7                                         | Protection against penetration of water during temporary immersion                         |
|                                                    |                                                                                                                                                    | 8                                         | Protection against pressurised water during continuous immersion                           |

## 2.4 Safety instructions for installation safety

---

Using the Drum washer Lavamatic XL properly as intended ensures it is operated safely. Negligent handling of the Drum washer Lavamatic XL can pose a risk to the life and limb of the operator and/or third parties as well as the system itself and any of the operator's material assets.

The following points must be observed to guarantee the safety of the system:

- Only operate the Drum washer Lavamatic XL if it is in perfect working order.
- All external contacts and connections must be in accordance with applicable safety regulations.
- All external contacts and connections must be installed correctly and must be adequately secured to prevent any malfunctions or damage.
- All of the safety systems and their operating and control elements must be in a technically faultless and functionally secure condition.
- Any changes or modifications are only permitted after consulting the manufacturer and receiving written approval.
- The maintenance instructions provided in these operating instructions are binding for ensuring the safety of the system.
- Do not use climbing aids to access the system or higher levels.

## 2.5 Safety instructions on storing hazardous materials

---

Safe storage of the hazardous materials used to operate the drum washer Lavamatic XL requires careful handling according to regulations.

Observe the following points to guarantee the safe storage of hazardous materials:

- Firmly attach warning signs indicating a hazardous zone where they are visible.
- Instruct operating personnel on handling sulphuric acid.
- Wear personal protective equipment (PPE).
- Store hazardous substance containers on suitable catchment containers.
- Install emergency shower for acid spills.

## 2.6 Safety instructions regarding operation and control

---

The following points must be observed when operating and controlling the drum washer Lavamatic XL:

- The Drum washer Lavamatic XL must only be operated by trained personnel.
- The instructed persons must be trained to handle hazardous materials.
- The relevant personnel entrusted with operation must have read and understand all parts of the operating instructions.
- Do not deactivate the safety systems of the drum washer Lavamatic XL. Safety systems are provided to protect against accidents and injuries.
- Only switch on the Drum washer Lavamatic XL if nobody is in the direct vicinity of the system and can be endangered by the system starting up.
- Do not climb into the Drum washer Lavamatic XL or grip into assembly openings when the Drum washer Lavamatic XL is ready for operation or is in operation. This can cause serious or fatal injuries.
- Inadequate components or components that are only fastened partially increase the safety risk.
- No foreign objects or tools must be in the Drum washer Lavamatic XL during operation. This can damage components.
- Observe the limit values detailed in the technical data and do not exceed them under any circumstances.
- Do not leave the Drum washer Lavamatic XL unattended for extended periods during operation.
- In the event of damage or malfunctions, switch off the Drum washer Lavamatic XL immediately and only place it back into operation once it has been repaired or the fault has been eliminated.

## 2.7 Safety instructions regarding maintenance, servicing and troubleshooting

Observe the following points during maintenance, servicing and troubleshooting:

- Wear personal protective equipment for all work in the system interior.
- Only authorised specialists may carry out any fault repairs.
- When completing any work to repair a fault, it must be ensured that the system and auxiliary equipment are switched off. When working on the electrical system, the Drum washer Lavamatic XL must be disconnected from the power supply and secured from being switched back on.
- Observe applicable local accident prevention regulations.
- Reaching into the system or other open system areas can cause serious injuries if the Drum washer Lavamatic XL is in operation or has not been switched off.
- Unsuitable spare and wear parts can pose a considerable safety risk to individuals and the system. Only use the spare and wear parts provided by the manufacturer.
- Follow the instructions for use when using cleaning agents.
- Wear personal protective equipment when using corrosive cleaning agents.

## 2.8 Information on safety systems

Safety systems are installed on the Drum washer Lavamatic XL to protect against accidents.

## 2.9 Instructions on fighting fires

Observe the fire-fighting measures indicated on the respective safety data sheets.

Suitable fire-extinguishing agents to extinguish sulphuric acid fires are foam, dry powder and carbon dioxide (CO<sub>2</sub>).

## 2.10 Information on selecting personal protective equipment

You must wear suitable personal protective equipment when operating, maintaining or repairing the system.



Wear a hard hat if at risk both from bumping into objects as well as from falling, swaying and toppling over objects.



On construction sites, do wear safety shoes with toe protection caps and anti-slip, sure-footed soles.



Protective masks protect from dust, gas and vapour hazards.



Wear protective clothing as a protection from the elements, from getting caught, from chemical effects and for maintenance purposes.



Wear protective goggles to protect eyes from mechanical, thermal, biological, electrical and chemical dangers.



Wear safety gloves which are suitable as a protection from mechanical/thermal or chemical hazards.



Ear muffs are to be provided from 80 dB(A) on and must be worn from 85 dB(A) on.

## 2.11 Notes on specific hazards

---

### 2.11.1 Electrical power

- Working on electrical systems or system components must only be completed by qualified electricians or authorised specialists under the direction and supervision of a qualified electrician in accordance with the electrical engineering regulations.
- System parts that need to be inspected, maintained or repaired must be disconnected from the power supply and secured from being switched back on as long as no voltage is required for the work. Only a qualified electrician may perform such work.

### 2.11.2 Working on platforms

- Portable ladders and lifting equipment must not permanently remain or be left unattended on the system.
- Unauthorised persons must not be granted access to ladders and lifting equipment used for maintenance purposes on the system. This must be clearly indicated with signs.

### 2.11.3 Handling sulphuric acid

- Carefully remove clothing immediately if clothing comes into contact with sulphuric acid.
- In case of contact with the skin, first dab the skin areas thoroughly. Then wash with plenty of water.
- If acid comes into contact with an eye, open the affected eye wide and rinse thoroughly for several minutes. Consult an ophthalmologist immediately.
- In case of extensive skin wettings, immediately rinse with the emergency shower and carefully remove the wetted clothing.
- Wear personal protective equipment in case of spillage of sulphuric acid. Absorb the acid with dry cloths and then rinse the wetted area with plenty of water.

## 2.12 Intended use

---

The Drum washer Lavamatic XL is a chemical wet scrubber used to reduce dust and ammonia emissions. It is delivered as a complete, pre-assembled module. The livestock shed ventilation is designed as per DIN 18910 or the German Animal Welfare Regulations (TierSchNutzV).

The system must only be used for this purpose while complying with the ambient conditions agreed upon in writing and using the auxiliary supplies and materials specified by the manufacturer.

The intended use includes the specified procedures, adherence to the specifications detailed in the operating instructions and use of any supplied or additionally available accessories. Any other use of the system is considered contrary to the intended use.

## 2.13 Reasonably foreseeable misuse

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The following is classified as reasonably foreseeable misuse:

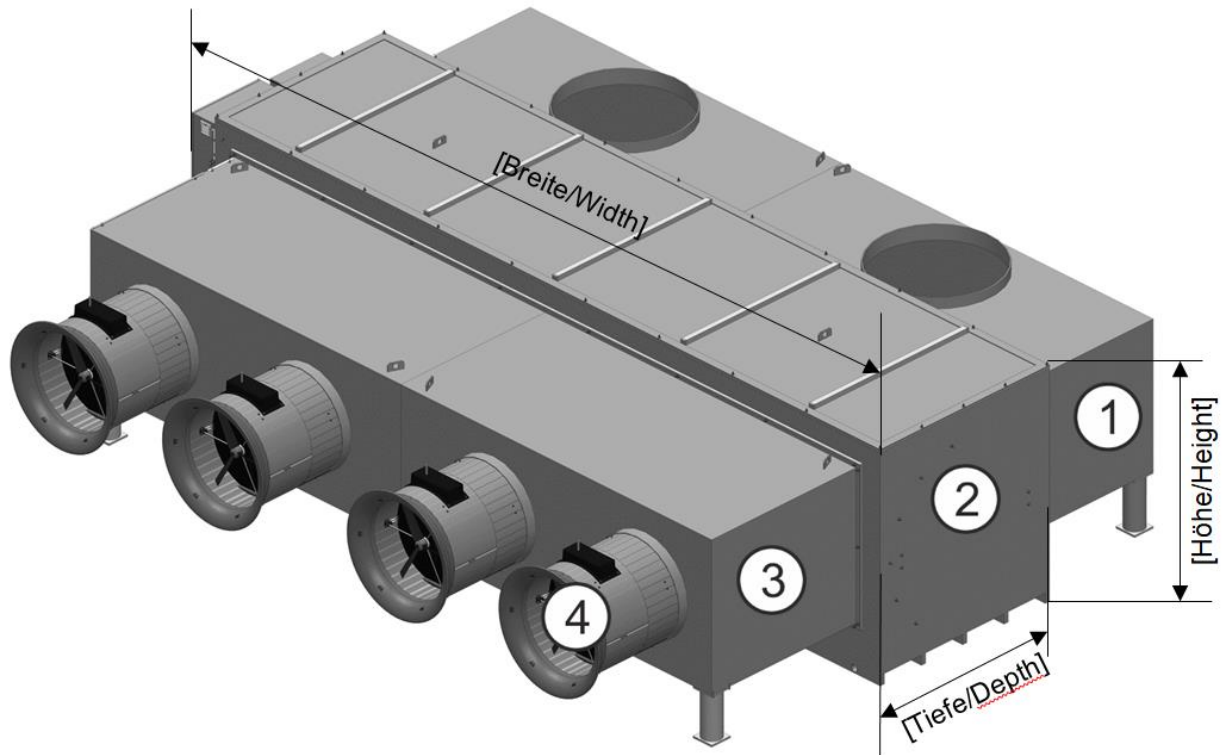
- The use of materials that generate their own source of energy (movement, heat, electrical energy) or loads (tension, pressure, torsion).
- The use of materials that do not adhere to the specifications stipulated by the manufacturer or have not been approved by the manufacturer.
- Changing the performance parameters of the system so that they exceed specified values.
- Mechanical modifications to the system, including the structure or modifying the structure at the location where the entire system is installed.
- Operating the system without or by bypassing the safety equipment.
- Operating the systems while exceeding permissible inspection and maintenance cycles.
- Allowing personnel who have not been instructed/trained or who are not qualified to operate the system.
- Completing work on or operating the system outside the limits or guidelines stipulated in the operating instructions.
- Using climbing aids to access the facility or higher levels on the facility.
- Storing the process water after mixing it with liquid manure.
- System shut down at temperatures below 1°C (risk of frost). All liquid-conducting pipelines must be emptied if the system is shut off at such temperatures.

## 3 Technical data

### 3.1 System data

#### 3.1.1 Dimensions

##### Drum washer without flue



1 Exhaust air module  
3 Supply air module

2 Drum module  
4 Supply air duct unit

| Module                                     | Width (mm) | Depth (mm) | Height (mm) | Weight (kg) |
|--------------------------------------------|------------|------------|-------------|-------------|
| Exhaust air module                         | 7425       | 1465       | 2120        | 440         |
| Drum module                                | 8275       | 2030       | 2350        | 2150        |
| Drum module, incl. water                   | 8275       | 2030       | 2350        | 6650        |
| Supply air module, without supply air duct | 7455       | 1810       | 2080        | 440         |
| Supply air duct unit, single               | -          | 1193       | Ø1194       | 50          |
| Whole unit                                 | 8275       | 6344       | 2350        | 3230        |
| Whole unit, incl. water                    | 8275       | 6344       | 2350        | 7730        |

### 3.1.2 Performance data

|           | Lavamatic XL | Dimension         |
|-----------|--------------|-------------------|
| Flow rate | 100000       | m <sup>3</sup> /h |

### 3.1.3 Electrical connection data

|                         | Lavamatic XL                                | Dimension |
|-------------------------|---------------------------------------------|-----------|
| Connection voltage      | 400_50/60                                   | V_Hz      |
| Control voltage         | 24 DC                                       | V         |
| Rated input             | 6 (max. 5 modules)<br>12 (max. 10 modules)  | kW        |
| On-site fuse protection | 16 (max. 5 modules)<br>25 (max. 10 modules) | A         |

## 3.2 Operating and ambient conditions

|                       | Value              | Dimension |
|-----------------------|--------------------|-----------|
| Target pH value       | approx. 3          | pH        |
| Conductivity          | <200               | mS/cm     |
| Water tank fill level | approx. 250 to 350 | mm        |
| Operating temperature | >1 to max. <50     | °C        |

## 3.3 Characteristics of the elutriation vessel

The elutriation vessel must be sealed to retain acids and alkali solutions. REVENTA GmbH recommends an epoxy resin sealant with high alkali and chemical resistance as a coating and using reinforced concrete with a suitable exposure class. Alternatively, acid-resistant IBC containers can be used.

## 3.4 Notes: exhaust air washer foundation

The exhaust air washer must be installed on a flat, level surface. The flatness must meet the requirements specified in Row 3 of DIN 18202.

The foundation must be suitable for the weight of the exhaust air washer.

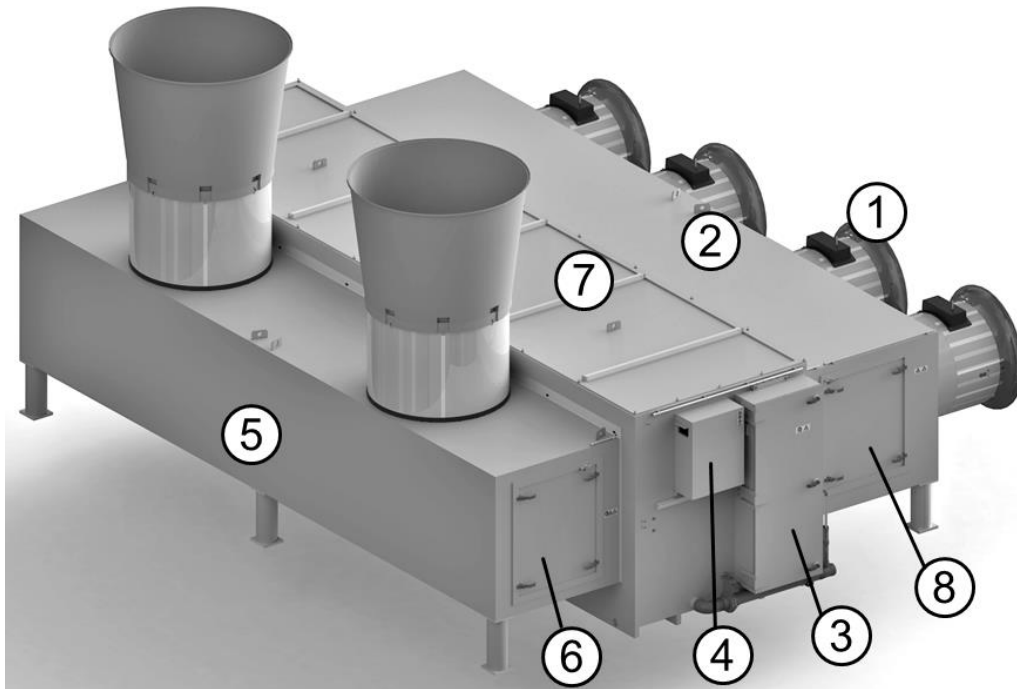
The necessary structural calculations are the responsibility of the system operator, and are not included in the scope of supply.

### 3.5 Auxiliary materials and consumables

| Description    | Description                                                                                                                                                  | Use                                                        |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|
| Water          | Drinking water quality as per drinking water regulations<br>System separation as per EN 1717 Category 5<br>Adjustable water pressure at 3 to 4 bar           | To clean the systems and as the basis for acidified water. |
| Sulphuric acid | 95 a 97 %<br>Safety data sheet number 17685<br>Manufacturer: Honeywell, for example                                                                          | To acidify water.                                          |
| Additive       | Struktol® SB2032<br>Density: 880 kg/m³ at 20 °C<br>Viscosity: 23 mPa.s at 25 °C<br>Shelf life: approx. 1 year<br>Manufacturer: Schill+Seilacher, for example | To decrease foaming in the acidified water.                |

## 4 Technical description

### 4.1 Functional description of the drum washer



Example of set-up

|   |                                 |   |                   |
|---|---------------------------------|---|-------------------|
| 1 | Flue unit                       | 2 | Supply air module |
| 3 | Measurement and control cabinet | 4 | Drive unit        |
| 5 | Exhaust air module              | 6 | Service hatch     |
| 7 | Drum module                     | 8 | Service hatch     |

The exhaust air from the livestock shed is conveyed by the fans into the supply air module of the cleaning system and from there on through a washing drum. The drum contains filtration material made of plastic which is continuously wetted thanks to the slow rotation of the water tank (pH value = 3). As the air flows through the drum, separation of ammonia and dust takes place on the filtration material. If the process water exceeds a pre-set conductance value, the liquid is drawn off and replaced with fresh water.

Both the exhaust air module and the supply air module contain a service hatch.

## 4.2 Description of the essential modules

---

### 4.2.1 Supply air module including flue unit

The supply air module carries shed air to the drum module via the fan unit. The Drum washer Lavamatic XL interior can be cleaned using the service hatch.

### 4.2.2 Drum module

The drum module contains the washing drum. The washing drum rotates in a water tank, which is filled with acidified water. The washing drum is wetted and cleaned with acidified water at the same time. The acidified water on the wetted washing drum removes the dust and ammonia from the shed air.

A circulation pump circulates the water in the water tank to determine the pH value and conductivity. The circulation pump conveys the acid and additive into the process water.

### 4.2.3 Exhaust air module with exhaust air flue

The exhaust air module is located at the drum module rear and features an exhaust air flue. The Drum washer Lavamatic XL interior can be cleaned using the service hatch.

### 4.2.4 Control of the drum washer Lavamatic XL

The drum washer Lavamatic XL is controlled via a central control module and a decentralised module. The central control module is installed in a machine room and operated using a touch screen. The central control module tasks include:

- Managing up to 10 systems.
- Displaying the operating modes of the drum washer Lavamatic XL in a system overview.
- System data recording: power consumption.
- Monitoring fill levels of consumables: additive and sulphuric acid.
- Configuration of the central control module, decentralised module and the system.
- Display of the alarm list.
- Drum motor control.
- Control for the acid pump, additive pump and circulation pump.
- Control for the valves for fresh water feed and water tank elutriation.
- Recording of measurement levels: differential pressure, temperature, humidity, pH value and conductance value.

A decentralised module is attached to the Drum washer Lavamatic XL. This decentralised module is the interface between the Drum washer Lavamatic XL and the inlets and outlets.

## 5 Transport, assembly and commissioning/decommissioning

|                                                                                   |                |                                                                                                                                                                                                                                                                                                                                                          |
|-----------------------------------------------------------------------------------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>WARNING</b> | <b>Chemical burns caused by sulphuric acid</b><br>Contact with the process water or sulphuric acid will cause chemical burns on the skin.<br>Wear personal protective equipment when working with hazardous substances.<br>Handle hazardous materials with care and observe the safety instructions on handling sulphuric acid.                          |
|  | <b>WARNING</b> | <b>Crushing and being drawn into rotating drums</b><br>When completing maintenance or cleaning work on running drums, there is a risk of body parts being drawn into the drum and being crushed.<br>Only complete maintenance and cleaning work when the system is switched off and is at a complete standstill.<br>Do not reach into the rotating drum. |

### 5.1 Transport

Only technical staff trained by REVENTA GmbH are permitted to transport the drum washer Lavamatic XL.

Rinse with water any components/modules contaminated with acid and transport in acid-resistant catchment containers only.

### 5.2 Installation

Only technical staff trained by REVENTA GmbH are permitted to assemble the drum washer Lavamatic XL.

### 5.3 Initial operation

Only technical staff trained by REVENTA GmbH are permitted to put the drum washer Lavamatic XL into operation.

## 5.4 Decommissioning and disassembly

---

The Drum washer Lavamatic XL must be in a hazard-free state when taken out of service. To do so, observe the following:

Only technical staff trained by Reventa are permitted to decommission and disassemble the drum washer Lavamatic XL.

Switch off the Drum washer Lavamatic XL and secure it against unintentional reconnection.

Drain all liquids from the water tank and all liquid-conducting pipelines. Empty the liquids into suitable catchment containers.

Only a qualified electrician may disconnect the electrical supply lines.

Only use suitable tools and lifting gear, where required.

## 5.5 Storage

---

Storage or intermediate storage must be in a dry and frost-free environment. The Drum washer Lavamatic XL must be protected against dust with suitable covers.

Adequate ventilation of the internal components must be ensured.

At the storage location, the Drum washer Lavamatic XL must be checked for any damage caused by corrosion every six months.

## 5.6 Putting back into operation

---

Observe the section "Operating the system | Switching on the system" when putting the drum washer Lavamatic XL back into operation.

## 5.7 Disposal

The various materials and media must be separated during disposal.

Information on disposing of hazardous substances is detailed in the corresponding data sheets provided by the relevant manufacturer. Substances that are hazardous to humans may leak during disposal. Safety instructions and legal requirements regarding materials that are hazardous to humans, the environment and system are also detailed in the corresponding data sheets provided by the relevant manufacturer.

### 5.7.1 Dispose of process water and elutriation material



#### WARNING

#### Formation of hydrogen sulphide harmful to health

Hydrogen sulphide ( $H_2S$ ), harmful to health, may form due to the sulphuric acid additive if you store process water after it has been mixed with liquid manure.

Do not mix the process water until shortly before the liquid manure is brought out.

Never store the process water after mixing it with liquid manure.

The nitrogen produced can be applied to plants if used properly. It is not recommended to use the nitrogen in an undiluted state due to the low pH value. It can be applied together with the liquid manure if the liquid manure is mixed with the elutriated process water immediately before application.

## 6 Operation and control

|                                                                                   |                |                                                                                                                                                                                                                                                                                                                                                          |
|-----------------------------------------------------------------------------------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>WARNING</b> | <b>Chemical burns caused by sulphuric acid</b><br>Contact with the process water or sulphuric acid will cause chemical burns on the skin.<br>Wear personal protective equipment when working with hazardous substances.<br>Handle hazardous materials with care and observe the safety instructions on handling sulphuric acid.                          |
|  | <b>WARNING</b> | <b>Crushing and being drawn into rotating drums</b><br>When completing maintenance or cleaning work on running drums, there is a risk of body parts being drawn into the drum and being crushed.<br>Only complete maintenance and cleaning work when the system is switched off and is at a complete standstill.<br>Do not reach into the rotating drum. |

### 6.1 Position and function of the operating controls

#### 6.1.1 Layout of the operating controls

##### Main switch

The main switch for the system is located on the central control cabinet.

## 6.2 Operating the system

---

The drum washer Lavamatic XL is operated on a central control module, which is installed in the equipment room.

### 6.2.1 Switching on the system

Before switching on the Drum washer Lavamatic XL, observe the following:

1. Perform visual inspection of the entire system for damage or faults.
2. Ensure there is fresh water supply to the system.
3. Close service hatches.
4. Check whether the operating supplies are connected and available in sufficient quantities.

Perform the following steps on the central control module:

1. Log in at service level (level 3) via a user with corresponding authorisation.
2. Check error messages and eliminate errors where necessary.
3. Set fresh water to automatic mode to fill the water tank.

When the process water tank has reached its target fill level on the central control module, perform the following next steps:

1. Set circulation to automatic mode.
2. Set acid and additive to automatic mode.
3. Set elutriation to automatic mode.
4. Set drum to automatic mode.
5. Disable the controller.

### 6.2.2 Switching off the machine

Switch off the drum washer Lavamatic XL as follows:

1. Close all manual and fresh water valves.
2. Switch off all drives and modules on the central control module.
3. Switch off the main switch on the central control module and secure it against being switched on again.

#### **Risk of frost**

If there is a risk of frost, also empty the system and all liquid-conveying pipelines to prevent pipelines from freezing.

Empty the liquids into suitable catchment containers.

Once there is no longer a risk of frost, put the system back into operation as described in the section "Operating the system | Switching on the system".

## 6.3 Replacing consumables

|                                                                                   |                |                                                                                                                                                                                                                                                                                                                                 |
|-----------------------------------------------------------------------------------|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>WARNING</b> | <b>Chemical burns caused by sulphuric acid</b><br>Contact with the process water or sulphuric acid will cause chemical burns on the skin.<br>Wear personal protective equipment when working with hazardous substances.<br>Handle hazardous materials with care and observe the safety instructions on handling sulphuric acid. |
|  | <b>WARNING</b> | <b>Health hazard due to chemical reaction</b><br>If suction lances for acids or additives are interchanged, this can cause chemical reactions and pose a health hazard.<br>Place the containers for the acid and the additive apart from one another.<br>Only use one consumable at a time. Do not interchange suction lances.  |

### 6.3.1 Acid

Only staff trained in handling concentrated sulphuric acid may replace the acid containers. Pay attention to the following in doing so:

1. Wear personal protective equipment (apron, gloves, goggles).
2. Replace the container for sulphuric acid only.
3. Open the fastener of the full sulfuric acid container.
4. Unscrew the connection from the empty container and remove the suction lance.
5. Insert the suction lance into the full container and screw the connection firmly into place.
6. Remove the empty container as specified on the safety data sheet.

### 6.3.2 Additive

Observe the following when replacing the containers for the additive:

1. Replace the container for the additive only.
2. Open the fastener of the full additive container.
3. Unscrew the connection from the empty container and remove the suction lance.
4. Insert the suction lance into the full container and screw the connection firmly into place.
5. Remove the empty container as specified on the safety data sheet.

## 6.4 Operating screens for the controller of the drum washer Lavamatic XL

### 6.4.1 Key assignment

#### Icon key assignment

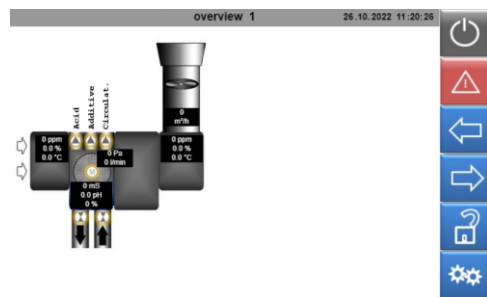
| Symbol                                                                              | Description                                                                |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
|    | Navigate back one level                                                    |
|    | Navigate to the previous or next operating screens                         |
|    | Scroll further within the configuration setting                            |
|    | Navigate to configuration (Level >=1)                                      |
|   | Navigate to operating log (Level >=1)                                      |
|  | Navigate to USB flash drive readout (Level >=1)                            |
|  | Navigate to user administration (Level >=3)                                |
|  | Display of machine status On or Off: Switch machine on or off (Level>=2)   |
|  | Indicates an alarm and navigates to alarm list                             |
|  | User logged on or off<br>Lock closed = logged out<br>Lock open = logged in |
|  | Delete active alarms (Level>=2)                                            |
|  | Apply configuration settings to all other modules (Level>=3)               |

## Component operating modes

| Symbol                                                                              | Description                                    |
|-------------------------------------------------------------------------------------|------------------------------------------------|
|    | Drum motor operating mode OFF                  |
|    | Drum motor operating mode MANUAL               |
|    | Drum motor operating mode AUTO not switched on |
|    | Drum motor operating mode AUTO switched on     |
|    | Fans switched off                              |
|    | Fans switched on                               |
|   | Fan malfunction                                |
|  | Container fill level (acid or additive) OK     |
|  | Container fill level (acid or additive) empty  |
|  | Flap in front of main fan closed               |
|  | Flap in front of main fan open                 |
|  | Flap in front of cleaning air fan closed       |
|  | Flap in front of cleaning air fan open         |
|  | Pump operating mode OFF                        |
|  | Pump operating mode MANUAL                     |

| Symbol                                                                            | Description                               |
|-----------------------------------------------------------------------------------|-------------------------------------------|
|  | Pump operating mode AUTO not switched on  |
|  | Pump operating mode AUTO switched on      |
|  | Pump malfunctioning                       |
|  | Valve operating mode OFF                  |
|  | Valve operating mode MANUAL               |
|  | Valve operating mode AUTO not switched on |
|  | Valve operating mode AUTO switched on     |

## 6.4.2 Central control module operating screens



### System overview

The operating modes are shown on the Overview operating screen.

Colours indicate the operating mode of individual components (see “Component operating modes” table, p. 31).

The arrow keys can be used to switch between different screens, depending on the system size.

|   | Zeit / time         | Meldung / message           |
|---|---------------------|-----------------------------|
| 0 | 01.01.2019 00:15:31 | 335: Protokoll:             |
| 1 | 01.01.2019 00:15:41 | 1: Modul 1: Tür AUF         |
| 2 | 01.01.2019 00:15:41 | 3: Modul 1: Absicherung     |
| 3 | 01.01.2019 00:15:41 | 301: CAN Modul 1            |
| 4 | 01.01.2019 00:15:31 | 332: Absicherung Modul 1.5  |
| 5 | 01.01.2019 00:15:31 | 333: Absicherung Modul 6.10 |
| 6 | 01.01.2019 00:15:31 | 334: Ausfall FI / RCD       |

### Alarm list

The “Alarm list” operating screen lists the system errors in a table.

Red Alarm

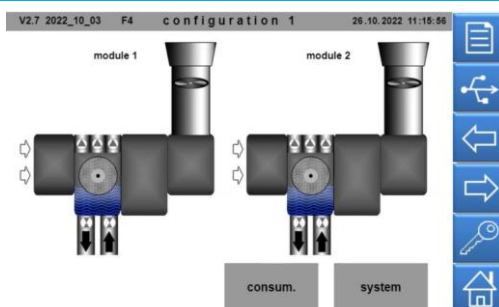
Yellow Warning

Green Message

Black Alarm no longer active,  
alarm not reset.

Each entry features a time stamp indicating the time the alarm started, the error code and the error text.

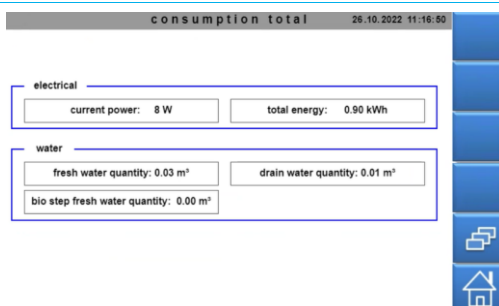
Errors can be deleted by pressing the reset button.



### Configuration

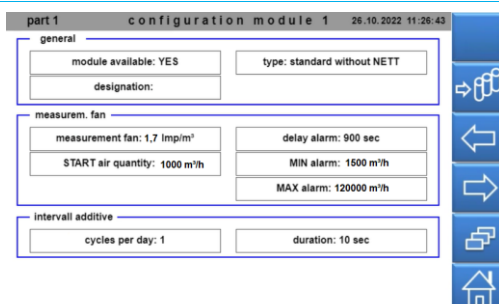
The “Configuration” operating screen displays the components which can be configured.

You can select the “System consumption” operating screen here.



### System consumption

This screen displays electrical power consumption, the volume of fresh water and the elutriation volume in the system.



### Configuration module

The parameters for the individual modules and their components can be set on the “Configuration module” operating screen.

part 2configuration module 102.11.2022 14:06:48

water niveau

restart after empty: YES

MIN alarm: 20 %

setpoint niveau: 27 %

MAX alarm: 30 %

empty niveau: 18 %

drain

stop-conductivity: 185 mS/cm²

MAX conductivity: 198 mS

duration: 45 sec

MAX niveau: 32 %

break: 120 sec

Daily: 0 l

water clock

fresh water: 1.00 l/min

Circulation: 0.20 l/imp

part 3configuration module 102.11.2022 14:07:15

ammonia

delay Alarm: 900 sec

MAX alarm: 15 ppm

difference press.

delay Alarm: 900 sec

MAX alarm: 180 Pa

pH-value limits

stop pH-value: 3.0 pH

MIN alarm: 2.0 pH

MAX alarm: 4.5 pH

conduct. limits

MIN alarm: 0 mS/cm²

MAX alarm: 230 mS/cm²

part 4configuration module 102.11.2022 14:07:31

analog values

water niveau 0%: 0.0 V

conductivity 0mS: 0.0 V

water niveau 100%: 10.0 V

conductivity 300mS: 14.9 V

temperature 0°C: 4.0 V

pH-value 0: 1.9 V

temperature 100°C: 14.0 V

pH-Wert 14: 9.7 V

humidity IN/OUT 0%: 0.0V

humidity BIO 0%: 0.0V

humidity IN/OUT 100%: 10.0V

humidity BIO 100%: 10.0V

ammonia 0ppm: 1.9V

difference pressure 0Pa: 0.0 V

ammonia 100ppm: 10.0V

difference pressure 200Pa: 10.0 V

part 5configuration module 102.11.2022 14:08:05

Fan

Delay OFF: 30 min

circulation

MIN flow: 10 l/min

Redundanz

MAX difference: 0 mS/cm²

MAX difference: 0.0 pH

part 1SYSTEM26.10.2022 11:15:25

clock

year: 2022

hour: 11

month: 10

minute: 15

day: 26

time zone: 1

set

display language

English

Touch

calibration

configuration

load defaults

back-up

## System configuration

System parameters such as the clock, language and number of fattening places.

The drum washer configurations and the process data can be saved or deleted

**REVENTA®**  
a Munters company

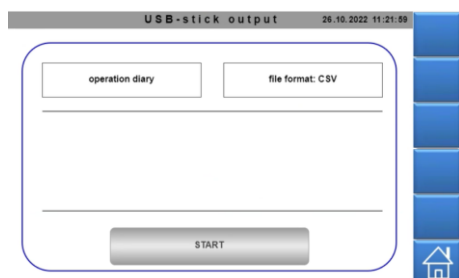
Drum washer® Lavamatic XL



### Recording operating data

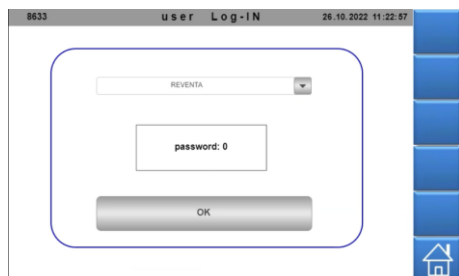
This is where you can view and enter system information in the operating log.

You can use the "New entry" button to start a new entry.



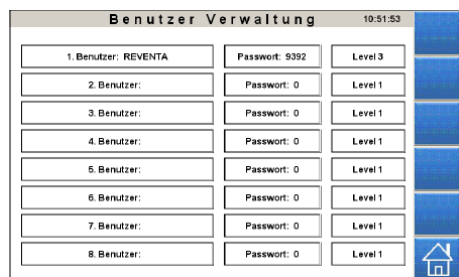
### Export operating log

This is where you can export stored system information to an external memory.



### User login

This is where users can log on.



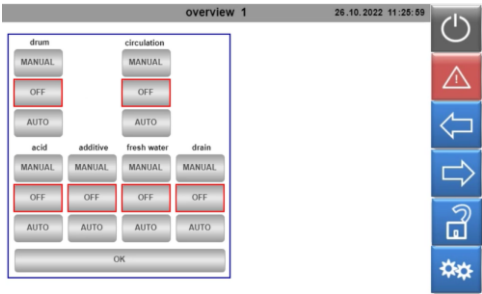
### User administration

This is where you can assign rights to users and allocate a separate password and user level for each user.

The user levels have the following rights:

|                |            |                                                                                                             |
|----------------|------------|-------------------------------------------------------------------------------------------------------------|
| Without log-in |            | Operating modes screen<br>Alarm list screen                                                                 |
| Level 1        | Authorised | Entry in the operating log<br>Export of system information                                                  |
| Level 2        | Operator   | Switching the drum washer on and off<br>Setting the operating modes<br>Resetting malfunctions               |
| Level 3        | Service    | Settings in user administration<br>Settings in the system configuration<br>Setting the configuration module |

6.4.3 Control module operating screens



Components operating modes

You can switch between the different operating modes for the different components in the control module.

Operating modes:

“MANUAL ”            Manual mode

“OFF”                Component switched off

“AUTO”              Automatic mode

The selected operating mode is highlighted in black.

## 6.5 Handling the drum washer Lavamatic XL



### NOTE

#### Additional information and parameters list

You will find additional information on handling the drum washer Lavamatic XL in the supplied operating manual "Lavamatic exhaust air washer control".

The adjustable parameters are listed in the appendix in the section "Overview of parameters".

### 6.5.1 Filling the water tank

To fill the water tank, switch the fresh water component to "manual mode" on the control module. The water tank can only be filled if the maximum fill level has not been reached yet.

The fill levels in the water tank control tank filling in automatic mode.

The values for the fill level can be set on the "Configuration module" control panel using the "Water level" parameters.

The volume of fresh water supplied is recorded via a water meter.

### 6.5.2 Elutriating the water tank

In manual mode, the water tank is elutriated until the water tank is emptied. If you wish to elutriate using the control module, switch off the fresh water component and switch the elutriating component to manual mode.

Elutriation is started in automatic mode by the following conditions:

- Maximum conductivity exceeded.
- The maximum filling level in the water tank exceeded.
- A fixed daily elutriation volume.

Elutriation is stopped in automatic mode by the following conditions:

- The conductance value has fallen below the "Stop conductance value" parameter.
- The fill level in the water tank has fallen below the minimum value.
- The daily defined elutriation volume has been reached.

The values for the elutriation process can be set on the "Module configuration" control panel using the parameters for "Elutriation".

A water meter records the volume of elutriated process water that has been drained.

### 6.5.3 Drum motor



#### NOTE

#### Damage to the drum if operated when dry

The seal on the drum can be damaged if the drum motor is activated when the water tank is empty.

Only start the drum motor if the water tank is filled.

The drum motor will rotate in manual mode even if the process water in the water tank has fallen below the minimum level.

The drum motor will stop in automatic mode when the process water in the water tank falls below the minimum fill level and will start when the minimum level is exceeded.

### 6.5.4 Circulation pump

The circulation pump will rotate in manual mode even if the process water in the water tank has fallen below the minimum level.

In automatic mode, the circulation pump will start when the drum motor starts.

### 6.5.5 Measuring temperature, humidity and ammonia

Sensors for measuring the temperature, humidity and optionally the ammonia content are located in the in-flowing air section of the Drum washer Lavamatic XL and in the out-flowing air section of the drum washer Lavamatic XL.

The analogue values are displayed on the touch screen.

If the different values exceed or fall below the adjustable limit values, an error is generated and the corresponding indicator is highlighted in red on the screen.

### 6.5.6 Measuring the pH value and conductance value

Sensors measure the pH value and the conductance value of the process water.

The analogue values are displayed on the touch screen.

If the different values exceed or fall below the adjustable limit values, an error is generated and the corresponding indicator is highlighted in red on the screen.

#### Conductance value

The elutriation process is started if the conductance value exceeds the adjustable limit value.

#### pH value

The acid metering pump is switched off if the pH value falls below an adjustable limit value.

The limit values for the pH value and conductance value can be set on the "Module configuration" control panel using the parameters for "pH value" and "Conductance value".

### 6.5.7 Fill level monitoring for consumables

#### Acid

Set the component to "MANUAL" operating mode to feed acid manually.

In automatic mode, an acid metering pump adjusts the acid content in the process water to pH value 3. The metering pump conveys acid into the process water from a container.

The fill level in the acid container is monitored by a float switch. If a message indicates the container is empty, an error message is generated, the acid container is displayed in red on the touch screen and the acid metering pump is stopped.

### **Additive**

Set the component to "MANUAL" operating mode to feed acid manually.

In automatic mode, a metering pump feeds the additive to the process water. The system starts metering on a cyclical basis.

The fill level in the additive container is monitored by a float switch. If a message indicates the container is empty, an error message is generated, the additive container is displayed in red on the touch screen and the additive metering pump is stopped.

The "Additive interval" parameters are configured on the "Module configuration" control panel to set cycles.

### **6.5.8 Ending the fattening period**

At the end of the fattening period, switch off the Drum washer Lavamatic XL, as described in the section "Operating the system | Switching off" and clean it (see section "Maintenance, servicing and repairs | Cleaning").

## 7 Maintenance, servicing and repairs

|                                                                                    |                |                                                                                                                                                                                                                                                                                                                                                          |
|------------------------------------------------------------------------------------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   | <b>DANGER</b>  | <b>Dangerous electrical voltage</b><br>Live parts are installed in the system. Contact with live system parts can be fatal.<br>Before working, disconnect the system from the supply voltage and secure it against unintentional reconnection.                                                                                                           |
|   | <b>WARNING</b> | <b>Chemical burns caused by sulphuric acid</b><br>Contact with the process water or sulphuric acid will cause chemical burns on the skin.<br>Wear personal protective equipment when working with hazardous substances.<br>Handle hazardous materials with care and observe the safety instructions on handling sulphuric acid.                          |
|  | <b>WARNING</b> | <b>Crushing and being drawn into rotating drums</b><br>When completing maintenance or cleaning work on running drums, there is a risk of body parts being drawn into the drum and being crushed.<br>Only complete maintenance and cleaning work when the system is switched off and is at a complete standstill.<br>Do not reach into the rotating drum. |

## 7.1 Service and maintenance schedule

### 7.1.1 Daily maintenance

The operating staff can perform daily maintenance.

| Component/module                       | Action                                                                    | Result/maintenance measure                                 |
|----------------------------------------|---------------------------------------------------------------------------|------------------------------------------------------------|
| Entire system                          | General visual inspection                                                 | Repair defective points                                    |
|                                        | Check for leaks                                                           | Repair defective points and replace pipelines if necessary |
| Consumables (acid, additive)           | Check the required amounts of consumables                                 | Refill with consumables                                    |
| Consumables pipelines (acid, additive) | Check consumables pipelines to ensure they are free of bubbles            | Vent the pipelines                                         |
| Circulation pump                       | Check the circulation pump works correctly                                | Re-establish correct functioning of the circulation pump   |
|                                        | Measure whether the pH value is near the value required (pH +0.3 to 0.1). | Feed the consumable required                               |
| Controller                             | Read the active error messages                                            | Reset active error messages                                |
| Drum                                   | Check that the drum rotates                                               | -                                                          |
| Drum                                   | Visual inspection                                                         | -                                                          |

### 7.1.2 Monthly maintenance

The operating staff can perform monthly maintenance.

| Component/module             | Action                                                                | Result/maintenance measure                                 |
|------------------------------|-----------------------------------------------------------------------|------------------------------------------------------------|
| System interior              | Visual inspection to detect encrusted deposits                        | Remove dirt or salt encrustations or deposits              |
| Conductivity sensor          | Measure conductivity with an external measurement device              | Calibrate or replace the sensor in the event of deviations |
| pH value sensor              | Calibrate the pH value sensor                                         | Replace the pH value sensor                                |
| Drum                         | Visual inspection of seals on the drum                                | Replace the seals                                          |
| Consumables (acid, additive) | Check whether the reading from the fill level indicators is plausible | Replace the fill level lance                               |

#### 7.1.2.1 Additional monthly servicing for systems with frequency converters

| Component/module | Action                                                 | Result/maintenance measure        |
|------------------|--------------------------------------------------------|-----------------------------------|
| Drum motor       | Read out the effective load of the drive controller    | Take note of the displayed values |
|                  | Read out the effective load of the motor               | Take note of the displayed values |
|                  | Observe limit values according to maintenance protocol | Take note of the displayed values |

### 7.1.3 Six-monthly maintenance

Only have technical staff trained by Reventa perform the six-monthly maintenance.

| Component/module                                                                                                          | Action                                                                    | Result/maintenance measure                                 |
|---------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|------------------------------------------------------------|
| Entire system                                                                                                             | General visual inspection                                                 | Repair defective points                                    |
|                                                                                                                           | Check for leaks                                                           | Repair defective points and replace pipelines if necessary |
| Expansion chamber and feed line                                                                                           | Visual inspection and cleaning                                            | Replace defective expansion chamber and feed lines         |
| Water meter                                                                                                               | Check the water meter functions correctly                                 | Replace the defective water meter                          |
| Circulation pump                                                                                                          | Check the circulation pump functions correctly                            | Repair the defective circulation pump                      |
| Washing water                                                                                                             | Measure pH value of washing water                                         | -                                                          |
| Washing water                                                                                                             | Calibrate the pH value sensor                                             | Replace the defective pH value sensor                      |
| Conductivity sensor                                                                                                       | Check the conductivity sensor functions correctly                         | Replace the defective conductivity sensor                  |
| Solenoid valves and servomotors                                                                                           | Check the magnetic valves and servomotors function correctly              | Replace defective magnetic valves or servomotors           |
| Drum                                                                                                                      | Visual inspection for damage to drum and to ensure it functions correctly | Repair or replace defective parts                          |
| a. Drive cog wheel<br>b. Drum cog wheel<br>c. Castors<br>d. Drum seals on sides (black)<br>e. Drum seal, horizontal (red) | Check wear parts                                                          | Replace defective wear parts                               |
| Controller                                                                                                                | Read controller database and check it is complete.                        | -                                                          |
| Controller                                                                                                                | Check maintenance interval in the database.                               | -                                                          |
| Consumables                                                                                                               | Check consumable consumption (sulphuric acid, additive) documentation.    | -                                                          |

#### 7.1.3.1 Additional annual maintenance for systems with frequency converters

| Component/module | Action          | Result/maintenance measure            |
|------------------|-----------------|---------------------------------------|
| Drum motor       | Change gear oil | Note the date for the next oil change |

## 7.2 Cleaning schedule

The six-monthly maintenance includes cleaning. The operator arranges cleaning.

| Component/module             | Action                                                                                                                                                                                                                      |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Supply air module, interior  | Clean the supply air module using a pressure washer without cleaning agents and without a dirt killer                                                                                                                       |
| Exhaust air module, interior | Clean the exhaust air module using a pressure washer without cleaning agents and without a dirt killer                                                                                                                      |
| Drum module, interior        | Clean the drum module using a pressure washer without cleaning agents and without a dirt killer                                                                                                                             |
| Drum and filtration material | Clean the drum and the filtration material using a pressure washer without cleaning agents and without a dirt killer                                                                                                        |
| Drum                         | Rinse the drum (see chapter "Cleaning the drum washer")                                                                                                                                                                     |
| Entire system                | Clean the overall system exterior as required<br>Clean the overall system exterior using a pressure washer without cleaning agents and without a dirt killer<br>Elektrokomponenten dürfen nicht mit Wasser gereinigt werden |

## 7.3 Specific care and maintenance

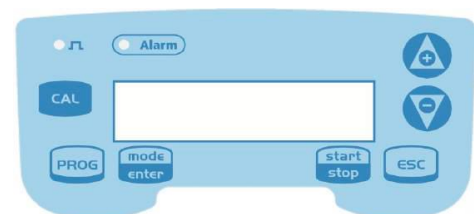
The electrodes are located in the measurement and control cabinet (see section "Technical description").

### 7.3.1 Calibrating the electrode for pH measurement

The pH electrodes for measurement are calibrated using two-point calibration.

The following requirements must be met before calibration:

- Temperature of 20 °C
- The values in the buffer solutions must be pH 7 and pH 4.



#### 7.3.1.1 Control Panel

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | Access to the programming menu                                                                                                                                                                                                                                                                                                                                                            |
|  | When pressed during the pump operation phase, it cyclically displays the programmed values on the display; When pressed at the same time as the ▼ or ▲ keys, it increases or lowers a value dependent on the selected operating mode. During programming it carries out an "enter" function, meaning that it confirms entry to the various menu levels and modifications within the same. |
|  | Starts and stops the pump. In the event of a level alarm (alarm function only), flow alarm and active memory alarm, it deactivates the signal on the display.                                                                                                                                                                                                                             |
|  | Used to "exit" the various menu levels. Before definitively exiting the programming phase, you will be asked if you wish to save any changes.                                                                                                                                                                                                                                             |
|  | Access to the pump calibration menu. If in Off mode, the calibration menu is not activated.                                                                                                                                                                                                                                                                                               |

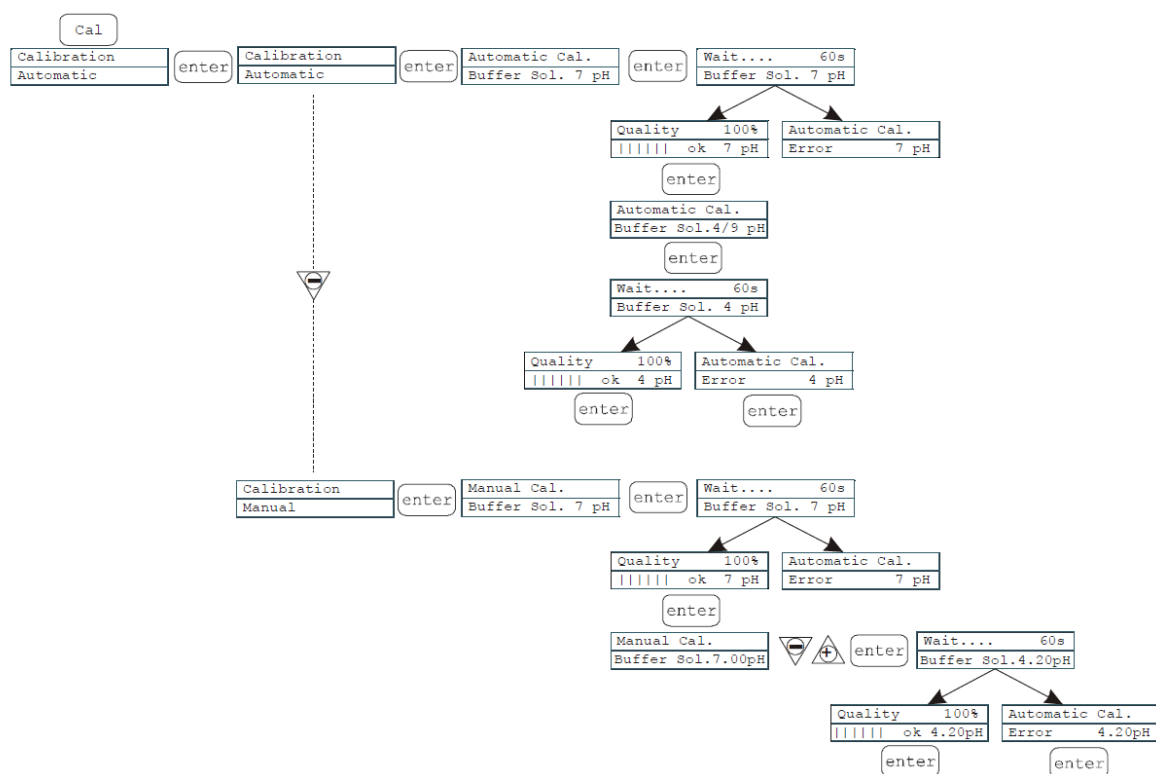
|                                                                                   |                                                                                                                                |
|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
|  | Used to run upwards through the menu or increase the numerical values to be changed. Can be used to start dosage in Batch mode |
|  | Used to run downwards through the menu, or decrease the numerical values to be changed.                                        |
|  | Flashing green LED during dosage                                                                                               |
|  | Red LED that lights up in various alarm situations                                                                             |

### 7.3.1.2 pH Calibration Menu

Pressing the CAL key for 3 seconds takes you into the calibration menu. If calibration was excluded during programming, the following appears on the display:

|             |
|-------------|
| Calibration |
| Off         |

If calibration is active:



### 7.3.1.3 Manual calibration

When the buffer solution value appears on the display, insert the probe in the bottle and press the **Enter** key. A 60 second countdown necessary to complete calibration will appear on the display. If the alignment quality is below 50%, an error message appears on the display and you should press **Enter** to exit calibration (the pump exits automatically after 4 seconds). If the quality is above 50%, the value is shown on the display and, after pressing the **Enter** key, the value of pH 7.00 flashes on the display. Use the ▼ or ▲ keys to enter the value of the solution in your possession, then press **Enter** to confirm and start the calibration procedure as before.

### 7.3.2 Calibrating the conductivity sensor

The following requirements must be met before calibration:

- Constant temperature during calibration
- Immerse the conductivity sensor in a reference solution with known conductivity (100 mS/cm).

Start the calibration procedure for the conductivity sensor:

6. Press the “PGM” key for more than 3 seconds. Select the calibration level using the arrow keys and confirm the selection with the “PGM” key. Select “Rel. cell const.” with the arrow keys and confirm with the “PGM” key.
7. If “Measured value stable” is displayed, confirm with the “PGM” key.
8. Use the arrow keys to correct the displayed uncompensated conductivity value to the conductivity value of the reference solution and confirm with the “PGM” key.
9. Press the “PGM” key for more than 3 seconds to accept the determined value.
10. Press the “EXIT” key. The sensor is in measuring mode and indicates the compensated conductivity value of the reference solution.



#### NOTE

#### Calibrate calibrated manual measurement devices regularly

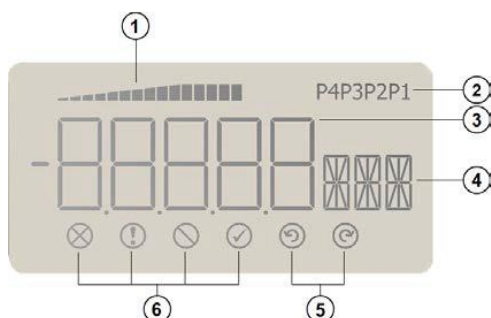
Manual measurement devices must be calibrated on a regular basis to guarantee correct conductance measurements.

### 7.3.3 Reading the power input, torque and capacity utilisation on the drum motor

#### 7.3.3.1 Operating keys

|  |                                                                                                  |
|--|--------------------------------------------------------------------------------------------------|
|  | Disables parameterisation mode.                                                                  |
|  | Enables parameterisation mode. Increases the parameter value.                                    |
|  | Enables parameterisation mode. Reduces the parameter value.                                      |
|  | Saves the changed parameter value or switches between parameter number and parameter value.      |
|  | If a changed value is not to be saved, the parameter mode can be exited by pressing the Esc key. |
|  | If the inverter is switched on: Switch to the parameter level.                                   |

### 7.3.3.2 Display



- |   |                                                        |
|---|--------------------------------------------------------|
| 1 | Inverter load display (with 100% value)                |
| 2 | Parameter set display                                  |
| 3 | Five digit 7-segment display with prefix and 4 x point |
| 4 | Three digit 14-segment display for units               |
| 5 | Enable right and enable left                           |
| 6 | 4 Inverter status displays                             |

### 7.3.3.3 Operation

| Operating mode                               | Display | Comment                                                                                                                                                                                                                                                                                                |
|----------------------------------------------|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ready for operation without setpoint present |         | <p>If the underscores flash slowly the frequency inverter is not ready for operation:</p> <ul style="list-style-type: none"> <li>Switch-on inhibit: Function "safe pulse block" or "quick stop active"</li> <li>Enable signal present before the frequency inverter is ready for operation.</li> </ul> |
| In operation                                 |         | Display of the operating value (e.g. Actual frequency) selected in parameter P001                                                                                                                                                                                                                      |
| In case of a warning                         |         | The actual operating display remains until the background changes to yellow.                                                                                                                                                                                                                           |
| In case of fault                             |         | Slow flashing of the display indicates that the fault is no longer present and the error message can be acknowledged.                                                                                                                                                                                  |
| Parameterisation                             |         | Parameter group:<br>Example motor data (P2 - -)                                                                                                                                                                                                                                                        |
|                                              |         | Parameter number:<br>Example nominal speed (P202)                                                                                                                                                                                                                                                      |
|                                              |         | Parameter value<br>Example: 1360 rpm                                                                                                                                                                                                                                                                   |
|                                              |         | PASS flashes if password protection is enabled in P004. The parameter settings are not saved.                                                                                                                                                                                                          |

#### 7.3.3.4 Parameterisation

In the operating display (**P000**) the parameter set display shows the actual parameter set, and for parameterisation (**≠ P000**), the parameter set which is being parameterised.

For control of the frequency inverter via the control panel, the parameter set can be switched over via **P100** even during operation.

Switching to parameter mode is performed in different ways depending upon the operating states and the enabling source.

1. If enabling is not present via the control panel, control terminals or a serial interface, switch-over from the operating value display to parameterisation mode can be made directly with ▼ or ▲.
2. If an enable is present via the control terminals or a serial interface and the frequency inverter is producing an output frequency, it is also possible to switch to the parameterisation mode directly from the operating value display using the ▼ or ▲ keys.
3. If the frequency inverter has been enabled via the control panel (start key) the parameterisation mode can be reactivated with the key combination START and OK. Exit is only possible using the START key. The STOP key retains its function

#### Changing parameter values

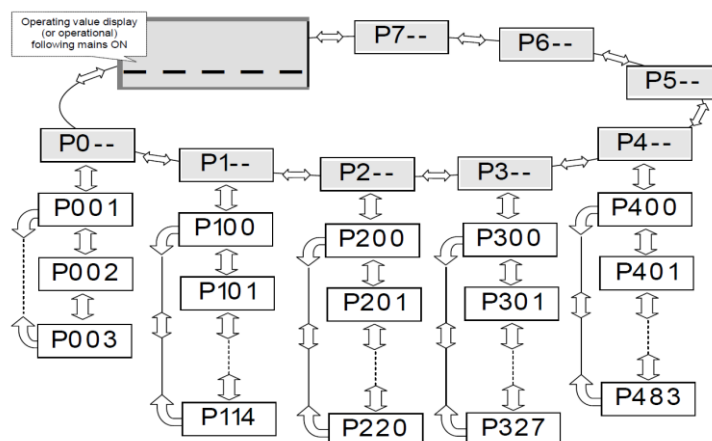
Each parameter has a parameter number □ P x x x (Chap. 5 "Parameter").

1. Press ▼ or ▲, to access the parameter area. The display changes to the menu group display P 0 \_ \_ ... P 8 \_ \_ .
2. Press the Start key to open the menu group. All parameters are arranged in a ring structure in the individual menu groups. It is therefore possible to scroll forwards or backwards within this section.
3. Select the required parameter with ▼ or ▲ and press the OK key.
4. Change the setting with ▼ or ▲ and confirm the changed setting by pressing the OK key.
5. Optionally, the parameter can be reset to its default value by pressing the ▼ and ▲ keys simultaneously.

As long as a changed value has not been confirmed by pressing OK key, the value display will flash; this value is not stored in the frequency inverter. Changed values which have not been saved flash.

Flashing only stops when these have been saved (by pressing the OK key).

Press the ESC key to exit from the menu.



Read the values for the drum motor's power input, torque and capacity utilisation on the frequency converter.

| Motor                                                                                                                                                          |                                                                                                                                                                   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Stöber Antriebstechnik                                                                                                                                         | Nord Drivesystems                                                                                                                                                 |
| <p>Motor power consumption</p> <p>E00: _____ A</p> <p><b>E00 max = A</b></p>                                                                                   | <p>Motor power consumption</p> <p>P719: _____ A</p> <p><b>P719 max. = 1,8 A</b></p>                                                                               |
| <p>Engine utilization</p> <p>E23: _____ %</p> <p><b>E23 max = 60%</b></p> <p>If the specified value is exceeded, the mobility of the drum must be checked.</p> | <p>Engine utilization</p> <p>P729: _____ %</p> <p><b>P729 max. = 60%</b></p> <p>If the specified value is exceeded, the mobility of the drum must be checked.</p> |
| <p>Mechanical performance motor</p> <p>E: _____ kW</p> <p><b>E max = kW</b></p>                                                                                | <p>Mechanical performance motor</p> <p>P727: _____ kW</p> <p><b>P727 max. = 60 kW</b></p>                                                                         |

## 7.4 Cleaning

|                                                                                   |                |                                                                                                                                                                                                                                                                                                                                                    |
|-----------------------------------------------------------------------------------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>DANGER</b>  | <p><b>Dangerous electrical voltage</b></p> <p>Live parts are installed in the system. Contact with live system parts can be fatal.</p> <p>Before working, disconnect the system from the supply voltage and secure it against unintentional reconnection.</p>                                                                                      |
|  | <b>WARNING</b> | <p><b>Chemical burns caused by sulphuric acid</b></p> <p>Contact with the process water or sulphuric acid will cause chemical burns on the skin.</p> <p>Wear personal protective equipment when working with hazardous substances.</p> <p>Handle hazardous materials with care and observe the safety instructions on handling sulphuric acid.</p> |
|  | <b>CAUTION</b> | <p><b>Risk of trapping in the closing flap</b></p> <p>When operators open and shut the closing flap in the exhaust air flue, there is a risk that parts of the body could become trapped.</p> <p>Do not reach into the closing flap.</p>                                                                                                           |

### 7.4.1 Cleaning the drum washer Lavamatic XL

If the degree of soiling makes it necessary, a basic cleaning of the drum washer Lavamatic XL must be carried out after the end of each fattening period and after 6 months at the latest. Proceed as follows to clean the drum washer Lavamatic XL:

1. Switch all components in the system to manual mode using the central control module.
2. Switch off the system and secure it against unintentional reconnection.
3. Fill the process water into suitable storage containers and dispose of it.
4. Blast the entire system interior using a pressure washer without cleaning agents and without a dirt killer.
5. Rinse the drum:
6. Fill the system to its target fill level with fresh water and let the drum rotate for about four hours. This rinses the filtration material in the interior. Do not set the acid metering and additive metering to automatic mode until the drum has been rinsed.

## 8 Troubleshooting

|                                                                                   |                |                                                                                                                                                                                                                                                                                                                                                    |
|-----------------------------------------------------------------------------------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>DANGER</b>  | <p><b>Dangerous electrical voltage</b></p> <p>Live parts are installed in the system. Contact with live system parts can be fatal.</p> <p>Before working, disconnect the system from the supply voltage and secure it against unintentional reconnection.</p>                                                                                      |
|  | <b>WARNING</b> | <p><b>Chemical burns caused by sulphuric acid</b></p> <p>Contact with the process water or sulphuric acid will cause chemical burns on the skin.</p> <p>Wear personal protective equipment when working with hazardous substances.</p> <p>Handle hazardous materials with care and observe the safety instructions on handling sulphuric acid.</p> |

## 8.1 Drum washer malfunctions

| Malfunction                                                  | Error code | Cause                                                           | Measure                                                                             |
|--------------------------------------------------------------|------------|-----------------------------------------------------------------|-------------------------------------------------------------------------------------|
| System has been stopped                                      | 332        | Motor circuit breaker or circuit breaker for supply has stopped | Check power supply; the power supply must be repaired by a specialist, if necessary |
|                                                              | 333        |                                                                 |                                                                                     |
|                                                              | 334        | Residual current circuit breaker has triggered                  | Check power supply; the power supply must be repaired by a specialist, if necessary |
|                                                              | 3          | Motor protection switch in the control module has triggered     | Check power supply; the power supply must be repaired by a specialist, if necessary |
|                                                              | 28         |                                                                 |                                                                                     |
|                                                              | 53         |                                                                 |                                                                                     |
|                                                              | 78         |                                                                 |                                                                                     |
|                                                              | 103        |                                                                 |                                                                                     |
|                                                              | 127        |                                                                 |                                                                                     |
|                                                              | 153        |                                                                 |                                                                                     |
|                                                              | 178        |                                                                 |                                                                                     |
|                                                              | 203        |                                                                 |                                                                                     |
|                                                              | 228        |                                                                 |                                                                                     |
| Acid metering has been stopped                               | 321        | Acid container empty                                            | Replace container                                                                   |
| Additive metering has been stopped                           | 322        | Additive container empty                                        | Replace container                                                                   |
| Washer function and drum have been stopped in automatic mode | 1          | The service hatch door switch has triggered                     | Close service hatch                                                                 |
|                                                              | 26         |                                                                 |                                                                                     |
|                                                              | 51         |                                                                 |                                                                                     |
|                                                              | 76         |                                                                 |                                                                                     |
|                                                              | 101        |                                                                 |                                                                                     |
|                                                              | 125        |                                                                 |                                                                                     |
|                                                              | 151        |                                                                 |                                                                                     |
|                                                              | 176        |                                                                 |                                                                                     |
|                                                              | 201        |                                                                 |                                                                                     |
|                                                              | 226        |                                                                 |                                                                                     |
|                                                              |            | Fill level in the water tank too low                            | Add fresh water to the water tank                                                   |
| Automatic tank filling has been stopped                      | 12         | The "Restart after tank empty" parameter has been deselected    | Select the "Restart after tank empty" parameter                                     |
|                                                              | 37         |                                                                 |                                                                                     |
|                                                              | 62         |                                                                 |                                                                                     |
|                                                              | 87         |                                                                 |                                                                                     |
|                                                              | 112        |                                                                 |                                                                                     |
|                                                              | 137        |                                                                 |                                                                                     |
|                                                              | 162        |                                                                 |                                                                                     |
|                                                              | 187        |                                                                 |                                                                                     |
|                                                              | 212        |                                                                 |                                                                                     |
|                                                              | 237        |                                                                 |                                                                                     |

## 9.1 EC Declaration of Conformity

Drum washer® Lavamatic XL

## 9.2 Overview of the parameters

### 9.2.1 Parameters for configuring individual modules on the central control module

| Parameter                           | Adjustment range             | Standard value | Description                                                                                                                  |
|-------------------------------------|------------------------------|----------------|------------------------------------------------------------------------------------------------------------------------------|
| <b>General</b>                      |                              |                |                                                                                                                              |
| Module present                      | NO<br>YES                    | NO             | Module presence                                                                                                              |
| Description                         |                              |                | Assignment of an individual flue designation                                                                                 |
| Number of drums                     | 1..2                         | 1              | Number of drums at hand                                                                                                      |
| <b>Measurem. fan</b>                |                              |                |                                                                                                                              |
| Measurement fan                     | 1..100 Imp/m <sup>3</sup>    | 1,7            | Setting the pulse rate                                                                                                       |
| Alarm delay                         | 0..3,600 sec                 | 900            | Time delay for generating the error "MIN air volume" or "MAX air volume".<br>A value of 0 deactivates the error.             |
| MIN Alarm                           | 0..100.000 m <sup>3</sup> /h | 1500           | Limit value to generate the "MIN air volume" error<br>A value of 0 deactivates the error.                                    |
| MAX Alarm                           | 0..100.000 m <sup>3</sup> /h | 120000         | Limit value to generate the "MAX air volume" error<br>A value of 0 deactivates the error.                                    |
| Start air volume                    | 0..100.000 m <sup>3</sup> /h | 1000           | Minimum air volume at which the drum motor is unblocked.                                                                     |
| <b>Intervall additive</b>           |                              |                |                                                                                                                              |
| Cycles per day                      | 0..24                        | 1              | Number of metering cycles per day                                                                                            |
| Duration                            | 0..900 sec                   | 10             | Duration of a metering cycle                                                                                                 |
| <b>Emergency cooling (optional)</b> |                              |                |                                                                                                                              |
| Limit temperature                   | 0,0..50,0 °C                 | 0.0            | Operating the Lavamatic XL outside these limit temperatures is not permitted and leads to irreversible damage to the system. |

| Parameter              | Adjustment range           | Standard value | Description                                                                                                                                                   |
|------------------------|----------------------------|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Water niveau</b>    |                            |                |                                                                                                                                                               |
| Restart after empty    | No/ Yes                    | YES            | Selects whether the drum motor may restart automatically if a minimum fill level is detected in the tank and the subsequent refilling process is carried out. |
| Setpoint niveau        | 0..100 %                   | 27             | Target fill level in the tank                                                                                                                                 |
| MIN Alarm              | 0..80 %                    | 20             | Limit value to generate the "Empty Tank 1" or "Empty Tank 2" error.<br>A value of 0 deactivates the error.                                                    |
| MAX Alarm              | 0..100 %                   | 30             | Limit value to generate the "Tank 1 or Tank 2 empty" error<br>A value of 0 deactivates the error.                                                             |
| Empty niveau           | 0..80 %                    | 18             | Limit value at which the drum motor is switched off due to insufficient fill level.                                                                           |
| <b>Drain</b>           |                            |                |                                                                                                                                                               |
| Stop conductance value | 0..300 mS/cm <sup>2</sup>  | 185            | Setting a threshold conductance value above which the elutriation process is stopped, triggered by the "MAX conductance value".                               |
| Duration               | 0..600 s                   | 45             | Setting an impulse and pause time which slows down the elutriation process due to an excessively high conductance value.                                      |
| Break                  | 0..600 s                   | 120            | -                                                                                                                                                             |
| MAX conductivity       | 10..500 mS/cm <sup>2</sup> | 198            | Setting a maximum conductance value above which the elutriation process is started.                                                                           |
| MAX niveau             | 10..100 %                  | 32             | Setting a maximum tank level above which the elutriation process is started.                                                                                  |
| Daily                  | 0...2,500 l                | 0              | Setting a daily minimum water volume for elutriation.                                                                                                         |
| <b>Water clock</b>     |                            |                |                                                                                                                                                               |
| Fresh water            | 0,1..100 l/Imp             | 1              | Setting the water meter impulse rate.                                                                                                                         |
| Circulation            | 0,1..100 l/10Imp           | 0,2            | Setting the water meter impulse rate.                                                                                                                         |

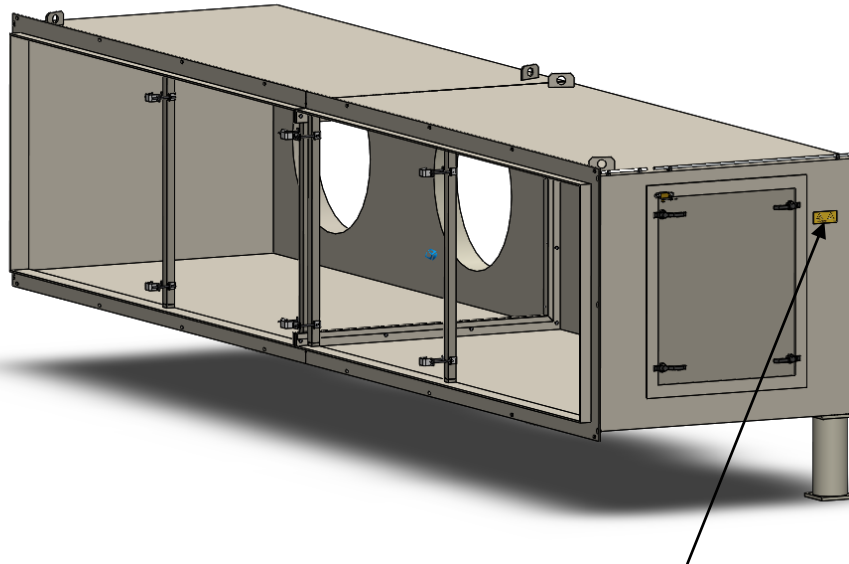
| Parameter                           | Adjustment range | Standard value | Description                                                                                         |
|-------------------------------------|------------------|----------------|-----------------------------------------------------------------------------------------------------|
| <b>Analogue values</b>              |                  |                |                                                                                                     |
| Water niveau 0 %                    | 0..10 V          | 0              | Analogue voltage from the fill level sensor when the fill level is 0%                               |
| Water niveau 100 %                  | 0..10 V          | 10             | Analogue voltage from the fill level sensor when the fill level is 100%                             |
| Conductivity 0 mS/cm <sup>2</sup>   | 0..10 V          | 0              | Analogue voltage from the conductance value sensor at a conductance value of 0 mS/cm <sup>2</sup>   |
| Conductivity 300 mS/cm <sup>2</sup> | 0..10 V          | 9,9            | Analogue voltage from the conductance value sensor at a conductance value of 200 mS/cm <sup>2</sup> |
| Temperature 0 °C                    | 0..10 V          | 4              | Analogue voltage from the temperature sensor at a temperature of 0 °C                               |
| Temperature 100 °C                  | 0..10 V          | 14             | Analogue voltage from the temperature sensor at a temperature of 100 °C                             |
| pH value: 0                         | 0..10 V          | 0              | Analogue voltage from the pH value sensor at a pH value of 0 pH                                     |
| pH value: 14                        | 0..10 V          | 9,7            | Analogue voltage from the pH value sensor at a pH value of 14 pH                                    |
| Humidity 0 %                        | 0..10 V          | 0              | Analogue voltage from the humidity sensor at a humidity level of 0%                                 |
| Humidity 100 %                      | 0..10 V          | 10             | Analogue voltage from the humidity sensor at a humidity level of 100%                               |
| Ammonia 0 ppm                       | 0..10 V          | 1.9            | Analogue voltage from the ammonia sensor at an ammonia level of 0 ppm                               |
| Ammonia 100 ppm                     | 0..10 V          | 10             | Analogue voltage from the ammonia sensor at an ammonia level of 100 ppm                             |
| Difference pressure 0 Pa            | 0..10 V          | 0              | Analogue voltage from the differential pressure sensor at a differential pressure of 0 Pa           |
| Difference pressure 200 Pa          | 0..10 V          | 10             | Analogue voltage from the differential pressure sensor at a differential pressure of 200 Pa         |

## 9.2.2 Parameters for system configuration on the central control module

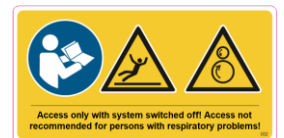
| Parameter                  | Adjustment range | Standard value | Description                                                                                                     |
|----------------------------|------------------|----------------|-----------------------------------------------------------------------------------------------------------------|
| Clock                      |                  |                |                                                                                                                 |
| Year                       | 2013..2099       | -              | Sets the required time.<br>Press the “Set” button to accept the time.                                           |
| Month                      | 1..12            | -              |                                                                                                                 |
| Day                        | 1..31            | -              |                                                                                                                 |
| Hour                       | 0..23            | -              |                                                                                                                 |
| Minute                     | 0..59            | -              |                                                                                                                 |
| Second                     | 0..59            | -              |                                                                                                                 |
| Display language           |                  |                |                                                                                                                 |
| German                     | -                | -              | Selects the required language                                                                                   |
| English                    | -                | -              |                                                                                                                 |
| Configuration              |                  |                |                                                                                                                 |
| Read back                  | -                | -              | Imports all configuration data from the memory card into the control system is protected against power failure. |
| Save                       | -                | -              | Saves all configuration data from the memory card into the control system is protected against power failure.   |
| Process data               |                  |                |                                                                                                                 |
| Reset                      | -                | -              | Deletes all process-data / relevant data in the controller and on the memory card.                              |
| Archive                    | No/Yes           | Yes            | Selects the data archive                                                                                        |
| Control                    |                  |                |                                                                                                                 |
| Resets controller          | -                | -              | Stops the CoDeSys program                                                                                       |
| Configure the IP address   | No/Yes           | Yes            | IP address configuration                                                                                        |
| General                    |                  |                |                                                                                                                 |
| Number of fattening places | 0..10000         | -              | Sets the shed size to calculate the fresh water and elutriation water consumption per fattening place.          |

## 9.3 Labeling plan

### 9.3.1 Supply air module



### 9.3.2 Exhaust air module



9.3.3 Drum module

